Syllabus (175 Credits) applicable to the students admitted to BE 3rd semester during the academic year 2020-21 and lateral entry students admitted during 2021-22

UMA391C	**Numerical Techniques and Integral Transforms**	**03-Credits**
Hrs/Week : 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**
Numerical analysis - I: Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).	
UNIT – II	**10 Hrs**
Numerical analysis - II: Numerical differentiation using Newton's forward and backward formulae problems. Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae) problems. Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method.	
UNIT - III	**10 Hrs**
Fourier series: Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.	
UNIT - IV	**10 Hrs**
Fourier transforms and z-transforms: Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems.	

Text Books:

1. Steven C. Chapra & Raymond P Canale, Numerical Methods for Engineers.
2. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.
3. H. K. Das, Advanced Engineering Mathematics, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. E Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.

Code:UAI302C	Data Structures and Applications	04 - Credits
Hrs/Week : 04		CIE Marks:50
Total Hrs: 52		SEE Marks:50

Prerequisite: C programming

Course outcomes:

On the successful completion of this course, students are able to:

1. Summarize linear and nonlinear data structures concepts, searching and sorting techniques.
2. Analyze and implement different data structures, searching and sorting techniques.
3. Compare and contrast different types of data structures and searching and sorting methods.
4. Develop solutions for the given problem by using relevant data structures.

UNIT - I	13 Hrs
Introduction to Data Structures: Basic Concepts: Abstract data type: Atomic and composite data, Data type, Data structure, Abstract data type, Model for an abstract data type: ADT operations, ADT data structures, Pointer to void. **Pointer to Function**: Defining pointers to functions, Using pointers to functions. **Stacks**: **Basic stack operations**: Push, Pop, Stack top. **Stack linked list**: Implementation, Data structure, Stack head, Stack data node, Stack algorithms, Create Stack, Push Stack, Stack top, Empty Stack, Full Stack, Stack count, Destroy Stack, **C language implementation**: Insert data, Push Stack, Print Stack, Pop character. **Stack ADT**: Data structure, ADT implementations, Stack structure, Create stack, Push stack, Pop stack, Stack top, Empty stack, Stack count, Destroy stack. **Stack applications**: Reversing data, Reverse a list, Convert decimal to binary, Infix to postfix transformation, Evaluating postfix expressions, Stack implementation using array.	
UNIT – II	**13 Hrs**
Queues: **Queue Operations**: Enqueue, Dequeue, Queue front, Queue rear, Queue example. **Queue Linked list design**: Data structure, Queue head, Queue data node, Queue algorithms, Create queue, Enqueue, Dequeue, Retrieving queue data, Empty queue, Full queue, Queue count, Destroy queue. **Queue ADT**: Queue structure, Queue ADT algorithms, Queue Implementation using array, Queue Applications. **Sorting:** Selection, Insertion, exchange and quick sorts. **Searching**: Sequential, binary search, hashed list searches.	
UNIT - III	**13 Hrs**
General Linear lists: Basic operations, Insertion, Deletion, Retrieval, Traversal. **Implementation:** Data structure, Head node, Data node, Algorithms, Create list, Insert node, Delete node, List search, Retrieve node, Empty list, Full list, List count, Traverse list, Destroy list. **List ADT**: ADT functions, Create list, Add node, Internal insertion function, Remove node, Internal delete function, Search list, Internal search function, Retrieve node, Empty list, Full list, List count, Traverse, Destroy list. **Circular linked lists and Doubly linked lists**: Create list, add node, delete node, retrieve node, search list.	

UNIT - IV	**13 Hrs**
Non-Linear lists: Trees: Basic tree concepts: Terminology, User representation, **Binary trees**: Properties, Height of binary trees, Balance, Complete and Nearly complete binary trees, **Binary tree traversals:** Depth-first traversals, Breadth-first traversals, **Expression Trees**: Infix traversal, Postfix traversal, Prefix traversal, **Huffman code, General trees, Binary search trees**: Basic concepts, **BST operations**: Traversals, Searches, Insertion Find the smallest and largest node, BST search, Insertion, Deletion, **Binary search tree ADT**, Data structure, Head and node structure, Algorithms, Create a BST, Insert a BST, Internal insert function, Delete a BST, Internal delete function, Retrieve a BST, Internal retrieve function, Traverse a BST, Internal traverse function, Empty a BST, Full BST, BST count, Destroy a BST, Internal destroy function. **Graphs: Basic concepts**, **Operations**: Insert vertex, Delete vertex, Add edge, Delete edge, Find vertex, **Graph storage structures**: Adjacency matrix, Adjacency list.	
Text Book: 1) Behrouz A. Forouzan and Richard F. Gilberg, 2nd Edition, Cengage Learning Publisher, 2005. **Data Structure A Pseudocode Approach with C**, (Chapter 1(1.2,1.3,1.5), 2,3,4 (4.1-4.4), 5, 6(6.1-6.3), 7(7.1-7.3), 11(11.1-11.3),12(12.2-12.4) 13(13.1-13.3) Appendix F.	
Reference Books: 1) Data Structures Using C, Aaron M. Tenanbaum, Yedidyah Langsam, Moshe J Augenstein Pearson Education. 2) Data Structures and Program Design in C, Robert Kruse, Bruce Leung, C. L. Tondo, Shashi Mogalla, 2nd Edition, Pearson Education. 3) Data Structures with C, Seymour Lipschutz, Schaum's outlines, MGH Education. 4) Data Structures Through C,Yeshwant Kanetkar , BPB publications.	

Code:UAI303C	Embedded Systems	04 - Credits
Hrs/Week: 04		CIE Marks:50
Total Hrs: 52		SEE Marks:50

Course outcomes:

On the successful completion of this course, students are able to:

1. Comprehend the difference between microprocessor and microcontroller architectures.
2. Simulate, analyze and develop basic programs using assembly and C language.
3. Demonstrate the use of Timers, Counters, Interrupts through programs.
4. Demonstrate the use of serial ports through programs for developing basic communication systems.
5. Analyze a problem and formulate appropriate computing solution for microcontroller based embedded applications.

UNIT - I	13 Hrs
Boolean Algebra: Definition of Boolean algebra, Boolean algebra theorems, A two-valued Boolean algebra, Boolean formulas and functions, Canonical Formulas, Manipulations of Boolean formulas. Gates and Combinational networks: Incomplete Boolean functions and Don't care conditions, Additional Boolean operations and Gates. Simplification of Boolean Expressions: K-maps and The Quine-McCluskey method. **Logic Design with MSI Components, Flip- Flops, Counters:** Binary adders and subtractors, Decimal adders, Comparators, Decoders, Multiplexers. The basic Bi-stable element, Latches, Master-Slave flip-flops (Pulse-Triggered flip-flops), Edge triggered flip-flops, Characteristic equations, Registers, Counters, Design of synchronous counters.	
UNIT – II	**13 Hrs**
The 8051 Microcontrollers, Assembly Language Programming: Microcontrollers and Embedded systems, Overview of the 8051 family, Inside the 8051, Introduction to 8051 Assembly programming, Assembling and running an 8051 program, the program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and PSW register, 8051 register banks and stack, pin description of the 8051. **Jump, Loop and Call Instructions, I/O Port Programming**: Loop and Jump instructions, Call instructions, Time delay for various 8051 chips, 8051 I/O programming, I/O bit manipulation programming.	
UNIT - III	**13 Hrs**
8051 Addressing Modes, Arithmetic, Logic Instructions and Programs: Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte-on-chip RAM in 8052. Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD, ASCII, and other application programs.	

UNIT - IV	**13 Hrs**
8051 Programming in C, Pin description of 8051: Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C. **8051 Timer Programming in Assembly and C**: Programming 8051 timers, counter programming, Programming timer 0 and 1 in 8051 C. **Interrupts Programming in Assembly and C**: 8051 interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C. **MOTOR Control:** DC and Stepper Motors.	

Text Books:

1) Donald D. Givone, Digital Principles and Design, McGraw Hill Edition 2002.
2) Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson 2nd Edition, 2011.

Reference Books:

1) Leach and Malvino, Digital Principles and Applications, TMH, New Delhi, 2002.
2) Yarbrough J. M, Digital logic- Applications and Design, Thomson Learning, New Delhi, 2001.
3) Kenneth J. Ayala, The 8051 Microcontroller Architecture, Programming and Applications, 2nd Edition, Penram International, 1996.
4) Uma Rao and Andhe Pallavi, The 8051 Microcontroller Architecture, Programming and Applications, Pearson Education Sanguine.
5) V. Udayshankar, M. S. Mallikarjunaswamy, 8051 Microcontroller: Hardware, Software and Applications, McGrawHill, New Delhi.

Code: UAI304C	Computer Organization	04 - Credits
Hrs/Week:04		CIE Marks: 50
Total Hrs:52		SEE Marks:50

Course outcomes:

On the successful completion of this course, students are able to:

1. Describe the fundamental organization of a digital computer.
2. Explain the functional units and components of a computer.
3. Explain various addressing modes, instruction formats and program control statements and write assembly-level programs using simple machine instructions.
4. Distinguish the organization of various parts of a system memory hierarchy.
5. Describe fundamental concepts of pipelining and parallel processing.

UNIT - I	10 Hrs
Basic structure of computers: Computer types, Functional Units, Basic operational concepts, Bus structures. **Machine instructions and programs:** Numbers, Arithmetic operations and characters, Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes, Assembly language, assembler directives, number notation, Stacks and Queues, Subroutines, Encoding of machine instructions.	
UNIT – II	**10 Hrs**
Input/output organization: Accessing I/O devices, Interrupts-Interrupt hardware, Enabling and Disabling Interrupts, Handling multiple devices, controlling device requests, Exceptions, Direct memory access-bus Arbitrations, Buses-Asynchronous bus and Synchronous bus, Interface Circuits-Parallel port and serial port, Standard I/O Interfaces-Peripheral component interconnect Bus, SCSI bus, USB.	
UNIT - III	**10 Hrs**
The memory system: Some Basic concepts, Semiconductor RAM memories, Read only memories, speed, size, and cost, cache memories. **Arithmetic Unit:** Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication. Integer Division, Floating point numbers and operations-IEEE standard for Floating point numbers, Arithmetic operations on Floating point numbers. Implementing Floating point operations.	
UNIT - IV	**10 Hrs**
Basic Processing Unit: Some fundamental concepts, Execution of complete instruction, Hardwired Control, Micro programmed control, Micro instructions. **Pipelining:** basic concepts, role of cache memory, pipeline performance. **Large computer systems**: forms of parallel processing, array processor, the structure of general purpose and multiprocessors. **Performance:** Processor Clock, Basic performance equation, pipelining and superscalar operations, Clock rate, Instruction set, compiler, performance measurement.	

Text Books:

1) Hamacher, Zvonko Vranesic, Safwat Zaky, 2002, Computer Organization, 5th Edition, MGH. (1.1-1.4, 2.1-2.5, 2.6.1, 2.6.3, 2.8-2.9, 2.12, 4.1, 4.2, 4.2.1-4.2.5, 4.4, 4.4.1, 4.5, 4.5.1-4.5.2, 4.6, 4.7, 5.1-5.5, 5.5.1, 6.1-6.7, 7.1-7.5, 7.5.1, 8.1, 8.1.1, 8.1.2, 12.1-12.3, 1.6)

Reference Book:

1) J.P. Hayes, 1998, Computer Architecture and Organization, 3rd Edition, MGH.
2) William Stallings, 2007, Computer Organization and Architecture, 7th Edition, PHI.

Code:UAI305C	**AI and its Applications**	**03-Credits**
Hrs/Week:03		CIE Marks:50
Total Hrs: 40		SEE Marks:50

Course outcomes:

On the successful completion of this course, students are able to:

1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.
2. Demonstrate proficiency in usage of hardware and software platforms for AI based applications.
3. Demonstrate awareness and understanding of various applications of AI techniques.
4. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

UNIT - I	**10 Hrs**
Introducing AI: Defining the Term AI, Discerning intelligence, Discovering four ways to define AI, Understanding the history of AI, Starting with symbolic logic at Dartmouth, Continuing with expert systems, Overcoming the AI winters, Considering AI uses, Avoiding AI Hype, Connecting AI to the underlying computer. **Defining the role of data**: Finding data ubiquitous in this age, Understanding Moore's implications, Using data everywhere, Putting algorithms into action. **Considering the use of algorithms:** Understanding the role of algorithms, Understanding what algorithm means, starting from planning and branching, Playing adversarial games, Using local search and heuristics, Discovering the learning machine, Leveraging expert systems, Introducing machine learning, Touching new heights. **Pioneering specialized hardware:** Relying on standard hardware, Understanding the standard hardware, Describing standard hardware deficiencies, Using GPUs, Considering the Von Neumann bottleneck, Defining the GPU, Considering why GPUs work well, Creating a specialized processing environment, Increasing hardware capabilities, Adding specialized sensors, Devising methods to interact with the environment.	
UNIT – II	**10 Hrs**
Seeing AI uses in computer applications: Introducing common application types, Using AI in typical applications, Realizing AI's wide range of fields, Considering the Chinese Room argument, Seeing how AI makes applications friendlier, Performing corrections automatically, Considering the kinds of corrections, Seeing the benefits of automatic corrections, Understanding why automated corrections don't work, Making suggestions, Getting suggestions based on past actions, Getting suggestions based on groups, Obtaining the wrong suggestions, Considering AI-based errors. **Using AI to address medical needs:** Implementing portable patient monitoring, Wearing helpful monitors, Relying on critical wearable monitors, Using movable monitors, Making humans more capable, Using games for therapy, Considering the use of exoskeletons, Addressing special needs, Considering the software-based solutions, Relying on hardware augmentation, Seeing AI in prosthetics, Completing analysis in new ways, Devising new surgical techniques, Making surgical suggestions, Assisting a surgeon, Replacing the surgeon with monitoring, Performing tasks using automation, Working with medical records,	

Predicting the future, Making procedures safer, Creating better medications, Combining robots and medical professionals. **Relying on AI to improve human interaction:** Developing new ways to communicate, Creating new alphabets, Automating language translation, Incorporating body language, Exchanging ideas, Creating connections, Augmenting communication, Defining trends, Using multimedia, Embellishing human sensory perception, Shifting data spectrum, Augmenting human senses.	
UNIT - III	**10 Hrs**
Performing data analysis for AI: Defining data analysis, Understanding why analysis is important, Reconsidering the value of data, Defining machine learning, Understanding how machine learning works. Understanding the benefits of machine learning, Being useful; being mundane, Specifying the limits of machine learning, Considering how to learn from data, supervised learning, Unsupervised learning, Reinforcement learning. **Employing machine learning in AI:** Taking many different roads to learning, Discovering five main approaches to AI learning, Delving into the three most promising AI learning, approaches, Awaiting the next breakthrough, Exploring the truth in probabilities, Determining what probabilities can do, Considering prior knowledge, Envisioning the world as a graph, Growing trees that can classify, Predicting outcomes by splitting data, Making decisions based on trees, Pruning overgrown trees. **Developing robots and flying with drones:** Defining robot roles, Overcoming the sci-fi view of robots, Knowing why it's hard to be a humanoid, Working with robots, Assembling a basic robot, Considering the components, Sensing the world, Controlling a robot, Acknowledging the state of the art, Flying unmanned to missions, Meeting the quad-copter, Defining uses for drones, Seeing drones in non-military roles, Powering up drones using AI, Understanding regulatory issues.	
UNIT - IV	**10 Hrs**
Understanding the Non starter Application: Using AI where it won't work, Defining the limits of AI, Applying AI incorrectly, Entering a world of unrealistic expectations, Considering the effects of AI winters, Understanding the AI winter, Defining the causes of the AI winter, Rebuilding expectations with new goals, Creating solutions in search of a problem, Defining a gizmo, Avoiding the infomercial, Understanding when humans do it better, Looking for the simple solution. **Seeing AI in space:** Observing the universe, Seeing clearly for the first time, Finding new places to go, Considering the evolution of the universe, Creating new scientific principles, Performing space mining, Harvesting water, Obtaining rare earths and other metals, Finding new elements, Enhancing communication, Exploring new places, Starting with the probe, Relying on robotic missions, Adding the human element, Building structures in space, Taking your first space vacation, Performing scientific investigation, Industrializing space, Using space for storage. **Adding new human occupations:** Living and working in space, Creating cities in hostile environments, Building cities in the ocean, Creating space-based habitats, Constructing moon-based resources, Making humans more efficient, Fixing problems on a planetary scale, Contemplating how the world works, Locating potential sources of problems, Defining potential solutions, Seeing the effects of the solutions, Trying again.	

Text Books:

1) John Paul Mueller and Luca Massaron, Artificial Intelligence for Dummies, John Wiley and Sons, 2018.

Reference Books:

1) Utpal Chakraborthy, Artificial Intelligence for all, BPB Publications, Feb. 2020.
2) Praphat Kumar, Artificial Intelligence, BPB Publications, Jan. 2019.
3) Nils J. Nilsson, The Quest for Artificial Intelligence: A History of Idea and Achievements, Stanford University, Camridge University Press, 2010.
4) Bernard Marr, Artificial Intelligence: How 50 Successful Companies used Artificial Intelligence to solve Problems, Wiley Publications, 2019.

Code: UAI306L	Problem Solving with Python Lab.	02-Credits
Hrs/Week: (02+02)		CIE Marks:50
Total Hours:28		SEE Marks:50

Course outcomes:

On the successful completion of this course, students are able to:

1. Write, test, and debug simple Python programs with conditionals and loops.
2. Develop Python programs step-wise by defining functions and calling them.
3. Use Python lists, Tuples, Dictionaries for representing compound data.
4. Read and Write data from/to files in Python.
5. Display drawing in the canvas and design GUI using widgets of python.

UNIT - I	07 Hrs
Data types in python: Comments in python, Doc strings, How python sees variables, Data types in python, built in data type, bool data type, Sequences in python, Sets, Literals in python, Determining the data type of a variable, user defined data types , constants in data type, Identifiers and reserved words, Naming conventions in python. **Operators in Python:** Operator, arithmetic operator, using python interpreter as a calculator, assignment operator, unary minus operator, relational operators, logical operators, boolean operators, bitwise operators, membership operators, identity operators, operator precedence and Associativity, Mathematical functions, using IDLE window, using command line window, executing at system prompt. **Input and Output:** Output statements, Input statements, Command Line arguments. **Control Statements:** Control statements, the if statement, a word on indentation, the if else statement, the if elif else statement, the while loop, the for loop, infinite loops, nested loops, the else suite, the break statement, the continue statement, the pass statement, the assert statement, the return statement.	
UNIT – II	**07 Hrs**
Arrays in Python: Array, advantages of array, creating an array, importing the array module, indexing and slicing on array, processing the arrays, types of arrays, working with arrays using numpy, creating arrays using array, creating arrays using linespace, creating arrays using log space, creating arrays using arrange function, creating arrays using zeros and ones functions, mathematical operations on arrays, comparing arrays, aliasing the arrays, viewing and copying arrays, slicing and indexing in numpy arrays, dimensions of arrays, attributes of an arrays, the reshape method, the flatten method, working with multi-dimensional arrays, indexing in multi dimensional arrays, slicing the multi dimensional arrays, matrices in numpy, getting diagonal elements of a matrix, finding maximum and minimum elements, finding sum and average of elements, products of elements, sorting the matrix, transpose of a matrix, matrix addition and multiplication, random numbers. **Strings and Characters:** Creating strings, length of a string, indexing in strings, slicing the strings, repeating the string, concatenation of strings, checking membership, comparing strings, removing spaces from a string, finding sub string, counting substrings in a string, strings are immutable, replacing a string with another string, splitting and joining stings, changing case of a string, checking starting and ending of a string, string testing methods, formatting the strings, working with characters, sorting strings, searching in the strings, finding number of characters and words, inserting sub string into a string. **Functions:** Difference between a function and a method, defining a function, calling a function, Returning Results from a	

function, Returning multiple values from a function, functions are first class objects, pass by object reference, Formal and actual arguments, positional arguments, keyword arguments, default arguments, variable length arguments, local and global variables, the global keyword, passing a group of elements to a function, recursive functions, anonymous functions or lambdas, F unction decorators, generators, structured programming, creating our own modules in python, the special variable name.

UNIT - III	**07 Hrs**

Lists and Tuples: Lists, creating lists using range function, updating the elements of a list, concatenation of two lists, repetition of lists, membership in lists, aliasing and cloning lists, methods to process lists, finding biggest and smallest elements in a list, sorting the list elements, number of occurrences of an elements in the list, finding common elements in two lists, storing different types of data in a list, nested list, nested lists as matrices, list comprehensions, Tuples, creating tuples, accessing the tuple elements, basic operations on tuples, functions to process tuples, nested tuples, inserting elements in a tuple, modifying elements of a tuple, deleting elements from a tuple. **Dictionaries:** Operations on dictionaries, dictionary methods, using of loop with dictionaries, sorting the elements of a dictionary using lambdas, converting lists into dictionary, converting strings into dictionary, passing dictionaries to functions, ordered dictionaries. **Regular Expressions in python:** Regular expressions, sequence characters in regular expressions, quantifiers in regular expressions, special characters in regular expressions, using regular expressions on files, retrieving information from a HTML file. **Exceptions:** Errors in a python program, exceptions, exception handling, types of exceptions, the except block, the assert statement, user-defined exceptions, logging the exceptions.

UNIT - IV	**07 Hrs**

Files in Python: Files, types of files in python, opening a file, closing a file, working with text files containing strings, knowing whether a file exists or not, working with binary files, the with statement, pickle in python, the seek and tell methods, Random accessing of binary files, random accessing of binary files using mmap, zipping and unzipping files, working with directories, running other programs from python program. **Date and Time:** The epoch, date and time now, combining date and time, formatting dates and times, finding durations using time delta, comparing two dates, sorting dates, stopping execution temporarily, knowing the time taken by a program, working with calendar module. **Graphical user Interfaces:** GUI in python, the root window, fonts and colors, working with containers, canvas, frame, widgets, button widget, arranging widgets in the frames, label widget, message widget, text widget, scrollbar widget, check button widget, radio button widget, entry widget, spin box widget, list box widget, menu widget.

Textbooks:

1. Dr. R. Nageswawa Rao, Core Python Programming, Dreamtech press, 2nd Edition 2018 (Chapter Numbers: 3,4,5,6,7, 8,9,10,11,16,17,18,22).

Reference Books:

1. Gowrishankar S. Veena A, Introduction to Python Programming, CRC Press Taylor & Francis Group, 1st Edition 2019.
2. Michael Urban and Joel Murach, Mike Murach Elizabeth Drake, Python Programming, 1st Edition, 2016.

Scheme and syllabus of BE 4th semester applicable to the students admitted during 2020-21 & lateral entry students admitted during 2021-22

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UMA431C	Statistics and Probability Distributions	3	3	--	--	50	50	100
2	UAI402C	Design and Analysis of Algorithms	4	3	2	--	50	50	100
3	UAI403C	Operating Systems	4	4	--	--	50	50	100
4	UAI404C	Introduction to Data Science	3	3	--	--	50	50	100
5	UAI405C	OOPS with Java Programming	3	3	--	--	50	50	100
6	UHS001N	Fundamentals of Quantitative Aptitude And Soft Skills	1	1	--	--	50	50	100
7	UAI406L	Design and Analysis of Algorithms Lab	1	--	--	2	50	50	100
8	UHS004M	Universal Human Values-II	--	3	--	--	--	--	--
8	UAI407L	Data Science Lab	1	--	--	2	50	50	100
9	UMA430M	Bridge course Maths –II	--	3	0	--	50	50	100
10	UHS126M	Constitution of India*	--	2	0	--	50	50	100
11	UHS488C	Samskruthika Kannada**	1	2	0	--	50	50	100
	UHS489C	Balake Kannada***							
		Total	**21**	**27**	**2**	**4**	**550**	**550**	**1100**

B. V. V. S	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS) BAGALKOT- 587 103 DEPT. OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Code:UAI402C	DESIGN AND ANALYSIS OF ALGORITHMS L:T:P:3:2:0	4 - Credits
Hrs/Week : 5 (3+2)		CIE Marks:50
Total Hours : 40+24		SEE Marks:50

UNIT - I	(10+6 hours)
Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures. **Fundamentals of the Analysis of Algorithm Efficiency:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, Example – Fibonacci Numbers. **Brute Force:** Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.	
UNIT – II	**(10+6 hours)**
Divide and Conquer: Mergesort, Quicksort, Binary Search, Binary Tree Traversals and Related Properties, Multiplication of Large Integers and Strassen's Matrix Multiplication. Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.	
UNIT - III	**(10+6 hours)**
Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction. **Space and Time Tradeoffs:** Sorting by Counting, Input Enhancement in String Matching, Hashing, B-Trees. **Dynamic Programming:** Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, Optimal Binary Search Trees. The Knapsack Problem and Memory Functions.	
UNIT - IV	**(10+6 hours)**
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Limitations of Algorithm Power:** Lower-Bound Arguments, Decision Trees, Problems Coping with the Limitations of Algorithm Power: Backtracking, Branch-and-Bound.	

Text Books:

1. "Introduction to The Design & Analysis of Algorithms", Anany Levitin, Pearson Education, 3rd Edition, 2017

Reference books:

1. "Introduction to Algorithms", Stein, PHI, 2nd Edition,
2. "Computer Algorithms", Horowitz E., Sahni S., Rajasekaran S., Galgotia Publications, 2001

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Code:UAI403C	OPERATING SYSTEMS L:T:P:4:0:0	4 - Credits
Hrs/Week : 4		CIE Marks:50
Total Hours : 52		SEE Marks:50

UNIT - I	13 Hrs

Introduction to operating systems, types and services:

Role of Operating systems: user view, system view: Types of OS, Batch Systems; Multiprogramming; Time Sharing; Distributed & Real time OS, Operating System structure; Operating System operations; Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines.

Process management: Process concept; Concepts of process: Process status, Process description, Process model, Operations on processes

UNIT – II	13 Hrs

Process management, threads and process synchronization

Process Scheduling: Basic concepts; scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling, Interprocess communication.

Threads: concepts, Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Thread scheduling.

Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

UNIT - III	13 Hrs

Deadlocks and memory management

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement; Allocation of frames.

UNIT - IV	13 Hrs

File system: concepts and implementation, secondary storage structures

File system: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management. Protection: Goals, principles and domain of protection, Access Matrix, Disk management and other issues**:** Disk management: Disk Structure and Scheduling.

Text Books:

1) Abraham Silberschatz, Peter Baer Galvin , Greg Gagne: Operating System 7th edition, Addison Wesley

Reference books:

1) D. M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002.

B. V. V. S	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS) BAGALKOT- 587 103 DEPT. OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Code:UAI404C	DATA SCIENCE L:T:P:3:0:0	3 - Credits
Hrs/Week : 3		CIE Marks:50
Total Hours : 40		SEE Marks:50

UNIT - I	10 Hrs
Introduction: Data Science. Applications of data science. Data science related to other field. Relationship between data science and Information science. Computational thinking. Skills for data science. Tools for data science. Issues of Ethics, Bias, and Privacy in Data Science. **Data: Introduction**: **Data types**: Structured Data, Unstructured Data, Challenges with Unstructured Data. **Data Collections**: Open Data, Social Media Data, Multimodal Data, Data Storage and Presentation. **Data Pre-processing**: Data Cleaning, Data Integration, Data Transformation, Data Reduction, Data Discretization.	
UNIT – II	**10 Hrs**
Techniques: Introduction, **Data Analysis and Data Analytics**, **Descriptive Analysis:** Variables, frequency Distribution, Measures of Centrality, Dispersion of a Distribution. **Diagnostic Analytics:** Correlations, Predictive Analytics, Prescriptive Analytics, Exploratory Analysis, **Mechanistic Analysis**: Regression. **Tools for data science:** Introduction, Getting Access to R, Getting Started with R**:** Basics, Control Structures, Functions, Importing Data. **Graphics and Data Visualization:** Installing ggplot2, Loading the Data, Plotting the Data. Statistics and Machine Learning: Basic Statistics, Regression, Classification, Clustering.	
UNIT - III	**10 Hrs**
Machine learning for data science: Machine Learning Introduction and Regression: Introduction, Machine Learning, Regression, Gradient Descent. **Unsupervised learning:** Introduction, Agglomerative Clustering, Introduction to Reinforcement Learning.	
UNIT - IV	**10 Hrs**
Applications, Evaluation, and Methods: Hands-On with Solving Data Problems: Introduction, Collecting and Analyzing Twitter Data, Collecting and Analyzing YouTube Data , Analyzing Yelp Reviews and Ratings. **Data Collection, Experimentation, and Evaluation: Data Collection Methods**: Surveys, Survey Question Types, Survey Audience, Survey Services, Analyzing Survey Data, Pros and Cons of Surveys, Interviews and Focus Groups, Why Do an Interview? Why Focus Groups? Interview or Focus Group Procedure, Analyzing Interview Data , Pros and Cons of Interviews and Focus Groups, Log and Diary Data, User Studies in Lab and Field, **Picking Data Collection and Analysis Methods:** Introduction to Quantitative Methods, Introduction to Qualitative Methods, Mixed Method Studies. **Evaluation:** Comparing Models, Training–Testing and A/B Testing, Cross-Validation.	
Text Books: 1) A hands on introduction to Data Science, Chirag Shah, Cambridge University Press, 2020.	

Reference books:

1) **"**Data Science from Scratch", Joel Grus, O'Rielly Publications, 2015.
2) **"** Introduction to Data Science", Laura Igual and Santi Segui, Springer International Publications, 2017

B. V. V. S	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS) BAGALKOT- 587 103 DEPT. OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Code:UAI405C	OBJECT ORIENTED PROGRAMMING WITH JAVA L:T:P:3:0:0	3 - Credits
Hrs/Week : 3		CIE Marks:50
Total Hours : 40		SEE Marks:50

UNIT - I	10 Hrs
Java Programming Fundamentals: Object Oriented programming features. **History and evolution of Java**: Java's lineage, bytecode, Java Buzzwords**,** An overview of Java, Data Types, Variables and Arrays, Operators, Control Statements. **Introducing Classes:** Class Fundamentals, Declaring Objects, Introducing Methods, Constructors, this keyword, garbage collection, method overloading.	
UNIT – II	**10 Hrs**
Inheritance: Inheritance Basics, Using Super, Creating a Multilevel Hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance. String Handling: The string constructors, string length, Special String Operations, Character Extraction, String Comparison, Searching Strings, Modifying a String. Packages and Interfaces: Packages, Access Protection.	
UNIT - III	**10 Hrs**
Importing packages and Interfaces. **Exception Handling:** Exception-Handling Fundamentals- Exception Classes, Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try Statements, throw and finally statements. **Multithreaded Programming:** The Java Thread Model, The Main Thread , Creating a thread Creating Multiple Threads, Using is Alive() and join(), Thread Priorities, Synchronization, Suspending, Resuming and Stopping Threads.	
UNIT - IV	**10 Hrs**
Files: The Stream Classes, Byte streams, Character Streams, Serialization and Console Class. **Collections:** Collections Overview, The Collection Interfaces: The collection Interface, The List Interface, The Set Interface, The Queue Interface and The Deque Interface. The Collection Classes (ArrayList, LinkedList), Accessing a Collection via an Iterator, Spliterators and Legacy Classes and Interface.	

Text Books:

1. Java The Complete Reference,- Herbert Schildt 9th Edition, MGH Education

Reference books:

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
2. Core Java Volume 1- Fundamentals, Cay S Horstmann ,Gary Cornell, 8th Edition Pearson Education.
3. Programming with Java, E Balagurusamy,6th Edition, MGH.

Scheme and Syllabus of BE 5th Semester 175 Credits

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1.	UAI501C	Principles of AI	3	3	--	--	50	50	50
2.	UAI502C	Machine Learning Algorithms	3	3	--	--	50	50	50
3.	UAI503C	Database Management Systems	3	3	--	--	50	50	50
4.	UAI504E	Professional Elective-I	3	3	--	--	50	50	50
5.	UAI505X	Open Elective-I	3	3	--	--	50	50	50
6.	UHS002N	Fundamentals of Quantitative Aptitude And Soft Skills	1	2	--	--	50	50	50
7.	UAI506L	AI and Machine Learning Lab	1	--	--	3	50	50	50
8.	UAI507L	Database Lab	1	--	--	3	50	50	50
9.	UAI508L	Robotics Lab	2	--	2	2	50	50	50
		Total	**21**	**17**	**2**	**8**	**450**	**450**	**900**

B. V. V. S's	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT- 587 103 DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Syllabus as per 175 Credits applicable to the students admitted to BE 5th semester during the academic year 2022-23

UAI501C	Principles of AI L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs
Introduction: What is AI? Foundations and History of AI. **Intelligent Agents:** Agents and environment, Concept of Rationality, The nature of environment, The structure of agents.	
UNIT – II	**10 Hrs**
Problem solving: Problem solving agents, Example problems, Searching for Solutions, Uninformed Search. **Strategies:** Breadth First search, Depth First Search, Iterative deepening depth first search.	
UNIT - III	**10 Hrs**
Informed Search Strategies: Heuristic functions, Greedy best first search, A*search. Heuristic Functions. **Logical Agents:** Knowledge–based agents, The Wumpus world, Logic, Propositional logic, Reasoning patterns in Propositional Logic. **First Order Logic:** Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.	
UNIT - IV	**10 Hrs**
Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution. **Uncertain Knowledge and Reasoning:** Quantifying Uncertainty: Acting under Uncertainty, Basic Probability Notation, Inference using Full Joint Distributions, Independence, Baye's Rule and its use. Wumpus World Revisited.	
Text Books: 1. Stuart J. Russell and Peter Norvig , Artificial Intelligence, 3rd Edition, Pearson, 2015.	
Reference Books: 1. Elaine Rich, Kevin Knight, Artificial Intelligence, 3rd edition, Tata McGraw Hill, 2013. 2. George F Lugar, Artificial Intelligence Structure and strategies for complex, Pearson Education, 5th Edition, 2011.	
Course Outcomes: **CO 1**. Apply knowledge of agent architecture, searching and reasoning techniques for different applications. **CO 2**. Analyze Searching and Inferencing Techniques. **CO 3**. Develop knowledge base sentences using propositional logic and first order logic **CO 4.** Demonstrating agents, searching and inferencing **CO 5**. Illustrate the application of probability in uncertain reasoning.	

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	2	2										2	3	
CO2		3											2	3	
CO3			3										2	3	
CO4			2	2	2								2	3	
CO5	1	2	2										2	3	

UAI502C	Machine Learning Algorithms L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I	10 Hrs
Introduction: Introduction to Machine Learning, Examples of Machine Learning Applications. Well posed learning problems, Designing Learning System, Perspectives and issues in Machine Learning. **Decision Tree Learning**: Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space search in decision tree learning, Inductive Bias in decision tree learning, Issues in decision tree learning	
UNIT – II	**10 Hrs**
Artificial Neural Networks (ANN): Introduction, Neural Network Representations, Appropriate Problems For Neural Network Learning, Perceptron, Multilayer Networks And The Back propagation Algorithm, Remarks On The Back propagation Algorithm, An Illustrative Example: Face Recognition. **Hypothesis and Performance Evaluation**: Basic Performance Criterion, Precision and recall, Other ways to measure Performance, Estimating Hypothesis Accuracy, Basics of Sampling Theory, General approach for deriving confidence intervals, difference in error of two hypothesis, comparing learning algorithms.	
UNIT - III	**10 Hrs**
Bayesian learning: Introduction, Bay's theorem, Maximum likelihood and least squared hypothesis, Maximum likelihood hypothesis for predicting probabilities, Minimum Description length principle, Bay's optimal classifier, Gibbs algorithm, Naive Bay's Classifier. An Example: Classify Text. **Instance Based Learning**: Introduction, k-Nearest Neighbor Learning, Locally Weighted Regression, Radial Basis function, and case based reasoning.	
UNIT - IV	**10 Hrs**
Dimensionality Reduction: Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multi dimensional scaling, Linear descreminant analysis, isomap, Locally Linear Embedding. **Clustering**: Introduction, Mixture Densities, K-means Clustering, Expectation Maximization Algorithm, Mixture Latent Variable models, Supervised learning after clustering, Hierarchical clustering, Choosing the number of clusters	
Text Books: 1. Tom Mitchell, Machine Learning, McGraw- Hill Publications, 2nd Edition, 2013. 2. Ethem Alpaydin, Introduction to Machine Learning, MIT press, Cambridge, Massachusetts,	

London, 2nd Edition, 2010.

Reference Books:

1. Trevor Hastie. Robert Tipeshirani, Jerome Fredman, Elements of Statistical Learning, Springer, 2nd Edition, 2010.
2. Luis Pedro Coelho and Willi Richart, Building Machine Learning Systems with Python, PACKT Publication, 2nd Edition, 2013. .

Course Outcomes:

CO1: Define machine learning and types of learning algorithms
CO2: Explain various machine learning algorithms.
CO3: Apply machine learning algorithm to solve problems of moderate complexity.
CO4: Analyze performance of algorithms by varying some parameters.
CO5: To formulate machine learning model for the simple problem.

Course Outcomes	Programme Outcomes											PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	3												2	2	
CO2	2												3	3	
CO3		2	3		2								3	3	
CO4			2		2								2	3	
CO5					3								2	2	2

B. V. V. S's

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT- 587 103
DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

UAI503C	Database Management Systems L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs
Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. **Overview of Database Languages and Architectures:** Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. Conceptual Data Modelling using Entities and Relationships: Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.	
UNIT – II	**10 Hrs**
Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. **Relational Algebra:** Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.	
UNIT - III	**10 Hrs**
SQL: Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL.Normalization: Database Design Theory-Introduction to Normalization using Functional and Multivalued **Dependencies:** Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms.	
UNIT - IV	**10 Hrs**
Transaction Processing: Introduction to Transaction Processing, Transaction and System concepts, Desirable properties of Transactions, Characterizing schedules based on recoverability, Characterizing schedules based on Serializability, Transaction support in SQL. **Concurrency Control in Databases:** Two-phase locking techniques for Concurrency control, Concurrency control based on Timestamp ordering, Multiversion Concurrency control techniques, Validation Concurrency control techniques, Granularity of Data items and Multiple Granularity Locking.	
Text Books: 1. Fundamentals of Database Systems, Ramez Elmasri and Shamkant B. Navathe, 7th Edition, 2017, Pearson.	

Reference books:

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill
2. SilberschatzKorth and Sudharshan, Database System Concepts, 6th Edition, Mc-GrawHill, 2013.
3. Coronel, Morris, and Rob, Database Principles Fundamentals of Design, Implementation and Management, Cengage Learning 2012.

Course Outcomes:

CO1: Provide a strong foundation in database concepts, technology, and practice.
CO2: Practice SQL programming through a variety of database problems.
CO3: Demonstrate the use of concurrency and transactions in database.
CO4: Design and build database applications for real world problems.

Course Outcomes	Programme Outcomes											PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	3	1										3		
CO2	2	3	3										3		
CO3	2	2	3										3		
CO4	3	3	3										3		

UAI504E	Computer Graphics with OpenGL L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I **10 Hrs**

Overview of Graphics Systems: Video Display Devices, Raster-Scan Displays, Graphics Workstations and Viewing Systems, Introduction to OpenGL, **Graphics Output Primitives:** Coordinate Reference Frames, Specifying A Two-Dimensional World-Coordinate Reference Frame in OpenGL, OpenGL Point Functions, OpenGL Line Functions, Line Drawing Algorithms: DDA, Bresenham's Line-Drawing Algorithm, OpenGL Curve Functions, Circle Generating Algorithms: Midpoint Circle Algorithm.**Attributes of Graphics Primitives**: OpenGL State Variables, Color and Grayscale, OpenGL Color Functions, OpenGL Point-Attribute Functions, OpenGL Line-Attribute Functions.

UNIT – II **10 Hrs**

Fill-Area primitives, OpenGL Polygon Fill-Area Functions, OpenGL Vertex Arrays, Pixel-Array Primitives, OpenGL Pixel-Array Functions, Character Primitives, OpenGL Character Functions, OpenGL Display Lists, OpenGL Display-Window Reshape Function.

Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, OpenGL Interactive Input-Device Functions, OpenGL Menu Functions, Designing a Graphical User Interface.

UNIT - III **10 Hrs**

Geometric Transformations-1: Basic Two-Dimensional Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two-Dimensional Composite Transformations, Other Two-Dimensional Transformations, Raster Methods for Geometric Transformations, OpenGL Raster Transformations, Transformations between Two-Dimensional Coordinate Systems.

Geometric Transformations-2: Geometric Transformations in Three-Dimensional Space, Three-Dimensional Translation, Three-Dimensional Rotation, Three-Dimensional Scaling, Composite Three Dimensional Transformations, Other Three Dimensional Transformations, Transformations between Three Dimensional Coordinate Systems, Affine Transformations, OpenGL Geometric

Transformations Functions.

UNIT - IV	10 Hrs

Two-Dimensional Viewing: The Two-Dimensional Viewing Pipeline, The clipping Window, Normalization and Viewport Transformations, OpenGL Two-Dimensional Viewing Functions, Clipping Algorithms, Two-Dimensional Point Clipping, Two-Dimensional Line Clipping: Cohen-Sutherland line Clipping, Polygon Fill-Area Clipping: Sutherlan-Hodgman Polygon Clipping, Curve Clipping, Text Clipping.

Viewing: Classical and Computer Viewing, Viewing with a Computer, Positioning of the Camera, Simple Projections, Projections in OpenGL, Hidden-Surface Removal, Interactive Mesh Displays, Parallel-Projection Matrices, Perspective-Projection Matrices, Projections and Shadows.

Text Books:

1. Computer Graphics with OpenGL, Donald Hearn and Pauline Baker, Pearson Education, 3rd Edition, 2004.

2. Interactive Computer Graphics A Top-Down Approach using OpenGL, Edward Angel Addison-Wesley, 5th Edition, 2008.

Reference books:

1. Computer Graphics using OpenGL, F.S.Hill Jr. Pearson Education, 2nd Edition, 2001.

2. Computer Graphics, James D. Foley, Andries Van Dam, Steven K Feiner, John F. Hughes, Addison-wesley, 1997.

Course Outcomes: At the end of the course the student will be able to:

CO1: Explain the fundamental concepts of computer graphics.

CO2: Implement the graphics algorithms to draw geometric primitives using OpenGL.

CO3: Develop an interactive 2D and 3D graphics applications.

CO4: Demonstrate 2D viewing and clipping algorithms.

CO5: Construct the graphical model with lighting and shading patterns.

Course	Programme Outcomes	PSO	PSO	PSO

Outcomes													**1**	**2**	**3**
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**			
CO1	3	3	1	3			2						1		
CO2	3	3	1	3			2						1		
CO3	3	3		3			2						1		
CO4	3	3		3			2						1		
CO5	3	3		3			2						1		

UHS002N	**Fundamentals of Quantitative**	**01-Credits**

Hrs/Week : 01	**Aptitude And Soft Skills**	CIE Marks:50
Total Hours:12	**L:T:P:2:0:0**	SEE Marks:50

Evaluation Methodology:

Continuous Internal Evaluation:

2CIEs with 30 Objective Questions in 60 minutes (2 x 15 marks)

1 CIE with Online Oral Evaluation in the form of a presentation/group discussion (15 marks)

1 assignment of 5 marks (average of weekly assignments)

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

B. V. V. S's

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT- 587 103
DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

UAI506L	AI and Machine Learning Lab L:T:P:0:0:2	01-Credits
Hrs/Week : 01		CIE Marks:50
Total Hours:12		SEE Marks:50

A. NO.	Assignment (Part A Artificial Intelligence)
1	Implement and Demonstrate Depth First Search Algorithm on Water Jug Problem
2	Implement and Demonstrate Best First Search Algorithm on any AI problem
3	Implement AO* Search algorithm.
4	Solve 8-Queens Problem using Hill-Climbing algorithm
5	Implementation of TSP using heuristic approach
6	Implement Tic-Tac-Toe game using python
7	Implementation of the problem solving strategies: Forward Chaining, Backward Chaining, Problem Reduction
8	Implement resolution principle on FOPL related problems
9	Implement Constraint Satisfaction Problem
10	Implement any Game and demonstrate the Game playing strategies
	Assignment (Part B Machine Learning)
1	Aim: Illustrate and Demonstrate the working model and principle of Find-S algorithm. Program: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
2	Aim: Demonstrate the working model and principle of candidate elimination algorithm. Program: For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3	Aim: To construct the Decision tree using the training data sets under supervised learning concept. Program: Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4	Aim: To understand the working principle of Artificial Neural network with feed forward and feed backward principle. Program: Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5	Aim: Demonstrate the text classifier using Naïve bayes classifier algorithm. Program: Write a program to implement the naive Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

6	Aim: Demonstrate and Analyse the results sets obtained from Bayesian belief network Principle. Program:- Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.
7	Aim: Implement and demonstrate classification algorithm using Support vector machine Algorithm. Program: Implement and demonstrate the working of SVM algorithm for classification.

B. V. V. S's	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT- 587 103 DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

UAI507L	**Database Management Systems Lab** **L:T:P:0:0:3**	**1-Credits**
Hrs/Week: 03		CIE Marks:50
Total Hours:12		SEE Marks:50

PART-A: SQL Programming ()

1. Design, develop, and implement the specified queries for the following problems using Oracle, MySQL, MS SQL Server, or any other DBMS under LINUX/Windows environment.
2. Create Schema and insert at least 5 records for each table. Add appropriate database constraints.

PART-B: Mini Project ()

- Use Java, C#, PHP, Python, or any other similar front-end tool.
- All applications must be demonstrated on desktop/laptop as a stand-alone or web based application (Mobile apps on Android/IOS are not permitted.)

PART-A

Sl. No	Assignment
1	Demonstrating creation of tables, applying the view concepts on the tables.
2	Implement the various concepts on constraints and update operations.
3	Demonstrate the concepts of JOIN operations
4	Introduce concepts of PLSQL and usage on the table.
5	Demonstrate the core concepts on table like nested and correlated nesting queries and also EXISTS and NOT EXISTS keywords.

PART- B
(Mini Project)

For any problem selected make sure that the application should have five or more tables indicative areas include; health care, salary management, office automation, etc.

B. V. V. S's	BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT- 587 103 DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

UAI508L	Robotics Lab (L:T:P:0:2:2)	2-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:24		SEE Marks:50

1. Write a C program to beep the buzzer at an interval of 2 seconds.
2. Write a C program to display a number in first row of LCD if it is odd number, else display in the second row of LCD.
3. Write a C program to on and off LED at regular interval of 5 seconds.
4. Write a C program to on LED whenever interrupt is raised.
5. Write a C program to move in a rectangular path where rectangle is of dimension 50X40
6. Write a C program to display counter values from 0 to 10 on LCD. A counter values starting from 0 to 10, with a gap of 1 second between each counter value increment. The display should stop after reaching 10 and should continue displaying it. The delay between each counter value increment has to be generated using Timer 5.
7. Write a C code to display the position of the obstacle on LCD using the front Sharp IR range sensor. The analog value of the Sharp sensor has to be converted into digital value and based on the digital value, you have to display the following on LCD:
8. When obstacle is between 10 cm to 20 cm, it should display "Obstacle is near".
9. When obstacle is between 20 cm to 50 cm, it should display "Obstacle is far".
10. When obstacle is between 50 cm to 80 cm, it should display "Obstacle is very far".
11. Write a C program to follow the white line using white line sensors on the device.
12. Write a C program to follow the black line using white line sensors on the device.
13. Write a C program to accelerate and decelerate the robot from its minimum to maximum speed and vice versa. The speed increment or decrement should happen at each Boot switch press; also the robot's current speed should be displayed on LCD. Initially the speed will be 0, on subsequent Boot switch press, the speed should be incremented by 63, and upon reaching the speed value 252, the subsequent Boot switch press should decrement the speed by 63. On reaching the speed 0, this cycle of incrementing and decrementing the robot's speed shall continue.

Scheme and Syllabus of BE 3rd Sem (NEP, 160 credits)

Sl. No.	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA301C	Numerical Techniques and Integral Transforms	03	03	-	-	50	50	100
2.	PCC	21UAI312C	Data Structures and Applications	03	03	-	-	50	50	100
3.	PCC	21UAI316C	Computer Organization	03	03	-	-	50	50	100
4.	PCC	21UAI304C	AI and its Applications	03	03	-	-	50	50	100
5.	PCC	21UAI305C	Problem Solving with Python	03	03	-	-	50	50	100
6.	PCC	21UAI313L	Data Structures Lab	01	-	-	02	50	50	100
7.	PCC	21UAI314L	Python Programming Lab	01			02	50	50	100
8.	AEC	21UAI315C	Working with Office	01	01	-	-	50	50	100
9.	UHV	21UHS324C	UHV – 2	01	01	-	-	50	50	100
10.	HSSM	21UHS321C	CIP	01	01	-	-	50	50	100
			Total	**20**	**18**	**00**	**04**	**500**	**500**	**1000**

I-Integrated (Theory and Practical)

B. V. V. S's	**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS)** **BAGALKOT- 587 103** **DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

Syllabus as per NEP (160 Credits) applicable to the students admitted to BE 3rd semester during the academic year 2022-23

21UAI302C	**Data Structures and Applications** **L:T:P:3:0:0**	**03-Credits**
Hrs/Week:03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**
The stack: Definition and Examples: Primitive operations, An Example, The stack as an Abstract data type. Representing Stacks in C: Implementing pop operation, Testing for exceptional conditions, Implementing the push operations. , An Example- Infix, Postfix and Prefix: Basic Definitions and Examples, Evaluating a postfix expression, Program to evaluate a postfix expression, Limitations of the program, Converting an expression from Infix to Postfix, Program to convert an expression from Infix to Postfix.	
UNIT – II	**10 Hrs**
Recursion: Recursive definition and processes: The factorial function, Properties of recursive definitions or Algorithms. , Recursion in C: Factorial in C., writing recursive programs: The Towers of Hanoi Problem. **Queues: The queue and its sequential representation**: The queue as an abstract data type, C implementation of queues, The insert operation, The priority queue, Array implementation of a priority queue**.** **Lists: Linked lists**: Inserting and removing nodes from a list, Linked implementation of stacks, The getnode and freenode operations, Linked implementation of queues, The linked list as a data structure, Examples of list operations, List implementation of priority queues, Header Nodes.	
UNIT - III	**10 Hrs**
Lists in C: Array implementation of lists, Limitations of the array implementation, Allocating and freeing dynamic variables, Linked lists using dynamic variables, Queues as lists in C, Examples of list operations in C, Non integer and non homogeneous lists, Comparing the dynamic and array implementation of lists, Implementing Header Nodes. An example: simulation using linked lists. **Other list structures**: Circular lists, The stack as a circular list, The queue as a circular list, Primitive operations on circular lists, The Josephus problem, Header nodes, Addition of long positive integers using circular lists**.**	
UNIT - IV	**10 Hrs**
Trees: Binary trees: Basics, Operation on Binary trees, Applications of Binary trees. Binary tree representations: Node representations of Binary trees, Node Representation of binary trees, Internal & external nodes, Implicit array representation of Binary trees, Choosing a Binary tree representation, Binary tree traversal in C, traversal using a father field, heterogeneous binary trees. **Trees and their applications**: C representation of trees, Tree traversals, General expressions as trees, Evaluating an expression tree, Constructing tree.	

Text Books:

1. Data structure using C", Aaron M. Tennenbaum, Yedidyah Langsam and Moshe J. Augenstein, Pearson Education/PHI 2006.

Reference books:

1. Behrouz A. Forouzan and Richard F. Gilberg, Thomson, "Computer Science A structured Programming Approach using C", II edition, 2003.
2. Richard F. Gilberg and Behrouz, "Data structures A pseudo code approach with c ", Thomson, 2005.
3. Robert Kruse and Breuse Leung, "Data structures and program Design in C", PEARSON Education, 2007.
4. Ellis Horowitz and Sartaj Sahni, Fundamentals of Data Structures in C, 2nd Ed, Universities Press, 2014.
5. Seymour Lipschutz, Data Structures Schaum's Outlines, Revised 1st Ed, McGraw Hill, 2014.
6. Reema Thareja, Data Structures using C, 3rd Ed, Oxford press, 2012.

Course Outcomes:

CO 1. Identify different data structures and their applications

CO 2. Apply stack and queues in solving problems.

CO 3. Demonstrate applications of linked list.

CO 4. Explore the applications of trees to model and solve the real-world problem.

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	2	2										1		
CO2		3	3	2	1								1		
CO3		3	3	2	1								1		
CO4		3	3	2	1								1		

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS)
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B. V. V. S's

21UAI303C	**Computer Organization L:T:P:3:0:0**	**03-Credits**
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**
Simplification of Boolean Expressions: K-maps and The Quine-McCluskey method. Logic Design with MSI Components, Flip- Flops, **Counters:** Binary adders and subtractors, Decimal adders, Comparators, Decoders, Multiplexers. The basic Bi-stable element, Latches, Master-Slave flip-flops (Pulse-Triggered flip-flops), Edge triggered flipflops, Characteristic equations, Registers, Counters, Design of synchronous counters.	
UNIT – II	**10 Hrs**
Basic structure of Computers: Computer types, Functional Units, Basic operational concepts, Bus structures. **Machine instructions and programs:** Numbers, Arithmetic operations and characters, Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes.	
UNIT - III	**10 Hrs**
Input/output organization: Accessing I/O devices, Interrupts - Interrupt hardware, Enabling and Disabling interrupts, Handling multiple devices, Controlling device requests, Exceptions, Direct memory access - Bus arbitrations, Buses - Asynchronous bus and Synchronous bus, Interface circuits - Parallel port and serial port, Standard I/O Interfaces - Peripheral component interconnect Bus, SCSI bus, USB. **The memory system:** Some basic concepts, Semiconductor RAM memories - Internal organization of memory chips, Static memories, Syncronous DRAMs, Syncronous DRAMs, Read only memories, speed, size, and cost, cache memories.	
UNIT - IV	**10 Hrs**
Arithmetic Unit: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer Division. **Basic Processing Unit:** Some fundamental concepts, Execution of complete instruction, Hardwired control, Micro programmed control, Micro instructions.	

Text Books:

1. Donald D. Givone, Digital Principles and Design, McGraw Hill Edition 2002
2. Hamacher, Zvonko Vranesic, Safwat Zaky, 2002, "Computer Organization", Fifth Edition, MGH.

Reference books:

1. J. P. Hayes,1998, "Computer Architecture and Organization", 3th Edition, MGH.
2. William Stallings, 2007, "Computer Organization and Architecture", 7th Edition, PHI.

Course Outcomes:

CO1: Understand the basic concepts of Boolean algebra and digital logic design.
CO2: Explain the functional units, addressing modes, instruction formats and assembly programming.
CO3: Demonstrate the organization of various I/O devices and system memory hierarchy.

CO4: Design of arithmetic and basic processing units

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**			
CO1	3	1	3	2			1						1		
CO2	3	2	3	1			2								
CO3	3	1	3	1			1						1		
CO4	3	2	3	3			1						1		

B. V. V. S's	**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS)** **BAGALKOT- 587 103** **DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

21UAI304C	**AI and Its Applications** **L:T:P:3:0:0**	**03-Credits**
Hrs/Week:03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**
Introducing AI: Defining the Term AI, Discerning intelligence, Discovering four ways to define AI, Understanding the History of AI, Starting with symbolic logic at Dartmouth, Continuing with expert systems, Overcoming the AI winters, Considering AIUses, Avoiding AI Hype, Connecting AI to the Underlying Computer. **Defining the Role of Data**: Finding Data Ubiquitous in This Age, Understanding Moore's implications, Using data everywhere, Putting algorithms into action. **Considering the Use of Algorithms:** Understanding the Role of Algorithms, Understanding what *algorithm* means, Starting from planning and branching, Playing adversarial games, Using local search and heuristics, Discovering the Learning Machine, Leveraging expert systems, Introducing machine learning, Touching new heights. **Pioneering Specialized Hardware:** Relying on Standard Hardware, Understanding the standard hardware, Describing standard hardware deficiencies, Using GPUs, Considering the Von Neumann bottleneck, Defining the GPU, Considering why GPUs work well, Creating a Specialized Processing Environment, Increasing Hardware Capabilities, Adding Specialized Sensors, Devising Methods to Interact with the Environment.	
UNIT – II	**10 Hrs**
Seeing AI Uses in Computer Applications: Introducing Common Application Types, Using AI in typical applications , Realizing AI's wide range of fields, Considering the Chinese Room argument, Seeing How AI Makes Applications Friendlier, Performing Corrections Automatically, Considering the kinds of corrections, Seeing the benefits of automatic corrections, Understanding why automated corrections don't work, Making Suggestions,Gettingsuggestionsbasedonpastactions,Gettingsuggestionsbasedongroups, Obtaining the wrong suggestions, Considering AI-based Errors. **Using AI to Address Medical Needs:** Implementing Portable Patient Monitoring, Wearing helpful monitors , Relying on critical wearable monitors, Using movable monitors, Making Humans More Capable, Using games for therapy ,Considering the use of exoskeletons, Addressing Special Needs , Considering the software-based solutions , Relying on hardware augmentation, Seeing AI in prosthetics , Completing Analysis in New Ways, Devising New Surgical Techniques, Making surgical suggestions , Assisting a surgeon, Replacing the surgeon with monitoring, Performing Tasks Using Automation, Working with medical records, Predicting the future, Making procedures safer, Creating better medications, Combining Robots and Medical Professionals. **Relying on AI to Improve Human Interaction:** Developing New Ways to Communicate, Creating new alphabets, Automating language translation, Incorporating body language, Exchanging Ideas, Creating connections, Augmenting communication, Defining trends , Using Multimedia , Embellishing Human Sensory Perception, Shifting data spectrum, Augmenting human senses	

UNIT - III	10 Hrs
Performing Data Analysis for AI: Defining Data Analysis, Understanding why analysis is important, Reconsidering the value of data, Defining Machine Learning, Understanding how machine learning works. Understanding the benefits of machine learning, Being useful; being mundane, Specifying the limits of machine learning, Considering How to Learn from Data, Supervised learning, Unsupervised learning, Reinforcement learning. **Employing Machine Learning in AI:** Taking Many Different Roads to Learning, Discovering five main approaches to AI learning, Delving into the three most promising AI learning, approaches, Awaiting the next breakthrough, Exploring the Truth in Probabilities, Determining what probabilities can do, Considering prior knowledge, Envisioning the world as a graph, Growing Trees that Can Classify, Predicting outcomes by splitting data, Making decisions based on trees, Pruning overgrown trees. **Developing Robots and flying with drones:** Defining Robot Roles, Overcoming the sci-fi view of robots , Knowing why it's hard to be a humanoid, Working with robots, Assembling a Basic Robot , Considering the components, Sensing the world , Controllingarobot,AcknowledgingtheStateoftheArt,Flyingunmannedtomissions,Meeting the quadcopter, Defining Uses for Drones, Seeing drones in non military roles, Powering up drones using AI, Understanding regulatoryissues.	
UNIT - IV	**10 Hrs**
Understanding the Non starter Application: Using AI Where It Won't Work, Defining the limits of AI, Applying AI incorrectly, Entering a world of unrealistic expectations, Considering the Effects of AI Winters, Understanding the AI winter, Defining the causes of the AI winter, Rebuilding expectations with new goals, Creating Solutions in Search of a Problem, Defining a gizmo, Avoiding the infomercial, Understanding when humans do it better, Looking for the simple solution. **Seeing AI in Space:** Observing the Universe, Seeing clearly for the first time, Finding new places to go, Considering the evolution of the universe, Creating new scientific principles, Performing Space Mining, Harvesting water, Obtaining rare earths and other metals, Finding new elements, Enhancing communication, Exploring New Places, Starting with the probe, Relying on robotic missions, Adding the human element, Building Structures in Space , Taking your first space vacation, Performing scientific investigation, Industrializing space, Using space for storage. **Adding New Human Occupations:** Living and Working in Space, Creating Cities in Hostile Environments, Building cities in the ocean, Creating space-based habitats , Constructing moon-based resources, Making Humans More Efficient, Fixing Problems on a Planetary Scale, Contemplating how the world works, Locating potential sources of problems, Defining potential solutions, Seeing the effects of the solutions, Trying again.	
Text Books: 1. "Artificial Intelligence for Dummies" by John Paul Mueller and Luca Massaron, Published by: John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030-5774, www.wiley.com, Copyright © 2018 by John Wiley & Sons, Inc., Hoboken, New Jersey, Published simultaneously in Canada.	

Reference books:

1. **"**Artificial Intelligence for all", Utpal Chakraborthy, BPB Publications, Feb2020
2. "Artificial Intelligence", Dr. Praphat Kumar, BPB Publications, Jan2019
3. "The Quest for Artificial Intelligence:A History of Idea and Achievements", Nils J.Nilsson, Stanford University , Cambridge University Press,2010.
4. "Artificial Intelligence: How 50 Sucessful Companies used Artificial Intelligence tosolve problems, Bernard Marr, Wiley Publications,2019.

Course Outcomes:

CO 1. Demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations

CO2. Demonstrate proficiency in usage of hardware and software platforms for AI based applications

CO 3. Demonstrate awareness and a fundamental understanding of various applications of AI techniques

CO 4. Demonstrate an ability to share in discussions of AI, its current scope and limitations, and societal implications.

Course Outcomes	Programme Outcomes												PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	2	1	1										1	3	
CO2	1	3	3		3								1	3	3
CO3	1	2	2										1	3	1
CO4	1	1	1			1		1					1	3	2

B. V. V. S's	**BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS)** **BAGALKOT- 587 103** **DEPARTMENT OF ARTIFICIAL INTELLIGENCE & MACHINE LEARNING**

21UAI305C	**Problem Solving with Python** **L:T:P:3:0:0**	**03-Credits**
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**
Python Basics, Entering Expressions into the Interactive Shell, The Integer, Floating-Point, and String Data Types, String Concatenation and Replication, Storing Values in Variables, Your First Program, Dissecting Your Program, Flow control, Boolean Values, Comparison Operators, Boolean Operators, Mixing Boolean and Comparison Operators, Elements of Flow Control, Program Execution, Flow Control Statements, Importing Modules, Ending a Program Early with sys.exit(), Functions, def Statements with Parameters, Return Values and return Statements, The None Value, Keyword Arguments and print(), Local and Global Scope, The global Statement, Exception Handling.	
UNIT – II	**10 Hrs**
Lists, The List Data Type, Working with Lists, Augmented Assignment Operators, Methods, Example Program: Magic 8 Ball with a List, List-like Types: Strings and Tuples, References, Dictionaries and Structuring Data, The Dictionary Data Type, Pretty Printing, Using Data Structures to Model Real-World Things, Manipulating Strings, Working with Strings, Useful String Methods.	
UNIT - III	**10 Hrs**
Pattern Matching with Regular Expressions, Finding Patterns of Text Without Regular Expressions, Finding Patterns of Text with Regular Expressions, More Pattern Matching with Regular Expressions, Greedy and Non greedy Matching, The findall() Method, Character Classes, Making Your Own Character Classes, The Caret and Dollar Sign Characters, The Wildcard Character, Review of Regex Symbols, Case-Insensitive Matching, Substituting Strings with the sub() Method, Managing Complex Regexes, Combining re .IGNORECASE, re .DOTALL, and re .VERBOSE, Project: Phone Number and Email Address Extractor, Reading and Writing Files, Files and File Paths, The os.path Module, The File Reading/Writing Process, Saving Variables with the shelve Module, Saving Variables with the pprint. pformat() Function, Project: Generating Random Quiz Files.	
UNIT - IV	**10 Hrs**
Classes and objects, Programmer-defined types, Attributes, Rectangles, Instances as return values, Objects are mutable, Copying, Classes and functions, Time, Pure functions, Modifiers, Prototyping versus planning, Classes and methods, Object-oriented features, Printing objects, Another example, A more complicated example, The init method, The __str__ method, Operator overloading, Type-based dispatch, Polymorphism, Interface and implementation, Inheritance, Card objects, Class attributes, Comparing cards, Decks, Printing the deck, Add, remove, shuffle and sort, Inheritance, Class diagrams, Data encapsulation.	
Text Books: 1. Al Sweigart, "Automate the Boring Stuff with Python",1 st Edition, No Starch Press, 2015. (Available under CC-BY-NC-SA license at https://automatetheboringstuff.com/) (Chapters 1 to 18)	

2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (Available under CC-BY-NC license at http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 13, 15, 16, 17, 18) (Download pdf/html files from the above links)

Reference books:

1. Database management systems, Ramakrishnan, and Gehrke, 3rd Edition, 2014, McGraw Hill.
2. Core Java Volume 1- Fundamentals, Cay S Horstmann ,Gary Cornell, 8th Edition Pearson Education.
3. Programming with Java, E Balagurusamy,6th Edition, MGH.

Course Outcomes:

1. Learn the syntax and semantics of Python programming language.
2. Illustrate the process of structuring the data using lists, tuples and dictionaries.
3. Demonstrate the use of built-in functions to navigate the file system.
4. Implement the Object Oriented Programming concepts in Python.

Course Outcomes	Programme Outcomes											PSO 1	PSO 2	PSO 3
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	3	1	1										3		
CO2	3	3	3										3		
CO3	3	2	2										3		
CO4	3	1	2										3		

B. V. V. S's

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS)
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21UA313L	**Data Structures Lab** **L:T:P:0:0:2**	**01-Credits**
Hrs/Week : 03		CIE Marks:50
Total Hours:40		SEE Marks:50

S. No.	Assignment
1.	Program on implementation of Stack using ADT
2.	Program on applications of stack using ADT
3.	Program on recursion
4.	Program on implementation of different types queues using ADT
5.	Program on developing stack and queue using linked list using ADT
6.	Program on implementing different operations on linked list using ADT
7.	Program on applications of linked lists using ADT
8.	Program on creation of BT and BST using ADT

Course Outcomes:

1. Design generic and reusable C code to implement ADT's for linear data structures like stack, queue, linked list and non linear data structures BT and BST and use the same to solve real time applications.
2. Compile, debug and execute the above C codes and analyze the output for different test cases.

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B. V. V. S's

21UAI314L	Python Programming Lab L:T:P:0:0:2	01-Credits
Hrs/Week : 03		CIE Marks:50
Total Hours:40		SEE Marks:50

Sl. No.	Assignment
1.	Implementation of Python fundamentals, data types, operators, flow control and exception handling in Python
2.	Demonstrating creation of functions, passing parameters and return values
3.	Demonstration of manipulation of strings using string methods
4.	Discuss different collections like list, tuple and dictionary
5.	Demonstration of pattern recognition with and without using regular expressions
6.	Demonstration of reading, writing and organizing files.
7.	Demonstration of the concepts of classes, methods, objects and inheritance
8.	Demonstration of classes and methods with polymorphism and overriding
9.	Demonstration of working with excel spreadsheets and web scraping
10.	Demonstration of working with PDF, word and JSON files

Course Outcomes:

CO 1. Demonstrate proficiency in handling of loops and creation of functions.
CO 2. Identify the methods to create and manipulate lists, tuples and dictionaries.
CO 3. Discover the commonly used operations involving regular expressions and file system.
CO 4. Interpret the concepts of Object-Oriented Programming as used in Python.
CO 5. Determine the need for scraping websites and working with PDF, JSON and other file formats.

B.V.V.S.
BASAVESHWAR ENGINEERIGN COLLEGE (Autonomous)
BAGALKOT-587103
An Autonomous Institution under Visvesvaraya Technological University
Belgaum – 590014, Karnataka. India

Syllabus III & IV Semester
2020-21 (175 credits) Admitted Batch

DEPARTMENT OF AUTOMOBILE ENGINEERING

Institution Vision and Mission

Vision

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio economic development.

Mission

- To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change
- To carry out innovative cutting edge research and transfer technology for industrial and societal needs
- To imbibe moral and ethical values and develop compassionate, humane professionals

Department Vision and Mission

VISION

To nurture academic excellence in the field of automobile engineering with innovative and challenging attitudes to social needs.

MISSION

1. To disseminate the knowledge to build the outstanding professionals in automobile engineering through teaching learning process.
2. To develop platform for higher learning, research and industry institute interaction to face global challenges inculcated with human and social values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To prepare the students with knowledge in basic science and engineering to meet global challenges
PEO2	To develop the students in automotive engineering, thermal, design, manufacturing, autotronics in line with present technology
PEO3	To develop the students as entrepreneurs and encourage to pursue higher education and research

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Apply engineering basic knowledge with modern computing tools in solving problems of design, production and servicing domains
PSO2	Mould and develop engineers to serve in industries as professionals or entrepreneur
PSO3	Prepare engineers to undertake research and higher learning

PROGRAMME OUTCOMES (POs)

Sl. No	Programme Outcomes	
PO 1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SCHEME OF TEACHING AND EXAMINATION FOR THE STUDENTS ADMITTED TO SECOND YEAR IN 2020-21

III SEMESTER

Sl. No	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UMA333C	Computational Methods for Mechanical Science	3	3	0	0	50	50	**100**
2	UAU312C	Thermodynamics	4	3	2	0	50	50	**100**
3	UAU313C	Production Technology	3	3	0	0	50	50	**100**
4	UAU314C	Mechanics of Materials	4	3	2	0	50	50	**100**
5	UAU325C	Automotive Chassis	3	3	0	0	50	50	**100**
6	UAU306C	Material Science and Metallurgy	3	3	0	0	50	50	**100**
7	UAU317L	Computer Aided Machine Drawing	1	0	0	2	50	50	**100**
8	UAU328L	Machine Shop Practice	1	0	0	2	50	50	**100**
9	UHS388C	Samskruthika Kannada#	1	2	0	0	50	50	**100**
	OR								
	UHS389C	Balake Kannada$							
10	UMA330M	Bridge Course Mathematics - I*	--	3	0	0	50	50	**100**
11	UBT133M	Environmental Studies*	--	2	0	0	50	50	**100**
		Total	**23**	**20/ 25***	**04**	**04**	**450/ 550***	**450/ 550***	**900/ 1100***

***Bridge course Mathematics – I** Mandatory subject only for lateral entry Diploma students admitted to 3rd Semester during academic year 2019-20. Passing this subject is compulsory, however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.

***Environmental studies:** Mandatory subject for lateral entry students. Question papers will be of objective type. Students have to pass the subject compulsorily, however, marks will not be considered for awarding Grade/Class/Rank.

 # Samskruthika Kannada: For students, **who speak, read and write Kannada.**

$Balake Kannada: For Non-Kannada speaking, reading and writing students

QUESTION PAPER PATTERN:

1. Total of **8** Questions with **2** from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than **4** sub divisions.
3. Any **Five** Full questions are to be answered choosing at least **one** from each unit.

Branches: Mechanical Engineering, Industrial Production & Automobile Engineering.

UMA333C: Computational methods for mechanical science

3 Credits (3-0-0)

Course Objectives:

- To enable the students to apply the knowledge of Mathematics in various engineering fields by making them
- To understand the numerical method of solving algebraic and transcendental equations.
- To determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
- To solve the first order first degree ordinary differential equations numerically.
- To obtain numerical solution of partial differential equation.
- Able to extremes the functional using integration technique

Course outcomes:

On completion of this course, students are able

CO1: To know how root finding techniques can be used to solve practical engineering problems.

CO2: To apply the concept of finding approximate value of the derivative & definite integral for a given data using numerical techniques.

CO3: To apply numerical techniques to solve the first order first degree ordinary differential equations.

CO4: To apply partial differential techniques to solve the physical engineering problems.

CO5: To implement integration technique to determine the extreme values of a functional.

Unit-I

Numerical analysis – I: 10 Hours

Introduction to find root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae (without proof).Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

Unit-II

Numerical analysis-II: 10 Hours

Numerical Integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems. Numerical solution of ODE and PDE: Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula.

Unit-III

Fourier series: 10 Hours

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

Unit-IV

Fourier transforms: **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms.

Calculus of Variations:

Variation of a function and a functional, external of a functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

Total: 40 Hours

Resources:

1. **Numerical Methods for Engineers** by Steven C Chapra & Raymond P Canale.
2. **Higher Engineering Mathematics** by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. **Advanced Engineering Mathematics** By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. **Advanced Engineering Mathematics** by E Kreyszig (John Wiley & Sons)

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

Sl.No.	Title of the Subject : **Thermodynamics**	Sem:3 Code: UAU312C Credits: 4											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Define, state, classifications, and concepts of fundamentals of thermodynamic nomenclature.	3	1	1	2								1
2	Apply the knowledge to analyze and derive the thermodynamics equations.	3	3	1	3					1			1
3	Discuss and analyze laws of thermodynamics and to solve the problems.	3	3	2	1		2						1
4	Evaluate the various thermodynamics gas cycles and to solve the problems	3	3	2	3					2			1
5	Analyze the various thermodynamics vapour cycles and to solve the problems	3	2	1	2					2			1
6	Builds the foundation for preparing students to work in the area of thermal systems	3	3	1	2	1	2	2		2	2	1	1

UAU312C: THERMODYNAMICS
4 Credits (L-T-P: 3-2-0)

UNIT – I **10L +4T HOURS**

FUNDAMENTAL CONCEPTS AND DEFINITIONS: Thermodynamics; definition and scope. Microscopic and macroscopic approaches, some practical applications of engineering thermodynamic. Types of system, control volume and characteristics of system boundary and examples. Thermodynamic properties; Types of properties, intensive and extensive properties. Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic processes; thermodynamic equilibrium; definition, mechanical equilibrium, thermal equilibrium, chemical equilibrium, dithermic wall, Zeroth's law of thermodynamics, temperature; concepts, scales, measurement.

WORK AND HEAT: Mechanics definition of work and its limitations. Thermo dynamic definition of work with examples and sign convention. Displacement work; expressions for displacement work in various processes through PV diagrams. Shaft work; electrical work. Other types of work. Heat; definition, units and sign convention and umerical.

UNIT – II **10L +8T HOURS**

FIRST LAW OF THERMODYNAMICS: Joule's experiments, equivalence of heat and work. Statement of the first law of thermodynamics, extension of the first law to non – cyclic processes, energy, energy as a property, modes of energy, specific heat at constant volume, enthalpy, specific heat at constant pressure. Steady flow energy equation with umerical.

SECOND LAW OF THERMODYNAMICS: Heat reservoir, heat source and sink, heat engines, heat pump, refrigerator and COP. Kelvin – Planck and Clausius's statement of second law of thermodynamics; equivalence of the two statements and umerical. PMM – I and PMM – II. Reversible and irreversible processes; factors that make a process irreversible and Carnot cycle.

UNIT – III **10L +8T HOURS**

ENTROPY: Entropy – Clasius's inequality, statement, proof, application to a reversible cycle. QR/T as independent path. Entropy; definition, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations.

GAS POWER CYCLES: Air-standard cycles; Carnot, Otto, Diesel, dual and Stirling cycles, P-V and T-S diagrams, definition, efficiencies and mean effective pressure. Comparison of Otto and Diesel cycle.

UNIT – IV **10L +6T HOURS**

VAPOR POWER CYCLES: Carnot vapor power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T – S diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapor power cycles. Basic air conditioning system; air conditioning principles, air-conditioning types, temperature and pressure fundamentals, types of compressors and refrigerants.

TOTAL: 40L+26T HOURS

Text books

1. "**Basic and Applied Thermodynamics**" by P .K. Nag, Tata McGraw Hill, 5th Edi. 2012
2. "**Thermodynamics an engineering approach**", by Yunus A. Cenegal

Reference Books:

1. Spalding and Cole, Engineering Thermodynamics, ELBS Edition Longmans,1997.
2. Engineering Thermodynamics by J.B. Jones and G.A.Hawkins, John Wiley and Sons.
3. Arora C.P. Thermodynamics, TMH, 1998.
4. Gordan J. Van Wylen and Richard E.Sountag, Fundamentals of Classical Thermodynamics, 4th Edition, Wiley, 1994.

Sl. No.	**Title of the Subject : Production Technology**	Sem:3 Code: UAU313C Credits : 3											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Classify manufacturing processes & enumerate the process	3	1										1
2	Illustrate the fundamental principles of metal cutting processes and specify suitable machine tools	3	2	2		2				2			3
3	Suggest a suitable machining process for a given job	3	2	2		3							2
4	Recommend a suitable moulding /casting method (sand/special) & a melting furnace to cast given auto components.	3	2	2		3							2
5	Enumerate the process steps involved in a sand casting process and their applications.	3	1	3		2		1		2			1
6	Suggest a suitable welding Brazing/Soldering process for a given precision job.	3	2	2		2		1					3

UAU313C: PRODUCTION TECHNOLOGY
3 Credits (L-T-P: 3 – 0 – 0)

UNIT – I **10 HOURS**

INTRODUCTION: Concept of manufacturing process, its importance. Classification of manufacturing processes. Advantages and limitations.

CUTTING TOOL MATERIALS: Desired properties, types of cutting tool materials – HSS carbides coated carbides and ceramics, cutting fluids, types and selection. Machinability, factors affecting machinability.

THEORY OF METAL CUTTING: Single point cutting tool nomenclature, geometry, orthogonal and oblique cutting, mechanism of chip formation, types of chips.

TURNING: Classification, constructional features of Turret and Capstan lathe, tool layout. Machining time.

UNIT – II **10 HOURS**

SHAPING AND PLANNING MACHINES: Classification, constructional features, driving mechanisms, shaping and planning operations. Machining time.

DRILLING AND MILLING MACHINES: Classification, constructional features, drilling and related operations, types of drilling tools, drill bit nomenclature. Milling Machines**:** classification, constructional features, milling cutters, nomenclature, milling operations, up milling and down milling, indexing: Simple and compound indexing. Machining time.

UNIT – III **10 HOURS**

GRINDING MACHINES: Types of abrasives, bonding process, grade and structure of grinding wheels and types. Classification, constructional features. Selection of grinding wheel.

BROACHING PROCESS: Types of broaching machines – constructional details, applications.

NON-TRADITIONAL MACHINING PROCESSES: Need for non-traditional machining, operation and applications of Abrasive Jet Machining, Electric Discharge Machining, Electro Chemical Machining. Laser Beam Machining and Electron Beam Machining.

UNIT – IV **10 HOURS**

PATTERNS: Definition, functions, materials used for pattern, various pattern allowances. Classification of patterns.

SAND MOULDING: Types of base sand, requirement of base sand. Types of sand moulds, ingredients for different sand mixtures. Method used for sand moulding. Cores: Definition, need and types.

WELDING PROCESS: Definition, classification, application, arc welding, gas welding, TIG and MIG.

PRINCIPLES OF SOLDERING AND BRAZING: Different types of soldering and brazing methods, plastic welding techniques.

TOTAL: 40 HOURS

Text Books:

1. **HMT Hand book,** McGraw-Hill, Edition 38, 2016
2. **Production Technology,** R. K. Jain, Khanna Publication, New Delhi, 17 Edition – 2009
3. **Fundamentals of metal machining and machine tools**", G. Boothroyd, McGraw-Hill Publication. Edition 2007.

Reference Books:

1. Manufacturing Process-I, Dr. K. Radhakrishna, Sapna Book House, 2nd Edition 2007.
2. Process and Materials of Manufacturing**,** Roy A Lindberg, 4th Ed Pearson Edu. 2006
3. Manufacturing Technology Vol-I **, P.Radhakrishnan, Sceitch Publications,Chennai**

	Title of the Subject: Mechanics of Materials	Sem: 3	Code: UAU314C		Credits: 4								
	Programme Outcomes / Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To define the fundamental terms of mechanics of materials	2	2	2									2
2	To derive equations for the stresses, strains and deformations in structural elements subjected to different types of loads	3	2	2									2
3	To solve numerical problems using the analytical and graphical methods	3	3	3									2
4	To compute the bending / shear stresses and deflection of beams	3	3	3									2
5	The students are able to apply the concepts of solid mechanics in the design of simple machine elements.	3	3	3									2
6	Simulate the mechanical elements receiving axial compressive loads under different end conditions and determine their columnar stability	3	3	3						2			2

UAU314C: MECHANICS OF MATERIALS
4 Credits (L-T-P: 3-2-0)

UNIT – I **10L+6T HOURS**

SIMPLE STRESS AND STRAIN: Introduction, stress, strain, mechanical properties of materials, linear elasticity, Hooke's law and Poisson's ratio, stress – strain relation – behavior in tension for mild steel and non ferrous metals. Extension shortening of a bar, bars with cross sections varying in steps, bars with continuously varying (circular and rectangular), elongation due to self weight, principle of super position.

STRESS IN COMPOSITE SECTION: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

UNIT – II **10L+6T HOURS**

COMPOUND STRESSES: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

THICK AND THIN CYLINDERS: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), thick cylinders subjected to internal and external pressures (Lame's equation).

UNIT – III **10L+8T HOURS**

BENDING MOMENT AND SHEAR FORCE IN BEAMS: Introduction, types of beams, loads and reactions, shear forces and bending moments, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (UDL) and couple for different types of beams.

BENDING AND SHEAR STRESSES IN BEAMS: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, moment carrying capacity of a section, shearing stresses in beams, shear stress across rectangular, circular, symmetrical I and T sections. Frames and over hanging beams.

UNIT – IV **10L+6T HOURS**

DEFLECTION OF BEAMS: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and simply supported beams for point load, UDL, UVL and couple, Macaulay's method.

TORSION OF CIRCULAR SHAFTS AND ELASTIC STABILITY OF COLUMNS: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts. Introduction to columns, Euler's theory for axially loaded elastic long columns, derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

TOTAL 40L+26T HOURS

TEXT BOOKS:

1. **Mechanics of Materials,** SI Edition, Barry J. Goodno, James M. Gere Cengage Learning, 2017
2. **A TEXTBOOK OF STRENGTH OF MATERIALS,** Dr. R. K. BansalISBN :9788131808146 6th Edition, 2019

REFERENCE BOOKS:

1. Strength of Materials**,** 4th edition, S S Bhavikatti, Vikas Publishing, 2013

2. Mechanics of Materials, Beer , Johnston, Dewolf, Mazurek, Sanghi, Jul 2017

	Title of the Subject: Automotive Chassis	Sem:3 Code: UAU325C Credits: 3											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1.	Classify automotive layouts and enumerate the merits and demerits and their applications.	1											2
2.	Illustrate the construction and working of suspension systems and specify suitable suspension systems for vehicles	1											2
3.	Enumerate the classification and working of brakes and select suitable system for vehicles	2	3	2	1								2
4.	Classify steering systems and working and diagnose its trouble shooting	3	3	2	2								2
5.	Recommend tires and wheels for different vehicles	1											2
6.	Suggest a suitable front and rear axles for various types of vehicles	1		3	3								2

UAU325C: AUTOMOTIVE CHASSIS
3 Credits (L-T-P: 3-0-0)

UNIT – I **10 HOURS**

LAYOUTS AND FRAMES: Types of automobiles, different automobile layouts; front wheel drive, rear wheel drive, four wheel drive, rear engine layout. Types of frames, materials, different loads on frame, cross members, channel sections, sub frames, passenger car frames, x member type frame, truck frames, box section type frame, testing of frames, bending and torsion test, body construction and repairs, frame alignment and frame defects.

SUSPENSION: Objects, basic considerations, types of suspension springs; construction, rigid axle suspension, operation, materials of leaf springs, coil springs, torsion bar, rubber springs, helper springs, air suspension, shock absorbers, independent suspension; front and rear, stabilizer bars, active suspension systems, suspension systems for commercial vehicles trouble shooting. Numerical problems.

UNIT – II **10 HOURS**

STEERING SYSTEMS: Two wheeled steering system, four wheeled steering system, steering systems for multi axle vehicles and long wheeled chassis vehicles, steering mechanisms, correct steering angle, cornering force, self- righting torque, under steer and over steer, steering linkages, types of steering gear boxes: rack and pinion, recirculating ball type, etc. Steering ratio, turning radius, steering adjustment, steering columns, power steering; hydraulic and electronic, advanced steering systems, trouble shooting of steering systems. Numerical problems.

UNIT – III **10 HOURS**

BRAKES: Function, stopping distance, brake efficiency, weight transfer, determination of braking torque, classification of brakes, types, construction, operation of braking systems; mechanical, hydraulic, disc, drum. Details of hydraulic systems: master and wheel cylinder, diagonal split systems, bleeding of brakes, factors affecting brake fluid, pressure differential valve, proportioning valve, metering valve, brake adjustment. Brake compensation, parking brakes, hill holders, servo brakes, power brakes. Vacuum servo brakes, air brakes, vacuum – boosted hydraulic brakes. Auxiliary braking systems; retarders, exhaust brake, jake brakes.

UNIT – IV **10 HOURS**

WHEELS AND TYRES: Types of wheels, construction, wheel dimensions, structure and function, desirable tyre properties, types, materials, manufacture, designation, factors affecting tyre life, rotation and trouble shooting. Heat dissipation, wheel alignment and wheel balancing.

FRONT AXLE: Types of front axle, stub axle, materials, loads and stresses, drive line, construction working of drive shaft, types of drive shaft.

REAR AXLE: Types of drive, torque reaction, driving thrust, construction of rear axle supporting; fully floating, semi floating, three quarter floating arrangements, trouble shooting. Numerical problems.

TOTAL: 40HOURS

TEXT BOOKS:

1. **Automobile Engineering Vol. 1** (Chassis, Body), Dr. Kirpal Singh, 14th Edition/Reprint 2019 ISBN:9788180142420, Standard publications, New Delhi
2. **Automotive Chassis Engineering**, David C Barton, John D Fieldhouse, Springer, 2018

REFERENCE BOOKS:

1.The Automotive Chassis: Engineering Principles, Jornsen Reimpell, Helmut Stoll, Jurgen Betzler, Butterworth-Heinemann, Elsevier.

1. **Automotive Mechanics –** SIE Paperback , William Crouse, Donald Anglin, McGraw Hill, Jul 2017

Sl.No	Title of the Subject :Material science and metallurgy	Sem:3		Code: UAU306C						Credits: 3			
	Programme Outcomes / Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Discuss the structure of crystalline solids and laws governing the diffusion phenomena	3	3	1	1								1
2	Analyze the mechanical behavior of materials to solve problems	3	3	3	2		1	1					3
3	Illustrate terminologies related to metallurgy and analyze the application of phase diagrams	3	1	1	3								1
4	Recommend heat treatment process for engineering applications	3	2	1	1								1
5	Evaluate the utility of composite materials and its engineering applications	3	2	1	1		1						1
6	Select suitable alloying materials for an engineering application	3	2	1	2		1	1					3

UAU306C: MATERIAL SCIENCE AND METALLURGY
3 Credits (L-T-P: 3 – 0 – 0)

UNIT – I **10 HOURS**

CRYSTAL STRUCTURE: Fundamental concepts of unit cell space lattice, Bravais space lattices, unit cells for cubic structure and HCP, crystallographic planes and directions, Miller indices, calculations of radius, coordination number and atomic packing factor for different cubic structures. Crystal imperfections; point, line, surface and volume defects. Diffusion; diffusion mechanism, Fick's laws of diffusion.

MECHANICAL BEHAVIOR: Stress-strain diagram to show ductile and brittle behavior of materials, mechanism of elastic action, linear and nonlinear elastic properties, true stress and strain. Plastic deformation, dislocation, slips and twinning, fracture-types, stages in cup and cone, Griffith's criterion.

UNIT – II **10 HOURS**

FATIGUE: Stress cycles, effects of stress concentration, size effect, surface texture on fatigue, S-N curves, factors affecting fatigue life and protection methods.

CREEP: Creep curves, mechanisms of creep. Creep-resistant materials.

SOLIDIFICATION AND PHASE DIAGRAMS: Mechanism of solidification, homogeneous and heterogeneous nucleation, crystal growth, cast metal structures. Solid solutions – types, rules governing the formation of solids solutions. Phase diagrams: basic terms, Gibb's phase rule, construction of phase diagrams, interpretation of equilibrium diagrams, types of phase diagrams. Lever rule.

UNIT – III **10 HOURS**

IRON CARBON EQUILIBRIUM DIAGRAM: Phases in the Fe-C system, invariant reactions, critical temperatures, microstructure of slowly cooled steels, effect of alloying elements on the Fe-C diagram, ferrite and austenite stabilizers. TTT diagram, drawing of TTT diagram, TTT diagram for hypo and hyper-eutectoid steels, effect of alloying elements on TTT diagram.

HEAT TREATMENT OF STEEL: Definition and aims of heat treatment, annealing and its types, normalizing, hardening, tempering, martempering, austempering, surface hardening like case hardening, carburizing, cyaniding, nitriding, induction hardening, hardenability, Jominy end-quench test.

UNIT – IV **10 HOURS**

ENGINEERING ALLOYS: Properties, composition and uses of low, medium and high carbon steels. Steel designation and AISI – SAE designation. Cast irons, gray CI, white CI, malleable CI, SC iron. Microstructures of cast iron. Light alloys, Al, Mg and Titanium alloys. Copper and its alloys. Brasses and bronzes.

COMPOSITE MATERIALS: Definition, classification, types of matrix materials and reinforcements, fundamentals of production of FRP's, production of MMC's, advantages and applications of composites.

TOTAL: 40HOURS

Text books:

1. Smith, **Foundations of material science and engineering-5th** edition,McGraw Hill,2009 ISBN-10:0073529249 ISBN-13:978-0073529240
2. Murthy, **Structure and properties of engineering materials**, TATA McGraw Hill,2003, ISBN-007048287X9780070482876

Reference Books:

3. William D.Callister Jr. **"**Materials Science & Engineering- An Introduction" Wiley India Pvt. Ltd, New Delhi,2010 ISBN:9788126521432,8126521430
4. Donald R. Askland, Pradeep P.Phule Thomson, Essentials of Materials For Science And Engineering", Engineering, 2007
5. James F. Shackel Ford, **"**Introduction to Material Science for Engineering", 8th edition Pearson,Prentice Hall, New Jersey, 2015

	Title of the Subject : **Computer Aided Machine Drawing**	Sem:3		Code: UAU 317L								Credits : 1	
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to utilize CAD software to generate 2D and 3D models.	3	1			3							2
2	Utilize CAD software commands and develop sections of solids.	3	2			3							2
3	Able to convert orthographic views to isometric views using CAD software.	3	2			3							2
4	Utilize advanced commands to generate assembly drawings of mechanical components.	3	2			3							2

UAU317L: COMPUTER AIDED MACHINE DRAWING

1. **Review of graphic interface of the software**
   Review of basic sketching commands and navigational commands. Standard sheet templates, and creating new templates, different line types and their applications.

    2. **Section of solids:** sections of square pyramids, hexagonal prism, cones and cylinders**.**

    3. **Orthographic views:** Conventions used in machine drawings. Sectional planes, Conversion of pictorial views into orthographic projections of simple machine parts with or without section (Bureau of Indian Standards conventions are to be followed for the drawings). Dimensioning and annotations.

2. **Thread forms:** Thread terminology, sectional views of threads. ISO Metric (Internal & External), BSW
   (Internal & External) square and Acme, Sellers thread, American Standard thread.

3. **Fasteners :**
   Hexagonal head bolt, nut and washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut. Flanged nut, slotted nut, taper and split pin for locking, counter sunk head screw, grub screw, Allen screw.

4. **Keys & Joints**
   Parallel key, taper key, feather key, Gib head key and Woodruff key joint (socket and spigot), knuckle joint (pin joint) for two rods.

5. **Couplings**
   Split Muff coupling, protected type flanged coupling, pin (bush) .type flexible coupling, Oldham's coupling and universal coupling (Hooks' Joint) GT&D, symbols.

Assembly Drawings (Part drawings should be given)

1) Plummer block (Pedestal Bearing)
2) Screw jack (Bottle type)
3) Petrol Engine piston
4) I.C. Engine connecting rod.

Laboratory Assessment:

1. This subject is to be evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
    - Performance and preparation of drawings :
      10 sheets manually drawn shall be submitted and each sheet shall be evaluated for 3 marks.
    - One practical test for 20 marks. (5 mark for conversion from isometric to orthographic, 15 marks assembly and printing).
3. The SEE practical is conducted for 50 marks of three hours duration. The distribution of marks as 30% from orthographic view, 70 % for part modeling, assembling and creating 2 D views from assembly using CAD Software. No viva voce.
4. Question paper shall have two parts, questions for first part shall be asked from conversion of isometric to orthographic views and second part shall be asked from assembly.
5. Student should answer two questions choosing one question from each part. At least one question shall be asked from first 3 assemblies

Sl.No	Title of the Subject :Machine Shop Practice	Sem:3 Code: UAU328L Credits 1											
	Programme Outcomes / Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Develop skills to operate lathe for turning, facing, tapering, knurling, step turning, forming and threading operation.	3	2	2		2				2			2
2	Apply skills to develop jobs on shaper and slotting machine.	3	2	2		2				2			2
3	Apply skills to develop jobs using milling machine.	3	2	2		2				2			2
4	Apply skills to finish turned or milled jobs using surface grinder.	3	2	2		2				2			2
5	Calculate machining time for different operations.	3	2			2				2			2

UAU328L: MACHINE SHOP PRACTICE

1 Credit (0 – 0- 2)

PART – A

1. Minimum four jobs using lathe of following machining operations:
   Plain turning, taper turning, step turning, thread cutting, facing, knurling, eccentric turning.

12 HOURS

PART – B

4. Cutting of gear teeth using milling machine.
5. Cutting of V – groove / Dovetail / Rectangular groove using shaping machine.
6. Demonstration of surface grinding.

12 HOURS

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up: Marks for each experiment = 30 marks/No. of proposed experiments.
   b. One practical test for 20 marks. (5 write-ups, 10 conduction, calculation, results etc., 5 viva-voce).
7. **Allocation of 50 marks for SEE**

Lathe work	: 30 Marks
Shaping or Milling	: 10 Marks
Viva-Voce	: 10 Marks

BE IV SEMESTER

Sl. No.	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	**UMA433C**	**Statistical Methods for Mechanical Science**	3	3	0	0	50	50	**100**
2	**UAU412C**	**Fluid Mechanics**	3	3	0	0	50	50	**100**
3	**UAU433C**	**Theory of Machines**	4	3	2	0	50	50	**100**
4	**UAU424C**	**Design of Machine Elements – I**	4	3	2	0	50	50	**100**
5	**UAU415C**	**Theory of Automotive Engines**	3	3	0	0	50	50	**100**
6	**UAU416C**	**Automotive Transmission Systems**	3	3	0	0	50	50	**100**
7	**UHS001N**	**Fundamentals of Quantitative Aptitude and Soft Skills**	1	1	0	0	50	50	**100**
8	**UAU437L**	**Foundry and Forging Practice**	1	0	0	2	50	50	**100**
9	**UAU438L**	**IC Engine and Fuels Laboratory**	1	0	0	2	50	50	**100**
10	**UAU439L**	**Material Testing and Measurement Laboratory**	1	0	0	2	50	50	**100**
11	**UMA430M**	**Bridge course Mathematics – II***	--	3	0	0	50	50	**100**
12	**UHS226M**	**Constitution of India***	--	2	0	0	50	50	**100**
		Total	**24**	**19/ 24***	**04**	**06**	**500/ 600***	**500/ 600***	**1000/ 1200***

***Bridge course Mathematics – II** Mandatory subject only for lateral entry Diploma students admitted to 3rd Semester during academic year 2019-20. Passing this subject is compulsory, however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for Passing/not passing the subject.

***Constitution of India:** Mandatory subject for lateral entry students. Question papers will be of objective type. Students have to pass the subject compulsorily, however, marks will not be considered for awarding Grades/Class/Rank.

QUESTION PAPER PATTERN:

1. Total of **8** Questions with **2** from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than **4** sub divisions.
3. Any **Five** Full questions are to be answered choosing at least **one** from each unit.

Branches: Mechanical Engineering, Industrial Production & Automobile Engineering.

UMA433C: Mathematical methods for Mechanical science

3 Credits (3-0-0)

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

- To form a specific relation for the given group of data using least square sense method.
- To specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course outcomes:

On completion of this course, students are able

CO1: To apply the least square sense method to construct the specific relation for the given group of data.

CO2: To apply the concept of probability to find the physical significance of various distribution phenomena.

CO3: To apply the concept of probability to perform engineering duties in planning and designing, engines, machines and other mechanically functioning.

CO4: To apply the concept of probability to study the performance of Mechanical systems.

CO5: To apply the concept of Markov Chain for commercial and industry purpose.

Unit –I

Complex Variables: **10 Hours**

Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms)

Complex Integration:

Line integral, Cauchy's theorem – corollaries (without Proof), Cauchy's integral formula. Taylor’s and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy’s residue theorem (without proof) – problems.

Unit-II

Special Function: **10 Hours**

Series solution of Bessel’s differential equation, recurrence formulae, generating function, orthogonal property, Bessel's integral formula.

Unit –III

Statistics and Probability **10 Hours**

Statistics: Curve fitting by the method of least squares: $y=a+bx$, $y=ab^x$ and $y=a+bx+cx^2$

Correlation and regression.

Probability: addition rule, conditional probability, multiplication rule, Baye’s rule.

Unit –IV

Probability distributions: **10 Hours**

Binomial distributions Poisson distributions and Normal distributions (No drivations). Concept of joint probability, Joint distributions - discrete random variables, Independent random variables, Problems on expectation and variance.

Markov chains:

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

Total: 40 Hours

Resources:

1. **Higher Engineering Mathematics** by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. **Theory and problems of probability** by Seymour Lipschutz (Schaum's Series).
3. **Advanced Engineering Mathematics** by H. K. Dass
4. **Advanced Engineering Mathematics** by E Kreyszig (John Wiley & Sons)
5. **Probability and stochastic processes** by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. **Advanced Engineering Mathematics** by Peter V. O'Neil.

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

	Title of the Subject :Fluid Mechanics	Sem:4 Code: UAU 412C Credits 3											
	Programme Outcomes / **Course Outcome**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Demonstrate the basic concepts of fluid mechanics, properties and fluid statics	3	1		1		1						1
2	Compute force of buoyancy and floatation and analyze its conditions	3	3	1	1		1						1
3	Formulate equations of motion of fluid and apply to fluid flow measurements	3	1		1		1						
4	Apply principles of dimensional analysis, similitude and use dimensionless parameters to solve the problems	3	3	1	1		1						1
5	Identify and optimize the fluid flow to analyze the problems	3	3	1	1		1	1					3
6	Evaluate the characteristics of laminar flow and viscous effects to solve problems	3	3	1	1		1	1					2

UAU412C: FLUID MECHANICS

3 Credits (L-T-P: 3 - 0 - 0)

UNIT - I **10 HOURS**

PROPERTIES OF FLUIDS: Introduction, properties of fluids, classification of fluids, thermodynamic properties of fluids.

FLUID STATICS - PRESSURE AND ITS MEASUREMENT: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, absolute, gauge, atmospheric and vacuum pressure, simple manometers, differential manometers.

UNIT - II **10 HOURS**

FLUID STATICS- HYDROSTATIC FORCES ON SURFACES: Total pressure and center of pressure, vertical plane surface submerged in liquid, horizontal plane surface submerged in liquid, inclined plane surface submerged in liquid, curved surface submerged in liquid.

BUOYANCY AND FLOATATION: Buoyancy, center of buoyancy, metacenter and metacentric height, conditions of equilibrium of floating and submerged bodies.

UNIT - III **10 HOURS**

FLUID KINEMATICS: Types of fluid flow, flow net, continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), velocity and acceleration, velocity potential function and stream function for 2D flow and types of motion.

FLUID DYNAMICS: Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids**.**

FLUID FLOW MEASUREMENTS: Introduction, venturimeter, orifice meter, Pitot tube.

. **UNIT - IV** **10 HOURS**

LAMINAR FLOW AND VISCOUS EFFECTS: Reynolds's number, critical Reynolds's number, laminar flow through circular pipe - Hagen Poiseulle's equation, laminar flow between parallel and stationary plates.

FLOW THROUGH PIPES: Frictional loss in pipe flow, major energy losses and minor energy losses in pipe flow, Darcy- equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, hydraulic gradient and total energy line.

DIMENSIONAL ANALYSIS: Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham's- π theorem, Raleigh's method, dimensionless numbers, similitude, types of similitude.

TOTAL: 40HOURS

Text books:

1. Kumar.D.S, **"Fluid Mechanics and Fluid power Engineering**" Kataria and sons-2010
2. Dr.Bansal.R.K, **"Fluid Mechanics**" by Lakshmi Publications, 2010.
3.OijushK.Kundu, **IRAM COCHEN,** EL SEVIER 3 rd Ed. 2005.

Reference Books:

1. Yunus A, Cenegel, John M, Cimbala, Fluid Mechanics, Fundamentals and Applications Tata
   by TATA McGraw Hill, 2013.
2. John F.Douglas, Janul and M.Gasiosek and john A.Swaffield, Fluid Mechanics published by prentice hall 2007.

	Title of the Subject :Theory of machines	Sem:4				Code: UAU433C					Credits 4		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Analyze the given machine/mechanism for their type and mobility	3	3	2	1	1	1			2		1	1
2	Determine the velocity and acceleration of links in the mechanism using graphical and analytical methods	3	3	2	1	1	1			2		1	1
3	Carry out the static and dynamic force analysis for a given mechanism.	3	3	2	1	1	1			2		1	1
4	Formulate the equations for kinematic and dynamic analysis of gear and gear trains	3	3	2	1	1	1			2		1	1
5	Analyze the dynamic forces and couples on rotating and reciprocating components of machines to compute the magnitude and direction of balancing mass.	3	3	2	1	1	1			2		1	1
6	Develop a cam profile for a given follower motions and ascertain the gyroscopic and centrifugal couple for a given application	3	3	2	1	1	1			2		1	1

UAU433C: THEORY OF MACHINES
4 Credits (L-T-P: 3-2-0)

UNIT - I 10L + 6T HOURS

INTRODUCTION: Definitions: link or element, kinematics pairs, degrees of freedom, Grubler's criterion, Kinematic chain, mechanism, structure, mobility of mechanism, inversion, machine.
KINEMATIC CHAINS AND INVERSIONS: Inversions of four bar chain; single slider crank chain and double slider crank chain.
MECHANISMS: Quick return motion mechanisms - drag link mechanism, Whitworth mechanism and crank and slotted lever mechanism.
VELOCITY ANALYSIS BY INSTANTANEOUS CENTER METHOD: Definition, Kennedy's theorem, determination of linear and angular velocity using instantaneous center method. Klein's construction: Analysis of velocity and acceleration of single slider crank mechanism.

UNIT - II 10L + 8T HOURS

STATIC FORCE ANALYSIS: Static force analysis: introduction: Static equilibrium, equilibrium of two and three force members. Members with two forces and torque, free body diagrams, principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.
DYNAMIC FORCE ANALYSIS: De Alembert's principle, inertia force, inertia torque, dynamic force analysis of four - bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams of flywheel, fluctuation of energy. Determination of flywheel size.
BALANCING OF ROTATING MASSES: Static and dynamic balancing, balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

UNIT - III 10L + 8T HOURS

BALANCING OF RECIPROCATING MASSES: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder inline engine , primary and secondary forces, V - engine and radial engine.
GOVERNORS: Types of governors, controlling force, stability, sensitiveness, isochronism, effort and power. Force analysis of Porter and Hartnell governors**.**
GEAR TRAINS: Simple gear trains, compound gear trains for large speed reduction, epicyclic gear trains, algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear train.

UNIT - IV 10L +6T HOURS

GYROSCOPE: Vectorial representation of angular motion, gyroscopic couple. Effect of gyroscopic couple on ship,plane disc, aeroplane, stability of two wheelers and four wheelers**.**
CAMS: Types of cams, types of followers, displacement, velocity and acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife - edge, roller and flat - faced follower, follower motions including SHM, uniform velocity, uniform acceleration and retardation and cycloidal motion.

TOTAL: 40L + 26T HOURS

Text Books:

1. "**Theory of Machines**", Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
2. "**Theory of Machines**", Sadhu Singh,Pearson Edn (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2nd Edi. 2006.

Reference books:

1. "Theory of Machines & Mechanisms", Shigley. J. V. and Uickers, J.J., OXFORD University press.2004.

2."Theory of Machines -I", by A.S.Ravindra, Sudha Publications Revised 5th Edi. 2004.

	Title of the Subject : Design of machine elements - I	Sem:3			Code: UAU424C							Credits: 4	
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Classify the design approaches, design procedure and consideration	3	1	2									1
2	Analyze the stress and strain of mechanical components, and identify, quantify failure modes for mechanical parts.	3	2	2	2								2
3	Design and analysis of shafts and other mechanical component subjected to twisting and bending moment.	3	3	3	3								2
4	Design and analyze keys, coupling, and knuckle joints for various load condition.	3	3	3	3								2
5	Ability to design and analyze screw threaded fastener for various load condition.	3	3	3	3								2

UAU424C: DESIGN OF MACHINE ELEMENTS - I
4 Credits (L T P: 3 - 2 - 0)

UNIT - I **10L +8T HOURS**

INTRODUCTION: Classification of design, design procedure, standardization, preferred numbers. Selection of materials, manufacturing consideration in design**.**

STRESSES IN ELEMENTARY MACHINE PARTS: Definitions derived from stress; strain diagram, loads, stress, strain, stress strain diagrams. Factor of safety, combined stresses, eccentric loading, theories of failure, stress concentration, stress concentration factor, variable stresses, endurance limit, fatigue stress concentration factor, notch sensitivity, impact loading, design criteria.

UNIT - II **10L +8T HOURS**

SHAFTS: Introduction, material used for shafting, stresses in shafts, design of shafts, shafts subjected to twisting moment, bending moment. Combined bending and twisting moment, axial load in addition to bending and torsion, fluctuating loads, design of shaft on the basis of rigidity, ASME and ISI codes for design of transmission shafting.

KEYS, COUPLINGS, COTTER AND KNUCKLE JOINTS: Types of keys, design of keys, shafts couplings; types, design of muff coupling, flange coupling, pin type flexible coupling. Oldham's coupling, universal coupling, socket and spigot type cotter joint, knuckle joint.

UNIT - III **10L +6T HOURS**

THREADED FASTENERS AND POWER SCREWS: Uses of screw threads, design of screw threads, design of screw threads, threaded fasteners, effect of initial tension, effect of applied loads; bolt stress, bolt spacing, effect of dynamic loads, bolts subjected to shear and eccentric loading, bolts subjected to shear eccentric loading, power screws; efficiency of screw threads, differential screws stress in power screws.

UNIT - IV **10L +6T HOURS**

RIVETED JOINTS: Types of joints, design stresses, design of typical joints, boiler joint, tank and structural joints.

WELDED JOINTS: Types of joint deign stresses, design of typical joints, eccentrically loaded welded joints.

TOTAL: 40L + 26T HOURS

TEXT BOOKS:
1. **Theory and problems of Machine Design** by Hall (Schaum's 'Outline)
2. **Design of Machine Members** by Vallance and doughtIe
3. **Machine design** by Maleev and Hartman.

REFERENCES:
1. A Text book of Machine Design by R.S.Khurmi and J.K.Gupta.
2. Elements of Machine Design by Pandya and Shah. Machine Design by Black
3. Mechanical Engineering Design by Shigley. Machine Design Elements by M.P. Sports.

DATA HANDBOOKS:
1. Machine design data hand book by Lingiah.
2. Machine design data hand book by Balaveera Reddy.

	Title of the subject : **Theory of automotive engines**	Sem: 4 Code: UAU 415C Credits: 4											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Compare and correlate between principle of engine operation, theoretical and actual cycle diagrams	3	3	2	3		1	2					3
2	Recommend the suitability of fuels for various applications and evaluate the performance of engine using key parameters	3	3	2	3		1	2					3
3	Correlate between power plants with valve timing diagrams of CI and SI Engines.	3	3	1	3		1	2					2
4	Evaluate abnormal combustion and its impact on engine performance	3	3	1	3		1	2					3
5	Illustrate the dual and multi fuel engines and its applications	3	3	1	3		1	2					2
6	Analyze the phases of combustion and their significance in Engine performance	3	3	1	3		1	2					3

AU415C: THEORY OF AUTOMOTIVE ENGINES
3 Credits (3- 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Historical development of automobiles. Types of power plant, Classification of engines; V - engines, stratified charge engines, variable compression ratio engine. Principle of engine operation - SI and CI two stroke and four stroke engines. Scavenging systems**:** Theoretical processes, parameters, relative merits and demerits, valve and port timing diagrams.

AIR STANDARD CYCLES: Otto, Diesel and dual cycle - efficiency and mean effective pressure. Fuel air cycles: Introduction and mixture strength variations.

UNIT - II **10 HOURS**

COMBUSTION IN S.I. ENGINES: Ignition limits, stages of combustion, ignition lag, effect of engine variables on ignition lag, flame propagation, effect of variables, abnormal combustion, detonation, theory of detonation, effect of engine variables on detonation, control of detonation, surface ignition. Knock rating of SI engine fuels. HUCR engine. Combustion chamber: requirements, types, advantages and limitations.

UNIT - III **10 HOURS**

COMBUSTION IN CI ENGINES: Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock. CI engine combustion chambers; open and divided. Swirl; induction, turbulent and combustion swirl chambers. M - Combustion chamber.

ENGINE PERFORMANCE: Performance parameters; BHP, FHP, IHP, specific fuel consumption, volumetric efficiency, thermal efficiency, specific weight, heat balance sheet and testing of engines.

UNIT - IV **10 HOURS**

LIQUID FUELS: Properties: specific gravity, viscosity, flash and fire points, calorific value, rating of fuels.

PETROL FUEL: Octane number, chemical energy of fuels, reaction equation, volatility properties of A/F mixture, combustion temperature.

DIESEL FUELS: Cetane number, vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue. Chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temperature, rating of fuels.

DUAL FUEL AND MULTI-FUEL ENGINES: Combustion in dual fuel engines, factors affecting combustion. Main types of gaseous fuels, supercharge knock control and performance of diesel fuel engines. Characteristics of multi fuel engines, modification of fuel system, suitability of various engines as multi fuel unit, performance of multi fuel engines.

TOTAL: 40 HOURS

Text books:

1**. I.C. Engines** By Mathur & Sharma, Dhanpat Rai & Sons, New Delhi, 1994

2.**Fuels & Combustion** by S.P. Sharma & Chandramohan, Tata McGrawHill, New Delhi ,1987

Reference books:

1. **I.C. Engines & Air pollution** by Obert, Harper & Row Roni publishers, New york, 1973 Fuels & Combustion by Smith & Stinson,
2. **I.C. Engines** by Lichty
3. **I.C. Engines** by Maleev, CBS Pub.
4. **Combustion fundamentals** by Roger A Strehlow

	Title of the Subject : **Automotive transmission systems**	Sem: 4			Code: UAU 416C					Credits: 3			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Illustrate the fundamentals related to various resistances offered to the motion of vehicle and tractive effort.	3	2	1	1					1	1	1	1
2	Recommend a suitable clutch for a given vehicle and their construction and working with details about trouble shooting	3	1	1	1					1	1	1	1
3	Assess the importance of torque converters and analyze the functioning of final drive	3	2	1	1					1	1	1	1
4	Analyze, interpret and compare various types of gear box and its operation.	3	1	1	1					1	1	1	1
5	Analyze the principle of hydrostatic drives and its applications.	3	2	1	1					1	1	1	1
6	Assess the potential, utility, features and mechanism of Automatic transmission.	3	2	1	1					1	1	1	1

UAU416C: AUTOMOTIVE TRANSMISSION SYSTEMS

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

POWER REQUIRED FOR PROPULSION: Resistances: wind, gradient and rolling resistances of an automobile. Traction, tractive effort, road performance curves; acceleration, gradability, drawbar pull, numerical problems.

CLUTCH: Need of clutch, requirements, materials, different types of clutches, principle of friction clutches, single plate, multi-plate, diaphragm, cone, centrifugal clutch, semi- centrifugal clutch. Method of actuation; mechanical, electromagnetic, hydraulic and vacuum, adjustment of clutch, wet and dry friction clutches, clutch trouble shooting diagnosis and numerical problems.

UNIT - II **10 HOURS**

FLUID COUPLING AND ONE WAY CLUTCHES: Necessity, constructional details, types, field of application, percentage slip, one way clutch, working fluid requirements, fluid coupling characteristics.

HYDRODYNAMIC TORQUE CONVERTERS: Introduction, comparison between fluid coupling and torque converter, performance characteristics, slip, principle of torque multiplication, 3 and 4 phase torque converter, typical hydrodynamic transmission.

DRIVE LINE: Front universal joint, CV joint-inner and outer, slip joint.

FINAL DRIVE GEARS: Axle ratio, gear tooth nomenclature. Differential, limited slip differential. Transfer case; inter axle differential, locking differential, electronic control of transfer cases and drive trains, all wheel drive. Trouble shooting diagnosis of final drive.

UNIT - III **10 HOURS**

GEAR BOX: Functions of transmissions, necessity of gear box, gears, gear ratio and torque, types of transmission; manual and automatic transmission, sliding-mesh gear box, constant-mesh gear box, synchromesh gear box. Transfer box. Transaxle; construction and operation, dual range transaxle. Selector mechanism and its types and interlock devices, gearbox lubrication. Calculation of gear ratios for vehicles, performance characteristics in different gears. Switches and sensors - Transmission Controlled Spark (TCS), trouble shooting diagnosis and servicing and maintenance of manual transmission and transaxle. Trouble shooting diagnosis of gear box. Numerical problems.

EPICYCLIC TRANSMISSION: Principle of operation, types of planetary transmission, calculation of gear ratio in different speeds, over drives, numerical problems.

HYDROSTATIC DRIVES: Principle of hydrostatic drives, different systems of hydrostatic drives, types of pumps, advantages and limitations, typical hydrostatic drives.

UNIT - IV **10 HOURS**

AUTOMATIC TRANSMISSION: Hydraulic system, automatic transmission fluid, transmission fluid coolers, basic hydraulic control circuits, accumulator, shift timing, governor pressure, throttle pressure, controlling shift timing and quality, hydraulic valves and valve bodies, starting controls and shift interlocks, electronic shift control, shift solenoid, automatic shift counter shaft transmission. Principle, general description of Borg-Warner automatic transmission, Continuous Variable Transmission(CVT).

ELECTRIC TRANSMISSION: General arrangement and description of electric transmission, their working principle and control mechanisms and limitations.

TOTAL: 40HOURS

TEXT BOOKS:

1. **Automobile Engineering – I & II –** Kirpal Singh
2. **Automobile Engineering –** G. B. S. Narang
3. **Automotive Mechanics –** William Crouse

	Title of the Subject :**Foundry & forging practice**	Sem:3			Code: UAU437L					Credits 1			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To have understood various processes carried out in Foundry.	3	2							2			1
2	Ability to prepare different types of mold cavities and different sand testing methods.	3	2	2						1			
3	Demonstrate various skills of sand preparation and different molding methods.	3	2	2		2		1		2			
4	Able to know manufacturing process that in turn provide the student with the capacity to better understand and realization of engineering products and system.	3	2	2		2							1
5	Aware of importance of manufacturing process in an industry and the applications.	3	2	2		2				2			1

UAU437L: FOUNDRY AND FORGING PRACTICE

1 Credit (0 - 0 - 2)

Part - A

1. TESTING OF MOLDING SAND AND CORE SAND

Preparation of sand specimens and conduction of the following tests:

a. Compression, shear and tensile tests on universal sand testing machine.
b. Permeability test
c. Core hardness & mould hardness tests
d. Grain fineness number test (Sieve analysis test)
e. Clay content test
f. Moisture content test.

Part - B

2. FOUNDRY PRACTICE

a. Use of foundry tools and other equipments.
b. Preparation of moulds using molding boxes using patterns or without patterns.
c. Preparation of one casting (Aluminum or cast iron - Demonstration only)

Part - C

3. FORGING OPERATIONS

a. Preparing minimum three forged models involving upsetting, drawing and bending operations.
b. Out of these three models, at least one model is to be prepared by using power hammer.

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
3. Performance and journal write-up: Marks for each experiment = 30 marks/No. of proposed experiments.

a. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc.5 (viva voce).

2. Allocation of 50 marks for SEE:

Part-A	: 20 Marks
Part-B or Part-C	: 20 Marks
Viva-Voce	: 10 Marks

	Title of the Subject **: IC Engine and fuels laboratory**	Sem: 4				Code: UAU 438L						Credits : 1	
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to know and analyze the various properties of fuels	3	2							2			1
2	Able to know and analyze the valve timing diagram for different engines	3	2							1			
3	Able to know and analyze and to perform experiments on various engines	3	2							2			
4	To conduct performance study against malfunctioning and emission tests	3	2										1

UAU438: I. C. ENGINE AND FUELS LABORATORY.

1 Credit (0-0-2)

Part - A

FUELS LAB:

1. Determination of flash point and fire point of lubricating oil using Ables'apparatus.

2. Determination of flash point and fire point of lubricating oil using Pensky Martin apparatus.

3. Determination of viscosity of lubricating oil using Redwood viscometer.

4. Determination of viscosity of lubricating oil using Saybolt viscometer.

Part - B

TESTS ON IC ENGINES:

1. Performance tests on I.C engines, calculations of IP, BP, FP, Thermal, volumetric and mechanical efficiency, SFC and heat balance sheet for:

   a) Four stroke single cylinder petrol engine.
   b) Four stroke single cylinder diesel engine.
   c) Four stroke twin cylinder diesel engine.
   d) Multi cylinder petrol engine for Morse test.
   e) Computerized single cylinder four stroke diesel engine.
2. Valve timing opening diagram of four stroke diesel / petrol engine.

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. **Allocation of 50 marks for CIE**
   - Performance and journal write-up :
     Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. **Allocation of 50 marks for SEE**

Part-A	: 10 Marks
Part-B	: 30 Marks
Viva-Voce	: 10 Marks

	Title of the Subject: Material testing & Measurement laboratory	Sem:3 Code: UAU439L Credits 1											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To conduct impact tests and find impact value of specimens.	3	1										2
2	To conduct hardness tests and find hardness number for different specimens.	3	2										2
3	To utilize UTM for tensile, compression and bending tests on mild steel and wooden specimens.	3	2										2
4.	Demonstrate calibration techniques to various measuring devices to standardize the instruments.	3	1										2
5.	Acquire knowledge about Measurements and Measuring procedures.	3	2										2

UAU439L: MATERIAL TESTING AND MEASUREMENT LABORATORY

1 Credit (0 - 0 - 2)

PART - A

a. Tensile and compression test of metallic and non - metallic specimens using a universal testing machine.
b. Shear test of metallic and non - metallic specimens using a universal testing machine
c. Bending test on metallic and non - metallic specimen.
d. Impact test: Izode and Charpy tests on M.S. Specimen.
e. Hardness test: Brinell, Rockwell and Vickers's test.

PART - B

a. Calibration of pressure gauge.
b. Calibration of micrometer using slip gauges.
c. Measurement of angle using sine bar/sine centre.
d. Measurement of screw thread parameters by two wire method.

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. **Allocation of 50 marks for CIE**
   - Performance and journal write-up :
     Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. **Allocation of 50 marks for SEE**

Part-A	: 20 Marks
Part-B	: 20 Marks
Viva-Voce	: 10 Marks

Time / Day	8.00 am to 9.00 pm	9.00 am to 10.00pm		10.15 am to 11.15am	11.15am to 12.15pm		2.00 pm to 05.00pm
Monday			TEA BREAK			LUNCH BREAK	
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							

B.V.V.S.

BASAVESHWAR ENGINEERIGN COLLEGE (Autonomous)

BAGALKOT-587103

An Autonomous Institution under Visvesvaraya Technological University

Belgaum – 590014, Karnataka. India

Syllabus V & VI SEMESTER
2019-2020 (175 Credits) Admitted Batch

DEPARTMENT OF AUTOMOBILE ENGINEERING

Institution Vision and Mission

Vision

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio economic development.

Mission

- To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change
- To carry out innovative cutting edge research and transfer technology for industrial and societal needs
- To imbibe moral and ethical values and develop compassionate, humane professionals

Department Vision and Mission

VISION

To nurture academic excellence in the field of automobile engineering with innovative and challenging attitudes to social needs.

MISSION

1. To disseminate the knowledge to build the outstanding professionals in automobile engineering through teaching learning process.

2. To develop platform for higher learning, research and industry institute interaction to face global challenges inculcated with human and social values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To prepare the students with knowledge in basic science and engineering to meet global challenges
PEO2	To develop the students in automotive engineering, thermal, design, manufacturing, autotronics in line with present technology
PEO3	To develop the students as entrepreneurs and encourage to pursue higher education and research

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Apply engineering basic knowledge with modern computing tools in solving problems of design, production and servicing domains
PSO2	Mould and develop engineers to serve in industries as professionals or entrepreneur
PSO3	Prepare engineers to undertake research and higher learning

PROGRAMME OUTCOMES (Pos)

Sl. No	Programme Outcomes	
PO 1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and umerical to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Scheme of syllabus for 5th Sem B.E. Automobile

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	**UAU541C**	**Heat Transfer**	3	3	0	0	50	50	**100**
2	**UAU532C**	**Design of Power Train and Suspension Systems**	3	2	2	0	50	50	**100**
3	**UAU523H**	**Entrepreneurship and Industrial Management**	3	3	0	0	50	50	**100**
4	**UAU524C**	**Auxiliary System for Automotive Engines**	3	3	0	0	50	50	**100**
5	**UAUXXXE**	**Dept. Elective – I**	3	3	0	0	50	50	**100**
6	**UCS559L**	**Advanced C Programming Lab**	2	2	0	2	50	50	**100**
7	**UHS002N**	**Advanced Quantitative Aptitude and Soft Skills.**	1	1	0	0	50	50	**100**
8	**UAU537L**	**Automotive Engine Servicing Laboratory**	1	0	0	2	50	50	**100**
9	**UAU548L**	**Automotive Scanning Laboratory**	1	0	0	2	50	50	**100**
		Total	**20**	**17**	**2**	**6**	**450**	**450**	**900**

Department Electives – I

Sl. No	Code	Subjects
1	UAU571E	Automotive Emissions and Control
2	UAU572E	Product Design and Development
3	UAU575E	Computer Graphics
4	UAU576E	Vehicle Transport Management

QUESTION PAPER PATTERN:

1. Total of 8 Questions with **2** from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than **4** sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

	Title of the Subject : Heat Transfer	**Sem:5 Code: UAU541C Credits 3**											
No.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Categorize the modes of heat transfer, boundary conditions, laws governing heat conduction and analyze conduction phenomenon.	3	2	1									2
2	Illustrate the solution to conductive heat transfer problems.	3	2	2									2
3	Analyze unsteady state heat conduction phenomenon and apply to solve numerical problems	3	2	2									2
4	Formulate the convective heat transfer phenomenon and its applications	3	2	2									2
5	Evaluate the utility of heat exchangers and its analysis to solve numerical problems	3	2	2									2
6	Describe radiation heat exchange phenomenon and its analysis	3	2	2									2

UAU541C: HEAT TRANSFER

3 Credits (L T P: 3 – 0 – 0)

UNIT – I **10 HOURS**

INTRODUCTORY CONCEPTS AND DEFINITIONS: Modes of heat transfer; basic laws governing conduction, convection, and radiation heat transfer; thermal conductivity; convective heat transfer coefficient; radiation heat transfer coefficient; combined heat transfer mechanism.

CONDUCTION: Basic equations, general form of one dimensional heat conduction equation in rectangular, cylindrical and spherical coordinates. Boundary conditions of first, second and third kinds; illustrative problems on mathematical formulation of conduction problems.

ONE-DIMENSIONAL STEADY STATE CONDUCTION : Steady state conduction in a slab, in a cylinder and in a sphere without heat generation; overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation.

UNIT – II **10 HOURS**

FINS: Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin efficiency; conduction in solids with variable thermal conductivity.

ONE-DIMENSIONAL TRANSIENT CONDUCTION: Conduction in solids with negligible internal temperature gradients (lumped system analysis); use of transient temperature charts (Heisler ‘s charts) for transient conduction in slab, long cylinder and sphere.

UNIT – III **10 HOURS**

CONCEPTS AND BASIC RELATIONS IN BOUNDARY LAYERS: Flow over a body – velocity boundary layer; laminar and turbulent layers, critical Reynolds number; general expressions for drag coefficient and drag force, thermal boundary layer.

FORCED AND FREE CONVECTION: Physical significance of Reynolds, Prandtl, Nusselt and Stanton numbers. Use of various correlations for hydrodynamically and thermally developed flows; use of correlations for flow over a flat plate, over a cylinder and umerical. Application of dimensional analysis for free convection-physical significance of Grashoff number.

UNIT – IV **10 HOURS**

HEAT EXCHANGERS: Classification of heat exchangers; overall heat transfer coefficient, fouling and fouling factor; LMTD and NTU methods of analysis of heat exchangers.

RADIATION HEAT TRANSFER: Thermal radiation; definitions of various terms used in radiation heat transfer; Stefan – Boltzman law, Kirchoff’s law, Planck’s Law and Wein’s displacement law, Lambert’s Law; radiation heat exchange between two parallel infinite black surfaces.

TEXTBOOKS:

I) **Heat Transfer** by P.K. Nag Tata Mc Graw Hill 2002
2) **Heat Transfer-** A Basic approach by M Necats Osisik Mc Graw Hill International ed 1988

REFERENCE BOOKS:

1) **Heat transfer** a practical approaches by Yunus A Cengel Tata Mc Graw Hill 2002.
2) **Principles of Heat Transfer** by Kreith Thomas learning 200 1.
3)**Fundamentals of Heat and Mass Transfer** by Frank. P. Incropera and David. P. Dewitt John Wiley and Sons 4th ed 1995.
4) **Heat Transfer**: Sucec Jaieo Book house 2002.
5) **Heat transfer:** Jojo Jaico Book house 2003

	Title of the Subject **: Design of Power Train and Suspension Systems**	Sem: **5**			Code: **UAU532C**						Credits**: 3**		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Analyze the concept of engineering system design and formulate design aspects of curved beams	3	2	3	1		1				1	1	1
2	Recommend a suitable spring for various applications	3	2	3	2		1				1	1	1
3	Analyze the gear mechanisms and its applications to automobiles.	3	2	3	2		1				1	1	1
4	Evaluate the design criterion for clutches and brakes its applications	3	2	3	2		1				1	1	1
5	Formulate the materials to design and analyze the various types of bearings	3	2	3	2		1				1	1	1
6	Design and develop the belts, ropes and chains.	3	2	3	2		1				1	1	1

UAU532C: Design of Power Train and Suspension System

3 Credits (L T P: 2 -2-0)

UNIT – I

10 HOURS

CRITERIA FOR VEHICULAR SYSTEM DESIGN: Vehicle load, Road, Wind and Gradient Resistance, Expectancy curves and Performance curves. Power and torque of propulsion, Driving Power and torque, Output Power and torque of the Propeller shaft, Output power and torque at fly wheels, Graphical representations of expectancy curves, Starting torque, Load-speed characteristics and performance curves (No derivation only problems).

DESIGN AND DEVELPOMENT OF CLUTCH ASSEMBLY FOR DIFFERENT TYPES OF VEHICLE POWER TRAINS:-Design and Development of clutch assembly using the vehicular design data calculation methods for the different types of vehicles, Calculations of required torque and BHP to be transmitted, types of clutches: - single plate, multi plate and cone clutches, selection criteria for the clutches. Analyses of various stresses, forces acting on clutch assembly and components (No derivation only problems).

Clutch assembly: clutch plates, pressure plates, springs, input and output shafts, rivets nuts and bolts, clutch plates, frictional materials and their selection criteria, materials used for various components.

UNIT – II

10 HOURS

DESIGN AND DEVELPOMENT OF GEAR TRAINS AND GEAR BOXES FOR DIFFERENT TYPES OF VEHICLE POWER TRAINS:-Design and Development of gear trains using the vehicular design data calculation methods for the different types of vehicles, Calculations of required torque and BHP to be transmitted, types of gear boxes, gear trains and gears, selection criteria, transmission efficiency, criteria for selection of different gear ratios in gear boxes, calculations of gear train dimensions, gear ratios, diameter of the gear shafts and gears etc (No derivation only problems).

LUBRICATION AND BEARINGS: Lubricants and their properties, mechanisms of lubrication bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, heat dissipated, bearing materials, design of journal bearing and thrust bearing (No derivation only problems).

UNIT – III

10 HOURS

DESIGN AND DEVELPOMENT OF CONVENTIONAL TRANSMISSION SYSTEMS FOR DIFFERENT TYPES OF TWO WHEELER AND THREE WHEELERS:-Design and Development of gear trains using the vehicular design data calculation methods for the different types of vehicles, Calculations of required torque and BHP to be transmitted, types of conventional transmission systems:-belts ropes and chains, force and stress analyses, calculations of dimensions for wire ropes. Belts:- types, Flat belts: length and cross section, selection of v-belts,wire ropes and chains for automotive and other applications (No derivation only problems).

DESIGN AND DEVELPOMENT OF PROPELLER SHAFTS FOR DIFFERENT TYPES OF VEHICLE POWER TRAINS:-Design and Development of propeller shaft using the vehicular design data calculation methods for the different types of vehicles, Calculations of required torque and BHP to be transmitted, Types of propeller shaft, selection criteria, types of joints used (No derivation only problems).

UNIT – IV

10 HOURS

SPRINGS: Types of springs, stresses in helical coil springs of circular and non-circular cross sections. Tension and compression springs, springs under fluctuating loads, leaf Springs: stresses in leaf springs. Equalized stresses, energy stored in springs, torsion, Belleville and rubber springs.

DESIGN AND DEVELPOMENT OF REAR AXEL GEAR TRAINS FOR DIFFERENT TYPES OF VEHICLE POWER TRAINS:-Design and Development of rear axle gear trains using the vehicular design data calculation methods for the different types of vehicles, Calculations of required torque and BHP to be transmitted, Types of gear trains, axle shaft design, gear train selection criteria, rear axle gear ratio calculations and selection criteria

DESIGN DATA HAND BOOKS:

1. **Design Data Hand Book** – K. Lingaiah, McGraw Hill, 2nd Ed.2003.
2. **Design Data Hand Book –** K. Mahadevan and K.Balaveera Reddy CBS Publication
3. **Machine Design Data Hand Book –** H.G. Patil, ShriShashiPrakashan, Belgaum.

TEXT BOOKS:

1. **Mechanical Engineering Design –** Joseph E Shigley and Charles R.Mischke. McGraw Hill International edition.
2. **Introduction engineering system design method –** V. Gupta and P. Murthy
3. **Automotive Mechanics** – N. K. Giri
4. **Machine Design –** Trika

	Title of the Subject : **Entrepreneurship and Industrial Management**	Sem: **5**				Code: **UAU523H**							Credits: **3**
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Assess the scope and significance of management and its principles	2	3	2	1	1	2		2	2	2	2	1
2	Illustrate the importance of planning and decision making	2	3	2	1	1	2		2	2	2	2	1
3	Demonstrate the communication skills to various Industrial fields	2	3	2	1	1	2		2	2	2	2	1
4	Develop entrepreneurial qualities to establish small scale Industry	1	3	2	1	1			2	2	2	2	1
5	Identify and develop the criterions for formulating project report	1	3	2	1	1			2	2	2	2	1
6	Evaluate the schemes to build business enterprise												

UAU523H: Entrepreneurship and Industrial Management
3 credit (3 – 0 – 0)

UNIT – I **10 Hours**

MANAGEMENT: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management – Management as an art or science, art or profession Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – early management approaches – Modern management approaches.

PLANNING: Nature, importance and purpose of planning process – Objectives – Types of plans (Meaning only) – Decision making – Importance of planning – steps in planning & planning premises – Hierarchy of plans.

UNIT – II **10 Hours**

ORGANISING AND STAFFING: Nature and purpose of organization –Principles of organization – Types of organization – Departmentation –Committees – Centralization Vs Decentralization of authority and responsibility – Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment (in brief).

DIRECTING & CONTROLLING: Meaning and nature of directing – Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Co – ordination. Meaning and steps in controlling – Essentials of a sound control system – Methods of establishing control (in brief)

UNIT – III **10 Hours**

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur – an emerging Class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Barriers to entrepreneurship.

SMALL SCALE INDUSTRY: Definition; Characteristics; Need and rationale: Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start an SSI – Government policy towards SSI; Different Policies of S.S.I.; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I., Effect of WTO/GATT, Supporting Agencies of Government for S.S.I., Meaning; Nature of Support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry (Definition only)

UNIT – IV **10 Hours**

INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

PREPARATION OF PROJECT: Meaning of Project**;** Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of Business Opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Total 40 Hours

TEXT BOOKS:

1. **Principles of Management** – P.C. Tripathi, P.N. Reddy; Tata McGraw Hill,
2. **Dynamics of Entrepreneurial Development & Management –** Vasant Desai Himalaya Publishing House
3. **Small Business Enterprises** – Poornima M Charantimath – Pearson Education – 2006 (2 & 4)

REFERENCE BOOKS:

1. **Management Fundamentals** – Concepts, Application, Skill Development Robert Lusier – Thomson
2. **Entrepreneurship Development** – S S Khanka – S Chand & Co
3. **Management** – Stephen Robbins – Pearson Education /PHI -17th Edition, 2003

	Title of the Subject : **Auxiliary Systems for Automotive Engine**	Sem: **5** Code**: UAU524C** Credits**: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Demonstrate the working of carburetors and petrol injections systems with its utility	3	3	3	3	1	1						3
2	Illustrate the types and characteristics of diesel injection systems	3	3	3	3	1	1						3
3	Elucidate the necessity and types of cooling systems	3	3	3	3	1							3
4	Enumerate manifolds and mixture distribution for intake and exhaust systems	3	3	3	3	1							3
5	Suggest lubricants and types of lubrication systems adopted in vehicles	3	3	3	3	1							3
6	Evaluate the scope and significance of turbo charging and its patterns	3	3	3	3	1	1						3

UAU524C: AUXILIARY SYSTEMS FOR AUTOMOTIVE ENGINE

Credits (3 – 0 – 0)

UNIT – I **10 HOURS**

CARBURETION: Carburetor principle, properties of air-petrol mixtures, mixture requirements for steady state and transient operation, mixture formation studies of volatile fuels, design of elementary carburetor, chokes, automatic chokes, effects of altitude on carburetion, carburetor for 2 – stroke and 4 – stroke engines, carburetor systems for emission control. Fuel flow systems for SI engines.

GASOLINE INJECTION: Petrol injection; advantages, disadvantages, Lucas petrol injection system, mechanical, pneumatic and electronic fuel injection systems, types. Performance and exhaust emissions of Gasoline Direct Injection (GDI) engine. Mixture and operation modes, fuel supply and engine management of GDI.

AIRCRAFT FUEL SYSTEMS: Basic fuel systems characteristics and functions, fuel properties and environment.

UNIT – II **10 HOURS**

DIESEL FUEL INJECTION: Cleaning systems, transfer pumps, injection pumps, injectors and nozzles – types, functions and necessities, fuel injection pump principle, ratio of piston displacement to fuel charge volume, delivery characteristics, injection lag, pressure waves in fuel lines, fuel pump and governors – types, constructional features and operation, factors influencing fuel spray atomization, penetration and dispersion of diesel and heavy oils and their properties, rate and duration of injection, fuel line hydraulics.

CRDI injection: Operating concept, design, control and regulation for cars and CVs.

Diesel spray characteristics: Macroscopic; front penetration, cone angle, liquid length.

Microscopic characteristics; droplet size and distribution.

UNIT – III **10 HOURS**

MANIFOLDS AND MIXTURE DISTRIBUTION: Intake system components: Air filter, intake manifold with mixture distribution, discharge coefficient, pressure drop, exhaust system components: exhaust manifold and exhaust pipe, spark arresters, waste heat recovery, exhaust mufflers, type of mufflers, exhaust manifold expansion.

COOLING SYSTEM: Necessity, variation of gas temperature, areas of heat flow, heat transfer, piston and cylinder temperature, heat rejected to coolant, quantity of water required. Cooling system: air cooling, water cooling, thermodynamics of forced circulation, water pumps, thermostats, pressurized water cooling, regenerative cooling. Comparison of air and water cooling. Radiators – types, cooling fan – power requirement, anti-freeze solution.

UNIT – IV **10 HOURS**

LUBRICATION SYSTEM: Lubricants, lubricating systems – types, lubrication of piston rings, bearings, oil consumption, oil cooling. Heat transfer coefficients, liquid and air cooled engines, coolants, additives and lubricity improvers, concept of adiabatic engines, oil filters, pumps, crankcase ventilation – types.

SUPERCHARGERS: Introduction, purpose, thermodynamic cycle, effect on the performance, limits of supercharging for petrol and diesel engines, modifications of an engine for super charging; methods of super charging, compressor design, performance measures and mapping, engine matching.

TURBOCHARGERS: Introduction, merits of turbochargers in diesel and gasoline engines, basic structure and functionality, turbocharger performance, engine/turbochargers matching basics, advanced engine requirements and turbo technologies.

TOTAL 40 HOURS

TEXT BOOKS:

1. **A Course in Internal Combustion Engines –** Mathur, M.L., and Sharma, R.P., Dhanpat Rai Publications (P) Ltd., 1998.
2. **Automobile Engineering Vol I & II –** Kirpal singh, Standard Pub,New Delhi, 2004
3. **Internal Combustion Engine –** Ramalingam, K.K, ScitechPublication (India) Pvt.Ltd.2000.

REFERENCES BOOKS:

1. **A Course in Internal Combustion Engines** – Domkundwar, V.M, Dhanpat Rai and Co., 1999.
2. **Internal Combustion Engines –** Ganesan, V., Tata McGraw-Hill Book Co., 2002.

Title of the Subject **: Automobile Engine Servicing Laboratory** | Sem: **5** | Code**: UAU537L** | Credits: **1**

No.	Programme Outcomes / Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Analyze the engine trouble shooting aspects and specifications of various vehicles	3	1							1	1	1	2
2	Able to demonstrate the dismantling and assembly of multi-cylinder of different engines with respective auxiliary systems.	3	1							1	1	1	2
3	Able to demonstrate the dismantling and assembly of two wheeler engines.	3	1							1	1	1	2
4	Conduct the testing of vacuum and compression test in engines and draw the inference.	3	1		1	1				1	1	1	2
5	Dismantle, assemble and analyze working and fault diagnosis of fuel system elements like carburetor and fuel injection pump.	3	1							1	1	1	2

UAU537L: AUTOMOBIE ENGINE SERVICING LABORATORY

1 Credit (0 – 0 – 2)

1. Study of hand tools- sketching, materials used and their applications
2. Technical specifications of all types of automobile engines
3. Trouble shooting charts of all engine components
4. Note the specifications of given engines and component standard dimensions. Dismantle, inspect, clean and assemble of engine components of SI and CI engines(two and four stroke) of any commercial vehicles. Note procedure of dismantling and assembly; identify the major components, noting their functions and materials used. Measurement & comparison of major components dimension with standard specifications. Inspection for wear and tear, crack and brake down, identify the service requirements of engines such as decarbonoizing, degresing, spark plug cleaning and adjusting, fuel injector cleaning etc.
5. Compression and vacuum test on diesel and petrol and diesel engines.
6. Study(Dismantling and assembly): Carburetors, fuel injection pumps, fuel filters, fuel pumps, turbochargers, cooling systems and components, lubrication system and components. Identify the location of above components in a vehicle and note their functions

Laboratory Assessment:

1.Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)

2.Allocation of 50 marks for CIE

- Performance and journal write-up :
  Marks for each experiment = 30 marks/No. of proposed experiments.
- One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).

1 Allocation of 50 marks for SEE

	Title of the Subject: **Automotive scanning Laboratory**	Sem: **5** Code: **UAU548L** Credits : **1**											
.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To study the head light beam testing for two and four wheeler and braking distance	2	1		1	1	1			1	1	1	1
2	To know the process of tyre retreading, painting of vehicles and able to draw the layout of a service station and bus depot	2	1		1	1	2			1	1	1	1
3	To study and practice on computerized wheel balancing machine, computerized wheel alignment machine, computerized engine analyzer.	2	1		1	1	2			1	1	1	1
4.	Study and demo of wind tunnel testing and know the various aspects	2	1		1	1	1	1		1	1	1	1

UAU548L: AUTOMOTIVE SCANNING LABORATORY

1 Credit (0 – 0 – 2)

1. Maintenance/service charts for different parts of chassis, suspension and transmission.
2. Study of head light beam testing for two and four wheeler.
3. Braking distance test for four wheeler.
4. Study of tyre retreading, tubeless tyre puncture repairs, painting of vehicles.
5. Sketch the layout of a service station and bus depot mentioning the various equipments required including the space needed.
6. Study and practice on computerized wheel balancing machine, computerized wheel alignment machine, computerized engine analyzer.
7. Study of two wheeler performance on two wheeler chassis dynamometer.

1. 8.Study of electrical components like battery, alternator, regulator on electrical test bench

8. Study and demo of wind tunnel testing I) testing for pressure distribution ii) testing for lift ,yaw ,drag

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
    - Performance and journal write-up :
      Marks for each experiment = 30 marks/No. of proposed experiments.
    - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).

2 Allocation of 50 marks for SEE

	Title of the Subject: **Automotive Emissions and Control**	Sem: **5** Code: **UAU571E** Credits: **3**											
.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Assess the effect and conduct risk analysis of air pollution.	3	2	1	2		2	3	1		2		1
2	Analyze, interpret and compare the sources and formation of various emissions in gasoline engines.	3	2	1	2		2	3	1		2		1
3	Discuss and differentiate the influence of fuel properties on emissions.	3	2	1	2		2	3	1		2		1
4.	Carry out the emission control measures for SI engines.	3	2	1	2		2	3	1		2		1
5.	Evaluate the formation and controlling of emissions in CI engines.	3	2	1	2		2	2	1		2		1
6.	Analyze and interpret the instrumentation utilized in measurement of emissions.	3	2	1	1	2	2	1	1		2		1

UAU571E: AUTOMOTIVE EMISSIONS AND CONTROL

3 Credits (3 – 0 – 0)

UNIT – I

10 HOURS

INTRODUCTION: Historical background, Euro norms, air quality standards. Effect of air pollution: effect on humans, animals and plants. Smog formation and its effects.

GENESIS AND FORMATION OF POLLUTANTS: Vehicle emissions; sources- evaporative, blow-by and exhaust pipe. Unburnt hydrocarbons, carbon monoxide, oxides of nitrogen, particulate emission of both SI and CI engines. Diesel smoke; types and reasons of smoke, mechanism of smoke formation. Thermodynamics state of burned gases, flame quenching combustion chamber deposits, soot and particulate formation, characteristics and composition of particulates. Effect of engine design and operating variables. Emission test procedures and standards: test cycles for light and medium duty vehicles, USEPA emission test cycles, European emission test procedure, types of emission driving cycle, motor cycle emission standards.

UNIT – II

10 HOURS

INFLUENCE OF GASOLINE AND DIESEL PROPERTIES ON EMISSION: Properties like density, olefin and aromatic content, volatility, octane number, additives, viscosity, distillation interval, cetane number, sulphur content on emissions. Emission control methods: Evaporative emission control; charcoal canister. Positive Crankcase Ventilation (PCV).

EXHAUST EMISSION CONTROL: Design modifications: lean burn strategies, compression ratio, cylinder size and combustion chamber shape, variable valve timing and lift, variable swept volume, downsizing and pressure charging, faster warm-up, heated air systems. Exhaust Gas Recirculation(EGR); control and related systems.

UNIT – III

10 HOURS

ADD-ON SYSTEMS FOR TREATMENT OF EMISSION WITHIN ENGINE: Air injection, thermal reactor, catalytic converter. Catalytic converter: catalysts, substrate, converter housing, oxidation and reduction catalyst, two and three way converter. Catalyst technology for control of cold start, catalyst and poisoning. Gasoline direct injection stratified charge engines; air motion and mixture formation in the cylinder, fuel injection and air fuel ratio control, emissions of gasoline direct injection engines. OBD systems.

UNIT – IV

10 HOURS

INSTRUMENTATION FOR POLLUTION MEASUREMENT: NDIR analyzers, gas chromatograph, Orsat apparatus, flame ionization detectors, chemilumiscence, smoke measurement; principle, Hartridge and Bosch smoke meter.

CI ENGINE EMISSION CONTROL TECHNOLOGY: Fuel injection variables, high injection pressures, high pressure distributor pumps, electronic unit injectors, common rail fuel injection systems, EGR, turbo charging, catalytic treatment, Diesel Particulate Filters (DPF); material, substrates, diesel exhaust after treatment with metal substrates.

TEXT BOOKS:

1. Theory of IC engines: Mathur and Sharma.
2. Automotive Mechanics: William H Crouse.
3. Engine Emissions: P.B.Pundir

	Title of the Subject**: Product Design and Development**	Sem: **5**	Code: **UAU572E**	Credits: **3**									
.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Understand the necessity of new product development and problems encountered in Developing new products.	3	2	3	1	1	1	1	2	1	1	2	1
2	Know the role of aesthetic in products.	3	2	3	1	1	1	1	1		1	2	1
3	Able to use different types of models designed by industrial engineer.	3	2	2	1	1	1	1	2		1	2	1
4.	Able to select the different materials based on the functions of the product.	3	2	2	1	1	1	1	1		1	2	1
5.	The ergonomic factors influencing the success of the product.	3	2	3	1	1	1	1	1	1	1	2	1
6.	Know how to add value to the products.	3	2	3	1	1	1	1	1	1	1	2	1

UAU572E: PRODUCT DESIGN AND DEVELOPMENT

3 Credits (3 – 0 – 0)

UNIT – I

10 HOURS

INTRODUCTION: Characteristics of successful product development, design and development of products, duration and cost of product development, the challenges of product development.

DEVELOPMENT PROCESSES AND ORGANIZATIONS: Generic development process, concept development: the front-end process, adopting the generic product development process, AMF development process, product development organizations, the AMF organization.

PRODUCT PLANNING: Product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process.

UNIT – II

10 HOURS

IDENTIFYING CUSTOMER NEEDS: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

PRODUCT SPECIFICATIONS: What are specifications, when are specifications established, establishing target specifications, setting the final specifications**.**

CONCEPT GENERATION: Activity of concept generation, clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process.

UNIT – III

10 HOURS

CONCEPT SELECTION: Overview of methodology, concept screening, and concept scoring.

CONCEPT TESTING: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect the results and the process.

PRODUCT ARCHITECTURE: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues.

INDUSTRIAL DESIGN: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assessing the quality of industrial design.

UNIT – IV **10 HOURS**

DESIGN FOR MANUFACTURING: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors**.**

PROTOTYPING: Prototyping basics, principles of prototyping, technologies, planning for prototypes.

PRODUCT DEVELOPMENT ECONOMICS: Elements of economic analysis, base case financial mode. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

MANAGING PROJECTS: Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation.

TEXT BOOK:

1.Product Design and Development – Karl.T.Ulrich, Steven D Eppinger – Irwin McGrawHill – 2000.

REFERENCE BOOKS:

1. Product Design and Manufacturing – A C Chitale and R C Gupta, PH1, **-** 3 rd Edition, 2003.
2. New Product Development – Timjones. Butterworth Heinmann –Oxford. UCI -1997
3. Product Design for Manufacture and Assembly – Geoffery Boothroyd, Peter Dewhurst and Winston Knight – 2002

	Title of the Subject**: Computer Graphics**	Sem: **5** Code: **UAU575E** Credits: **3**											
.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To understand the fundamental concepts of graphics with suitable commands	3	2	3	2	2					1		1
2	To apply comprehensive transformation techniques of computer graphics	3	3	2	2	2					1		1
3	To know and draw the creation of two and three dimensional transformations	3	3	2	2	2					1		1
4.	To know and analyze plane and space curves	3	2	3	2	2					1		1

UAU575E: COMPUTER GRAPHICS

3 Credits (3 – 0 – 0)

UNIT – I

10 HOURS

SCAN CONVERSION AND CLIPPING REPRESENTATION: Scan conversion and clipping representation of points, lines, line drawing algorithms: DDA algorithm, Bresenham's integer line algorithm, Bresenham's circle algorithm, mid point line and circle, polygon filling algorithms: scan conversion, seed filling, scan line algorithm. Viewing transformation, clipping points, lines, text, polygon, Cohen-Sutherland line clipping, Sutherland – Hodgmen algorithm.

UNIT – II

10 HOURS

TWO DIMENSIONAL TRANSFORMATIONS: Representation of points, transformations: rotation, reflection, scaling, combined transformations, translations and homogeneous coordinates, geometric interpretation of homogeneous coordinates, over all scaling, points at infinity, rotation about an arbitrary point, reflection through an arbitrary line.

UNIT – III

10 HOURS

THREE DIMENSIONAL TRANSFORMATIONS: Three dimensional transformations and projections 3D transformation matrix: general matrix, translation, scaling, shearing, rotation, reflection, multiple transformations, rotation about an axis parallel to coordinate axis, rotation about an arbitrary axis in space, reflection through an arbitrary plane, orthographic, parallel projection transformations, one, perspective projections – one point, two point and three point.

UNIT – IV

10 HOURS

PLANE AND SPACE CURVES CURVE: Plane and space curves curve representation, non-parametric curves, parametric curves, parametric representation and generation of line, circle, ellipse, parabola, hyperbola, generation of circle, ellipse, parabola, hyperbola, cubic spline, normalized cubic splines, Bezier curves: blending function, properties, generation, B-spline curves- Cox-de Boor recursive formula, properties, open uniform basis functions, non-uniform basis functions, periodic B-spline curve.

TEXT BOOKS:

1. Ibraham Zeid, "CAD/CAM-Theory and Practice" McGraw Hill, 2006
2. Rogoer's Adams, "Mathematical Elements for Computer Graphics", McGraw Hill. 1990 **Reference**

Reference Books:

1. Xiang Z, Plastock, R. A, Computer Graphics, Schaums outlines, McGraw Hill. 2007.
2. Foley, Van- Damn, Finner and Hughes, "Computer Graphics", principles and practice, Addison Wesley. 2000
3. Sinha AN., Udai A D., Computer Graphics, Tata McGraw Hill, 2008.

	Title of the Subject**: Vehical Transport Management**	Sem: **5** Code: **UAU576E** Credits: **3**											
.	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Analyze public transport in India and different forms of ownership.	1		1					1	1	1		2
2	Define and analyze the vehicle maintenance and its types and selection and roles of crew.	1	1						1	1	1		2
3	Define route planning process and application bus scheduling methods of bus scheduling and implementation.	1	2						1	1	1		2
4.	Analyze fare structure and collection systems, their principles and compare various fare collection systems.	1	1	1					1	1	1		2
5.	Define different operating cost and analyze for optimized transport and functions of PRO in public transport.	1	1	1					1	1	1		2
6.	Analyze the prevention of accidents and future of road transport.	1	1	1					1	1	1		2

UAU576E : VEHICLE TRANSPORT MANAGEMENT
3 Credits (3 – 0 – 0)

UNIT – 1

10 HOURS

INTRODUCTION: Historical background, the growth of a network, trams, trolley buses, buses, private cars, subsidies. Motor vehicle act 1988. Maintenance – preventive, breakdown, overhauling – major, minor, repair schedules and workshop, facilities, documentation, analysis and corrective maintenance schedules.

ORGANIZATION AND MANAGEMENT: Forms of ownership, municipal undertaking, company undertaking, traffic, secretarial and engineering deportments, management, principle of transport, - internal organization-centralized control, de-centralized control, staff administration: industrial relation, administration, recruitment and training, drivers and conductors duties, training of drivers and conductors, factors affecting punctuality, welfare, health and safety.

UNIT – II

10 HOURS

ROUTE PLANNING: Source of traffic, town planning, turning points, stopping places, shelters, survey of route, preliminary schedule test runs, elimination of hazards, factors affecting frequency, direction of traffic flow, community of interest, estimating, traffic volume, probable weekday travelers, passengers during various periods of the day, estimated number of passengers, estimated traffic, possibility of single verses double deck and frequency.

TIMING, BUS WORKING AND SCHEDULES: Time table layout, uses of flat graph method of presentation, preparation of vehicle and crew schedule preparation of the duty roster, co-operation with employers, use of the vehicle running numbering determination of vehicle efficiency checking efficiency of crew, duty arrangements.

UNIT – III

10 HOURS

COLLECTIONS: Need, principles of collection, tickets, the way bill, stage by stage, bell punch system, bell graphic system, reduced ticket stocks will brew system, mechanical ticket machines, T.I.M and straight machines, Vero meter, one-man operation, two stream boarding, pre paid tickets, lenson parason coach tickets exchanges, the fare box, electronic ticket machines, box system personal and common stock flat fare platform control.

FARE STRUCTURE: Basis of fares, historical background, effects of competition and control, calculating average zone system, concession fares, straight and tapered scale elastic and inelastic demand co-ordination of fares concessions fares changes for workman, standard layout of fare table, anomalies double booking inter availability through booking and summation, private hire charges.

UNIT – IV

10 HOURS

OPERATING COST AND TYPES OF VEHICLES: Classification of costs, average speed, running costs, supplementary costs, depreciation obsolescence, life of vehicles, sinking fund, factor affecting cost per vehicles mile incidence of wages and overheads, 100 seats miles basis, average seating capacity, vehicles size and spread overs, types of vehicle economic considerations authorization of trolley, bus services, statuary procedure taxes and hire car.

PUBLIC RELATIONS DIVISIONS:
Dissemination of information, maintaining goodwill handling complaints, traffic advisory committees, local contractors co-operation with the press news and articles – facilities for visitors- forms of publicity – importance of quality – inter departmental liaison advertisements, sings, notice and directions general appearance of premises, specialized publicity. Prevention of accidents: Emphasis of safe driving, annual awards, bonus encouragement, vehicle design, platform layout, location of stops, scheduled speed, route hazards, records, elimination of accident prone drivers.

TEXT BOOKS:

1. Bus operation – L.D.Kitchen, Iliffe & Sons , London
2. Bus & coach operation – Rex W. Faulks, Butterworth Version Of 1987, London

REFERENCE BOOKS:

1. Compendium of transport terms – Cirt,Pune
2. M.V. Act 1988 – Central Law Agency, Allahabad
3. The elements of transportation – R.J. Eaton
4. Goods vehicle operation – C.S. Dubbar

Scheme of syllabus for 6th SEM B.E. Automobile

Sl. No	Subject Code	Subjects	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	**UAU621C**	**Automotive Engine Component Design**	4	4	0	0	50	50	**100**
2	**UAU622H**	**Engineering Economics**	3	3	0	0	50	50	**100**
3	**UAU623C**	**Automotive Electrical Systems**	3	3	0	0	50	50	**100**
4	**UAUXXXE**	**Dept. Elective – II**	3	3	0	0	50	50	**100**
5	**UAUXXXN**	**Open Elective – I**	3	3	0	0	50	50	**100**
6	**UAU627L**	**Automotive CAD Laboratory**	1.5	0	0	3	50	50	**100**
7	**UAU638L**	**Automotive Power Train and Electrical Servicing Lab**	1.5	0	0	3	50	50	**100**
8	**UHS003N**	**Career Planning and Professional Skills**	1	2	0	2	50	50	**100**
9	**UAU609P**	**Mini Project**	3	0	0	6	50	50	**100**
10	**UXHVM**	**Universal Human Values**	0	3	0	0	50	50	**10**
		Total	**23**	**21**	**0**	**14**	**500**	**500**	**1000**

Department Electives – II

Sl. No	Code	Subjects
1	UAU651E	CAD/CAM
2	UAU653E	Automotive Air Conditioning
3	UAU654E	Advanced Automotive Materials
4	UAU655E	Diesel Engine Management System and Components

QUESTION PAPER PATTERN:

1. Total of **8** Questions with **2** from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than **4** sub divisions.
3. Any **Five** Full questions are to be answered choosing at least **one** from each unit.

	Title of the Subject: **Automotive Engine And Component Design**	Sem: **6** Code: **UAU621C** Credits: **4**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Correlate and analyze the vehicle design problems.	3	3	3	1	1	1			2	1	1	1
2	Estimate and analyze the expectancy curves and compare with performance curves.	3	3	3	1	1	1			1	1	1	1
3	Design a cylinder head, block and valves with live time approach	3	3	3	1	1	1			2	1	1	1
4	Select a suitable piston, connecting rod, crank shaft and flywheel with live time approach.	3	3	3	1	1	1			1	1	1	1
5	Recommend a suitable crank shaft and flywheel for given applications	3	3	3	1	1	1			2	1	1	1
6	Develop valve configurations for various applications	3	3	3	1	1	1			2	1	1	1

UAU621C: AUTOMOTIVE ENGINE COMPONENT DESIGN

4 Credits (4 - 0 - 0)

.UNIT - I **13 HOURS**

ENGINE SELECTION CRITERIA: Road, wind and gradient resistance, starting torque, load-speed characteristics, expectancy curves and performance curves.
CARBURETION: Air-fuel ratio, throat diameter, air and fuel flow rate, change in air-fuel ratio at altitude, velocity of air at venture throat, pressure drop, mass flow of fuel.
INJECTION: Injection in CI engines; volume of fuel injected, velocity and duration of injection, orifice area of injector, pressure difference.
DESIGN OF CYLINDER BLOCK, CRANK CASE AND CYLINDER HEADS: Cylinder heads, gaskets, cylinder wear, water jacket, cylinder liners, crank case, oil sumps and cooling features.
Engine mountings, front and rear mountings, type of engine blocks, manifolds; types, inlet and exhaust manifolds, dual manifolds, design of manifolds, mufflers; types, design.

UNIT - II **13 HOURS**

DESIGN OF CYLINDER BLOCK, CRANK CASE AND CYLINDER HEADS: Cylinder heads, gaskets, cylinder wear, water jacket, cylinder liners, valve seats. Crank case - general form of crank case, oil sumps and cooling features, flywheel mountings, engine mountings, front and rear mountings. Production of engine blocks, manifolds and mufflers - inlet and exhaust manifolds, mixture distribution, heating by exhaust gas, dual manifolds, general design of manifolds, effect of firing order, mufflers, general design.
DESIGN OF PISTON, PISTON RINGS, PISTON PIN: Piston temperatures, piston slap, compensation of thermal expansion in pistons. Piston rings, forms of gap, stresses in piston rings, ring collapse, heat treatment, piston ring selection, shape. Piston pin, locking of piston pins, length of piston.

UNIT - III **13 HOURS**

DESIGN OF CONNECTING ROD: Length of rod, cross section, buckling, drilled connecting rods, piston pin bearing, offset connecting rods, effects of whipping, bearing materials, lubrication.
DESIGN OF CRANK SHAFT: Balance weights, local balance, crankshaft proportions, oil holes drilled in crank shafts, balancing and torsional vibration analysis, vibration dampers, firing order, bearings, lubrication.

UNIT - IV **13 HOURS**

DESIGN OF FLYWHEEL: Necessity, capacity, mounting of flywheels, coefficient of fluctuation of speed, fluctuation of energy, maximum fluctuation of energy, energy stored in a flywheel, stresses, construction.
DESIGN OF VALVE AND VALVE MECHANISM: Angle of seat, operating conditions, operating temperatures, valve cooling, sodium cooled valves, valve rotators, valve seats, valve guides, valve springs, valve clearance, valve timing, OHV, OHC, dual valves, types of valve operating mechanisms. Valve train component details, camshaft, drives of cams, cam types, tappets, automatic zero clearance tappets, push rods, rocker arms and rocker shaft.

Text Books:

1. High Speed Engines - P.M.Heldt, Oxford & IBH, 1965
2. Auto Design – R.B Gupta, Satya Prakashan, New Delhi 2002
3. Automotive mechanics- N.K. Giri

Reference Books:

1. A course in I.C. Engine - Mathur & Sharma, Dhanput Rai & Sons, Delhi, 1994
2. Internal Combustion Engines-V Ganesan, Tata McGraw Hill,Delhi, 2002
3. Automobile Engineering Vol. II - Kirpal Singh, Standard publications, New Delhi, 2004
4. Modern Petrol Engine - A.W.Judge, B.I. Publications. 1983

	Title of the Subject**: Engineering Economics**	Sem**: 6** Code**: UAU622H** Credits **: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Describe various economic terms and analyze the basic concepts of price, product and market and correlate them	2	2	1	1	1	2		1		2	2	2
2	Illustrate the role of banking, stock exchange, insurance, wages and their role in economics of business	2	2	1	1	1	2		1		2	2	2
3	Classify taxes and depreciation in monetary system and evaluate their role in economics	2	2	1	1	1	2		1		1	2	2
4	Assess various costs, cost accounting procedure and its implementation in business enterprises	2	2	1	1	1	2		1		1	2	2
5	Evaluate the concept of interest and its significance with analysis of cash flow and apply to investments	2	2	1	1	1	2		1		1	2	2
6	Analyze book keeping approach, their role and implementation in assessments	2	2	1	1	1	2		1		2	2	2

UAU622H: ENGINEERING ECONOMICS

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Definition of various economic terms such as economic goods, utility, value, price, wealth, wants capital, rent and profit, laws of returns.

DEMAND AND SUPPLY: Law of diminishing utility and total utility. Demand schedule. Law of demand. Elasticity of demand, law of substitution, law of supply, supply schedule, elasticity of supply.

WAGES: Nominal and real wages, factors affecting real wages, theory of wages, difference in wages, methods of wage payment.

UNIT - II **10 HOURS**

MONEY AND EXCHANGE: Theory of exchange, barter, stock exchange, speculation money qualities of a good money, function of a money, classification of money, value of money, index number, appreciation and depreciation of money value, Gresham's law and its limitations.

TAXATION AND INSURANCE: Principle of taxation, characteristics of a good taxation system, kinds of taxes, and their merits and demerits, vehicle insurance, loss assessment.

INTEREST AND DEPRECIATION: Introduction, theory of interest, interest rate, interest from lender's and borrower's view point, simple and compound interest. Nominal and effective interest rates, interest formulae. Annual compounding, annual payments and continuous compounding annual payment, simple numerical problems. Need for depreciation causes of depreciation life and salvage value methods of depreciation, simple numerical problems.

UNIT - III **10 HOURS**

COSTS: Standard costs estimated cost, first cost, fixed cost, variable costs, incremental cost, differential cost, sunk and marginal cost, breakeven and minimum cost analysis, simple numerical problems.

COST ACCOUNTING: Introduction, objectives of cost accounting, elements of cost material cost, labour cost, and expenses, allocation of overheads by different methods, simple numerical problems.

UNIT - IV **10 HOURS**

BASIS FOR COMPARISON OF ALTERNATIVES: Present worth methods, capital recovery methods, and rate of return method, simple numerical problems.

BOOK KEEPING AND ACCOUNTS: Introduction, necessity for book keeping, single entry and double entry, ledger, trial balance, final accounts, trading accounts, profit and loss accounts, balance sheet, simple problems.

TEXT BOOKS:

1. Engineering Economy - TARACHAND, 2000
2. Engineering Economy **-** RIGGS J.L., McGraw Hill, 2002
3. Engineering Economy **-** THUWSEN H.G., PHI, 2002

REFERENCE BOOKS:

1. Industrial Engineering and Management - O.P KHANNA, Dhanpat Rai & Sons.
2. Financial Management -I.M PANDAY, Vikas Publishing House
3. Engineering Economy - Paul Deoarmo, Macmillan Pub, Co., 2001
4. Mechanical Estimation and Costing - D. Kannappan.

	Title of the Subject: **Automotive electrical Systems**	Sem:**6** Code**: UAU623C** Credits: **3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Discuss the need, types, rating and characteristics of a battery.	3	2	2	1	2	1				1	1	1
2	Explain the different dash board instruments and safety devices. .	3	2	1	1	2	1				1	1	1
3	Analyze the ignition fundamentals, types and its operation.	3	2	2	2	2	1				1	1	1
4	Assess the importance of starting motors and their working.	3	2	1	1	2	1				1	1	1
5	Analyze different types of charging systems and their characteristics.	3	2	1	2	2	1				1	1	1
6	Analyze and interpret the features and types of lighting and air conditioning systems.	3	2	1	1	2	1				1	1	1

UAU623C: AUTOMOTIVE ELECTRICAL SYSTEMS

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

STORAGE BATTERY: Introduction, principle of lead acid cells, construction and elements, electrolyte and their preparation, specific gravity, capacity and efficiency, battery tests, battery ratings, chemical action in cell, direction of current flow, recharging batteries, temperature effect on battery characteristics, methods of charging. Working principles of Alkaline, Nickel - Cadmium, silver - zinc battery, Lithium batteries. Battery trouble shooting.
Networks and multiplexing. Other electric and electronic devices.
Vehicle security systems: seat belts, air bags.
INDICATING AND WARNING DEVICES AND DASH BOARD INSTRUMENTS: Fuel gauge, oil-pressure gauge; balancing coil, thermostatic, electronic and digital gauges, water temperature gauge, speedometers; mechanical, electrical, digital. Warning lights; oil pressure, water temperature, horn, windscreen-wipers, signaling devices. Trouble shooting.

UNIT - II **10 HOURS**

GENERATOR / ALTERNATOR: Principle of generation of direct current, generator constructional details; commentators, principle of commutation, armature, field magnets, windings, brushes, wiring circuit of generators, types of generators, generator drives, cutout relay, ammeter. Construction of alternator, rectification, voltage regulation, testing of alternator. Alternator terminals, cooling, instrument panel. Charge indicators, charging system test, charging system service and fault diagnosis.
STARTER MOTOR AND DRIVES: Introduction**,** starting motor principle, torque and power requirements, starting motors and its characteristics. Starting motor drives. Starting system tests. Servicing starting motors. Starting motor trouble shooting.

UNIT - III **10 HOURS**

IGNITION SYSTEM: Ignition fundamentals, types of ignition systems and related components. Spark plugs; general considerations, characteristics, materials. Ignition timing; advance mechanism; centrifugal and vacuum. Ignition system tests, oscilloscope pattern. Setting ignition timing; types.
ELECTRONIC IGNITION: Pickup coil voltage pulse, high energy ignition system, electronic spark advance, optical photo diode distributor, distributors less ignition system, multiple coil ignitions, direct capacitor charge ignition. Distributor less ignition system, C.D.I, systems. Artificial intelligence.
Ignition system trouble shooting and trouble codes.

UNIT - IV **10 HOURS**

LIGHTING AND ELECTRICAL ACCESSORIES: Introduction, principle of automobile illumination, lightings, control of head light beam, head light dazzle, fog lamps, side and taillight, brake warning light, instrument and indicator lights, ignition warning light, direction indicators, parking light, fluorescent lighting. Automatic head lamp controls, fiber optic lighting, computer control lighting, distributed lighting, head lamp aiming. Lighting system trouble shooting and recent developments; L.E.D.
VENTILATION, HEATING AND AIR CONDITIONING: Passenger compartment heater, heater controls, heated air distribution, basic refrigeration cycle: refrigerant flow control valves, refrigerants, refrigerant oil. Types of air conditioner: manually controlled, automatically controlled and electronic automatic temperature control.

TEXT BOOKS:

1. Automobile Engineering: Kirpal Singh
2. Automobile Mechanics : William H Crouse
3. Automotive Electrical equipments: P.L.Kohli

	Title of the Subject : **Automotive CAD Laboratory**	Sem: **6**				Code: **UAU627L**				Credits : **1.5**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Utilize the CATIA software commands to generate geometrical primitives and sketcher	3	1	1	1	3				1	1	1	2
2	Utilize the CATIA software commands to generate 2D and 3D models.	3	1	1	1	3				1	1	1	2
3	Able to convert, modify and develop solid and surface models for FEM solutions.	3	1	1	1	3				1	1	1	2
4.	Develop program for generating component profile using NC programming for milling and turning jobs.	3	1	1	1	3				1	1	1	2

UAU627L: AUTOMOTIVE CAD LABORATORY

1.5 Credit (0 - 0 - 3)

1. Modeling – Introduction. Development of 2D and 3D geometric modeling using anyone parametric software. Exercises on automotive components - 3D modeling (1 – 4 components) Softwares – Pro-E, CATIA, UNIGRPHICS etc.
2. Analysis – FEA (Preprocessor, solver, post processor)
   a) Exercise involving simple structures.
   b) Validation of result with analytical solution.
3. Introduction to CNC programming(G codes & M codes) a)Turning b) Milling Simple Exercises (2 – 4 Nos.) using CNC Simulator.

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   a. Performance and journal write-up :
      Marks for each experiment = 30 marks/No. of proposed experiments.
   b. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

	Title of the Subject:: **Automotive power train and electrical servicing lab**	Sem: **6** Code: **UAU638L** Credits : **1.5**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To know the electrical and power train trouble shooting aspects and specifications of various vehicles	2	1	1			1			2	1	1	1
2	Able to demonstrate the dismantling of various transmission elements like clutch, gear box etc. and study its details	2	1	1			1			2	1	1	1
3	Able to demonstrate the dismantling of electrical elements and study its details	2	1	1			1			2	1	1	1
4.	To be able to know the seat adjustments and door mechanisms	2	1	1			1			2	1	1	1

UAU638L: AUTOMOTIVE POWER TRAIN AND ELECTRICAL SERVICING LAB

1.5 Credit (0 - 0 - 3)

1. Writing technical specifications and description of all types of chassis and transmission components of automobiles, including body and interiors (two wheeler, four wheeler and heavy vehicle – one each)
2. Trouble shooting charts for major parts like clutch, gear box, differential, brakes, wheels with tyres, steering system and suspension.
3. Testing and servicing of electrical components like battery, starting system, ignition system, central locking system, lighting system, and alternator. Experiments on microprocessors related to automobiles
4. Dismantle and assemble of major systems (clutch system, Gear boxes, Propeller shaft, Differential, Front and Rear axles, brake system, steering system and suspension system) and identifying remedies (like backlash adjustment, brakes adjustment, bleeding of brakes) for the possible problems based on trouble shooting charts.
5. Draw sketch of seating arrangements, seats for commercial vehicle and study the comfort levels provided for driver and passengers.
6. Draw sketches of different mechanisms of door, seat adjustments mechanisms.

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   c. Performance and journal write-up :
      Marks for each experiment = 30 marks/No. of proposed experiments.
   d. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE

UAU609P: MINI PROJECT
3 Credits (0-0-3)

Scheme of Examination

1. **CIE – 50 Marks**
   - Identification of project
   - Finalization of topic
   - About the Project
   - Objectives of Project

2. **SEE – 50 Marks**
   - Project Report + Submission
   - Presentation

	Title of the Subject: **CAD/CAM**	Sem**: 6** Code**: UAU651E** Credits **: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Evaluate the influence of computers in design and manufacturing	3	2	3	1	2	1				1	2	1
2	Asses the role of hardware structure and types hardware for CAD	3	2	3	1	2	1				1	2	1
3	Classify CAD model and know-how to developing models using different approaches.	3	2	3	1	2	1				1	2	1
4	Develop programs to generate the drawings on computers and manufacture products on NC machines.	3	2	3	1	2	1				1	2	1
5	Enumerate the different types of robots and manufacturing systems, their features and application.	3	2	3	1	2	1				1	2	1
6	Analyze and interpret the potential of Finite Element Analysis and their need and significance.	3	2	3	1	2	1				1	2	1

UAU651E: CAD/CAM

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Advantages and disadvantages of CAD and CAM.

HARDWARE FOR CAD: Basic hardware structure, working principles, usage and types of hardware for CAD - Input devices, output devices, memory, CPU, hardcopy and storage devices.

UNIT - II **10 HOURS**

COMPUTER GRAPHICS: Software configuration of a graphic system, function of graphics package, construction of geometry, wire frame and solid modeling, geometry transformation - two dimensional and three dimensional transformation, translation, scaling, reflection, rotation, CAD/CAM integration. Desirable modeling facilities. Introduction to exchange of modeling data - basic features of IGES, STEP, DXF, DMIS.

INTRODUCTION TO ROBOTICS: Introduction, robot configuration, robot motion, programming of robots, end effectors work cell, control and interlock, robot sensor, robot applications.

UNIT - III **10 HOURS**

NC, CNC, DNC TECHNOLOGIES: NC, CNC, DNC, modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC.

CNC TOOLING: Turning tool geometry, milling tooling system, tool presetting, ATC, work holding.

CAM PROGRAMMING: Overview of different CNC machining centers, CNC turning centers, high speed machine tools.

UNIT - IV **10 HOURS**

CNC PROGRAMMING: Part program fundamentals, steps involved in development of a part program. Manual part programming, milling, turning, turning center programming.

INTRODUCTION TO FINITE ELEMENT ANALYSIS: Introduction, basic concepts, discretization, element types, nodes and degrees of freedom mesh generation, constraints, loads, preprocessing, application to static analysis.

TEXT BOOKS:

1. CAD/CAM Principles and Application - by P.N. Rao, Tata McGraw Hill.
2. CAD/CAM - by Groover, Tata McGraw Hill.

REFERENCE BOOKS:

1. Introduction to the Design and Analysis of Algorithms – S.E. Goodman, S.T. Headetmiemi, McGraw Hill Book Company – 1988.
2. Principles of Interactive Computer Graphics - by Newman and Sproull, Tata McGraw Hill, 1995.
3. NC Machine Programming and Software Design – Chno- Hwachang, Michel. A. Melkanoff, Prentice Hall, 1989.
4. Numetical Control and CAM - Pressman RS and Williams JE, Johnwiley.
5. Computer Graphics by Steven Harrington, McGraw Hill Book Co.
6. CAD-CAM - by Chris McMahon & Jimmie Browne – Pearson education Asia 2001.
7. CAD/CAM – Ibrahim Zeid, Tat McGraw Hill, 1999.
8. Computer Aided Manufacturing - by P.N. Rao, N.K. Tewari and T.K. Kundra Tata McGraw Hill 1999.
9. Introduction to FEM - T Chandra patta Ashok D Bebgundu.

	Title of the Subject : **Automotive air Conditioning**	Sem**: 6**			Code**: UAU653E**					Credits: **3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To understand the basic concepts of refrigeration and air - conditioning.	2	1	1	1	1	1	1			1		1
2	Know-how on components vehicle air-conditioning system.	2	1	1	1	1	1	1			1		1
3	To study the control systems in air - conditioning and trouble shooting.	2	1	1	1	1	1	1			1		1
4	To study refrigerants, their environmental impact and legislation.	2	1	1	1	1	1	1			1		1

UAU653E: AUTOMOTIVE AIR CONDITIONING

3 Credits (3 - 0 - 0)

UNIT - 1

10 HOURS

AIR CONDITIONING FUNDAMENTALS: History of automotive air conditioning systems. Introduction to heating and ventilation. Basic theory of cooling, vapour compression refrigeration, alternative cycles, expansion valve system, fixed office valve system, dual air-conditioning.
Refrigeration and cooling; refrigeration, evaporation, condensation, heat transfer, refrigeration cycle, refrigerant and flow control valves.

UNIT - I1

10 HOURS

AIR CONDITIONING COMPONENTS: Compressor, compressor clutch, types of air conditioning compressors, cycling and non cycling compressor, electrically driven compressor, condenser, receiver-drier/accumulator, expansion valve, fixed orifice valve, evaporator, anti-frosting devices, basic control switches.

UNIT - III **10 HOURS**

AIR CONDITIONING CONTROLS: Electrical and electronic control, electrical principles, sensors and actuators, testing of sensors and actuators, oscilloscope waveform sampling, multiplex wiring systems, OBD and EOBD, ready wiring diagrams, automotive A/C manual control systems - case studies.
Diagnostics and troubleshooting: initial vehicle inspection, temperature measurement, pressure gauge, cycle testing, A/C system leak testing.

UNIT - IV **10 HOURS**

SERVICE AND REPAIR: Precaution, refrigerant, recovery, recycle and charging, system oil, system flushing, odour removal, retrofitting, replacement and adjustment of components, fixed orifice valve replace.
ENVIRONMENT AND LEGISLATION: Global warming, ozone layer, legislation.
Ventilating the passenger compartment, heater controls, heated air distribution, heated wind shield. Solar powered ventilation, electronic automatic temperature control.

TEXTBOOKS:
1. Automotive air conditioning and climate control: **Steven Daley** (Butterworth Heinmann, Elsevier)
2. Automotive mechanics – **William Crouse**.

	Title of the Subject: **Advanced Automotive Materials**	Sem:**6**			Code: **UAU 654E**				Credits: **3**				
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To understand the basic knowledge and use of advanced materials and composites in automotive engineering.	2	1	1	2	1	1	1			1		1
2	Know-how on polymers and its application in automotives.	2	1	1	1	1	1	1			1		1
3	To study the use and significance of carbon polymers.	2	1	2	1	1	1	1			1		1
4	To understand the future trends in body materials.	2	1	1	1	1	1	1			1		1

UAU654E: ADVANCED AUTOMOTIVE MATERIALS

3 Credits (3 - 0 - 0)

UNIT - I

10 HOURS

INTRODUCTION TO ADVANCED MATERIALS: Composites and hybrids Sandwich materials, Metal matrix composites: automotive applications. Ceramic and glasses; automotive glazing, sustainable materials. Advanced composites.

UNIT - II

10 HOURS

POLYMERS: Processing of polymers, components for noise and vibration isolation and control on automotive industry. Recycling of polymers and biopolymers and steel processing: formability of steel sheets and tailor welded blanks for automotive application. Thermoplastics, thermosets.

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UNIT - III

10 HOURS

CARBON FIBERS: Carbon-fibers-reinforced silicon carbide. Magnesium: Properties and automotive application for magnesium. New brake disc material **-** Elements of ceramic brake disc, material behaviour, material properties, advantages.

Titanium and Nickel: Properties and their automotive applications

UNIT - IV

10 HOURS

BODY MATERIALS: Future trends in body materials; objectives and contents. Mechanical and physical properties of materials. Material selection for automotive body components.

Trimming of plastics. Insulating materials and sealing compounds.

Factors influencing material change in future, emission control and fuel systems.

BOOKS: 1. Encyclopedia of automobile engineering (vol. 6)

1. Materials for automotive bodies – Geoff Davis (B/H)
2. Encyclopedia of automobile engineering (vol. 4)
3. Automotive Hand book(9th Edition) – Bosch(Wiley)

	Title of the Subject **: Diesel Engine Management Systems and Components**	Sem**: 7**			Code: **UAU655E**					Credits **: 3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1.	To study fuel injection basic principle, fuel injection parameters and mixture distribution	2	2	1	1			1			1	1	1
2.	Able to know electric fuel pumps: introduction, types, gear type fuel pump, fuel coolers	2	2	1	1			1			1	1	1
3.	To study common rail systems**:** Operating concept, design, control regulation for cars and commercial vehicles	2	2	1	1	1		1			1	1	1
4.	To study the requirements and functions of OBD systems	2	2	1	1	1		1			1	1	1
5.	To study air filters and its types and alternate fuels for diesel engines	2	2	1	1			1			1	1	1

UAU655E: DIESEL ENGINE MANAGEMENT SYSTEMS AND COMPONENTS

3 Credits (3 - 0 - 0)

UNIT – I

10 Hours

FUEL INJECTION: Basic principle, fuel injection parameters, mixture distribution.
ELECTRIC FUEL PUMPS: Introduction, types, gear type fuel pump, fuel coolers, supplementary valves, discrete cylinder systems, unit Injector system. Pre-injection, main injection, high pressure solenoid valve. Diesel spray characteristics: macroscopic characteristics; front penetration, cone angle, liquid length. Microscopic characteristics; droplet size and distribution.

UNIT – II

10 Hours

COMMON RAIL SYSTEMS: Operating concept, design, control regulation for cars and commercial vehicles. High pressure pumps, accumulators, high pressure sensors, relief and control valves.
Electronic diesel control: Requirements, operating concept, system modules, fuel injection control, Lambda closed loop control, torque control electronic control systems, data exchange with other systems.

UNIT - III

10 Hours

FAULT DIAGNOSTICS: OBD system for passenger cars and light duty trucks; requirements and functions of OBD systems. General fuel efficiency enablers; reduction in parasitic losses, piston and ring pack, dynamic seals, bearings, advanced coating and lubricants, accessories, cycle efficiency, waste gas energy, engine mass.

UNIT - IV

10 Hours

AIR FILTERS; CARS AND CVS. Hot film air mass meter, accelerator pedal sensor.
Alternate fuels for diesel engines: Bio-diesel, rape oil, bioparaffins, synthetic fuels, dimethyl ether.

BOOKS: Diesel engine management systems and components - Konard Reif (Springer)
Fuel injection: Daniela Siano

Time / Day	8.00 am to 9.00 pm	9.00 am to 10.00pm		10.15 am to 11.15am	11.15am to 12.15pm		2.00 pm to 05.00pm
Monday			TEA BREAK			LUNCH BREAK	
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							

BASAVESHWAR ENGINEERIGN COLLEGE (Autonomous)
BAGALKOT-587103
An Autonomous Institution under Visvesvaraya Technological University
Belgaum – 590014, Karnataka. India

Syllabus VII & VIII SEMESTER
2018-19 & 2019-20 (175 Credits) Admitted Batch

DEPARTMENT OF AUTOMOBILE ENGINEERING

INSTITUTION VISION AND MISSION

Vision

To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic socio economic development.

Mission

- To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change
- To carry out innovative cutting edge research and transfer technology for industrial and societal needs
- To imbibe moral and ethical values and develop compassionate, humane professionals

DEPARTMENT VISION AND MISSION

VISION

To nurture academic excellence in the field of automobile engineering with innovative and challenging attitudes to social needs.

MISSION

1. To disseminate the knowledge to build the outstanding professionals in automobile engineering through teaching learning process.
2. To develop platform for higher learning, research and industry institute interaction to face global challenges inculcated with human and social values.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1	To prepare the students with knowledge in basic science and engineering to meet global challenges
PEO2	To develop the students in automotive engineering, thermal, design, manufacturing, autotronics in line with present technology
PEO3	To develop the students as entrepreneurs and encourage to pursue higher education and research

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1	Apply engineering basic knowledge with modern computing tools in solving problems of design, production and servicing domains
PSO2	Mould and develop engineers to serve in industries as professionals or entrepreneur
PSO3	Prepare engineers to undertake research and higher learning

PROGRAMME OUTCOMES (POs)

Sl. No	Programme Outcomes	
PO 1	**Engineering knowledge**	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**	Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**	Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Scheme of syllabus for 7th Sem B.E. Automobile

S. No	Sub Code	Subjects	Credits	Hours/ Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UAU721C	Vehicle Body Engineering	3	3	0	0	50	50	100
2	UAU712C	Vehicle Dynamics	3	3	0	0	50	50	100
3	UAU723C	Autotronics	3	3	0	0	50	50	100
4	UAU XXXE	Dept .Elective - III	3	3	0	0	50	50	100
5	UAUXXXN	Open Elective - II	3	3	0	0	50	50	100
6	UAU716L	Automotive Reconditioning Laboratory	1	0	0	2	50	50	100
7	UAU717P	Project Phase - I	5	0	0	10	50	50	100
8	UAU718L	Internship	2	0	0	0	50	50	100
		Total	**23**	**15**	**0**	**12**	**400**	**400**	**800**

Department Elective – III

Sl. No	Code	Subjects
1	UAU761E	Non Traditional marching process
2	UAU762E	Rocket and Jet Propulsive Systems
3	UAU763E	On and Off Board Vehicle Diagnostics
4	UAU764E	Electrical Vehicles

QUESTION PAPER PATTERN:

1. Total of 8 Questions with **2** from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than **4** sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

	Title of the Subject **: Vehicle body engineering**	Sem**:7**			Code: **UAU721C**					Credits: **3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To know and analyze classification, vehicle body construction, design and development of various types of vehicles and their layouts body design nomenclatures.	3	2	3	3	1							3
2	To know and analyze fixed and free control systems, aerodynamic styling, trimming, materials and paintings used in vehicle body design and development of various vehicles.	3	2	3	3	2							3
3	Analyze the forces and couples acting on vehicle during various running conditions.	3	2	3	3	2							3
4	Develop templates / prototypes and analyze the various aerodynamic forces and couples acting on the vehicle, pressure distribution analysis and flow visualization techniques while testing in wind tunnel.	3	2	3	3	2							3
5	To analyze and develop SFD and BMD for load distribution and stress analysis in vehicle body design.	3	2	3	3	2							3
6	To analyze space optimization techniques, visibility, body development skills, luxury, ergonomics for both driver and passengers. NVH analysis and safety.	3	2	3	3	2							3

UAU 721C: VEHICLE BODY ENGINEERING

3 Credits (4 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Classification of coachwork type: styling forms, coach and bus body style, layout of cars, buses and coach with different seating and loading capacity, commercial vehicle types, vans and pick-ups. Terms used in body building construction, angle of approach, angle of departure, ground clearance, cross bearers, floor longitudes, posts, seat rail, waist rail, cant rail, roof stick, roof longitude, rub rail, skirt rail, truss panel, wheel arch structure, wheel arch, post diagonals, gussets.

VEHICLE BODY MATERIALS: Properties, manufacturing methods and suitability for vehicle body construction Aluminum alloys, steel, alloy steels, plastics and composite materials, semi rigid PUR foams and sandwich panel construction. Paints and adhesives.

UNIT - II **10 HOURS**

AERODYNAMICS: Basics, various types of forces and moments, effects of forces and moments, various body optimization techniques for minimum drag, study of wind tunnels, flow visualization techniques, tests with scale models, aerodynamic study for heavy vehicles.

LOAD DISTRIBUTION: Type of body structures, vehicle body stress analysis, vehicle weight distribution, calculation of loading for static loading, symmetrical, longitudinal loads, side loads, stress analysis of bus body structure under bending and torsion.

UNIT - III **10 HOURS**

INTERIOR ERGONOMICS: Introduction, seating dimensions, interior ergonomics, seat comfort, driver seat design, dash board instruments, electronic displays, commercial vehicle cabin ergonomics, mechanical package layout, goods vehicle layout. Visibility, regulations, driver's visibility, methods of improving visibility, window winding mechanisms.

VEHICLE STABILITY: Introduction, longitudinal, lateral stability, vehicle on a curvilinear path, critical speed for toppling and skidding. Effect of operating factors on lateral stability, steering geometry and stabilization of steerable wheels, mass distribution and engine location on stability.

UNIT - IV **10 HOURS**

NOISE AND VIBRATION: Noise characteristics, sources of noise, noise level measurement techniques, body structural vibrations, chassis bearing vibration, designing against fatigue, methods of noise suppression.

SAFETY: Impact protection basics, physics of impact between deformable bodies, design for crash worthiness, occupant and cargo restraint, passive restraint systems, side impact analysis, bumper system, energy absorbent foams, laws of mechanisms applied to safety.

TEXT BOOKS:

1. Sydney F page, "Body Engineering"' Chapman & Hall Ltd, London, 1956
2. "Giles J Pawlowski", Vehicle body engineering Business books limited, 1989
3. John Fenton, "Vehicle body layout and analysis", Mechanical Engg. Publication ltd, London.

REFERENCE BOOKS:

1. Hand book on vehicle body design – SAE publication
2. Automotive chassis by P.M. Heldt, Chilton & Co, 1970
3. Vehicle Safety 2002, Cornwell press, Townbridge, UK, ISBN 1356 -1448.
4. Redesign of bus bodies – part I & part II – CIRT pune (Report), 1983
5. Ed W.H. Hucho, Aerodynamics of Road Vehicles, 4th Edition, Butter worth's 1987

	Title of the Subject **: Vehicle Dynamics**	Sem:**7** Code: **UAU712C** Credits**: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Classify and determine first and second order vibratory systems and formulate using basic approach.	3	3	1	2							1	2
2	Analyze the response of damped systems for varying degree of damping and compute the natural frequency of damped free vibration of mechanical systems.	3	3	2	2							1	2
3	Evaluate on numerical methods and their significance in multi degree freedom systems.	3	3	1	2							1	2
4	Illustrate the natural frequencies and mode shapes for multi-degree of freedom vibrating systems.	3	3	1	2							1	2
5	Investigate the response of vibrating systems due to engine unbalance	3	3	3	2							1	2
6	Asses the tire mechanics and analyze the vehicle control parameters	3	3	2	2							1	2

UAU712C: VEHICLE DYNAMICS

3 Credits (3 - 0 - 0)

UNIT - II 10 HOURS

UNDAMPED FREE VIBRATION: Introduction, sinusoidal motion, single degree of freedom system, Newton's method, energy method and De'Alembert's principle, undamped free vibration - natural frequency of free vibration, problems.

DAMPED FREE VIBRATION: Single degree of freedom systems, different types of damping, concept of critical damping and its importance, response study of viscous damped systems for cases of under damping and over damping, logarithmic decrement, problems.

UNIT - II 10 HOURS

FORCED VIBRATION: Single degree of freedom systems, steady state solution with viscous damping due to harmonic force solution by complex algebra, vibration isolation - transmissibility ratio, energy dissipated by damping equivalent viscous damping, structural damping, sharpness of resonance, base excitation, problems.

SYSTEMS WITH TWO DEGREE OF FREEDOM: Introduction, principle modes and normal modes, co-ordinate coupling, generalised and principle co-ordinate, free vibrations in terms of initial conditions, Lagrange's equation, semi-definite systems, applications: Vehicle suspension, dynamic vibration absorber, dynamics of reciprocating engines, problems.

UNIT - III 10 HOURS

NUMERICAL METHODS FOR MULTI DEGREE OF FREEDOM SYSTEMS: Introduction, influence coefficients, Maxwell's reciprocal theorem, Dunkerley's method, orthogonality principle, method of matrix iteration- method of determination of all the natural frequencies using sweeping matrix and orthogonality principle, Holzer's method for systems with free, fixed free and fixed ends, Stodola method, Rayleigh Ritz method for beam vibration.

UNIT - IV 10 HOURS

VEHICULAR VIBRATION: Vibration due to road roughness, vibration due to engine unbalance, reciprocating and rotating unbalance, transmissibility of engine mounting vibration with two degree of freedom, compensated suspension systems forced vibration.

TYRE MECHANICS: Vehicle control - low speed cornering and static steering, steady-state cornering - steering factors, vehicle control parameters (under steer, neutral steer and over steer), roll steer, compliance steer, ride steer, slip angle steer, steady state handling - lateral acceleration gain, characteristic speed, yaw velocity gain, critical speeds.

TEXT BOOKS:

1. Mechanical Vibration - G.K.Grover, Nemchand & Brothers,1989
2. Mechanical Vibration – V.P.Singh, Dhanpat Rai & Company Pvt. Ltd., 3rd Edition, 2006.
3. Fundamentals of vehicle dynamics - Thomas D. Gillespie, SAE USA 1992

REFERENCE BOOKS:

1. Vibration Theory Mechanical Vibrations- S.S.Rao, Pearson Edu.Inc., 4th Edition, 2003
2. Theory & Problems of Mechanical Vibration - William W. Seto, McGrawHill (schaum's outline series)
3. Problems in Automobile Mechanics - N.K.Giri, Khanna Pub.2004
4. Mechanics of Pneumatic Tyre - S.K.Clark, Prentice Hall
5. Mechanical Vibration Analysis- P.Srinivasan, TMH

	Title of the Subject: **Autotronics**	Sem**:7** Code**: UAU723C** Credits: **3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1.	To justify the need of Autotronic systems and explain the construction of various electronically controlled chassis and vehicle safety systems.	3	2	2	2	3	1	1			1	1	1
2.	The student will be able to analyze the working of electronic control systems used in modern automobiles	3	2	2	2	2	1	1			1	1	1
3.	To apply the knowledge of working of various sensors in the control of vehicular systems	3	2	2	2	2	1	1			1	1	1
4.	To compare the working of programmed control systems with conventional vehicular control systems	3	2	2	2	3	1	1			1	1	1
5.	To evaluate the performance of vehicle embedded with engine management systems	3	2	2	2	3	1	1			1	1	1

UAU723C: AUTOTRONICS

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Need for electronics in automotive control systems, structure of vehicle electronics systems, common features of vehicle systems, measurement system, sensors and actuators.

INTRODUCTION TO ELECTRONICS: Electronic components, diodes, transistors, electronic circuits, analog circuits, digital circuits, integrated circuits, microprocessor systems, systems approach to control and instrumentation.

UNIT - II **10 HOURS**

ELECTRONIC IGNITION SYSTEMS: Types of ignition systems, conventional ignition system, CDI, programmed ignition system, distributor-less ignition system, direct ignition.

ELECTRONIC FUEL CONTROL: Electronic control of carburetion, petrol injection system, single and multi point injection system, components, flow diagram, diesel fuel injection.

UNIT - III **10 HOURS**

ENGINE MANAGEMENT SYSTEM: Combined ignition and fuel management system, exhaust emission control, digital control techniques, complete vehicle control systems, artificial intelligence and engine management.

CHASSIS ELECTRICAL SYSTEMS: Anti-lock brakes, active suspension, traction control, electronic control of automatic transmission.

UNIT - IV **10 HOURS**

ELECTRONICS FOR COMFORT, SAFETY AND SECURITY: Electric seats, mirrors and sun-roof operation, central looking and electric windows, cruise control, In Car Entertainment (ICE) and communications, adaptive noise control, airbags and seatbelt tensioners, obstacle avoidance radar, security systems - engine immobilizer, ICAT.

TEXT BOOK:

1. Automotive electrical and electronic systems: Tom Denton, 3rd edition, SAE International.

REFERENCE BOOKS:

1. Automotive electronics: Eric Chowanietz, Newnes, 1995.
2. Understanding automotive electronics, William B Ribbens, Butterworth-Heinemann.
3. Automotive Electrics Automotive Electronics, Robert Bosch.

	Title of the Subject **: Automotive Reconditioning Lab**	Sem: **7**					Code: **UAU 716L**				Credits: **1**		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Demonstrate and calibrate the fuel injection pump.	2	1	2	1	1				1	1	1	1
2	Able to demonstrate experiment on reboring machine.	2	1	2	1	1				1	1	1	1
3	Able to demonstrate line bearing reboring process.	2	1	2	1	1				1	1	1	1
4	Able to demonstrate crank shaft grinding process.	2	1	2	1	1				1	1	1	1
5	Able to demonstrate connecting rod alignment and reboring process.	2	1	2	1	1				1	1	1	1

UAU 716L: Automotive Reconditioning Lab

1Credit (0-0-2)

1. Study and Practice of Line reboring machine
2. Study and Practice of calibration FIP
3. Study and Practice of vertical cylinder reboring machine
4. Study and Practice of reboring small and big end of connecting rod ‘
5. Study and Practice on body repairs tinkering and painting
6. Study and Practice of refacing of given valve
7. Study and Practice of surface grinding machine
8. Study and Practice of crank shaft grinding machine

Laboratory Assessment:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE
   - Performance and journal write-up :

   Marks for each experiment = 30 marks/No. of proposed experiments.
   - One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce).

3. Allocation of 50 marks for SEE

	Title of the Subject : **Non-Traditional Machining Processes**	Sem**: 7** Code: **UAU761E** Credits **: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Define and Classify different non - traditional machining techniques and their working principle.	3	1	1	1								2
2	Classify the NTM systems based on applications and limitation.	3	2	1	1								2
3	Ability to analyze the working parameters for optimize productivity.	3	2	1	1								2
4	Compare two or more NTM methods on the basis of merits and demerits.	3	3	1	1								2

UAU761E: NON-TRADITIONAL MACHINING PROCESSES

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: History, classification, comparison between conventional and non-conventional machining process selection.

ULTRA SONIC MACHINE(USM): Introduction, equipment, tool materials and tool size, abrasive slurry, cutting tool system design: effect of parameter: effect of amplitude and frequency and vibration, effect of abrasive grain diameter, effect of applied static load, effect of slurry, tool and work material.

UNIT - II **10 HOURS**

ABRASIVE JET MACHINING(AJM): Introduction, equipment, variables in AJM: carrier gas, type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number. abrasive particles per unit volume of the carrier gas, work material, Stand Off Distance(SOD), nozzle design, shape of cut. Advantages and disadvantages of AJM. Water Jet Machining: principle, operation, application, advantages and limitations of water jet machinery.

ELECTROCHEMICAL MACHINING(ECM): Introduction, study of ECM machine, elements of ECM process: Cathode tool, anode work piece, source of DC power, electrolyte, chemistry of the process, ECM process characteristics - material removal rate, accuracy, surface finish, ECM tooling: ECM tooling technique and example, tool and insulation materials, tool size electrolyte flow arrangement, handling of slug, economics of ECM, advantages, limitations.

UNIT - III **10 HOURS**

CHEMICAL MACHINING(CHM): Introduction, elements of process, chemical blanking process: Preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, applications of chemical blanking, chemical milling (contour machining): process steps - masking, etching, process characteristics of CHM: material removal rate accuracy, surface finish.

ELECTRICAL DISCHARGE MACHINING(EDM): Introduction, machine, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) electrode feed control, electrode manufacture, electrode wear , EDM tool design choice of machining operation electrode material selection, under sizing and length of electrode, machining time. Flushing; pressure flushing, suction flushing, side flushing, pulsed flushing synchronized with electrode movement.

UNIT - IV **10 HOURS**

PLASMA ARC MACHINING(PAM): Introduction, equipment, non-thermal generation of plasma, selection of gas, mechanism of metal removal, PAM parameters, process characteristics. Safety precautions, applications, advantages and limitations.

LASER BEAM MACHINING(LBM): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, process characteristics, applications, advantages and limitations.
ELECTRON BEAM MACHINING(EBM): Principle, equipment, operations, applications, advantages and limitation of EBM.

TEXT BOOKS:

1. **Modern Machining Process -** by Pandey and Shah, TATA McGraw Hill 2000
2. **New Technology -** by Bhattacharya, 2000

REFERENCE BOOKS:

1. **Production Technology –**HMT, TATA McGraw Hill. 2001
2. **Modern Machining Process** – Aditya, 2002
3. **Non-Conventional Machining -** P.K.Mishra, The Institution of Engineers (India) Test book series, Narosa Publishing House – 2005.
4. **Metals Handbook -** Machining volume 16 Joseph R. Davis (Editor), American Society of Metals (ASM)

	Title of the Subject **: Rocket and Jet Propulsive Systems**	Sem: **7**				Code**: UAU762E**				Credits **: 3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to know the principles of aircraft propulsion, types of power plants	2	2	2	1	1	1	1		1	1	1	1
2	Able to know the fundamentals of gas turbine engines illustration	2	2	2	1	1	1	1		1	1	1	1
3	To study the subsonic and supersonic inlets	2	1	1	1	1	1	1		1	1	1	1
4	To study the compressors principle and types of compressor used in jets	2	1	2	1	1	1	1		1	1	1	1
5	Able to know the ram jet propulsion and operating principle	2	2	2	1	1	1	1		1	1	1	1

UAU762E: ROCKET AND JET PROPULSION SYSTEM
3 Credits (3 - 0 - 0)

UNIT - I 10 HOURS

INTRODUCTION: Review of thermodynamic principles, principles of aircraft propulsion, types of power plants, basics of heat transfer; conduction, convection, radiation, diffusion mass transfer basic concepts and governing equations.

FUNDAMENTALS OF GAS TURBINE ENGINES ILLUSTRATION OF WORKING OF GAS TURBINE ENGINE: Thrust equation - factors affecting thrust - effect of pressure, velocity and temperature changes of air entering compressor - methods of thrust augmentation - characteristics of turboprop, turbofan and turbojet - performance characteristics.

UNIT - II 10 HOURS

SUBSONIC AND SUPERSONIC INLETS FOR JET: Engines internal flow and stall in subsonic inlets - boundary layer separation - major features of external flow near a subsonic inlet - relation between minimum area ratio and eternal deceleration ratio - diffuser performance - supersonic inlets - starting problem on supersonic inlets - shock swallowing by area variation - external declaration - models of inlet operation.

COMBUSTION CHAMBERS AND NOZZLES: Classification of combustion chambers - important factors affecting combustion chamber design - combustion process - combustion chamber performance - effect of operating variables on performance - flame tube cooling - flame stabilization - use of flame holders - theory of flow in isentropic nozzles - convergent nozzles and nozzle choking - nozzle throat conditions - nozzle efficiency - losses in nozzles - over expanded and under - expanded nozzles - ejector and variable area nozzles - interaction of nozzle flow with adjacent surfaces - thrust reversal.

UNIT - III 10 HOURS

COMPRESSORS PRINCIPLE OF OPERATION OF CENTRIFUGAL COMPRESSOR: Work done and pressure rise - velocity diagrams - diffuser vane design considerations – Concept of pre whirl - rotation stall - elementary theory of axial flow compressor - velocity triangles - degree of reaction - three dimensional - air angle distributions for free vortex and constant reaction designs - compressor blade design - centrifugal and axial compressor performance characteristics**.**

INTODUCTION TO TURBINES: Types of turbines - operating principle - design consideration - velocity triangles - degree of reaction - performance parameters - basics of blade design principle.

UNIT - IV 10 HOURS

RAMJET PROPULSION: Operating principle - sub critical, critical and supercritical operation - combustion in ramjet engine - ramjet performance - sample ramjet design calculations - introduction to scramjet - preliminary concepts in supersonic combustion - integral ram- rocket.

FUNDAMENTALS OF ROCKET PROPULSION: Types and classification of rockets operating principle - specific impulse of a rocket - rocket nozzle classification - rocket performance considerations.

Text Books

1. V. Ganesan, “ Gas Turbine”, Tata McGraw Hill Pub. Co. Ltd., 1996 2. Hill, P.G. & Peterson,
2. C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999. 43

References

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Longman,
2. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985
4. “Rolls Royce Jet Engine” – Third Edition – 1983. 5. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and R

	Title of the Subject **: On and off board diagnostics**	Sem: **7**				Code**: UAU 763E**					Credits**: 3**		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To study the introduction of diagnostics; System structure, on-board diagnostics, off-board diagnostics	2	2	1	1			1			1	1	1
2	To study the risks and challenges of OBD software and description of the problem domain; basic objects and relations, integration with real time system.	2	2	1	1			1			1	1	1
3	To study and analyse the neural network based intelligent performance and emissions prediction system for on-based diagnostics	2	2	1	1			1			1	1	1
4	To study and analyse the fuzzy system for automotive fault diagnosis.	2	1	1	1			1			1	1	1

UAU763E: ON AND OFF BOARD DIAGNOSTICS

3 Credits (3 - 0 - 0)

UNIT - I **10 Hours**

INTRODUCTION: DEFINITION OF DIAGNOSTICS: System structure, on-board diagnostics, off-board diagnostics, model based approach to diagnosis, VMBD (vehicle model based diagnosis) project, common rail demonstrator, DTI (distributor type injection) demonstrator. Prospects for failure diagnostics of automotive electronic control system.

History of diagnostics tools, present state and changes in diagnostics techniques, OBD-II diagnostic logic, future trends of diagnostics technique. Further improvement of diagnostic function.

UNIT - II **10 Hours**

A new object oriented diagnostic system management for power train control units with OBD. Impact of legal regulation (OBD-II), challenges for OBD software. Description of the problem domain; basic objects and relations, integration with real time system. In-cylinder diagnosis by laser tomography; measurement methods. Portable on-board diagnostic OBD-II /CAN scan tool. An on-board diagnosis method for three way catalyst deterioration Engine knock detection. OBD-II Performance of three way catalysts. Product, tools and emerging research.

UNIT - III **10 Hours**

Evolution knock detection products, stages of knock detector development and tool requirements, next generation of knock systems.

Virtual sensing**:** A neural network based intelligent performance and emissions prediction system for on-based diagnostics and engine control. Operation of virtual sensing system, virtual sensor architecture virtual sensors prediction and training, applications to diesel and petrol engine, applications of virtual sensing, engine diagnostics, engine control and engine modeling.

UNIT - IV **10 Hours**

High temperature measurements for on-board diagnostics of LEV/ULEV systems. Emissions after cold start, catalyst heating systems, temperature measurement systems.

Heavy duty approach to on board diagnostics. An advanced electronic control and diagnostics systems for automatic transmission: Function, structure, software, sensors, actuators, operation, diagnosis. Fuzzy system for automotive fault diagnosis.

OBD-II system in the Hyundai Accent (case study).

BOOKS: Ronald Jurgen

No.	Title of the Subject **: Electric vehicles**	Sem: **7** Code**: UAU764E** Credits : **3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Know-how of power plants used in vehicles and their significance.	2	1	2	1	2	2	2	1		2		1
2	To provide exposure to electric vehicle battery technology and control systems.	2	1	2	1	2	2	2	1		2		1
3	To introduce power drives and their drive train configuration.	2	1	2	1	2	2	2	1		2		1
4	To provide knowledge electric vehicle design and safety.	2	1	2	1	2	2	2	1		2		1

UAU764E: ELECTRIC VEHICLES

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION: Electric vehicles; early systems, charging techniques for lead acid batteries, charging techniques for nickel based batteries, charging techniques for non aqueous batteries, Battery state of charge measurement, battery management, connection methods, battery exchange, infrastructure implications, recharging/refueling of other power storage devices.

Economic and environmental comparison of alternative vehicle options.

Electric vehicles; configuration of EVs, performance, traction motor characteristics, tractive effort and transmission requirements.

UNIT- II **10 HOURS**

BATTERIES: Storage batteries; advanced lead acid, metal foil lead acid, nickel **-** iron, nickel **-** zinc, nickel **-** cadmium, sodium **-** sulphur, sodium **-** nickel chloride, lithium **-** iron sulphide, lithium **-** solid polymer, lithium **-** ion, aluminum **-** air and zinc **-** air. Formation of GHG emissions from EV fuel cycle.

CONVERSION: Conversion overview, summary of EV conversion process. Controller; overview, solid state controller, manual switch versus solid state component.

UNIT - III **10 HOURS**

PROPULSION METHODS: DC Motors; series wound motors, shunt wound motors, compound wound motors, separately excited motors. AC Motors; induction motors, synchronous motors, brushless DC motors, switched reluctance motors, motor cooling, power train options for electric vehicles.

ELECTRIC PROPULSION SYSTEMS: DC motor drives, chopper control of DC motors. Drive train configuration and design objectives, control strategies.

UNIT - IV **10 HOURS**

VEHICLE DESIGN AND SAFETY: Effect of battery weight and volume, designing for minimum weight, safety of batteries, safety of alternative energy generating and storage systems, safety of other electrical systems, general design and safety issues, heating and air conditioning, auxiliary power subsystem, braking, suspension and wheel systems, rolling resistance.

Prototype and experimental electric cars**.**

CONTEMPORARY VEHICLE TECHNOLOGY: GM; EV1, Zafure, Ford; Think City, Ka Litmus, Nissan Hypermini, Toyota RAV 4 EV, Honda EV.

TEXT BOOKS:

1. Vehicular Electrical Power Systems – Emadi, Ehasni, Mercel (Marcel Dekker)
2. Electronic Engine Controls – Steve V Hatch(Cengage learning)
3. Electric and Hybrid vehicles – Pistoia (Elsevier)
4. Fuel cells principles and applications - B.Vishwanath, M. Aulice Scibion (University Press)
5. Electrical vehicle machine and drives – K.T.Chau (Wiley)

No.	Title of the Subject : Project Phase - I	Sem: 7 Code: UAU717P Credits:5											
	Course Outcomes	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Applying knowledge of basic science, core and elective engineering subjects to identify and execute the problems.	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**
2	Conduct and analyze the literature survey in the identified fields and define the objectives, proposed action plan and methodology.	**3**	**3**	**2**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**
3	Able to interact, analyze and create the directions and dimensions for problem solving.	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**
4	Skill developments in project report preparation, presentation, communication and justification.	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**3**

UAU 777P: Project Phase – I
5 Credits (0-0-10)

- Project Batch may consist of maximum of Four Students however under exceptional conditions it may be extended up to 5 students.
- Guide/s may be identified by the students or it may be allotted by the department.
- The students along with the respective guides have to decide the project work and submit the title and synopsis of the project work to the Departmental committee (DC) consisting of 1) HOD or HOD Nominee 2) Project Coordinator and 3) Respective Project Guide/s
- Each student in the batch is directed to maintain the project progress record book to enter the progress of project work during the contact hours with the respective guides.
- The contact hour schedule may be defined by the guides in consent with their batches as per convenience
- The CIE evaluation is to be conducted for 50marks by the guide by reviewing the progress of the project work, attendance through the record books conducting at least one demo/seminar presentation for the same project work before SEE examination.
- Students have to submit the synopsis in 2 copies containing objectives, methodology, literature review, etc as a project report-I for VII Semester SEE Examination purpose. (one report to the Guide and one report to DC)
- The SEE examinations will be conducted by DC separately for each project batch for 50marks.
- In case of the change of the title/synopsis/project work, may be done in consent with the respective guides before SEE examination and the same should be brought to the notice of DC.

Project- I

Examination	CIE	SEE
Marks	50 Marks	50 Marks

UAU718L: INTERNSHIP
CREDIT: 2

Students have to submit a report of the training undergone. Evaluation will be done at the end of the semester by evaluation committee set by the department.

Scheme of Evaluation for Internship (Mandatory)

- Students should complete 6 weeks
- Scheme of evaluation consists of both CIE and SEE.

➢ **CIE consists of 3 phases**

A report about the industry / institute and objectives after **2** weeks of internship **15 Marks**

➢ A report on study/ methodology of internship after **4** weeks **15 Marks**

➢ A presentation on internship after completion of **6** weeks **20 Marks**

Total: 50 Marks

- SEE to be conducted along with 7th semester examination, which includes viva-voce and report submission (both internal examiners)
-

Viva Voce	**25 marks**
Report	**25 marks**
Total	**50 marks**

The report should be in the format prescribed by department.

BE VIII SEMESTER

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	**UAUXXXE**	**Dept. Elective - IV**	3	3	0	0	50	50	**100**
2	**UAUXXXE**	**Dept. Elective - V**	3	3	0	0	50	50	**100**
3	**UAUXXXE**	**Dept. Elective - VI**	3	3	0	0	50	50	**100**
4	**UAU804P**	**Project Phase - II**	12	0	0	24	50	50	**100**
5	**UAU805S**	**Technical Seminar**	1	0	0	0	50	50	**100**
		Total	**22**	**9**	**0**	**24**	**250**	**250**	**500**

Department Electives – IV

Sl. No	Code	Subjects
1	UAU821E	Alternative Energy Sources
2	UAU822E	Computational Fluid Dynamics
3	UAU823E	Intelligent Transport Systems and Future trends
4	UAU824E	Robotics and Automation

Department Electives – V

Sl. No	Code	Subjects
1	UAU831E	Hydraulic and Pneumatics
2	UAU832E	Composite Materials
3	UAU833E	Engine Trouble Diagnosis and Rebuilding
4	UAU834E	Hybrid Vehicles

Department Elective – VI

Sl. No	Code	Subjects
1	UAU841E	Automotive Vehicle Safety
2	UAU842E	Advanced I.C. Engines
3	UAU843E	Finite Elements of Method
4	UAU844E	Earth Moving Equipments

	Title of the Subject : **Alternative Energy Sources**	Sem: **8** Code**: UAU821E** Credits**: 3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to know the need, availability, classification of renewable energy sources and its environmental impact	2	1	1	2		2	3	1		2		2
2	Able to know the solar energy and its applications with collectors and their types.	2	1		2		2	3	1		2		2
3	To know and analyze of bio mass and its utility with its derived products and their application in IC engines and subsequent modification	2	2	1	2		2	3	1		2		2
4	Ability to study and the use of alcohol fuels, its properties and its comparison with conventional fuels.	2	2	1	2		2	3	1		2		2
5	To study and analyze the use of biodiesel, LPG and natural gas properties and its performance	2	1	1	2		2	3	1		2		2
6	Analyze the issue and challenges associated with hydrogen as an energy carrier, properties, production, storage and transportation and utilization with modifications involved.	2	2	1	2		2	3	1		2		2

UAU821E: ALTERNATIVE ENERGY SOURCES

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

ALTERNATIVE ENERGY RESOURCES: Types of energy sources need for energy sources, availability, merits and demerits. Green house gases and climate change. Renewal energy sources: definition, classification and comparison with conventional fuels.

SOLAR ENERGY: Solar radiation, geometry, radiation measurement devices; pyranometer and pyreliometer, solar energy collectors and their types, performance characteristics of collectors, applications of solar energy, solar energy storage system, photovoltaic conversion, solar cell characteristics.

UNIT - II **10 HOURS**

BIOMASS ENERGY: Introduction, definition of biomass, types of biomass, biomass conversion techniques, bio gas, composition, bio gas generation process, factors affecting bio gas generation, selection of biogas plant, types of bio gas plants, construction and their working, problems involved in production and transportation, application of bio gas for IC engines, dual fuel approach, modifications required. Producer gas: Production through pyrolysis, composition, performance modifications needed.

UNIT - III **10 HOURS**

ALCOHOL FUELS: Introduction, suitability, production of methanol and ethanol; through municipal solid wastes, grains and sugarcane. Properties; comparison of alcohols and gasoline as engine fuels, exhaust emission study, performance of IC engines using pure ethanol and methanol, ethanol and methanol blends, change in properties of alcohol **-** gasoline blends, alcohols as diesel fuels; performance and limitations. General implications; crop pattern, food shortages through grain and sugarcane based alcohols.

BIODIESEL: Introduction, feed stock for biodiesel production, non edible oils, raw materials for sustainable biodiesel. Vegetable oils, types, properties. Animal fat wastes for bio diesel production. Thermodynamic characteristics. Biodiesel esterification. Biodiesel emissions.

UNIT - IV **10 HOURS**

HYDROGEN ENERGY: Scope and scale of hydrogen as fuel, issues and challenges of hydrogen as fuel, properties; comparison with gasoline, production methods; electrolysis, thermochemical, coal gasification, solar photolysis, storage; gas, liquid and metal hydrides, transportation; pipe line, liquid and solid, combustion, utility, safety and management, emission and performance characteristics of hydrogen engine, engine modifications required. Natural gas, Liquefied Petroleum Gas (LPG), composition, properties, LPG kits, modification, natural gas engines, performance and pollution study. Fuel cell; utility and methods.

TEXT BOOKS:

1. Theory of IC engines: Mathur and Sharma
2. Non-conventional energy sources: G.D. Rai.
3. Solar energy: S.P.Sukatme

	Title of the Subject : **Computational Fluid Dynamics**	Sem: **8**		Code**: UAU822E**				Credits:**3**					
	Course Outcomes / **Programme Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To basic concepts of computational fluid dynamics.	3	2	2	2	2		1	1		1		1
2	To understand fundamental of fluid flow	3	2	2	2	2		1	1		1		1
3	To apply FEM and FDM methods for solving simple problems	3	3	2	2	2		1	1		1		1
4	To apply CFD as a design tool	3	2	2	2	3		1	1		1		1

	Title of the Subject: **Intelligent transport systems and future trends**	Sem: **8**				Code: **UAU823E**					Credits **: 3**		
		Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to know the overview and structure, history, application and architecture of intelligent Transport Systems(ITS)	2	2	2	1	2	2	2	1		1	1	2
2	To study the evolution and future trends of ITS and. data acquisition systems	2	1	1	1	2	2	2	1		1	1	2
3	To study the steer- by- wire system architecture, potential and challenges	2	2	1	1	2	2	2	1		1	1	2
4	Able to know the details and dynamics of automated driving	2	2	2	1	2	2	2	1		1	1	2
5	To study the body design and electrical and electronic possibilities of ITS	2	2	2	1	2	2	2	1		1	1	2

UAU 823E: INTELLIGENT TRANSPORT SYSTEM AND FUTURE TRENDS

3 Credits (3 - 0 - 0)

UNIT - I **10 Hours**

INTELLIGENT TRANSPORT SYSTEM (ITS): Overview and structure, history, application and architecture. Emergence and characteristics of ITS. Structure of ITS, technology and user services. ITS standards. Benefits and constraints of ITS deployment. Advanced driver assistance system; Overview, research. Infrastructure based automated driving vehicles, cyber cars. Future of driver assistances. Long -term goal-autonomous driving. BVS Systems: requirements, (special and general), advantages, components of bus, access methods, network topology.

UNIT - II **10 Hours**

EVOLUTION AND FUTURE TRENDS; safety and energy efficiency, navigation/telematic services; comfort and safety benefits, traffic information services, client feed back. Traffic management. Lane assistance.

DATA ACQUISITION: Introduction, data types, vehicle dynamic sensors, inertial sensors, acceleration sensors, rotation rate sensors, steering angle sensors. Human machine interface design in modern vehicles.

UNIT - III **10 Hours**

STEER- BY- WIRE: System architecture, potential and challenges. Concept sketching, full size tape drawing, clay modeling, ergonomics in the automotive industries. Control system in automobiles: Open loop, feed forward, closed loop or feedback control, sequential control. Vehicle navigation : Functions of navigation, digital map near vision system; application, far – infrared system (FIR), near infrared (NIR) ; operating principles.

AUTOMATED DRIVING: Requirements, sensor technology, actuator technology, legal aspects. Sports car engines characteristics.

UNIT - IV **10 Hours**

BODY DESIGN: Styling process, studios; working environment and structure. Mechanical design, design possibilities, advances in manufacture methods, material advances, energy conversation, power system, vehicle sales. Automotive embedded systems, infotainment and navigation systems, automotive antennas, urban and extra urban vehicles, rethinking the vehicle design.

ELECTRICAL AND ELECTRONIC POSSIBILITIES: electronic advances in power train design, electronically controlled valve actuation, electronic transmission control, electronic developments in chassis system.

BOOKS: Encyclopedia of automobile engineering (vol. 4, 5 and 6)

New trends and developments in automotive system engg –Maxcello Chiaberge (INTECH)

	Title of the Subject : **Robotics & Automation**	Sem: **8** Code: **UAU824E** Credits: **3**											
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To understand features of various robot.	3	3	3	2	2	2	1	1	1	1	2	1
2	To understand the features robot drives and controls.	3	3	3	2	2	2	1	1	1	1	2	1
3	To know how the sensor technology used in robotics.	3	3	3	2	2	2	1	1	1	1	2	1
4	To use the programs for simple robot tasks.	3	3	3	2	2	2	1	1	1	1	2	1

UAU824E: ROBOTICS AND AUTOMATION

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION AND MATHEMATICAL REPRESENTATION OF ROBOTS:

Types of robots, notation, position and orientation of a rigid body, successive rotations, Euler angles for fixed frames X-Y-Z and moving frame ZYZ. Transformation between coordinate system, homogeneous coordinates, types of joints: rotary, prismatic joint, cylindrical joint, spherical joint, representation of links using Denvit-Hartenberg parameters: link parameters for intermediate, first and last links, link transformation matrices, transformation matrices of SCARA manipulator.

UNIT - II **10 HOURS**

KINEMATICS OF SERIAL MANIPULATORS:

Direct kinematics of 2R, 3R, RRP, RPR manipulator Stanford arm, inverse kinematics of 2R, 3R manipulator. Velocity and statics of manipulators: 7 hours differential relationships, Jacobian, differential motions of a frame (translation and rotation), linear and angular velocity of a rigid body, linear and angular velocities of links in serial manipulators, 2R, 3R manipulators, Jacobian of serial manipulator, velocity ellipse of 2R manipulator, singularities of 2R manipulators, statics of serial manipulators, static force and torque analysis of 3R manipulator, singularity in force domain.

UNIT - III **10 HOURS**

DYNAMICS OF MANIPULATORS:

Kinetic energy, potential energy, equation of motion using Lagrangian, equation of motions of one and two degree freedom spring mass damper systems using Lagrangian formulation, inertia of a link, recursive formulation of dynamics using Newton Euler equation, equation of motion of 2R manipulator using Lagrangian, Newton-Euler formulation. Trajectory planning: joint space schemes, cubic trajectory, joint space schemes with via points, cubic trajectory with a via point, third order polynomial trajectory planning, linear segments with parabolic blends, Cartesian space schemes, Cartesian straight line and circular motion planning.

UNIT - IV **10 HOURS**

CONTROL:

Feedback control of a single link manipulator **-** first order, second order system, PID control, PID control of multi link manipulator, force control of manipulator, force control of single mass, partitioning a task for force and position control lever, peg in hole hybrid force and position controller, actuators and sensors in industrial robots.

TEXT BOOKS:

1. Fundamental Concepts and Analysis, Ghosal A., Robotics, Oxford,2006
2. Introduction to Robotics Analysis, Systems, Applications, Niku, S. B., Pearso Education, 2008

REFERENCE BOOKS:

1. Introduction to Robotics: Mechanical and Control, Craig, J. J., 2nd Edition, Addison-Welsey, 1989.
2. Fundamentals of Robotics, Analysis and Control, Schilling R. J., PHI, 2006.

	Title of the Subject : **Hydraulics and Pneumatics**	Sem**: 8**				Code: **UAU831E**					Credits**: 3**		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
01	To draw block diagram and explain working principles of fluid power systems	2		1								1	2
02	To analyze given hydraulic and pneumatic circuits	2	2	1	2							1	2
03	To compute dimensions of various hydraulic and pneumatic components using analytical equations	3	3	2	2							1	2
04	To design basic hydraulic and pneumatic circuits for a given application	2	2	2	1							1	2
05	To design electro-hydraulic and electro-pneumatic circuits for a given application	1	2	2								1	2

UAU831E: HYDRAULICS AND PNEUMATICS

3 Credits (3 - 0 - 0)

UNIT - I **10 HOURS**

INTRODUCTION TO HYDRAULIC POWER: Pascal's law and problems on Pascal's law, continuity equations, introduction to conversion of units. Structure of hydraulic control system.

SOURCE OF HYDRAULIC POWER: Pumps; pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps.

HYDRAULIC ACTUATORS AND MOTORS: Linear hydraulic actuators [cylinders], mechanics of hydraulic cylinder loading, hydraulic rotary actuators, gear motors, vane motors, piston motors, hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance.

UNIT - II **10 HOURS**

CONTROL COMPONENTS IN HYDRAULIC SYSTEMS: Directional control valves - symbolic representation, constructional features, pressure control valves - direct and pilot operated types, flow control valves.

HYDRAULIC CIRCUIT DESIGN AND ANALYSIS: Control of single and double - acting hydraulic cylinder, regenerative circuit, pump unloading circuit, double pump hydraulic system, counter balance valve application, hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits.

UNIT - III **10 HOURS**

MAINTENANCE OF HYDRAULIC SYSTEMS: Hydraulic oils - desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting.

INTRODUCTION TO PNEUMATIC CONTROL: Choice of working medium, characteristics of compressed air. Structure of pneumatic control system.

PNEUMATIC ACTUATORS: Linear cylinders - types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod - less cylinders - types, working advantages. Rotary cylinder types construction and application. Design parameters - selection.

UNIT - IV **10 HOURS**

DIRECTIONAL CONTROL VALVES: Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, use of memory valve. Signal processing elements: Use of logic gates - OR and AND gates pneumatic applications. Practical examples involving the use of logic gates.

MULTI - CYLINDER APPLICATIONS: Coordinated and sequential motion control. Motion and control diagrams - signal elimination methods. Electro-pneumatic control: principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. Compressed air: production of compressed air compressors, preparation of compressed air driers, filters, regulators, lubricators, distribution of compressed air piping layout.

TEXT BOOKS:

9. Fluid Power with applications: Anthony Esposito, Fifth edition pearson education, Inc. 2000.
10. Pneumatics and Hydraulics: Andrew Parr. Jaico Publishing Co. 2000.

REFERENCE BOOKS:

1. Oil Hydraulic Systems – Principles and Maintenance: S.R. 2002 Majumdar, Tata Mc Graw Hill publishing company Ltd. 2001.

	Title of the Subject **: Composite Materials**	Sem: **8**			Code**: UAU832E**					Credits: **3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1.	To understand the concepts of composite materials and their processing	2	2	2	2	1	1			1	2	1	1
2.	To laminates for various automotive applications	2	2	2	1	1	1			1	2	1	1
3.	Know of mechanical properties of metal matrix composite	3	2	1	2	1	1			1	2	1	1
4.	To approaches for fabrication of MMC and applications	2	2	2	1	1	1			1	2	1	1

UAU832E: COMPOSITE MATERIALS
3 Credits (3 - 0 - 0)

UNIT - I 10 HOURS

INTRODUCTION TO COMPOSITE MATERIALS:
Definition, classification and characteristics of composite materials - fibrous composites, laminated composites, particulate composites.

FIBER REINFORCED PLASTIC PROCESSING: Lay up and curing, fabricating process, open and closed mould process, hand layup techniques; structural laminate bag molding, production procedures for bag molding; filament winding, pultrusion, pull forming, thermo-forming, injection molding, blow molding.

UNIT - II 10 HOURS

CHARACTERISTICS OF FIBER-REINFORCED LAMINA:
Fundamentals, Elastic properties of a lamina, unidirectional, continuous fiber zero degree and angle-ply lamina. Lamina to laminate, lamination theory, lamina strains and stresses due to applied loads. Inter-laminar stresses. A, B, D matrices, simple problems.

UNIT - III 10 HOURS

METAL MATRIX COMPOSITES:
Reinforcement materials, types, characteristics and selection base metals selection. Need for production MMC"s and its application, mechanical properties, isostress, iso strain for fiber reinforced MMC"s applications and mechanics of fiber reinforced plastics: automobile, aircraft missiles. Space hardware, electrical and electronics, marine, recreational and sports equipment.

UNIT - IV 10 HOURS

FABRICATION PROCESS FOR MMC'S:
Powder metallurgy technique, liquid metallurgy technique and secondary processing, special fabrication techniques.

STUDY PROPERTIES OF MMC'S: Physical , mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties.

TEXT BOOKS:
1. Composite Science and Engineering by K. K. Chawla Springer Verlag 1998.
2. Introduction to composite materials by Hull and Clyne, Cambridge University.

'REFERENCE BOOKS:
1. Fiber Reinforced Composites by P. K. Mallick, Marcel Dekker,Inc 2
2. Mechanics of Composite Materials, Robert M. Jones, McGraw Hill Kogakusha Ltd.1998
3. Composite materials hand book, Meing Schwaitz," McGraw Hill book company.1984

	Title of the Subject: **Engine trouble diagnosis and rebuilding**	Sem: 8			Code: **UA833E**					Credits: **3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	To study the diagnosis of vehicle introduction, risk assessment and reduction, terminology. fault code readers, systems, data sources.	2	2	1	1	2	1				1	1	1
2	To know the scope and utility of tools and equipment , basic equipment, scanners	2	2	1	1	2	1				1	1	1
3	To study and analyze OBD monitors, misfire detection, future developments in diagnostic systems	2	2	1	1	2	1				1	1	1
4	To study various engine testing instruments and tune-up techniques	2	2	1	1	2	1				1	1	1
5	To study the diesel engine trouble diagnosis	2	2	1	1		1				1	1	1

UAU833E: ENGINE TROUBLE DIAGNOSIS AND REBUILDING
3 Credits (3 - 0 - 0)

UNIT - I **10 Hours**

DIAGNOSIS: Introduction, risk assessment and reduction, terminology. Fault code readers, systems, data sources.
TOOLS AND EQUIPMENT: Basic equipment, scanners.

UNIT - II **10 Hours**

DIAGNOSTIC TECHNIQUES: Introduction, diagnostic process, mechanical and electrical diagnostic techniques, fault codes and systems.
Sensors, actuators and oscilloscope diagnostics; Introduction, sensors, actuators, engine waveforms, communications networks.
ON-BOARD DIAGNOSTICS: Gasoline OBD monitors, misfire detection, future developments in diagnostic systems.

UNIT - III **10 Hours**

ENGINE SYSTEMS DIAGNOSTICS: Engines, fuel system, ignition system, emission, fuel injection system, diesel injection system, engine management, exhaust and air supply, cooling and lubrication.
ENGINE TESTING INSTRUMENTS; Tachometer, dwell meter, cylinder compression tester, vacuum gauge, exhaust gas analyzer, engine analyzer, oscilloscope, chassis dynamometer.
ENGINE TUNE-UP: Meaning, significance and procedure.

UNIT - IV **10 Hours**

PRACTICAL APPROACH AND TROUBLE DIAGNOSIS: Engine trouble diagnosis; engine not cranking, engine runs but misses, engine lacks power, engine overheating, engine idles rough, engine backfires, engine carbonizing, engine run-on or dieseling, engine stalling, engine backfires, excessive fuel , excessive oil consumption, engine noises, low compression.
DIESEL ENGINE TROUBLE DIAGNOSIS.

BOOKS: Advanced automotive fault diagnosis - Tom Denton (third edition Rantledge)
Automotive Mechanics - William Crouse

	Title of the Subject: **Hybrid Vehicles**	Sem**: 8**			Code**: UAU834E**					Credits: **3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to classify drives in hybrid vehicles their principles and merits.	2	1	1				2					2
2	Able to classify and analyze different electronic control system and their application.	3	1	1				1					2
3	List different batteries their merits, demerits and specification.	3	1	1				1					2
4	List different power sources used in hybrid vehicles and compare with analyze.	3	1	1				3					2
5	To define vehicle safety system and working principles and applications.	2	1	1				2	1				2
6	Able justify working principles of hybrid vehicles and carry out performance analysis.	2	1	1				1	1				2

UAU834E: HYBRID VEHICLES
3 Credits (3 - 0 - 0)

UNIT - I **10 Hours**

HYBRID DRIVES: Introduction, features , functional classification, start/stop system, mild hybrid, full hybrid, plug-in-hybrid, batteries for hybrid vehicles, optimization of hybrid configurations. Changing modes for conductive charging. Super capacitor, fuels cells, solar cells, the flywheel, the hydraulic accumulator, compressed air storage, thermal energy storage, non battery energy sources.

UNIT - II **10 Hours**

HYBRID ELECTRIC VEHICLES(HEVS) AND DRIVE STRUCTURES: Concept of electric drive train, architecture of hybrid electric drive train, series hybrid drive(electrical coupling), parallel hybrid electrical drive train(mechanical coupling), parallel hybrid drive train with torque coupling, power split hybrid drive, speed coupling, hybrid drive train with torque and speed coupling. Control of hybrid vehicles.

UNIT - III **10 Hours**

Road performance simulation of battery, hydrogen and hybrid cars, simulation of efficient IC Engine. Flywheel technologies, hybridization of energy storage, regenerative braking; braking energy versus vehicle speed, braking power, vehicle speed, vehicle deceleration rate. Electric motor drive design. Brake system of HEVs and FCV. Power train options for hybrid vehicles.

UNIT - IV **10 Hours**

FUEL CELLS: Fundamentals, operating principles of fuel cells, fuel cell system characteristics, fuel cell technologies, non-hydrogen fuel cells, fuel cell hybrid electric drive train design, configuration, control strategy, parametric design. Inductive charging. Factors affecting plug-in hybrid fuel consumption. Relative fuel economy potential of intelligent, hybrid and intelligent-hybrid passenger vehicle. Vehicle models for simulation studies, hybrid vehicles with telematics. Hybrid system configuration of BMW, Volkswagan, Fiat, Volvo, Toyota. All-electric hybrid vehicles, electromechanical hybrid vehicles, heat engine electric hybrid vehicles, production.

BOOKS: Electric and hybrid vehicles - Gianfranco pistoia (elsevies)

	Title of the Subject: **Automotive vehicle safety**	Sem: **8**				Code: **UAU841E**						Credits: **3**	
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Able to know the vehicle safety objectives, general implications. basic concepts of vehicle safety	2	2	2	2		1			1	1	1	1
2	To study the brake-by-wire, vehicle dynamics human factors, comfort, ergonomics.	2	2	1	2		1			1	1	1	1
3	To study and analyze the risk evaluation, human error control and bio-kinetics	2	1	2	2		1			1	1	1	1
4	To study the compatibility requirement for cars in frontal and side impact collision type; geometry, mass and structure	2	2	2	2		1			1	1	1	1

UAU 841E: AUTOMOTIVE VEHICLE SAFETY
3 Credits (3 - 0 - 0)

UNIT - I **10 Hours**

Introduction to vehicle safety: Objectives, general implications. Basic concepts of vehicle safety: Underlying principles, public health analogy, prioritization of effort, triology, cause and effect, immediate objectives. Driving forces for increased vehicle safety, safety legislation, accident data.

UNIT - II **10 Hours**

Accident avoidance: Human factors, comfort, ergonomics, acceleration and braking; adaptive cruise control, brake-by-wire, vehicle dynamics. Design requirement of frontal collision, rear end collision and roll over. Occupant protection: Restraint systems, seat belts, air bags for frontal impacts, side protection by air bags, additional air bag applications, sensors for systems.

UNIT - III **10 Hours**

Risk Evaluation, human error control, risk communication, universal design, occupant injury prevent; bio-kinetics. Human simulation application, crash testing, accident reconstruction. Development criteria and standards for vehicle. Compatibility, accident analysis, impact analysis; frontal impact, side impact, computer simulation.

UNIT - IV **10 Hours**

Body structure of small car in frontal vehicle to vehicle crash; introduction, safety improvement for small cars, new design concept, structure and crash performance.

Compatibility requirement for cars in frontal and side impact: Introduction, collision type, geometry, mass and structure stiffness, car to car side impact, finite element modeling.

Books: Automotive vehicle safety – George A Peters, Barbara j Peters (SAE)
Automotive vehicle safety – Ulrich Seiffest, Lothar Wech
Vehicle compatibility in automotive crashes – Stanley H Backaities(SAE)

	Title of the Subject : **Advanced IC Engines**	Sem**: 8**				Code: **UAU842E**					Credits: **3**		
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Analyze the thermodynamic analysis and pressure variations in single and multiple cylinders of SI and CI engines and variation of mixture strength and emissions .	3	1	1									2
2	Analyze the combustion analysis, its phases and heat release patterns and their variations, air cleaners and silencers in SI and CI engines.	3	1	1									2
3	Analyze cycle – by – cycle fluctuations in single cylinder and cylinder to cylinder and problems of power /energy imbalance, misfiring in the SI engines and types of combustion chambers in both engines.	3	1	1									2
4	To know and analyze the causes of knocking and its impacts on engine performance and their controlling methods.	3	1	1									2
5	Analyze the various construction, working and applications of V- type, stratified charge, multi valve, lean burn, MPFI and VCR engines.	3	1	1									2
6	Analyze the principle and feature of supercharging, free piston, Stirling and Wankel engine.	3	1	1									2

UAU 842E: ADVANCED I.C. ENGINES

3 Credits (3 - 0 - 0)

UNIT - I 10 HOURS

COMBUSTION IN SPARK IGNITION ENGINES: Thermodynamic analysis of SI engine combustion: burned and unburned mixture states. Analysis of cylinder pressure data, combustion process characterization, flame structure and speed; laminar burning speeds, partial burning and misfire: definitions, causes of cycle - by - cycle and cylinder to cylinder variations, partial burning, misfire and engine stability. Abnormal combustion: knock and surface ignition, knock fundamentals, fuel factors.

UNIT - II 10 HOURS

COMBUSTION IN COMPRESSION IGNITION ENGINES: Types of diesel combustion systems: Direct injection systems, indirect injection systems, comparison of different combustion systems, analysis cylinder pressure data; combustion efficiency, DI engines, IDI engines, ignition delay: definitions and discussion, fuel ignition quality, auto ignition fundamentals.

UNIT - III 10 HOURS

MODERN DEVELOPMENTS IN I.C.ENGINES:

Lean burn engines, ceramic and adiabatic engines, multi-valves, tuned manifolds, cam less valve gearing, variable valve timing, turbo and supercharging - waste gating, EGR, part-load charge stratification in GDI systems. Sports vehicle engines, Stirling engines, MPFI engines - operation and performance.

UNIT - IV 10 HOURS

SPECIAL TYPES OF ENGINES: Introduction to working of stratified charged engines, Wankel engine, variable compression engine, surface ignition engines, free piston engines, current engines and future trends (e.g. convergence of SI and CI engine technology, control developments, fuel quality), effect of air cleaners and silencers on engine performance.

TEXT BOOKS:

1. Internal Combustion Engines Fundamentals - John B. Heywood, McGraw Hill International Edition,

2. A course in I.C. Engines - Mathur & Sharma, Dhanpat Rai & sons, New Delhi,1994

REFERENCE BOOKS:

1. I.C.Engines by Taylor, MIT Press England 1989

2. I.C.Engines By Lichty., McGraw Hill

3. Fuels & Combustion By Smith & Stinson., McGrawHill

4. Motor Vehicle Engines by M.Khovakh., Mir Publishers

5. I.C. Engines by V.Ganesan, Tata Mc Graw Hill,1994

	Title of the Subject: **Finite Element Methods**	Sem: **8**	Code**: UAU843E**	Credits: **3**									
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Exposure to the fundamentals of continuum mechanics	2	2	2	1	1					1	1	1
2	Able to analyze the various interpolation models in FEM	2	2	1	2	2					1	1	1
3	To apply finite element procedures for simple 2D structural elements	2	2	1	2	2					1	1	1
4	To be able to compute the Jacobian matrix, stiffness matrix and force terms	2	2	1	2	1					1	1	1
5	Apply FEA method to analyze the various heat transfer problems	2	2	1	2	2					1	1	1

UAU843E: FINITE ELEMENT METHODS
3 Credits (3 - 0 - 0)

UNIT - 1 10 HOURS

INTRODUCTION: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, principle of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method Galerkins method and matrix techniques. Basic procedure: General description of Finite Element Method, discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half bandwidth, stiffness matrix of bar element by direct method, properties of stiffness matrix, preprocessing, post processing. Engineering applications of finite element method. Advantages and disadvantages of FEM.

UNIT - II 10 HOURS

INTERPOLATION MODELS: Polynomial form of interpolation functions - linear, quadratic and cubic, simplex, complex, multiplex elements, selection of the order of the interpolation polynomial, convergence requirements, static condensation. Penalty approach and elimination method. One dimensional bar element: Recall of 1D linear bar element. Lagrangian interpolation, higher order one dimensional elements- quadratic, cubic element and their shape functions, properties of shape functions, effect of temperature on 1D elements and stress calculation.

UNIT - III 10 HOURS

TWO DIMENSIONAL ELEMENTS: Shape functions and stiffness matrix of 2D elements four - node quadrilateral, nine - node quadrilateral eight - node quadrilateral, serendipity and Lagrange comparison with 2D Pascals triangle. CST and LST shape functions , Jacobian matrix, stiffness matrix, force terms, stress calculation and numerical integration. Introduction to 3-D elements shape function of tetrahedron element.
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UNIT - IV 10HOURS

TRUSSES AND BEAM ELEMENTS: Analysis of trusses and beam elements its shape functions, stiffness matrix and stress calculation heat transfer problems: steady state heat transfer, 1D heat conduction governing equation, boundary conditions, one dimensional element, functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins.

Text Books:

1. Finite Elements in engineering, Chandrupatla T.R., 3rd Pearson Edition.
2. Finite Element Analysis, C.S.Krishnamurthy,–Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1995.
3. "Fundamental Finite Element Analysis and Application" by "Asghar Bhatti" by PageTurner 2013.
4. "Advanced Topics in Finite Element Analysis of Structures with Mathematica and MATLAB Computations" by M. Asghar Bhatti by PageTurner 2013.

Reference Books: 1. The FEM its basics and fundamentals: O.C.Zienkiewicz, Elsevier, 6e.
2. Finite Element Method, J.N.Reddy, McGraw –Hill International Edition.
3. Finite Element Methods, by Daryl. L. Logon, Thomson Learning 3rd edition, 2001.

	Title of the Subject: **Earth Moving Equipment and Heavy Duty Trucks**	Sem: **8**			Code: **UAU844E**					Credits**: 3**			
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex problems	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1.	List various types of earthmovers and explain their working principles and applications	3											2
2.	Describe and differentiate the systems used in earth movers with conventional vehicles	3	2										2
3.	Prepare maintenance schedules for earthmovers and tractors	3	2	2	1								3
4.	To identify the hydraulic components and analyze hydraulic circuits used in earthmovers	3	2										3
5.	Apply analytical methods to calculate productivity of earthmovers.	3	3	3	1								3

UAU844E: EARTHMOVING EQUIPMENTS AND HEAVY DUTY TRUCKS

3 Credits (3 – 0 - 0)

UNIT - I 10 HOURS

EQUIPMENTS AND OPERATION: Different types of earth moving equipments and their applications. Dozers, loaders, shovels, excavators, scrapers, motor graders, rollers, compactors, tractors and attachments. Types of soil.

UNIT - II 10 HOURS

UNDER CARRIAGE AND SUSPENSION: Tyre and tracked vehicles, advantages and disadvantages, under carriage components like tracks, roller frames, drive sprockets, track rollers, track chains and track shoes.

SUSPENSION: Rubber spring suspension and air spring suspension.

TRANSMISSIONS AND FINAL DRIVES: Basic types of transmissions, auxiliary transmission, compound transmission, planetary transmission, constructional and working principles, hydroshift automatic transmission and retarders. Final drives; types of reductions like, single reduction, double reduction final drives and planetary final drives, PTO shaft.

UNIT - III 10 HOURS

HYDRAULICS: Basic components of hydraulic systems like pumps (types of pumps), control valves like flow control valves, directional control valves and pressure control valves, hydraulic motors and hydraulic cylinders. Depth and draft control systems.

STEERING AND BRAKES: Power steering types like, linkage type power steering, semi integral power steering and integral power steering. Steering of tracked vehicles: articulated steering, clutch /brake steering system. Brakes: types of brakes like, disc brake, engine brakes etc.

UNIT - IV 10 HOURS

METHODS OF SELECTION OF EQUIPMENTS: Selection of machines, basic rules of equipments including the nature of operation, selection based on type of soil, selection based on haul distance, selection based on weather condition.

CALCULATION OF OPERATING CAPACITY: Methods of calculating operating capacity, calculation of productivity of EMEs.

TEXT BOOKS:

1. Diesel equipment: volume I and II by Erich J.schulz
2. Construction equipment and its management By S.C. Sharma

REFERENCE BOOKS:

1.Farm machinery and mechanism by Donald R. hunt and L. W.garner
2.Theory of ground vehicles by J.Y.Wong john wiley and sons
3.Moving the earth by Herbert Nicholas
4.On and with the earth by Jagman Singh, W.Newman and Co. culkatta

	Title of the Subject: **Project Phase - II**	Sem: **8**		Code: **UAU 804P**				Credits **: 12**					
	Programme Outcomes / **Course Outcomes**	Engineering knowledge	Problem analysis:	Design/development of solutions	Conduct investigations of complex	Modern tool usage:	The engineer and society:	Environment and sustainability:	Ethics:	Individual and team work	Communication:	Project management and finance:	Life-long learning:
1	Applying knowledge of basic science, core and elective engineering subjects to analyze, design, develop and solve the problems.	3	3	3	2	2	2	1	2	2	2	2	3
2	Develop, fabricate and test the models, further analyze and compare performance results/ outcomes the projects.	3	3	3	2	2	2	1	2	2	2	2	3
3	Able to articulate and analyze the results and conclude with scope for future works and cost analysis.	3	3										3
4	Skill developments in presentation, communication and project report preparation	3	3							3	2	3	3

UAU 804P: PROJECT PHASE – II

12 Credits (0-0-12)

- The project work defined in project -I has to be continued for the project work – II.
- The guides have to review the progress of the project work continuously during the contact hours.
- The contact hour schedule may be defined by the guides in consent with their batches as per convenience
- CIE evaluation has to be done by DC based on the progress of the project work by conducting minimum of two demos/ seminar presentation for 25 marks each.
- The students of the project batches are supposed to submit the final project report earlier to SEE examination with the consent of the guide to the DC.
- The SEE examinations will be conducted by PEC consisting of 1) HOD/His Nominee, 2)Internal Examiner/Project Coordinator, 3)External Examiner separately for each project batch for 50marks

Project-II

Examination	**CIE-I**	**CIE-II**	**SEE**
Marks	**25 Marks**	**25 Marks**	**50 Marks**

UAU805S: TECHNICAL SEMINAR
CREDIT: 1

Each student has to submit the synopsis of the seminar topic and gets approval from the department committee (DC) consisting of HoD, BoE and respective seminar guide. The department committee allots the guide for the student. Students are required to present the seminar on said topic in consultation with the guide.

Mode of Evaluation:

Sl. No	Particulars	Marks
1	Selection of seminar topic	4
2	Collection of information	12
3	Preparation of PPT	12
4	Presentation of seminar	12
5	Queries and discussion	10
	Total	50

Scheme:

Examination	CIE	SEE
Marks	50	50

Time / Day	8.00 am to 9.00 pm	9.00 am to 10.00pm		10.15 am to 11.15am	11.15am to 12.15pm		2.00 pm to 05.00pm
Monday			TEA BREAK			LUNCH BREAK	
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF BIOTECHNOLOGY

SCHEME OF TEACHING AND EXAMINATION
B.E. III SEMESTER

2021-22

Sl. No	Subject Code	Subject Title	Hours/Week					Exam marks		
			Credits	Lecture	Tutorial	Practical	Total hours	CIE	SEE	Total
1	UMA392C	Numerical Techniques and Fourier series	3	3	0	0	3	50	50	100
2	UBT313C	Microbiology	3	3	0	0	3	50	50	100
3	UBT305C	Biochemistry	3	3	0	0	3	50	50	100
4	UBT315C	Bioprocess Principles and Calculations	3	2	2	0	4	50	50	100
5	UBT317C	Cytogenetics & Cell Culture Techniques	3	3	0	0	3	50	50	100
6	UBT312C	Unit Operations	3	3	0	0	3	50	50	100
7	UBT307L	Biochemistry Lab	1.5	0	0	3	3	50	50	100
8	UBT308L	Microbiology Lab	1.5	0	0	3	3	50	50	100
9	UBT311L	Unit Operations Lab	1	0	0	2	2	50	50	100
10	UHS388C UHS389C	Saamskrutika Kannada* Balake Kannada**	1	2	0	0	2	50	50	100
			23	**19**	**2**	**8**	**29**	**500**	**500**	**1000**

UMA392C: Numerical Techniques & Fourier Series
3 Credits (3-0-0)

Unit-I

Numerical Analysis-I: **10 Hours**

Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).

Unit-II

Numerical Analysis-II: **10 Hours**

Numerical differentiation using Newton's forward and backward formulae-problems.Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method.

Unit-III

Fourier series: **10 Hours**

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

Unit-IV

Fourier transforms and z-transforms: **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems.

Resources:

1. Numerical Methods for Engineers by Steven C Chapra& Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Course outcomes:

On the successful completion of this course, students are able

1. The ability to solve engineering problems using non-linear equations and interpolation techniques.
2. The ability to solve problems using numerical differention
3. Be capable to perform numerical integration and solutions of ordinary differential equations.
4. Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.
5. It is essential to understand the basic concepts of Fourier transforms to solve ordinary differential equation and pde..

UBT313C: Microbiology
3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Scope of microbiology, History of microbiology-Evolution of microbes. Contributions of Scientist for the development of microbiology. Microbial diversity & taxonomy, Prokaryotes & Eukaryotes. Microscopy: Principles and applications of Bright field microscopy, Dark-Field Microscopy, Phase contrast microscopy, Fluorescence Microscopy and Electron microscopy (SEM & TEM).

UNIT 2

Microorganisms **10 Hours**

Bacteria- Morphology and ultra structure of Bacteria, Culturing of bacteria, reproduction and growth (continuous and batch). Viruses, fungi, algae, protozoa, actinomycetes- structure and modes of reproduction. Fastidious microorganisms. Microbial toxins. Microbial Techniques: Pure culture techniques- Aerobic and Anaerobic culture techniques. Fermentation(acid & alcohol).

UNIT 3

Control of Microorganisms **10 Hours**

Control of microorganisms by Physical methods and chemical methods, antibiotics, chemotherapeutic agents and Phage biotics. Medical Microbiology: Normal micro-flora, common diseases caused by microbes-pathogenesis, symptoms, diagnosis, treatment, prevention.

UNIT 4

Agricultural and Environmental Microbiology **12 Hours**

Microbiology of soil, Air and Aquatic Microbiology, Biofertilizer, Plant endophytes, Microbes in bioremediation and biocontrol agents.

Industrial Microbiology: Microbial processes using yeasts and bacteria (production of alcohol, vinegar, cheese), Microbes as source of protein (SCP), gelatin agents (alginate, xanthin, agar agar) Microbial insecticides, Enzymes from Microbes (amylase, protease), Useful products from microorganisms using recombinant DNA technology (vaccines and antibiotics).

Total: 42 hours

Text Books

1. Pelczar, Chan and Noel Kreig, "Microbiology"- 7th Edition Tata Macgraw Hill, 2019
2. Tortora, Funke and Case, "Microbiology an Introduction" -8th Edition, Pearson Education, 2006

Reference Books

1. Stainer R.Y., Ingraham J.L., "General Microbiology"- 5th Edition Mc.Millan Press, 2010
2. Madigan, Martinko, Parker, Brock's, "Biology of Microorganisms" - 10th Edition, Prentice Hall, Pearson Education, 2010
3. Prescot and Dunn, "Industrial Microbiology"-Agribios India, 2004
4. J. Salle, "Fundamental Principles of Bacteriology" – 7th Edition, Tata Macgraw Hill, 2007
5. E Alcamo I "Fundamentals of Microbiology"6th Edition, Jones & Bartlet, Pub. 2001.
6. Prescott, Harley & Klein, "Microbiology" -7th Edition, WCB/McGraw Hill, Int., 2008.

Course Outcomes

1. Ability to know the basic concepts of Microbiology, scope and organization of organisms in the taxonomy
2. Ability to understand the techniques to study microorganisms through microscopy
3. Capable to analyze the techniques and study the structure of different microbes and their applications
4. Ability to analyse the different techniques to control the growth of microbes in different areas.
5. Ability to discuss the causative organisms of the disease and their effect on society
6. Ability to analyse the applied techniques in the environment industries and create awareness to society

UBT305C: Biochemistry
3 Credits (3-0-0)

UNIT- 1

Principles of Bioenergetics and introduction of enzymes: **12 Hours**

Energy Flow cycle, energy conversion. Structure and properties of ATP, Bioenergetics of metabolic pathway. Definition & Classification of Enzymes , Chemical nature and properties of enzymes

Carbohydrate Metabolism:

Glycolysis, TCA cycle, Electron transport chain and oxidative phosphorylation and respiration energetics. Calvin Cycle, Glyoxylate cycle, Pentose Phosphate Pathway, Gluconeogenesis and regulation of gluconeogenesis.

Disorders of carbohydrate metabolism- Galactosemia, Lactose intolerance, Glycogen storage disorder etc. (Defective enzyme lead to disorder during metabolism)

UNIT- 2

Lipid Metabolism: **10 Hours**

Biosynthesis of fatty acids. cholesterol, phospholipids and glycolipids, Regulation of fatty acid biosynthesis, biodegradation of fatty acid, ketone bodies production during starving and diabetes.

Disorders of lipid metabolism- Sphingolipidoses. Etc

UNIT- 3

Nucleic acid Metabolism: **10 Hours**

Biosynthesis of purines - origin of ring atoms, formation of IMP, conversion of IMP to AMP and GMP. De novo synthesis of pyrimidine nucleotides - biosynthesis of UTP & CTP. Biodegradation of purines & pyrimidines. Recycling of Purine and Pyrimidine nucleotides by salvage pathways.

Disorders of nucleic acid metabolism-Lesch-Nyhan Syndrome and Gout.

UNIT- 4

Amino Acid Metabolism: **10 Hours**

Biosynthesis of amino acids starting from acetyl CoA (with reference to oxaloacetate family)- Aspartate, Asparagine, Methionine, Lysine, Threonine. Biodegradation of amino acids- deamination, transamination and urea cycle. Disorders of amino acid metabolism-Phenylketonuria, Albinism, Maple Syrup Urine Disease, Tyrosinemia.

Total: 42 Hours

Text Book

1. David L. Nelson and Michael Cox, "Lehninger Principles of Biochemistry" –7th Edition, 2017.

Reference Books

1. Lubert Stryer, "Biochemistry" -Freeman & Co., Pub, 2010.
2. Voet & Voet, "Biochemistry"- 3rd Edition, John Wiley,New York Pub., 2004.
3. Thomas M. Davlins " Biochemistry with clinical correlations" Wiley-Liss; 5 edition,2001.
4. Mathews, Vanholde & Arhen "Biochemistry" -3rd Edition, Pearson Education Pub., 3 edition 2010.
5. K. Trehan, "Biochemistry" -New Age International Pub, 2nd edition, 2003
6. Elliot & William H, "Biochemistry & Molecular Biology" Oxford Pub., 2005.
7. Helmreich JEM, "Biochemistry of cell signaling" –Oxford Pub. 2005.
8. U. Sathyanarayana, "Biochemistry" -Books and Allied Pub, 2007
9. Berg J.M., Stryer, Tymoczko J.L. "Biochemistry" Freeman & co 2010.
10. Freifelder D. "Molecular Biology" -Narosa Publications, 2nd Edition 2003.

Course Outcomes

1. Ability to interpret principles of bioenergetics of high energy compounds and classify enzymes.
2. Ability to understand Carbohydrate metabolism along with disorders.
3. Ability to recognize the importance of Lipid metabolism & the enzymes responsible to homoestasis of biochemical reaction.
4. Ability to understand the origin of atom in the formation of purine and pyrimidine.
5. Ability to comprehend Nucleic acid metabolism and its metabolic disorders.
6. Ability to explain Amino acid metabolism and its metabolic disorders.

UBT315C: Bioprocess Principles and Calculations
3 Credits (2-2-0)

UNIT 1

Introduction & Basic Chemical Calculations **10 Hours**

Development and overview of traditional and modern applications of biotechnological processes. Process flow sheet and unit operations in chemical and bioprocess industries. Fundamental and derived quantities, Inter-conversion of units from one system to another (FPS, CGS, MKS, SI).Concept of mole and molecule, Composition of mixtures and solutions- Percentage by weight, mole and volume; Normality, Molarity, Molality; average molecular weight; ppm, pH and pK Buffer calculations. Numerical problems

UNIT 2

Material balance without chemical reactions **10 Hours**

General material balance equation for steady and unsteady states. Material balances in Distillation, Absorption, Extraction, Crystallization, Drying, Mixing, and Evaporation Operations. Numerical problems Numerical problems.

UNIT 3

Material balance involving chemical reactions **10 Hours**

Principles of Stoichiometry. Definitions of limiting and excess reactants, fractions and percentage conversion, yield and percentage yield, selectivity and related problems. Material balances involving bypass & recycle; Fuels and Combustion: calculations involving Excess air and Air-fuel ratio. Numerical problems.

UNIT 4

Energy Balance **10 Hours**

General energy balance equation for steady state. Thermo physics and Thermo chemistry: Heat capacity, estimation of heat capacity for solids, liquids, gases and their mixtures. Enthalpy, Standard Heat of formation, standard heat of reaction, Standard heat of combustion and calorific value, Calculation of Δ (HR) at elevated temperature. Heat effects of biochemical reactions. Numerical problems.

Total: 40 hours

Text Books

1. Hougen OA, Wats (2018) Chemical Process Principles: Part I, 2nd Edn., John Wiley, USA.
2. P.M.Doran (2012) Bioprocess Engineering Principles, 2nd Edition, Elsevier India Pvt Ltd.
3. Gavhane K A (2009) Process Calculations Stoichiometry, 2nd Edn, Nirali Prakashan, India.
4. M.L.Shuler and F.Kargi (2008) Bioprocess Engineering--basic Concepts, 2nd Edn. Prentice-hall of India Pvt Ltd.
5. Narayanan K V, Lakshmikutty B (2016) Stoichiometry and Process Calculations, 2nd Edition, PHI India.

Reference Books

1. D.M.Himmelblau (2014) Basic Principles and Calculations in Chemical Engineering, 8th Edn, Phi Learning Pvt Ltd.
2. Segel IH (2010) Biochemical Calculations 2nd Edn., John Wiley & Sons, NewYork.
3. Bailey JE and Ollis DF (1993) Biochemical Engg. Fundamentals, McGraw Hill, Newyork, USA.

Course Outcomes

1. Define the process operations and terms of calculations
2. Apply various types of unit systems and convert units from one system to another.
3. Develop strategy for solving problems involving gases, vapours etc.
4. Adopt the tools learned from the course to solve numerical problems which contain oneor more unit operations.
5. Able to solve material balance problems involving reactions.
6. Develop mathematical relations for both mass and energy balances for different processes.

UBT317C: Cytogenetics and Cell Culture Techniques
3 Credits (3-0-0)

UNIT- 1

Cell cycle and its regulation: **10 hours**

Cell & cell organelles, chromosome structure and its organisation, Cell division-mitosis and meiosis & their significance, (gametogenesis) cell cycle: check points, cell cycle and Regulation, factors regulating M phase initiation, M phase kinase, activation and inactivation.

Introductory genetics:

Mendel's laws of inheritance, Gene interactions-complete, incomplete, supplementary, complimentary, epistasis-inhibitory. Multiple allelism, Linkage, recombination and chromosomal mapping. Sex linked inheritance and extra chromosomal inheritance.

UNIT- 2

Plant cell culture **12 Hours**

History and Introduction, requirements, lab organisation, media constituents, choice of media sterilization of media, explant selection, sterilisation and preparation for inoculation, role of growth hormones in cell culture. Cellular totipotency, cytodifferentition, organogenic differentiation, embryogenesis. Plant growth factors and hormones - auxins, gibberlins, cytokines and others. Stoichometry of cell growth and product formation.

Culture techniques and applications, cell and organ culture, , protoplast culture , somatic hybridization, haploid production ,micro propagation: somaclonal variation Regeneration of plantlets-shooting, rooting and hardening, synthetic seeds.

UNIT 3

Animal cell culture Techniques: **10 Hours**

History and development of mammalian cell culture. lab organization, Introduction to balanced salt solutions. Cell culture media (Natural and Artificial) - components of the medium, functions of media components. Role of antibiotics in media. Cell lines – Mechanical and enzymatic mode of desegregation, establishment of primary culture. Subculture - passage number, split ratio, seeding efficiency, criteria for subculture. Cell lines -definite and continuous cell lines. Measurement of cell number Haemocytometer and coulter counter.

UNIT 4

Cell line Characterisation and Maintenance: **10 Hours**

Measurement of Cell viability and Cytotoxicity. Dye exclusion and inclusion tests, clonogenic assay, and MTT, PDT. Characterization, maintenance and preservation of cell lines (cryopreservation). Cell line contaminations, detection and control, cell transformation – normal v/s. Transformed cells, growth characteristics of transformed cells. In Vitro Fertilization (IVF) and Embryo Transfer Technique (ETT). Embryo splitting. Diagnosis of genetic diseases.

Total: 42 Hours

Textbooks

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter Molecular biology of The Cell, GS pub,2002
2. Culture of Animal cells-3rd Edition-R.Ian Freshney.Wiley Less 2010.

Reference Books

1. Rastogi S C "Cell Biology" - New Age International Pub. 2005.
2. Powar C.B., "Cell Biology", Himalaya Pub. 2006.

3. Channarayappa, Cell biology, Universities Press,2010.
4. Gardener, Simmons and Snustad,“Principles of Genetics”John Willey Publisher,2003
5. Singh B.D, “Fundamentals of Genetics”, Kalyani Pub, 2010.
6. Biotech Expanding Horizons-B. D. Singh, Kalyani Publishers,2010.
7. Introduction to Plant biotechnology by H. S. Chawla, 2nd Edition, Oxford and IBH Publishers, 2010

Course Outcomes: Student will be

1. Able to understand the chromosome structure, cell cycle regulation and Mendalian genetics.
2. Able to use the plant cells to produce in vitro cultures
3. Able to apply the tissue culture techniques in various applications
4. Able to acquire working knowledge of culture of animal cells in *in vitro* conditions.
5. Able to identify, describe and classify the contaminants of cell culture and cryopreservation techniques
6. Able to identify the various applications of cell culture techniques

UBT312C: Unit Operations
3 credits (3-0-0)

UNIT 1

Introduction to Fluid Mechanics **10 Hours**

Units, Dimensions, Basic and Derived units, Dimensional homogeneity, Dimensionless numbers, Rayleigh method, Buckingham's pi theorem, Similitude. Fluid definition and classification (Types of fluids – Newtonian and Non Newtonian); Rheological behaviour of fluids. Fluid statics and its applications Hydrostatic equilibrium, Pressure measurement - Manometers.

UNIT 2

Flow Past Immersed Bodies **10 Hours**

Types of flow - laminar and Turbulent; Reynolds number; Basic equations of fluid flow - Continuity equation and Bernoulli equation; Correction for Bernoulli's equation, Pump work in Bernoulli's equation; Flow through circular and non circular conduits – Friction factor relations for smooth and commercial pipes.

UNIT 3

Flow measurements **10 Hours**

Orifice meter, Venturimeter, Rota meter principles advantages and disadvantages derivation the discharge and numerical problems. Pumps, principle, construction numericals. Centrifugal & Reciprocating pumps, Characteristics of centrifugal pumps. Pipes, fittings and valves.

UNIT 4

Mechanical Operations **10 Hours**

Filtration: Types of filtration, Filter media and filter aids, calculation of resistances and rate of filtration, filtration equipment. Settling, Free and Hindered, Stoke's law, Newton's law, Terminal settling velocity, Batch sedimentation theory (Kynch), Agitation: Theory of mixing, Power number calculations, mixing equipment. Flow patterns in agitated tanks, mechanism of mixing, scale up of mixing systems. Size Separation: Particle shape, size, screen analysis, screening equipment. Size Reduction: Characteristics of comminute products, crushing laws and work index; Size reduction equipment.

Total: 40 hours

TEXT BOOKS

1. McCabe WL, Smith JC and Harriott (2005) Unit operations of Chemical Engineering, 7th Edn., McGraw-Hill Publications, USA.
2. Gavhane KA (2012) Unit Operations I & II, 22nd Edn., Nirali Prakashan, India

REFERENCE BOOKS:

1. Alan S Foust, Wenzel LA, Clump CW, Maus L, and Anderson LB (2008) Principles of Unit Operations. 3rd Edn., John Wiley & Sons, USA.
2. R. P. Chhabra V. Shankar (2017) Coulson and Richardson's Chemical Engineering Volume 1A: Fluid Flow: Fundamentals and Applications. 7th Edition, Elsevier, USA.
3. R. P. Chhabra Basavaraj Gurappa (2019) Coulson and Richardson's Chemical Engineering Volume 2A: Particulate Systems and Particle Technology. 6th Edition, Elsevier, USA

COURSE OUTCOMES:

1. Understand the basic concept of fluid mechanics and flow measurements.
2. Predict the dimensional analysis and solution for fluid flow problems.

3. Predict the pressure drop in fluid flow and flow through packed beds.
4. Estimate the flow rate of fluids and design the pumps for transportation of fluids.
5. Analyse and solve the problems on filtration and settling.
6. Analyse the forces involved in flow through solids and its operations

UBT307L: Biochemistry Lab

1.5 Credits (0-0-3)

LIST OF EXPERIMENTS

1. pH measurements, volume / weight measurements, concentration units, Specificity, precision, Accuracy.
2. Classes of carbohydrates, lipids and proteins.
3. Reagent preparation and preparation of buffers of constant strength.
4. Qualitative tests for carbohydrate and lipids.
5. Qualitative tests for amino acids and proteins.
6. Estimation of sugar by Folin and O-toluene method.
7. Estimation of amino acid and protein by ninhydrin method
8. Determination of Saponification value of lipids.
9. Determination of Iodine value of lipid.
10. Determination of acetyl value of a lipid.
11. Estimation of urea by diacetyl monooxime method.

Reference Books

1. Laboratory manual of Biochemistry by Pattabiraman , 4th Edition, International book publishers India, 2017.
2. Sadasivam and Manickam, "Biochemical Methods", 2nd Edition, New age international Publishers, 2017.

Course Outcomes

1. Ability to understand the basic aspects of standard reagent & buffer preparations.
2. Ability to identify various biomolecules qualitatively.
3. Ability to estimate the concentration of carbohydrates in a given sample
4. Ability to evaluate the concentration of amino acid quantitatively.
5. Ability to analyze the types of lipids.
6. Ability to apply knowledge of acid & iodine value to determine the quality of lipids.

UBT308L: Microbiology Lab
1.5 Credits (0-0-3)

LIST OF EXPERIMENTS

1. Study of microscopes: Types, working principle, parts of the microscope, handling (operating) & caring.
2. Media preparation: NA, Peptone broth, PDA, Macconkeys agar.
3. Isolation of bacteria by serial dilution, pour plate ,spread plate and streak plate techniques
4. Isolation and identification of bacteria and fungi from different sources.
5. Study of colony characteristics and Morphology of bacteria, yeasts and fungi.
6. Study of different staining techniques. (Simple staining differential staining)
7. Enumeration of microorganisms using colony counter
8. Fermentation of Carbohydrates (gas production)
9. Growth curve of bacteria and yeast.
10. Antibiotic susceptibility testing of bacteria & Observation of motility by hanging drop technique.

Reference Books

1. Pelczar, Chan and Krieg, "Microbiology" -7th Edition, Tata McGraw Hill, 2019.
2. K. R. Aneja, "Experiments in Microbiology, Plant Pathology and Biotechnology" – 5th Edition, New age International Pub. 2010.

Course Outcomes

1. To analyse the principle and procedures of different experiments
2. To perform simple and differential staining techniques
3. To prepare the media for culturing microbes
4. To observe the motility of organisms
5. To interpret the instruments and different components used in lab
6. To interpret the subject orally

UBT311L: Unit Operations Lab

1 Credit (0-0-2)

LIST OF EXPERIMENTS

1. Friction in circular and non-circular pipes
2. Flow rate measurement using Orifice meter
3. Flow rate measurement using Venture meter
4. Batch sedimentation test
5. Constant pressure /constant filtration using leaf filter
6. Verification of Stoke's law in Free / Hindered settling
7. Determination of screen effectiveness and sieve analysis
8. Verification of Bernoulli's theorem
9. Unsteady state flow
10. Study of pump characteristics
11. Study of packed bed characteristics
12. Distillation

Reference Books

1. Mccabe W.L. And Smith J.C, "Unit Operations In Chemical Engineering" -7th Edition, Mcgraw-Hill, 2017.
2. Goenkloplis, "Principles Of Unit Operations" -P H I Publication, 1993.
3. Badger, Banchero And Walter (1955). Introduction To Chemical Engineering, 3rd Edn, Mcgraw- Hill Publications, USA.
4. Alan S Foust, Wenzel LA, Clump CW, Maus L, And Anderson LB (2008). Principles of Unit Operations. 2nd Edn., John Wiley & Sons, USA.
5. Coulson And Richardson's (2011); Chemical Engineering, Vols I & II., 6 Th Edn., Reed Educational And Professional Publishing Ltd., USA.

Course Outcomes

On successful completion of this course students will be able to

1. Determine energy loss due to friction in flow systems
2. Measure flow rate of incompressible fluids
3. Perform particle size analysis
4. Evaluate performance of size reduction and filtration equipments
5. Understand the working principles of mass transfer equipments
6. Evaluate the performance of mass transfer equipments

QUESTION PAPER PATTERN FOR CIE AND SEE:

CIE:

1. Question paper consists of two parts viz., part A and part B.
2. Part A is compulsory and will consist of 10 questions each one mark or 5 questions of each two marks or a combination of one and two marks totaling to 10 marks.
3. Part B consists of 2 units. Two questions from each unit uniformly covering the syllabus of the unit under consideration. Each question will carry 15 marks and should not have more than 3 sub divisions. Any one full question to be answered from each unit.
4. Each CIE test will be for a total of 40 marks then reduced to 20 marks.

SEE:

1. Question paper consists of two parts viz., part A and part B.
2. Part A is compulsory and it consist of 20 questions of each one mark or 10 questions of each two marks or a combination of one and two marks totaling to 20 marks.
3. Part B consists of 4 units. Two questions from each unit uniformly covering the syllabus of the unit under consideration. Each question will carry 20 marks and should not have more than 4 sub divisions. Any one full question to be answered from each unit.
4. The SEE will be for a total of 100 marks then reduced to 50 marks

B.E. IV SEMESTER

2021-22

Sl. No.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	UBT415C	Biostatistics & Bio-modelling (BS)	3	2	2	0	4	50	50	100
2	UBT406C	Immunotechnology (PC)	3	3	0	0	3	50	50	100
3	UBT412C	Heat & Mass Transfer (PC)	3	3	0	0	3	50	50	100
4	UBT419C	Thermodynamics (PC)	3	3	0	0	3	50	50	100
5	UBT418C	Molecular Biology (PC)	3	3	0	0	3	50	50	100
6	UHS001N	Fundamentals of Quantitative Aptitude and Soft Skills	1	2	0	0	2	50	50	100
7	UBT410L	Immunotechnology Lab	1	0	0	2	2	50	50	100
8	UBT413L	Biostatistics Lab	1.5	0	0	3	3	50	50	100
9	UBT408L	Molecular biology Lab	1.5	0	0	3	3	50	50	100
		Total	**20**	**16**	**2**	**8**	**26**	**450**	**450**	**900**

UBT415C: Biostatistics & Bio-modelling

3 Credits (2-2-0)

UNIT 1

Introduction and Descriptive Statistics **10 Hours**

Scope of biostatistics, presentation of data, Diagrammatic and graphical represent,(simple, multiple, component bar diagrams, pie chart, histogram, frequency polygon, frequency curve, ogive curve). Measure of central tendency (meaning of central tendency, arithmetic mean, median, Quartiles, mode, geometric mean, harmonic mean their merits and demerits). Measure of dispersion: meaning, range, quartile deviation, mean deviation and standard deviation, coefficient of variation, skewness and kurtosis. Correlation and linear regression analysis, curve fittingstraight line).

UNIT 2

Probability and Probability Distributions **10 Hours**

Definition of probability, Event, Mutual Exclusive, Independent, Complimentary Events Addition and Multiplication theorem of probability and examples. Discrete probability distributions: Bernoulli's , Binomial and Poisson distribution. Continuous probability distribution – normal, Standard normal variate, properties of normal curve, T, Fand χ^2 (Chi square -goodness of fit test) distributions and their applications in Biology.

UNIT 3

Statistical Inference , ANOVA and Design of Experiments **10 Hours**

Estimation theory and testing of hypothesis point estimation, interval estimation. Sample, population, sample size determination. Methods of Sampling techniques- random (simple, stratified and systematic) non random sampling -(Judgement and convenience). Definition of analysis of variance(one way and two way classifications), Basic principles of experimental design and limitations-randomization, replication, local control, Types of statistical designs of biological experiments and limitations-CRD, RCBD, LSD, Plackett-Burmann design, Response surface methodology(RSM).

UNIT 4

Bio-modeling **10 Hours**

Microbial Growth in a Chemo-stat, Growth Equations of Microbial Populations, product formation models, Models of Commensalisms, Batch culture model, Mutualism, Predation and Mutation. Simple Prey predator model, Volterra's Model for n Interacting Species. Basic Models for Inheritance, Applications of probability in genetics, Hardy - Weinberg law. Selection and Mutation Models, Genetic Inbreeding Models. Dose response studies.

Total: 40 hours

Text Books

1. Marcello Pagano & Kimberlee Gauvreu, "Principles of Biostatistics" -Thompson Learning Pub, 2006.
2. J.N.Kapur, "Mathematical Models in Biology and Medicine", 1st Edition, New age international Pvt. Ltd, 2001.

Reference Books

1. Norman T J Bailey, "Statistical methods in Biology" -Cambridge Press, 3rd Edition, 2000.
2. B.L.Agarwal Basic statistics, New age international Publishers, Fifth Edition 2009.
3. Ronadd N Forthofer and Eun Sul Lee, "Introduction to Biostatistics" -Academic Press, 1995.
4. Khan and Khanum, Fundamentals of Biostatistics,Ukaaz pub,3 rd edn,2008
5. S I Rubinow, "Introduction to Mathematical Biology" -John Wiley, 1975.
6. Richard A. Johnson, "Miller & Freund's Probability and statistics for engineers" Prentice Hall, 6th Edition,, 2000.

7. Veer Bala Rastogi, “Fundamentals of Biostatistics” -Ane Books, 3rd Edition, 2015
8. S C Gupta and V.K. Kapoor, Fundamentals of Applied Statistics, Sultan Chand and Sons.4th Edition, 2007.

Course Outcomes

1. Demonstrate and understand the basic concepts of biostatistics, analysis of measure of central tendency and dispersion.
2. Ability to know the basic principles of probability and distributions in Biology and Genetics
3. Analyse and interpret data regarding various distributions (T-test, F-test, and chi square)
4. Basic principles and designs of experimentation and ANOVA
5. Perform experimental design (RSM, Plakett Burman, LSD, CRD, RCBD)
6. Ability to study the microbial growth in chemostat, product formation and biomodelling in various parameters

UBT406C: Immunotechnology

3 Credits (3-0-0)

UNIT 1

The immune system: **10 Hours**

Introduction, Cells and Organs of the immune system: Lymphoid cells, phagocytes, mast cells and dendritic cells. Primary (thymus, bonemarrow and lymphatic system) and secondary Lymphoid organs(lymph nodes, spleen, MALT, CALT). Innate and adaptive immunity. Antigens, Antibodies, Complement system- complement activation,(classical, alternative and lectin pathway) regulation and biological consequences of compliment activation. Cytokines and their role in immune response. Monoclonal antibodies and applications

UNIT 2

Humoral and cell mediated immunity **10 Hours**

Introduction to humoral and cell mediated immunity. B-lymphocytes and their activation; Basic structure of immuno globulins; immunoglobulin classes (IgG, IgA, IgE, IgD and IgM) and biological activity. Antigenic determinants on immunoglobulin's- Isotype, Allotype and Idiotype. Thymus derived lymphocytes (T cells) and types, T-cell maturation and activation, mechanisms of T cell activation. Cell death and T-cell populations. Major Histocompatibility Complex and antigen presentation. Antigen presenting cells, dendritic cells, macrophages, mechanism of phagocytosis.

UNIT 3

Immunological disorders **10 Hours**

Hypersensitivity reactions and its types. Autoimmune disorders- Organ specific, Systemic Autoimmune diseases, Animal models for autoimmune diseases and treatment of autoimmune disease. Primary and secondary immunodeficiency disorders (AIDS). Transplantation Immunology: immunological basis of graft rejection, Types of transplantations.

Vaccines: Active and Passive immunization. Designing vaccines for active immunization: Live, attenuated vaccines. Inactive vaccines, subunit vaccines, recombinant vector vaccines and DNA vaccines.

UNIT 4

Immunodiagnosis **10 Hours**

Antigen-antibody reactions- Precipitation reactions, agglutination reactions, Blood typing A, B, ABO & Rh. Principal and applications of ELISA, Radio immuno assay (RIA), western blot analysis, immuno-electrophoresis, Immunofluorescence. Non-isotopic methods of detection of antigens - enhanced chemiluminescence assay. Purification and synthesis of antigens.Immuno-informatics.

Total: 40 hours

Text Books

1. Roitt's Essential Immunology by Wiley Blackwell 13th Edition 2017
2. Kuby J Immunology by, W H Freeman publishers 8th Edition, 2019

Reference Books

1. Ashim K and Chakravarthy- Immunology & Immunotechnology, Oxford University Press, 1st edition, 2006.
2. Rastogi S C Immunodiagnostics Principles and practice New Age International.2005
3. Peter Wood Understanding Immunology, Pearson Education, 3rd Edition, 2011.
4. Charles Janeway, Jr. and Paul Travers Immunobiology - the immune system in health and disease, Garland Publishing, Inc. 6th Edition, 2005
5. William E Paul Fundamental Immunology, Lippincott Williams & Wilkins,7th Edition 2012

Course Outcomes

1. Able to understand Immune system.
2. Able to Analyze the cell and humoral immune system.
3. Able to explain the immunological disorders.
4. Able to Evaluate the Transplantation immunology.
5. Able to understand the designing of Vaccines.
6. Able to understand antigen antibody reaction and application of Electrophoresis in Immunology.

UBT412C: Heat and Mass Transfer
3 Credits (3-0-0)

UNIT-I

Introduction to Heat Transfer **10 Hours**

Modes of heat transfer; Conduction – steady state heat conduction through uni-layer and multilayer plane wall sphere, cylinder; Insulation – types, critical radius, Optimum thickness of insulation. Forced and Natural convection; Significance of Dimensionless numbers (Nu, Gr, Pr, Re, Pe numbers only); Heat transfer without phase change, heat transfer in laminar and turbulent flow inside closed conducts, concepts of film heat transfer coefficients.

UNIT-II

Heat Transfer Equipments **10 Hours**

Equations and numerical problem for calculations of film heat transfer coefficients, Heat transfer with phase change - Condensation – film wise and drop wise; Boiling – types of boiling. Co current and counter current flow. Individual and overall Heat transfer coefficients, LMTD, Elementary design of double pipe heat exchanger and shell and tube heat exchanger.

UNIT-III

Basics of Mass Transfer **10 Hours**

Diffusion - Fick's law of diffusion. Measurement of diffusivity, Theories of mass transfer, Mass transfer coefficients and their correlations. Liquid-Liquid, Solid-Liquid, Liquid-Gas, Solid-Liquid-Gas Mass transfer. Principles, mass transfer considerations, design equations and equipments for leaching, extraction, absorption, adsorption, crystallization and evaporation

UNIT-IV

Mass transfer Operations **10 Hours**

Distillation: Methods of distillation –Simple, Flash distillation of binary mixtures – relative volatility, fractionation of binary mixtures -McCabe Thiele method, Extractive and Azeotropic distillation, numerical. Drying: Drying rate, drying curve and calculations, drying equipment.

Total: 40 Hours

Textbooks:

1. McCabe WL, Smith JC and Harriott (2005) Unit operations in Chemical Engineering, 7th Edn., McGraw-Hill Publications, USA
2. Treybal RE (2012) Mass Transfer Operations, 3rd Edition, McGraw-Hill Publications, USA.
3. R. P. Chhabra V. Shankar (2018) Coulson and Richardson's Chemical Engineering Volume 1B: Heat and Mass Transfer: Fundamentals and Applications, 7th Edition, Butterworth-Heinemann

Reference Books:

1. Pauline Doran (2012) Bioprocess Engineering Principles, 2nd Edition, Academic Press
2. Alan S Foust, Wenzel LA, Clump CW, Maus L and Anderson LB (2008). Principles of Unit Operations, 2nd Edn., John Wiley & Sons, USA.
3. Kern (2001). Process Heat Transfer, 2nd Edn. McGraw-Hill Publications, USA.
4. Perry RH and Green DW (2008). Perry's Chemical Engineering Hand Book, 8th Edn., McGraw- Hill Publications.

Course Outcomes

1. Define the different modes of heat transfer and solve the problems
2. Determine heat flux and temperature distribution in steady state one- dimensional problems using thermal resistance concept.
3. Estimate the heat transfer rate for different types of heat exchangers.

4. Predict mass transfer rates and mass transfer coefficients.
5. Estimate the number of theoretical plates required for effective separation of liquid mixtures.
6. Determine various parameters of mass transfer operations.

UBT419C: Thermodynamics
3 Credits (3-0-0)

UNIT-I

Introduction **10 Hours**

System, surrounding & processes, closed and open systems, intensive & extensive properties, state and path functions, equilibrium state, reversible and irreversible processes. First Law of Thermodynamics: General statement of first law of thermodynamics, first law for cyclic process, Non-flow process, flow process.

UNIT-II

Second law of thermodynamics & P-V-T behaviour **10 Hours**

General statement of the second law, concept of entropy, the Carnot principle, calculation of entropy changes, Clausius inequality, entropy and irreversibility, third law of thermodynamics. P-V-T behaviour of pure fluids, equations of state and ideal gas law, processes involving ideal gas law: constant volume, constant pressure, constant temperature, adiabatic and polytropic processes. Equations of real gases, principles of corresponding states, compressibility charts.

UNIT-III

Thermodynamic Properties of Pure Fluids **10 Hours**

Derived properties, work function, Gibbs free energy, relationships among thermodynamic properties. Fundamental property relations, Maxwell's relations, Clapeyron equation, entropy-heat capacity relation, Effect of temperature on U, H & Entropy (S), relationships between Cp & Cv, Gibbs Helmholtz equation. Fugacity, fugacity coefficient, Determination of fugacity of pure gases, fugacity's of solids and liquids. Activity and activity coefficient, Thermodynamic diagrams. Properties of solutions.

UNIT-III

Thermodynamic Properties of Pure Fluids **10 Hours**

Partial molar properties, Chemical potential, Gibbs-Duhem equation & its applications, Henry's law & Raoult's law. Criteria of phase Equilibria, criterion of stability, Duhem's theorem, Vapour- Liquid Equilibria: VLE in ideal solutions, Consistency test for VLE data, calculation of activity coefficients using Gibbs - Duhem equation, Liquid-Liquid Equilibrium diagrams.

Textbooks:

1. Smith JM and Van Ness HC (2004) Introduction to Chemical Engineering thermodynamics, 6th Edition, McGraw Hill Publications, USA.
2. Stanley I. Sandler (2006) Chemical and Engineering Thermodynamics, 4th Edn., John Wiley & Sons, USA.
3. Narayanan KV (2001) A Textbook of Chemical Engineering Thermodynamics, Prentice Hall Publication, India.

Reference Books:

1. Bailey JE and Ollis DF (2010) Biochemical Engg. Fundamentals, 2nd Edition, McGraw Hill, New York, USA.
2. Rao YVC (1997) Chemical Engineering Thermodynamics, New Age International, India.
3. Segel IH (1993) Biochemical Calculations, 2nd Edn., John Wiley & Sons, USA.
4. Shuler ML and Kargi F (2001) Bioprocess Engineering, 2nd Edn., Prentice Hall International, USA. 5. Eruster L (2013) Bioenergetics, Academic Press, New York.

Course Outcomes

1. Explain the fundamental concepts of the laws of thermodynamics and apply the first law of thermodynamics to solve engineering problems.

2. Understand the second law of Thermodynamics and apply in engineering problems and solve the problems related to properties of fluids.
3. Estimate the thermodynamic properties, such as enthalpies, entropies, Gibbs energies, fugacity coefficients, and activity coefficients of pure fluids as well as fluid mixtures.
4. Analyze and find properties such as Pressure, Volume and Temperature for equations of states. Calculate entropy for the processes, and various types of energies such as internal energy, enthalpy, Helmholtz free energy and Gibbs free energy.
5. Predict equilibrium compositions of mixtures under phase.
6. Generate Vapor Liquid Equilibrium data for ideal and non-ideal solutions and check for their consistency by various methods.

UBT418C: Molecular Biology

3 Credits (3-0-0)

UNIT 1

Introduction **12 Hours**

Genes and their location. Information flow in biological systems: central dogma, updated central dogma. Signalling (signal transduction)-molecular mechanism. Reverse genetics, Genetic code-its features, codon and anticodon.

UNIT 2

Transcription **10 Hours**

Mechanism of transcription in prokaryotes and eukaryotes, Bacterial RNA polymerase, structure and function of RNA polymerases (prokaryotes & eukaryotes), general transcription factors, post transcriptional processing, transcription inhibitors, Si RNA, antisense RNA technology.

Translation:

Protein synthesis: Initiators, Elongation factors, termination codons, Mechanism of translation, Structure and function of prokaryotic and eukaryotic ribosomes, Post translational modification. Differences between prokaryotic and eukaryotic protein synthesis, inhibitors of translation.

UNIT 3

Gene Expression in Prokaryotes **10 Hours**

Regulation of gene expression in prokaryotes: Operon model-structure and function, galactose and lactose operon, tryptophan Operon-regulation by attenuation mechanism; positive versus negative regulation, cyclic AMP effect/catabolite repression.

Gene Expression in Eukaryotes:

Regulation of eukaryotic gene expression, hormonal regulation- peptide and steroid hormones, transcriptional control, super secondary structures-Helix turns Helix. Zinc fingers and Leucine Zippers. Gene silencing-methylation, chromatin modification

UNIT 4

Transposons and Oncogenes **10 Hours**

Transposons-replicative and non replicative mechanisms, Insertion sequences, AC/DS elements, transposition in maize (Mc Clintock's work), cut and paste transposition, Oncogenes and protooncogenes,v-onc, tumour suppressor genes, , retroviruses and its life cycle.

Genetic Recombination:

Genetic recombination in bacteria- transformation, transduction and recombination, Mechanism of recombination-homologous (Holliday model), site specific recombination, double strand break repair model

Total: 42 hours

Text Books

1. David L. Nelson and Michael Cox, "Lehninger Principles of Biochemistry" –7th Edition, 2017
2. James D Watson "Molecular Biology of the Gene", , Pearson Edu.Pub. 5th Edition, 2008

Reference Books

1. David Freifelder "Essentials of Molecular Biology" Narosa Pub.House 2nd Edition, 2008
2. Alberts *et al* "Molecular Biology of the Cell" CBS Pub, 4th Edition, 2002.
3. NPTEL Source material

Course Outcomes

1. Emphasize on the basic aspects of molecular biology; the key areas and apply the knowledge in information flow in biological systems, reverse genetics and genetic code.
2. Classify and compare the mechanism of DNA repair processes, replication.

3. Acquire working knowledge on the mechanism of transcription, translation and post translational processes stepwise and their applications in the research.
4. Identify the various mechanism of gene regulation in prokaryotes and eukaryotes.
5. Identify the steps of transposition and concept of oncogenes.
6. Identify, describe and classify the molecular mechanism of genetic recombination.

UBT410L: Immunotechnology Lab

1 Credit (0-0-2)

LIST OF EXPERIMENTS IN IMMUNOTECHNOLOGY LABORATORY

1. Agglutination Technique: Blood group identification and Rh factor
2. Laboratory diagnosis of diseases-Widal test (Tube agglutination) and VDRL
3. Ouchterlony Double Diffusion (ODD)
4. Radial Immunodiffusion (RID)
5. Countercurrentimmunoelectrophoresis (CCIEP)
6. Rocket immunoelectrophoresis (RIEP)
7. Western blot (IgG Purification)
8. ELISA/DOT Blot.
9. Quantitative precipitinassay (QPA).
10. Separation of lymphocytes fromperipheralblood.

Reference Books

1. Frank C Hay and Olwyn westwood Practical Immunology john Wiley and sons Ltd, 4th Edition,2008
2. R K Sharma and S P S Sangha Basic Techniques in Biochemistry and Molecular biology, I K International, 2009
3. K. R. Aneja, "Experiments in Microbiology, Plant Pathology and Biotechnology" – 5th Edition, New age International Pub. 2017.

Course Outcomes

1. Ability to understand the principle of agglutination reaction and identify the blood group of sample.
2. Apply the knowledge of immunology to identify the antigen and antibody.
3. Apply the concept of antigen antibody reaction to laboratory diagnosis of diseases.
4. Ability to analyse the antibody titre in samples.
5. Apply the knowledge of immunodiffusion to identify the antigens
6. Ability to the principle of purification for antibody purification.

UBT413L -Biostatistics Lab
1.5 Credits (0-0-3)

LIST OF EXPERIMENTS

1. Procedure for creating Data file, Diagram and Graphs.
2. Procedure and calculation of Mean, Median, Mode, Standard Deviation and Variance.
3. Procedure and calculation of t, Z and F test.
4. Calculation of Chi-square test.
5. ANOVA- one-way analysis
6. ANOVA- two-way analysis.
7. Experimental Research Design – CRD- Analysis.
8. Experimental Research design – RBD- Analysis.
9. Experimental Research design – Latin square- Analysis.
10. Calculation of Regression and correlation.
11. Multiple Regression Analysis.
12. Placket-Burman Design for media optimization.
13. Response Surface Methodology for media optimization.

Reference Books

1. Marcello Pagano & Kimberlee Gauvreu, “Principles of Biostatistics” -Thompson Learning Pub, 2nd Edition, 2006.
2. Ronadd N Forthofer and Eun Sul Lee, “Introduction to Biostatistics” -Academic Press, 2014.
3. Agarwal B L., “Basic Statistics”-New Age International Pub, 5th Edn, 2009
4. Norman T J Bailey, “Statistical methods in Biology” -Cambridge Press, 3rd Edition, 2000.

Course Outcomes

1. Able to collect data, interpretation, prepare graphs
2. Able to know about central tendency and measures of dispersion
3. Able to calculate probability distributions (t, f, chi square)
4. Able to state hypothesis and calculate ANOVA(one way and two way)
5. Able to calculate correlation and regression analysis
6. Able to design experiments and Analysis(CRD,RCBD,LSD,PB ,RSM)

UBT408L: Molecular biology Laboratory

1.5 Credits (0-0-3)
LIST OF EXPERIMENTS

1. Study of standard practices in Molecular Biology Lab
2. Standard Operating Procedure for Centrifuge
3. Standard Operating Procedure for Gel documentation unit
4. Study of absorption spectra (proteins./ any biomolecule)
5. Agarose gel electrophoresis
6. Isolation of genomic DNA (plant / animal / microbial sources)
7. Isolation of plasmid DNA from *E. coli.*
8. Estimation of DNA by diphenylamine method.
9. Estimation of RNA by orcinol method.
10. Purity analysis of nucleic acids by UV-Vis Spectrophotometer.
11. PAGE - demo expt.

REFERENCE BOOKS:

1. Sadasivam and Manickam, "Biochemical Methods", 2nd Edition, New age international Publishers, 2017.
2. Sambrook & Russell, "Molecular Cloning", 3rd Edition, Cold Spring Harber Lab, 3rd Edition 2002.

COURSE OUTCOMES:

1. Able to Know the significance of understand the standard practices in Molecular biology lab Able to analyze the concentration and purity of DNA
2. Able to conduct and analyze agarose gel electrophoresis.
3. Able to perform absorption spectra and understand SOP for various lab equipments
4. Able to conduct observations and experiments including Genomic DNA/plasmid DNA /RNA/protein.
5. Demonstrate the knowledge of quantification and purity analysis of biomolecules.
6. Gain knowledge in demonstration of PAGE

QUESTION PAPER PATTERN FOR CIE AND SEE:

CIE:

5. Question paper consists of two parts viz., part A and part B.
6. Part A is compulsory and will consist of 10 questions each one mark or 5 questions of each two marks or a combination of one and two marks totaling to 10 marks.
7. Part B consists of 2 units. Two questions from each unit uniformly covering the syllabus of the unit under consideration. Each question will carry 15 marks and should not have more than 3 sub divisions. Any one full question to be answered from each unit.
8. Each CIE test will be for a total of 40 marks then reduced to 20 marks.

SEE:

5. Question paper consists of two parts viz., part A and part B.
6. Part A is compulsory and it consist of 20 questions of each one mark or 10 questions of each two marks or a combination of one and two marks totaling to 20 marks.
7. Part B consists of 4 units. Two questions from each unit uniformly covering the syllabus of the unit under consideration. Each question will carry 20 marks and should not have more than 4 sub divisions. Any one full question to be answered from each unit.
8. The SEE will be for a total of 100 marks then reduced to 50 marks

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF BIOTECHNOLOGY

B.E. V SEMESTER

2021-22

Sl. No	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	UBT520C	Fundamentals of Bioinformatics	3	2	2	0	4	50	50	100
2	UBT516C	Bioprocess and Reaction Engineering	3	3	0	0	3	50	50	100
3	UBT519C	Genetic Engineering & Applications	3	3	0	0	3	50	50	100
4	UCS559L	Advanced C Programming Lab	2	0	0	2	2	50	50	100
5	UHS002N	Advanced Quantitative Aptitude and Soft Skills	1	2	0	0	2	50	50	100
6	UBT506H	Industrial Safety & Bioethics	3	3	0	0	3	50	50	100
7	UBT52XE	Elective-1	3	3	0	0	3	50	50	100
8	UXX00XN	Open Elective -1	3	3	0	0	3	50	50	100
9	UBT514L	Bioinformatics Lab	1	0	0	2	2	50	50	100
10	UBT515L	Genetic Engineering Lab	1	0	0	2	2	50	50	100
		Total	**23**	**19**	**2**	**6**	**27**	**500**	**500**	**1000**

Elective -1

UBT521E: Environmental BT

UBT522E: Biomedical Instrumentation

UBT525E: Stem cell technology

UBT527E: Nutraceuticals

UBT520C: Fundamentals of Bioinformatics

3 Credits (2-2-0)

UNIT 1

Introduction to Bioinformatics and Biological Database **12 Hours**

Introduction to bioinformatics, Components of bioinformaticsand interdisciplinary nature of bioinformatics, Classification of biological databases; Primary database: NCBI, GenBank, DDBJ and EMBL, PIR, Uniprot; Secondary databases: PROSITE, PRINTS, BLOCKS and Pfam; Structure databases: Protein Data Bank (PDB), MMDB, CATH, SCOP; Specialized databases: PubMed, OMIM, Metabolic Pathway-KEGG;ExPasy and PubChem databases, File format: GenBank flat file, PDB flat file.

Tutorials: Practices on other primaryandsecondarydatabases

UNIT 2

Sequence alignment and database searches **10 Hours**

Introduction, Types of sequence alignment,Comparison between global and local alignment,Pairwise sequence alignment: Dot matrix analysis, Dynamic programming, Global alignment-Needleman-Wunch algorithm, Local Alignment-Smith & Waterman algorithm, Substitution matrix- BLOSUM and PAM; GAP Penalty; Low complexity regions;Word/k-tuple method- BLAST, FASTA.

Multiple Sequence Alignment:Introduction, applications of MSA; Types of MSA: Progressive method of MSA-Clustal W; Iterative method of MSA; Motifs and Patterns; Statistical models of MSA-Position Specific Scoring Matrix (PSSM) and Profiles.

Tutorials: Solving problems on pairwise sequence alignment

UNIT 3

Phylogenetic analysis and predictive methods using sequences **10 Hours**

Introduction, concepts of trees, types of evolutionary trees, Rooted and unrooted trees, Steps in constructing phylogenetic trees,Tree building methods - Distance based methods: Neighbor Joining (NJ) method, Fitch-Margoliash (FM) method; Character based method: Maximum parsimony; Tree Evaluation methods, Phylogenetic Softwares.

Predictive Methods using sequences: Structure of Prokaryote and Eukaryote genes; Algorithms for Prokaryotic and Eukaryotic gene prediction, Web based tools for gene prediction (ORF finder, GenScan). Protein Secondary Structure Prediction, Tertiary Structure Predictions: Homology modelling.

Tutorials: Practices on prediction of phylogenetic trees

UNIT 4

Plasmid mapping and primer designing &molecular modelling techniques **10 Hours**

Restriction mapping, Web based tools: Restriction Mapper and REBASE. Utilities of Mac Vector and Vector NTI; Basics of Primer designing, Primer design softwares (PRIME3). Rational Approaches in Drug Design, molecular docking, deriving the Pharmacophoric Pattern, quantitative structure-activity relationship (QSAR), deriving bioactive conformations,Calculation of Molecular Properties,Dockingsoftwares (AUTODOCK, HEX)

Tutorials: Solving problems related to Restriction mapping and Primer designing

Total: 42 hours

Text Books

1. Bioinformatics – Andreas D Baxevanis. Wiley Interscience, 4 th Edition, 2020.
2. Bioinformatics –David W Mount, cold spring harbor, 2 nd Edition, 2005.

Reference Books

1. Introduction to Bioinformatics – Arthur Lesk, Oxford, 2nd Edition,2006.
2. Bioinformatics – Stuart M Brown, NYU Medical Center, NY USA. 2000.
3. Fundamental Concepts of Bioinformatics – D E Krane & M L Raymer, Pearson, 2006.
4. Computational methods for macromolecular sequence analysis – R F Doolittle. academic Press, 1996.

Course Outcomes

1. Importance of databases involved in bioinformatics along with their file formats
2. Will have idea on searching similar sequences in databases and find similarity between given set of sequences
3. Derive evolutionary relationship between genes and proteins by phylo-genetic analysis
4. Explain various statistical tools involved in predicting the structure of genes and proteins
5. The principle behind restriction mapping and primer designing
6. Different approaches involved in silico drug design

UBT516C: Bioprocess Reaction Engineering
3Credits (3-0-0)

UNIT 1

Kinetics of Homogeneous reactions **10 Hours**

Basic Concepts of Bioreactor and bioprocess engineering, Concentration dependent term of a rate equation. Rate Constant. Representation of elementary reaction and Non elementary reactions, Kinetic Models of Non elementary Reactions, Testing Kinetic Models. Temperature-dependent term of a rate equation: Temperature dependency from Arrhenius law, Collision theory, Transition state theory, Thermodynamic approach, Activation Energy.

UNIT 2

Interpretation of Batch Bioreactor Data **10 Hours**

Constant volume batch reactor, Integral method of analysis of data -first order, second order, zero order reactions, fractional life, homogenous catalyzed reactions, irreversible reaction in series, irreversible reactions in parallel, reactions of shifting order, autocatalytic reactions, reversible reactions, differential method of analysis of data and numerical

UNIT 3

Introduction to Reaction Design **10 Hours**

Introduction. Factors to be consider for designing a reactor, Types of reactors, Basic design equation, relation between Concentration and conversion, Performance equation for ideal batch reactor, MFR/CSTR and PFR, space time and space velocity for flow reactors, design of flow reactors and numerical.

UNIT 4

Design for single reactions **10 Hours**

Introduction .Size comparison of single reactors, multiple reactors CSTR in series /MFR in series, CSTR in parallel .PFR in series, in parallel, Reactors of different types in series, and numerical.

Total: 40 hours

Text Books

1. Scott Fogler, H (2016) Elements of Chemical Reaction Engineering, 6th edn., Prentice Hall India Pvt. Ltd.
2. Levenspiel O (2006) Chemical Reaction Engineering, Wiley Eastern, 3rd edn, New Delhi.
3. Kargi and Shuler (2015) Bioprocess Engineering. 3nd edn., Prentice Hall PTR.

Reference Books:

1. Bailey JE and Ollis DF (2010) Biochemical Engineering Fundamentals, 2nd edn. Mc Graw- Hill.
2. Charles D. Holland (1990) Fundamentals of Chemical Reaction Engineering, John Wiley and Sons.
3. Pauline M Doran., Bioprocess Engineering Principles, 2nd Edition, Academic Press, USA, 2013.
4. Tapobrata Panda., Bioreactors: Analysis and Design, 1st Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.

Course Outcomes

1. Understand the basic concept of reaction engineering.
2. Predict the order and rate of the different reactions.
3. Analyse the batch bioreactor data for different reactions.
4. Design the suitable bioreactor for different biochemical reactions.
5. Predict the residence time distribution to determine the conversion in non ideal flow reactors
6. Analyse bioreactors for various cell cultures.

UBT519C: Genetic Engineering & Applications

3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Tools of genetic engineering- vectors in recombinant DNA technology, biology and salient features of vectors, Types of vectors - plasmids, cosmids, bacteriophage lambsa vectors.

Enzymes in Genetic Engineering

Introduction- Restriction Endonucleases-classification, mode of action, applications. Enzymes used in nucleic acid modification – Alkaline phosphatase, polynucleotide Kinase, Ligases, terminal deoxy nucleotidyl transferase.

UNIT 2

Nucleic acid hybridization and amplification **10 Hours**

Methods of nucleic acid detection, Fluorescent In situ hybridization (FISH), colony hybridization, polymerase chain reaction (PCR), its types and applications, methods of nucleic acid hybridization, Southern, Western and Northern hybridization techniques.

Construction of DNA Libraries

Construction of Complementary DNA (cDNA), genomic DNA libraries and cDNA libraries.

UNIT 3

Gene transfer techniques **12 Hours**

Gene transfer techniques in plants, animals and microbes –Transformation, microinjection, electroporation, microprojectile system, and liposome mediated transfer, embryonic stem cell method. Agrobacterium-mediated gene transfer in plants – Ti& Ri Plasmid: structure and functions, Ti based vectors- Binary vectors and Cointegrate vectors.

Transgenic Science and Genetic Improvement

Transgenic science in plant improvement, Antisense RNA technology (Flavrsavr tomatoes). Application of plant transformation for productivity and performance – Herbicide resistance - glyphosate. insect resistance - Btgenes(*Bacillus thuringiensis* and its mode of action), Cry proteins – mechanism of action.

UNIT 4

Gene therapy **10 Hours**

Introduction, Methods of Gene therapy-gene targeting, gene augmentation, assisted killing, prodrug therapy and gene silencing. Gene therapy in the treatment of cancer, SCID, muscular dystrophy. Use of thrombolytic agents in blood clotting. Challenges in gene therapy.

APPLICATIONS

Engineering microbes for the production of Insulin, growth hormones, monoclonal antibodies.

Total: 42 hours

Text Books

1. Molecular Biotechnology, Principles and applications of Recombinant DNA by Bernard R Glick and Jack J Pasternak, CBS Publishers,2nd Edition, 2017.
2. Recombinant DNA by Watson, et al., Freeman Publishers 2nd Edition 2010.

Reference books

1. Principles of gene manipulation, Primrose S.B., Blackwell Scientific Publications, 6th Edition, 2001.
2. Biotechnology Expanding Horizon, B.D.Singh, 3rd revised edition, Kalyani Publishers, 2010
3. NPTEL Source material

Course Outcomes

1. Emphasize on the basic aspects of genetic engineering; the key areas and apply the knowledge in vectors used in genetic engineering experiments.
2. Apply the properties of various enzymes and vectors in gene and genome manipulation.
3. Acquire working knowledge on the mechanism of methods of nucleic acid detection, hybridization and amplification and their applications in the research.
4. Acquire working knowledge on the construction of genomic and cDNA libraries their applications in the research and biology of *Bacillus thuringiensis*.
5. Identify the various gene transfer techniques in plants, animals and microbes that are essential for controlled protein production in the industry and acquire knowledge on various strategies of Gene therapy and its application in therapeutics.
6. Identify and apply the current applications and advances of biotechnology and describe the steps involved in the production of biopharmaceuticals in microbial systems and industrial utilization

UCS 559L: Advanced C Programming Lab

2 Credits (2-0-0)

Unit 1

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers

Unit 2

Pointer Applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.
Data Structures, Data structure Operations,
Stacks: Definition, Stack Operations, Array Representation of Stacks.

Unit 3

Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

Unit 4

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists. Implementation of stack and queue using linked list.

Text Books

1. Gilberg &Forouzan, DataStructur Structures: A Pseudo-code approach with C, Cengage
    a. Learning,2nd Edition, 2014
2. Yashwant Kanetkar,Data Structures through C,BPB Publications,2017

References

1. Gilberg&Forouzan, DataStructur Structures: A Pseudo-code approach with C,Cengage
    a. Learning,2nd Edition, 2014
2. Reema Thareja,Data Structures using C,Oxford press, 3rd Edition 2012
3. Jean-Paul Tremblay & Paul G,An Introduction to Data Structures with Applications,2nd Edition,2013

Course outcomes

1. Define advanced C programming concepts like pointers, data structures.
2. Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
3. Analyze different data structures and use suitable data structure to implement requirement specification.
4. Implement, interpret, debug and test any given advanced C program.
5. Develop software product using advanced C programming concepts to solve real world problem.

UBT506H: Industrial Safety & Bioethics

3 Credits (3-0-0)

UNIT 1

Introduction to Bioethics & Biosafety **10 Hours**

Definition and scopeof bioethics and biosafety, Ethical implications and need for biosafety, Legal and Socio-Economic impacts of Biotechnology. Convention on biological weapons. Bioterrorism-classification of biological agents with examples.

Biosafety regulation guidelines

Recombinant DNA Advisory Committee (RDAC), Institutional Biosafety committee(IBC), Review Committee on Genetic Modification (RCGM), Genetic Engineering Approval Committee (GEAC), Biosafety guidelines-national guidelines, Cartagena Protocol on Biosafety.

UNIT 2

Biosafety Regulation **12 Hours**

Genetically modified organisms and their release in environment, Laboratory associated infections and other hazards, Good Lab Practices and Good Manufacturing Process (GLP &GMP). Biosafety levels for microorganismBL1,BL2,BL3, BL4) plants (BL1-P,BL2-P,BL3-P,BL4-P) animals (BL1-N,BL2-N,BL3-N,BL4-N).

Risk assessment during laboratory research and risk groups. Recombinant organisms and transgenic crops. Guideline for labeling GM crops. Containments; Physical, Biological. Field trial methods using transgenic plants.

UNIT 3

Food and Pharma safety **10 Hours**

Biosafety assessment procedures for biotech foods and Pharma products. Procedure to apply patent, Copy right, Plant Breeder's Right, Environmental aspects of biotech applications. Special application of patent laws in biotechnology and case studies. Flavr Savr Tomato as model case, case studies of relevance (Eg. Bt cotton, Bt brinjal). Licensing and cross licensing.

UNIT 4

Industrial safety **10 Hours**

Need for safety, importance of occupational safety, Health and safety programs, Safe and unsafe conditions.

Accidents: Accident preventive measure, Measurement and control of safety performance, 5E's for accident prevention Safety policy

Fire: Fire extinguishers and fire exits, extinguishing agents. Importance of safety in food and Pharma industry. Food safety, Biological, chemical and Physical Hazards-HAACP system, Pharma safety. Food and safety act. Injuries by industrial sector

Total: 42 hours

Text Books

1. Bioethics and Biosafety by Sateesh M.K., I.K.International pub, Kindle edition, 2012
2. Biotechnology Expanding Horizon, B.D.Singh, 3rd revised edition, Kalyani Publishers, 2015

Reference Books

1. Biotechnology and Safety Assessment by Thomas, J.A., Fuch, R.L. Academic Press.3rd Edition,2002.
2. Biological safety Principles and practices,by Fleming, D.A., Hunt, D.L., ASM Press, 4th Edition,2006.
3. IPR-Biosafety and Bioethics Deepa Goel, Shomini Parashar, 2nd edition, Pearson Education India Publishers, 2010

Course outcomes: Student will be able to

1. Emphasize on the basic aspects of Biosafety and ethics; the key areas and apply the knowledge in the social, legal & ethical issues connected with BT, BWC and Bioterrorism
2. Interpret & describe biosafety regulation guidelines committees, Cartagena protocol & their relevant applications in BT
3. Identify biosafety levels as relevant to Biotechnology & apply this knowledge in maintenance of biosafety, GLP, GMP in research lab, field & industry.
4. Acquire working knowledge on the risk assessment, containment, GMO labeling and transgenic field trials in the research.
5. Identify the various forms of IPR and understand the importance of patents in modern scientific and industrial research and discuss special application of patent laws in biotechnology with case studies.
6. Identify & discuss the potential dangers in Biotechnology and gain knowledge on safety aspects in food and Pharma industry and apply precautionary measures to avoid /overcome it.

UBT521E: Environmental BT

3 Credits (3-0-0)

UNIT 1

Microorganisms **10 Hours**

Issues and scope of Environmental BT. Characteristics of soil, microbial flora of soil, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

Bioaccumulation of toxicants

Characteristics of Xenobiotics, Relationship of Bioaccumulation with Chemical Structure, Ecophysiology of Bioaccumulation, Process of toxicants uptake, Factors affecting bioaccumulation, measurement of bioaccumulation.

UNIT 2

Biological treatment of wastewater **12 Hours**

Waste water characteristics BOD, COD, Primary & Secondary treatment,nanofiltration, ultafilration and microfiltration. Microbial removal of phosphorous and Nitrogen, Nutrient removal by Biomass production Wastewater treatment of food processing industries like sugar factories, vegetable oil industries, potato processing industries, dairy industries, beverages industries, and distilleries.

Solid waste management

Basic aspects, general composition of urban solid wastes, aerobic treatment, anaerobic treatment, biogas generation; Solid waste management through Biotechnological processes involving Hazardous wastes, Biomedical wastes, MoEF rules.

UNIT 3

Bioleaching & Biomining **10 Hours**

Microbes in Bioleaching- types, methods of bioleaching, Microbial recovery of metal, phosphate, petroleum.

Bioremediation

Major contaminants of air, water and soil, Biomonitors of environment (Bioindicators), Bioremediation using microbes, Phytoremediation, Biofilms its applications. Bio-stimulation of Naturally occurring microbial activities, Bio-augmentation.

UNIT 4

Biotechnology in biodiversity conservation **10 Hours**

Value of biodiversity, threats to biodiversity, Biosphere reserves and Ecosystem Conservation, Approaches to Bioresource conservation programme, Biotechnological processes for bioresource assessment, BT in ex situ conservation of Biodiversity, BT and its role in utilization of Biodiversity, International initiatives for biodiversity management.

Total: 42 hours

Text Books

1. Environmental Biotechnology by Pradipta Kumar Mohapatra.,I K International Publishing house,1st Edition,2007.
2. Text book of microbiology by R C Dubey and D K Maheshwari,4th Edition,2013.

Reference Books

1. Environmental Biotechnology by Foster C.F., John ware D.A., Ellis Horwood Limited,1987.
2. Bioprocess Technology- fundamentals and applications, S O Enfors & L Hagstrom RIT,2000
3. Comprehensive Biotechnology Vol. 1- 4 : M.Y. Young,Pergamon Press.2nd Edition,2011
4. Industrial Microbiology : L.E. Casida, Willey Eastern Ltd., 1989.
5. Industrial Microbiology : Prescott & Dunn, CBS Publishers, 4th Edition,2006.
6. Biotechnology, Economic & Social Aspects : E.J. Dasilva, C Ratledge & A Sasson, Cambridge Univ. Press, Cambridge.1st Edition, 2009.

Course Outcomes : Students will be able to

1. Understand issues and scope of Environmental BT and concepts of Bioaccumulation.
2. Develop different treatment methods for waste water by using BT approach.
3. Develop different treatment methods for solid waste by using BT approach.
4. Apply the knowledge of bioleaching for metal recovery and bioremediation processes to remove environmental contaminants.
5. Understand the Value of biodiversity and threats to biodiversity.
6. Apply the knowledge of BT in biodiversity conservation.

UBT522E: Biomedical Instrumentation
3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Sources of Biomedical signals, Basic medical instrumentation system, Performance requirements of medical instrumentation systems, PC based medical instruments, General constraints in design of medical instrumentation systems. 4 Hours UNIT 2. **BIOELECTRIC SIGNALS AND Electrode**

Origin of bioelectric signals, Recording electrodes, - Electrode-tissue interface, metal electrolyte interface, electrolyte -skin interface, Polarization, Skin contact impedance, Silver – silver chloride electrodes, Electrodes for ECG, EEG, EMG, Electrical conductivity of electrode jellies and creams, Microelectrode. Patient Safety: Electrode shock hazards, Leakage currents.

UNIT 2

ECG & EEG **10 Hours**

Electrical activity of heart, Genesis & characteristics of Electrocardiogram (ECG), Block diagram description of an Electrocardiograph, ECG Lead Systems, Multichannel ECG machine Genesis of Electroencephalogram (EEG), Block diagram description of an Electroencephalograph, 10-20 Electrode system, Computerized analysis of EEG.

Cardiac pacemakers and defibrillators

Need for Cardiac pacemaker, External pacemaker, Implantable pacemaker, Programmable pacemakers, DC defibrillator, AC defibrillator and Implantable Defibrillator.

UNIT 3

Patient monitoring system **10 Hours**

Bedside monitors, Central Monitoring System, Measurement of Heart rate -Average heart rate meter, Instantaneous heart rate meter, (Cardio tachometer), Measurement of Pulse Rate, Blood pressure measurement -direct and indirect method, Rheographic method, Oscillometric method, Ultrasonic Doppler shift method, Measurements of Respiration rate -Thermistor method, impedance puenmography, CO2 method, and Apnea detector. Blood flow meters: Electromagnetic and its types, Ultrasonic, NMR, Laser Doppler. Blood gas analyzers: Blood pH measurement, Measurement of Blood pCO2, pO2.

Physiological Transducers

Introduction, classification, performance characteristics of transducers-static and dynamic transducers, Displacement, position and motion transducers, Pressure transducer, Transducers for body temperature measurement, Optical Fiber sensor and Biosensor

UNIT 4

Recording systems **10 Hours**

Basic recoding system, general considerations for signal conditioners, preamplifiers-instrumentation amplifier, isolation amplifier, ink jet recorder, potentiometric recorder, thermal array recorder and electrostatic recorder. 4 Hours UNIT 8. ANALYSIS a) Cardiac output measurement: Indicator dilution method, Dye dilution method, Thermal dilution techniques, Measurement of Continuous cardiac output derived from the aortic pressure waveform, Impedance technique. 4 Hours b) Pulmonary function analysis: Pulmonary function measurement, Spirometry, Puemotachometer, Measurement of Volume, Nitrogen washout technique.

Total: 40 hours

Text Books

1. Hand book of Biomedical Instrumentation – R. S. Khandpur, 2nd Edition, Tata McGraw- Hill Publishing Company Limited, 2003.
2. Introduction to Biomedical Engineering by J Enderle, S Blanchard & J Bronzino, Elsevier, 3rd Edition, 2011.

Reference Books

1. Principals of applied Biomedical instrumentation – John Wiley and sons,3rd Edition,2008.
2. Introduction to Biomedical equipment technology – Joseph J Carr, John M Brown Prentice hall 4th Edition, 2005.

Course Outcomes

1 Able to understand basic concepts of biomedical signals.
2 Able to know ECG and EEG.
3 Able to understand the patient monitoring system and recording systems
4 Able to develop recording system

UBT525E: Stem cell Technology
3 Credits (3-0-0)

UNIT 1

Stem cells and cellular pedigrees **10 Hours**

Scope of stem cells – definition of stem cells – concepts of stem cells – differentiation , maturation , proliferation , pluripolericy, self – maintainance and self – renewal –problems in measuring stem cells – preservation protocols.

UNIT 2

Stem cell concept in plants **10 Hours**

Stem cell and founder zones in plants – particularly their roots – stem cells of shoot meristems of higher plants.

UNIT 3

Stem cell concept in animals **10 Hours**

Skeletal muscle stem cell – Mammary stem cells – intestinal stem cells – keratinocyte stem cells of cornea – skin and hair follicles –Tumour stem cells, Embryonic stem cell biology - factors influencing proliferation and differentiation of stem cells – hormone role in differentiation.

UNIT 4

Haemopoietic stem cell **10 Hours**

Biology – growth factors and the regulation of haemopoietic stem cells.

Potential uses of stem cells

Cellular therapies – vaccines – gene therapy – immunotherapy – tissue engineering –blood and bone marrow – Fc cells.

Total: 40 hours

Text Books

1. J. J. Mao, G. Vunjak-Novakovic et al (Ed): Translational Approaches in Tissue Engineering & Regenerative Medicine 2008, Artech House, INC Publications.
2. Robert Lanza et al. Principles of Tissue Engineering, Academic Press; 3 edition (2007)

Reference Books

1. Stein et al. Human Stem Cell Technology and Biology: A Research Guide and Laboratory Manual.Wiley-Blackwell; 1stEdition 2011.
2. Lanza et al. Handbook of Stem Cells, Two-Volume Set: Volume 1-Embryonic Stem Cells; Volume 2-Adult & Fetal Stem Cells (v. 1).Academic Press,1st Edition, 2004.
3. R Lanza, Langer R and Vacanti J: Principles of Tissue Engineering. Elsevier.4th Edition, 2013.
4. JD Bronzino; Tissue Engineering and Artificial organs, Taylor and Francis, 4th Edition, 2006.

UBT527E: Nutraceuticals

Credits (3-0-0)

UNIT 1

Introduction to Nutraceutical and dietetics **10 Hours**

Organizational elements, classification of nutraceuticals, dietary supplements, fortified foods, functional foods and phytonutraceuticals. Scope involved in the industry, Indian and global scenario. Recommended dietary intake (RDA), acceptable dietary intake, nitrogen balance, protein efficiency ratio, net protein utilisation. Basics of energy balance - Basal Metabolic Rate (BMR), Body Mass Index (BMI) and Standard Dynamic Action (SDA) with special reference to nutraceutical industry.

UNIT 2

Nutrition related diseases and disorders **10 Hours**

Carbohydrates, Protein, amino acids, Fat, vitamins and minerals - Excess and deficiency, symptoms, prevention and management.Role of nutraceuticals with special reference to diabetes mellitus, hypertension, hypercholesterolemia, cancer, glands in the prevention and treatment. Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress.Role of nutraceuticals and functional foods in pediatrics, geriatrics, sports, pregnancy and lactation.

UNIT 3

Nutraceuticals of microbial, plant and animal origin **10 Hours**

Concept of prebiotics and probiotics - principle, mechanism, production and technology involved, applications - examples of bacteria used as probiotics, use of prebiotics in maintaining the useful microflora - extraction from plant sources. Synbiotics for maintaining good health.Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment. Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids. Animal metabolites - Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides

UNIT 4

Biotechnology in Phytonutraceuticals **10 Hours**

Role of medicinal and aromatic plants in nutraceutical industry – propagation - conventional and tissue culture, cultivation, post harvest technology and strategies for crop improvement, development of high yielding lines and yield enhancement, plant genomics and metabolomics. Biofortification and nutritional enhancement.GM foods with enhanced nutraceutical properties.Golden rice, GM Tomatoes.

Total: 40 hours

Text Books

1. Israel Goldberg (Ed.) (1999) Functional foods, designer foods, pharma foods, Nutraceuticals, Aspen publishers Inc., USA
2. L. Rapport and B. Lockwood ,Nutraceuticals,Pharmaceutical Press.,2nd Edition,2002.

Reference Books

1. M. Maffei ,Dietary Supplements of Plant Origin, Taylor & Francis,1st Edition,2003.
2. Shahidi and Weerasinghe, Nutraceutical beverages Chemistry, Nutrition and health Effects, , American Chemical Society,1st Edition, 2004.
3. Richard Neeser& J. Bruce German (2004) Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Jean, Marcel Dekker, Inc.
4. Timotht S. Tracy, Richard L. Kingston, Herbal Products 2nd Edition, 2007.

Course Outcomes:

1. To be aware of basic concepts of nutraceuticals and nutrition
2. To have a general idea of scope of nutraceuticals and functional foods
3. To have brief idea about nutrition related health disorders and the role of nutraceuticals
4. To classify nutraceuticals and the role of nutraceuticals among different age groups
5. To learn about the basic aspects of nutraceuticals derived from microbial, plant and animal origin
6. To know about the role of biotechnology in production of plant secondary metabolites

UBT514L: Bioinformatics Lab
1.0 Credits (2-0-0)

List of Experiments

1. Bibliographic search from PUBMED, SCIRUS and MEDMINER
2. Sequence retrieval from Nucleic acid and Protein databases.
3. Sequence searches using BLAST – Retrieval of homologs, paralogs, orthologs, andXenologs
4. Pair wise comparison of sequences – Analysis of parameters affecting alignment.
5. Multiple alignments of sequences and pattern determination using PROSITE
6. Evolutionary studies / Phylogenetic analysis – Analysis of parameters affecting trees.
7. Identification of functional sites in Genes / Genomes.
8. Secondary structure prediction of proteins and comparison with PDB.
9. Restriction mapping: Analysis of maps for suitable molecular biology experiment.
10. Primer Design: Factors affecting primer design.
11. PDB structure retrieval and visualization: Analysis of homologous structures.
12. Determination of ligand-protein interactions using SPDBV/ LIGPLOT
13. Superposition of structures – Calculation of RMSD.
14. Docking studies – Analysis of substrate / ligand binding using homologous structures.

Reference Books

1. Bioinformatics – Andreas D Boxevanis. Wiley Interscience,2nd Edition,2001.
2. Discovering Genomics, Proteomics & Bioinformatics – A M Campbell & L J Heyer, Pearson Education,2nd Edition, 2007
3. Fundamental Concepts of Bioinformatics – D E Krane & M L Raymer, Pearson, 2006.
4. Computational methods in Molecular Biology – S.L.Salzberg, D B Searls, S Kasif, Elsevier, 1998.
5. Bioinformatics – methods and applications: Genomics, proteomics and drug Discovery – s c Rastogi, N. mendiratta & prastogi, phi, 4th Edition,2013

Course Outcomes

1 Ability to Search literature and sequence databases
2 Ability to retrieve and search sequences from databases
3 Ability to align pair wise and multiple sequences
4 Ability to identify evolutionary and relationships and functional sites in genomes
5 Ability to evaluate primer designing and restriction mapping
6 Ability to docking and superimpose the structures

UBT515L: Genetic Engineering Laboratory
1.0 Credits (0-0-3)
List of Experiments in Genetic Engineering Laboratory

1. Transformation.-
2. Blue white colony screening.
3. Thermal denaturation of DNA.
4. Restriction Digestion.
5. Ligation Experiment.
6. Southern Blotting – Agarose Gel Electrophoresis
7. Electroblotting and analysis.
8. SOP for PCR
9. SOP for Gel Documentation
10. SOP for UV-Spectrophotometer
11. SOP for Lyophilizer
12. PCR (Amplification with specific primers)

Reference Books

1. Sadashiva and Manickam, "Biochemical Methods", 2nd Edition, New age international Publishers, 2017.
2. Sambrook & Russell, "Molecular Cloning", Cold Spring Harber Lab, 3rd Edition, 2002.
3. Current protocols in molecular biology-Greena Publishing Associates, NY, 1988

Course Outcomes

1. To demonstrate proficiency in Transformation and screening of transformants.
2. To apply the knowledge of thermal denaturation to calculate Tm value.
3. To evaluate the functions of restriction digestion and Ligation on DNA.
4. To demonstrate proficiency in Electro-blotting and detection.
5. To demonstrate understanding of SOP and PCR.
6. To gain knowledge in common and advanced laboratory practices in Genetic engineering lab.

QUESTION PAPER PATTERN OF CIE (Continuous Internal Evaluation):

1. CIE comprises of 3 tests, each of 30 marks and I hr duration, totaling to 90 marks and later is scaled down to 45 mark
2. Each CIE will be covering one and half unit
3. Any two full questions to be answered out of three questions and each question carries fifteen marks
4. Assignment: quiz/ objective tests etc carries five mark

QUESTION PAPER PATTERN of SEE:

1. Total of Eight Questions with Two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four sub questions.
3. Any Five Full questions are to answered choosing at least one from each unit.

Laboratory Assessment:

1) Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)

2) Allocation of 50 marks for CIE

- Performance and Journal write-up: marks for each experiment = 30 marks/No. of proposed experiments.
- One practical test, for 20 marks (5 write-up, 10 conduction, calculation, Result etc., 5 –viva-voce)

3) Allocation of 50 marks for SEE

Major and Minor	: 35 marks (Write-up 25%, conduction 50%, calculation and results 25%)
Spotting	: 08 marks
Viva-Voce	: 07 marks

B.E. VI SEMESTER

2021-22

Sl. No.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	UBT615C	Enzyme Kinetics and Biotransformation	3	3	0	0	3	50	50	100
2	UBT616C	Upstream processing Technology	3	2	2	0	4	50	50	100
3	UBT617C	Bioprocess Equipment Design	3	2	2	0	4	50	50	100
4	UHS003N	Career Planning and Professional Skills	1	2	0	0	2	50	50	100
5	UBT62XE	Elective – 2	3	3	0	0	3	50	50	100
6	UBT63XE	Elective – 3	3	3	0	0	3	50	50	100
7	UXX00XN	Open Elective -2	3	3	0	0	3	50	50	100
8	UBT614L	Upstream Processing Lab	1.5	0	0	3	3	50	50	100
9	UBT608L	Bio-kinetics & Enzyme Technology Lab	1.5	0	0	3	3	50	50	100
10	UBT610P	Mini Project	2	0	0	4	4	50	50	100
		Total	**24**	**18**	**4**	**10**	**32**	**500**	**500**	**1000**

Elective-2

UBT621E Microbial BT
UBT623E Plant BT
UBT625E Biofuels technology
UBT627E Tissue engineering

Elective-3

UBT631E Genomics & Proteomics
UBT632E Animal BT
UBT633E Pearl programming
UBT634E Transport phenomena

UBT615C: Enzyme Kinetics and Biotransformation
3 Credits (3-0-0)

UNIT- 1

Enzyme **10 Hours**

Mechanism of enzyme action. Derivations of Km value (Michaelis-Menton constant), Lineweaver-Burk plot., Enzyme inhibition and kinetics

Multi-Substrate Reactions:

Introduction to enzyme catalyzed reaction Ping-pong mechanism, Sequential mechanism (ordered and random), Enzyme models - Host guest complexation chemistry. Mechanism of Enzyme catalysis - Acid-Base catalysis, covalent catalysis and -entropy effect.

UNIT- 2

Enzymatic Techniques: **10 Hours**

Strategies of purification of enzymes: choice of source, methods of homogenization, Criteria of purity: tests for purity, tests for catalytic activity, active site titrations, Molecular weight determination and characterization of enzymes.

Immobilization of enzymes

Techniques of enzyme immobilization; design and configuration of immobilized enzyme reactions,Kinetics of immobilized enzymes**,** immobilized enzymes in bioconversion processes(uses). The design and construction of novel enzymes

UNIT- 3

Enzymes of biological importance **10 Hours**

Enzyme pattern in diseases like in Myocardial infarctions (SGOT, SGPT, & LDH Acetylcholinesterase, angiotensin converting enzyme (ACE), pseudocholinesterase, 5'- nucleotidase (5NT), glucose-6-phosphate dehydrogenase (GPD). Use of isozymes as markers in cancer.

UNIT 4

Industrial uses of enzymes **10 Hours**

Enzymes used in detergents, use of proteases, leather and wool industries; methods involved in production of glucose syrup from starch (using starch hydrolyzing enzymes).Uses of lactase in dairy industry, glucose oxidase and catalase in food industry. Uses of proteases in food industries.

Total: 40 Hours

Text Books

1. Enzymes: Biochemistry , Biotechnology, Clinical Chemistry by Trevor Palmer, Horwood Publishing Ltd, East-West Press, 2nd Edition, 2008
2. David L. Nelson and Michael Cox, "Lehninger Principles of Biochemistry" –7th Edition 2017
3. Nicholas C. Price and Lewis Stevens Fundamentals of Enzymology , Oxford university Press,3rd edition, 2009

Reference Books

1. U. Sathyanarayana, "Biochemistry" -Books and Allied Pub,5th Edition, 2017.
2. James R Hanson "An Introduction to Biotransformation in Organic Chemistry" Oxford university Press,1997.
3. Daniel L. Purich, Melvin I. Simon, John N. Abelson" Contemporary Enzyme Kinetics and Mechanism" Academic press, 3rd edition, 2009.

4. K. Faber” Biotransformations in Organic: Springer- Verlag.1st Edition, 1999.
5. Bailey and Ollis, “Biochemical Engineering Fundamentals”, Mcgraw Hill (2nd Ed.), 2017.
6. Plowman,”Enzyme Kinetics’ McGraw Hill, 2010

Course Outcomes:

1. Ability to understand mechanism of enzyme reactions.
2. Ability to understand how to characterize the enzymes.
3. Ability to apply the techniques of immobilization of enzymes and know its uses.
4. Ability to know the importance of enzymes in diagnostics.
5. Ability to know the application of enzymes in wool, leather and detergent industries.
6. Ability to apply knowledge of using enzymes in food industries.

UBT616C: Upstream Processing Technology

3 Credits (2-2-0)

UNIT 1

Fermentation process: **10 Hours**

Range of fermentation processes, chronological development of fermentation industry, component of the fermentation process. Basic functions of a fermenter for microbial, plant and animal cell culture. Body parts of fermentor, aseptic operation and containment. Sterilization of fermentors. Types of Fermentors, Classification of Fermentation Systems: Batch, fed batch and continuous process and their applications.

Scale Up: Process engineering concepts, engineering considerations, mechanical considerations, energy considerations. Process GMP considerations of scale up, operations and quality.

UNIT 2

Raw materials and media sterilization: **10 Hours**

Media requirement for typical fermentation process, selection of typical raw materials, types of fermentation media. Preparation and handling of fermentation media, sterilization and its practical limits, Batch sterilization, Continuous sterilization and Filter sterilization.Different methods for optimization (Plackett-Burman Design, RSM)

UNIT 3

Microbial system: **10 Hours**

Isolation of industrially important microorganisms, Strain development methods, Preservation of industrially important microorganisms. Development of inoculumfrom laboratory scale to pilot scale and large scale fermentation (for bacterial, yeast, mycelial processes). Criteria for the transfer of inoculum. Aseptic transfer of inoculum to the fermentor. Trouble shooting during fermentation process (microbial contamination).

Secondary metabolite production: secondary metabolite production in bacteria, yeast and fungi. Production of lactic acid, butanol, antibiotics and enzymes.

UNIT 4

Plant Cell system: **10 Hours**

Isolation and culture of single cells, Bioprocess using plant cell cultures. Bioreactors for suspension cultures, immobilized cells and organized tissues. Secondary metabolite enhancement techniques(alkaloids, steroids, phenolics).

AnimalCellsystem :

Scale up of animal cell culture, factors affecting cell culture, Batch reactors, continuous culture, perfusion systems. Scale up of monolayer culture- roller bottles, nunc cell factory microcarriers culture. Growth monitoring.

Genetically engineered cells for bioprocessing; process, selection of host vectors, process constraints- genetic instability, mass transfer and others.

Large scale production of insulin by mammalian cell culture. Cellbank preparation & cell reviving techniques

Monoclonal antibody production: SUDBRCS (Single use disposable bioreactor configuration, types of production (perfusion culture, submerged culture, suspended adhered culture).

Total: 40 hours

Text Books

1. Principles of fermentation Technology by P.F. Stanbury and A. Whitaker, Butterworth-Heinemann; 3rd Edition,2016.
2. Bioprocess Engineering by Michael L. Shuler, Shuler & Kargi, Fikret Kargi, Pearson Publishers, 2nd Edition, 2012.

Reference Books

1. Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.2nd Edition, 1995.
2. Introduction to plant Biotechnology by H.S. Chawla, , Oxford & IBH Publishers, 3nd Edition, 2018.
3. Introduction to Plant tissue Culture, M.K. Razdan, Oxford & IBH Publishers,3rd Edition,2019
4. Culture of animal cells by Ian Freshney , John Willey & Sons Publ. 7th Edition.2016

Course Outcomes

1 Understand the fermenter and fermentation processes
2 Prepare and sterilize the industrial media
3 Design and optimize the media formulation using design of experiments
4 Develop the inoculum and improve the strain for industrially important microorganism
5 Distinguish the bioreactors for various cell systems
6 Develop plant & animal system for fermentation process and to use the Genetically modified cell into the fermentation process

UBT617C: Bioprocess Equipment Design
3 Credits (2-2-0)

UNIT 1

Process design of double pipe heat exchanger **10 Hours**

Introduction to heat exchanger, Functional design – Energy balance equation, log mean temperature difference (co-current, counter current), Heat transfer coefficients (inside, outside & overall), area, length, number of hair pins, diameter of tube. Pressure drop calculations. Detailed drawing of sectional front view of Heat exchanger.

UNIT 2

Process design of shell & tube heat exchanger **10 Hours**

Introduction to Heat Exchanger, Functional design – Energy balance equation, log mean temperature difference (co-current, counter current), Heat transfer coefficients (inside, outside and overall), area, length, number of tubes, tube sheet diameter, pitch type, diameter of tube sheet. Mechanical design – baffle, thickness of shell, thickness of tube sheet, thickness of head, pressure drop calculations – tube side and shell side. Detailed drawing of sectional front view of Heat exchanger (1-1, 1-2) with tube sheet layout.

UNIT 3

Process design of fermentor **10 Hours**

Functional design- Based on the type of bioreactor (batch reactor& MFR) and cell growth kinetics and performance equation, determines the volume of the reactor, according to H/D ratio determine height and diameter. Mechanical design- Thickness of the shell (cylindrical, spherical), thickness of top & bottom cover, flange calculations – width and thickness of gasket, number of bolts, bolts circle diameter and bolt diameter.

UNIT 4

Process design of plate column distillation column **10 Hours**

Functional design- material balance, energy balance, height of the packed column using McCabe Thiele's method, Mass transfer coefficients, Diameter of columns (Top and bottom), top and bottom free space. Detailed drawing for the above design (showing clearly inlets, outlets liquid distributors, packing support)

Total: 40 hours

Reference Books

1. Joshi, M.V., Process Equipment Design, Macmillan India, 1991.
2. Brownell, L.E. and Young, E.H., Process Equipment Design - Vessel Design, John Wiley and Sons, Inc.1959.
3. Ludwig, E.E., Applied Process Design for Chemical and Petrochemical Plants, Vol. 1 and 2, 3rd Ed., Gulf Publishing Co. 1997.
4. Indian Standards Institution, Code for Unfired Pressure Vessels, IS – 2825.
5. Bhattacharya, B.C, Introduction to Chemical Equipment Design, CBS Publications, 1985.
6. Perry's Chemical Engineers Handbook. 7th Edition Mc Graw Hill Publications

Course Outcomes

1. Design a Double pipe Heat Exchanger as per standard procedure.
2. Design a Shell and Tube Heat Exchanger as the procedure
3. Design a Reaction Vessel Fermentor as per the Procedure
4. Design a Distillation column as per the procedure
5. Draw the Various notation of the engineering drawing
6. Draw the pipe and welded joints

UBT621E: Microbial BT
3 Credits (3-0-0)

UNIT 1

Microbial biotechnology **10 Hours**

a) In Bacteria: Genetic Transfer in bacteria, Transformation, Conjugation, Translation, cloning techniques, polymerase chain reaction, expression of cloned Genes, Recovery and purification of expressed proteins.

b) In Yeast: Introduction of DNA into yeast cells, yeast cloning vectors, expression of foreign genes in yeast, expression of foreign gene products in secreted form.

UNIT 2

Industrial microbiology **10 Hours**

Vitamins as laxatives and analgesics; non steroidal contraceptives, external antiseptics, antacids and others. Antibiotics and hormones. Impact of Biotechnology on vaccine development; sub unit vaccines, fragments of antigen sub unit as synthetic peptide vaccines. Production of Microbial enzymes, strain -medium, fermentation processes. Large scale application of Microbial enzymes - starch processing, textile designing, detergents, cheese industry.

UNIT 3

Microbial by products **10 Hours**

Bacillus thuringinesis, Sphaericus, Popilliae, Baculoviruses. Bacterial Polysaccharides - structure & role in nature xanthan Gum - structure, production & Biosynthesis polyesters. Saccherification& fermentation. Metabolites from microorganisms, Amino acids, antibiotics. Organic synthesis & Degradation, classification of enzymes, microbial transformation of steroids & sterols.

Environmental microbiology

Sewage & Waster water microbiology, Microbiological Degradation of xenobiotics microorganisms in mineral recovery microorganisms in the removal of heavy metals from aqueous effluents.

Food microbiology

Microbial spoilage of food and its control; food preservatives; fermented foods; single cell protein (SCP) and single cell oil (SCO); food borne infections and their control.

UNIT 4

Bioremediation and bioleaching **10 Hours**

Uses of Bacteria in Bioremediation – Biodegradation of hydrocarbons, Granular sludge consortia for bioremediation, crude oil degradation by bacteria, Immobilization of microbes for bioremediation, Methanotrophs, PCB dechlorination, Genetic engineering of microbes for bioremediation. Phytoremediation – plants capable of assimilating heavy metals. Studies of Pyrite Dissolution in Pachuca Tanks and Depression of Pyrite Flotation by Bacteria, Factors Effecting Microbial Coal Solubilization, Sulfur Leaching by Thermophilic Microbes of Coal Particles Varying in size, Microbiological Production of Ferric Ion for Heap and Dump Leaching, New Bacteriophage which infects Acidophilic, Heterotrophic Bacteria from Acidic Mining Environments, Treatment of Coal Mine Drainage with Constructed Wetlands.

Total: 40 hours

Text Books

1. Microbiology by Pelczar, Chan and Kreig 7th Edition ,Mc Graw Hill Publishers,2017
2. Fundamentals of Biotechnology by Paul Prave, Uwe Faust, Wolfgang Sitig and Dieter A Sukatsch. VCH Publishers, 2000.

Reference Books

1. Principles of fermentation Technology by Peter Stanbury Allan Whitaker Stephen Hall, Aditya books (P) Ltd. 3rd Edition, 2016.
2. Alexander N Glazer, Hiroshi Nikaido by Microbial Biotechnology, W H Freeman & Company New York, 2007

UBT623E: Plant BT
3 Credits (3-0-0)

UNIT 1

Plant genetic engineering **10 Hours**

Induction of tumours by Agrobacterium, introduction of binary vectors into Agrobacterium by triparental mating, leaf disc transformation using Agrobacterium, GUS expression in transformed tissues, extraction of DNA from transformed plants, Southern hybridization to check plant
22 transformation, PCR amplification of T-DNA in transformed plant tissues. Agrobacterium mediated gene transfer and cloning. Types of plant vectors and their use in gene manipulation. Viruses as a tool to delivery foreign DNA.

Transformation technology

Plant transformation technology -Basis of tumor formation, hairy root, features of Ti and Ri plasmids, mechanisms of T-DNA transfer, role of virulence genes, use of Ti and Ri-plasmids as vectors, binary vectors. Vectorless or direct DNA transfer-particle bombardment, electroporation, microinjection, transformation of monoctos. Mechanism of transgene interaction - Transgene stability and gene silencing. Generation and mainteance of transgenic plants.

UNIT 2

Applications **10 Hours**

Application of plant transformation for productivity and performance – Herbicide resistance phosphoinothricin, glyphosate, atrazine, insect resistance -bt genes, Structure and function of Cry proteins – mechanism of action, critical evaluation of its impact in on insect control. Non-bt like protease inhibitors, alpha amylase inhibitor, virus resistance -coat protein mediated, nucleocapsid gene, disease resistance -chitinase, 1-3 beta glucanase, RIP, antifungal proteins, thionins, RS proteins, abiotic stress – drought and salinity, post-harvest losses, long shelf life of fruits and flowers, use of ACC synthase, polygalacturanase, ACC oxidase, male sterile lines, barstar and barnase systems.

UNIT 3

Secondary metabolites & gene markers **10 Hours**

Metabolic engineering and industrial products -Plant secondary metabolites. Industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines. Molecular marker-aided breeding -RFLP maps, linkage analysis, RAPD markers, STS, microsatellites, SCAR (sequence characterized amplified regions), SSCP (single strand conformational polymorphism), AFLP, QTL, map-based cloning, molecular marker assisted selection.

UNIT 4

Nitrogen fixation **10 Hours**

Nitrogen fixation and biofertilizers -Diazotrophic microorganisms, nitrogen fixation genes. Two component regulatory mechanisms. Transfer of *nif*genes to non-diazotrophic microorganisms, *nod* genes structure function and role in nodulation, Hydrogenase -Hydrogen metabolism. Genetic engineering of hydrogenase genes.

Algae

Blue-green algae and Azolla -Identification of elite species and mass production for practical application. Mycorrhizae -importance in agriculture and forestry. Algae as a source of food, feed, single cell protein, biofertilizers; industrial uses of algae. Mass cultivation of commercially valuable marine macroalgae for agar agar, alginates and other products of commerce and their uses. Mass cultivation of microalgae as a source of protein and feed.

Total: 40 hours

Text Books

1. Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.2nd Edition, 1995.

2. Introduction to plant Biotechnology by H.S. Chawla, Oxford & IBH Publishers, 3nd Edition, 2018

Reference Books

1. Introduction to Plant tissue Culture, M.K. Razdan, Oxford & IBH Publishers,3rd Edition, 2019
2. P K Gupta, Elements of Biotechnology. 2nd Edition, Rastogi publication 2010

Course Outcomes

1 Study plant genetic engineering and transformation technology.
2 Study Application of plant transformation for productivity and performance
3 Study Metabolic engineering and industrial products.
4 Study nitrogen fixationandIdentification of elite species and mass production for practical application of algae.

UBT625E: Biofuels Technology

3 Credits (3-0-0)

UNIT 1

Biochemistry of biofuels and energy resources: 10 Hours

Basic principle of light energy conversion to chemical energy &carbon fixation. Biochemistry involved in conversion of sugars to alcohols. Renewable and non-renewable resources.

Biofuels

Introduction to Biofuels - definition, advantages and disadvantages. Biofuel life cycle. Biomass as an energy core and its different mode of utilization. Conventional fuels and their environmental impacts. Modern fuels and their environmental impacts. Biofuel energy content. World scenario of biofuel production and use.

UNIT 2

Biofuel feed stocks 10 Hours

Starch feed stocks-cereal grains, tubers & roots; Sugars feed stocks-sugarcane &sugarbeet; cellulosic feed stocks - forest residues, agricultural residues, Agricultural processing by-products, dedicated energy crops, municipal solid waste and paper waste. Lipid feed stocks :-Oilseed crops with examples, Algae, Waste oil, Animal fats. Next generation feed stocks. Environmental impacts of feed stocks.

Types of biofuels

First generation biofuels-vegetable oil biodisel, bioalcohols, bioethers, biogas syngas, solid biofuels. Second generation biofuels and third generation biofuels

UNIT 3

Technologies for biofuels 10 Hours

Historical background.Biochemical platform – bioethanol production, standardization, emissions and properties of bioethanol. Thermochemical platforms - biodiesel production, standardization, properties and emissions of biodiesel. BtL fuels -production, properties and emissions. Biohydrogen processing and uses. Converting solid wastes to pipeline gas. Biomethanation, Microbial fuel cells. Blending of biofuels.

UNIT 4

Biofuels in perspective 10 Hours

Integrated refining concepts with reference to ethanol production. Economic feasibility of producing biodisel, Issues with biofuel production & use. Impact of biofuel in global climate change & food production. 1st versus 2nd generation biofuels..Strategies for new vehicle technologies. Current research on biofuel production. Market barriers of biofuels.

Total: 40 hours

Text Books

1. Advances in feedstock conversion technologies for alternative fuels and bioproducts by Majid Hosseini, Academic press, 2019
2. Handbook of Biofuels Production edited by Rafael Luque, Carol Sze Ki Lin, Karen
3. Wilson, James Clark, Woodhead Publishing, 2016

Reference Books

1. Biotechnology, Economic & Social Aspects: E.J. Dasilva, C Ratledge & A Sasson, Cambridge Univ. Press, Cambridge, 2000
2. Biofuels for Aviation: feedstocks, technology & implementation by Cristopher Chuck Acedemic Press, 2016
3. Second and third generation of feed stocks: The evolution of biofuels edited by Angelo Basile, Francesco Dalena, Elsevier Publication , 2019.

4. BIOFUELS: A Promising Alternate for Next Generation Fuels by B. Bharathiraja, J, Jayamuthunagai, R. Praveen Kumar , MJP Publisher, 2019
5. Biomass and Biofuels: Advanced Biorefineries for Sustainable Production and Distribution by Shibu Jose, Thallada Bhaskar CRC Press, 2015

Course Outcomes

1. Ability to understand the bioconversion process in biofuel production.
2. Able to know biofuel life cycle.
3. Able to know types of feed stocks used for biofuel.
4. Able get the knowledge about the technologies used for biofuel production.
5. Able to know the issues related with biofuels
6. Able to know first and second generation biofuels.

UBT627E- Tissue Engineering
3 Credits (3-0-0)

UNIT-I

Introduction to tissue engineering, Cell and Tissue Biology: 10Hours

Basic definition of tissue engineering;current scope of development; use in therapeutics**.** Introduction to cell – biology and biochemistry. Tissuedevelopment and organization. Stem cells (embryonic), Stem cells (adult). Introduction to cell adhesion,Adhesion Receptors in Tissue Structures, Cell Adhesion to Biomaterials, Measurement of Cell Adhesion,Effect of Biomaterial on Physiological Behavior. Introduction to cell migration, Characteristics ofMammalian Cell Migration, Measurement of cell characteristics morphology, number viability, cell-fateprocesses, cell motility, cell function.

UNIT-II

Extracellular Matrix: 10Hours

Introduction, ECM and Functional Integration of Implanted Materials, Basement Membranes and Focal Adhesions, Focal Adhesions as Signaling Complexes, ECM and Skeletal Tissues,Sources of ECM for Tissue Engineering Applications, Properties of ECM , Mining the ECM for Functional Motifs, Summary of Functions of ECM Molecules, Polymeric Materials and their Surface Modification,Formation of Gradient Structures.

UNIT-III

Biomaterials & Drug Delivery Systems 10Hours

Introduction to synthetic polymers, Biodegradable materials vspermanent materials, Natural biopolymers and hydrogels, Mechanical properties of biomaterials, Surface modification and characterization of polymers, Immune response to biomaterials, In vitro assessment/biocompatibility/protein adsorption. Polymeric scaffolds for tissue engineering applications.Drug delivery, Mechanisms of Drug Delivery, Protein-Drug Properties, Drug Delivery in Tissue Engineering.

UNIT-IV

Tissue Engineering Bioreactors - Design and Fabrication 10Hours

Introduction, Most common Bioreactors inTissue Engineering, Cell Seeding in Bioreactors, Bioreactor Applications in Functional Tissues, DesignConsiderations, Challenges in Bioreactor\ Technologies.

Clinical & Regulatory Aspects of Engineered Tissues:

Tissue Engineering of Skin, Bone Tissue Engineering, Cartilage Tissue Engineering, Neuronal, Tissue Engineering, Cardiovascular TissueEngineering, Musculoskeletal Tissue Engineering, (tendon/ligament/muscle).

Total 40 Hours

Text Books

1. Channarayappa,Cell Biology,Universities Press,kindle Edition,2010.
2. Robert Lanza Robert Langer Joseph Vacanti Anthony Atala Principles of Tissue Engineering Academic Press 5th Edition 2020.

Reference Books

1. Patrick CW, Mikos AG, McIntire LV, Frontiers in Tissue Engineering, Pergamon Press,1st Edition,1998.
2. Bernhard O Palsson, Sangeeta N Bhatia,Tissue Engineering, Pearson Prentice Hall.1st Edition 2003.

Course Outcomes:

1. Identify and differentiate between various stages of tissue development & stem cells.
2. Differentiate between various stages of tissue development & stem cells.
3. Analyze the mechanism and organization of ECM and its functions.
4. Apply the knowledge of drug delivery mechanism in therapeutics.
5. To strengthen the concept of protein drug interactions.
6. Integrate the knowledge of clinical and regulatory aspects on different engineered tissues in medical human tissue products and pharmaceutical sector

UBT631E: Genomics and Proteomics

3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Genes and Proteins, Polymorphisms – types of polymorphism, commercializing the Genome - Revenue opportunities: a) genome sequences and database subscriptions, b) prediction of new genes and their function by databases. Sequencing & genome projects: Early sequencing efforts. Methods of preparing genomic DNA for sequencing, DNA sequence analysis methods, Sanger Dideoxy method, Fluorescence method, shotgun approach. Next generation sequencing Genome projects on E.coli., Arabidopsis and rice; Human genome project .

UNIT 2

Functional Genomics **10 Hours**

Gene variation and Single Nucleotide Polymorphisms (SNPs) genotyping tools -DNA Chips, comparative genomics. Functional genomic studies with model systems such as Drosophila, Yeast or C. elegans. Applications in Functional genomics, medicine and Gene Knockdown. Metagenomics- definition & concept. C-Value and paradox of genomes, Repetitive and coding sequences, Genetic and physical maps, chromosome walking Methods of molecular mapping, Marker assisted selection, map based cloning, Bioinformatics analysis-clustering methods. Approaches to physical mapping

UNIT 3

Structure of Proteins **10 Hours**

Conformational analysis and forces that determine protein structures, geometries, phi, psi, omega angles, Ramachandran diagram, allowed chi angles of side chains in proteins, hydrogen bonding, disulphide bonds, Vanderwaal's force , salt bridges hydrophobic interactions, alpha helices, beta sheets, helix to coil transition, general features and thermodynamic aspects of protein folding, folding kinetics, protein-ligand interactions (Examples of bio-molecular interactions), fibrous proteins (structure of collagen, keratin) and Quaternary structures.

UNIT 4

Proteomics **10 Hours**

Introduction to proteomics, Sample preparation, protein extraction Denovo protein synthesis, LCMS/MS, M/Z ratio, sequencing and identification, Predictive Methods using Protein sequences: Protein Identity based on composition, Related web based software (JPRED, PROSEC, NNPREDICT and SOPMA) Proteome analysis "Protein Chip" - interactions and detection techniques, two dimensional PAGE for proteome analysis, Applications of proteome analysis to drug development and toxicology. Crisper-cas. Challenges in proteomics.

Total: 40 hours

Text Books

1. Introduction to Genomics – Arthur M Lesk, Oxford University Press, 2nd Edition,2012.
2. Plant Genome Analysis – Peter M Gresshoff, CRC Press.1st Edition,1994.

Reference Books

1. Genetic Analysis – Principles, Scope and Objectives by JRS Finchman, Blackwell Science,1st Edition,1994.

2. A M Campbell & L J Heyer Discovering Genomics, Proteomics & Bioinformatics –, Pearson Education, 2nd Edition, 2006.
3. Albala J S & I Humprey-Smith Protein Arrays, Biochips and Proteomics, CRC Press,1st Edition,2003.

Course Outcomes:

1. To know about genes, prediction methods, DNA sequencing methods and brief history
2. Able to be aware of Functional genomics of different organisms
3. To know about molecular markers, gene and physical mapping techniques
4. To know about Protein structure analysis and molecular interactions
5. To know about different protein database and proteome analysis
6. To know the applications of genomics and proteomics in medicine

UBT632E: Animal BT
3 Credits (3-0-0)
UNIT 1

Cell Lines **10 Hours**

Primary culture – Mechanical and enzymatic mode of desegregation, establishment of primary culture. Subculture -passage number, split ratio, seeding efficiency, criteria for subculture. Cell lines -definite and continuous cell lines, characterization, authentication, maintenance and preservation of cell lines. Contamination -bacterial, viral, fungal and mycoplasma contaminations, detection and control, cell transformation – normal vs. transformed cells, growth

Cell Culture

Scale-up of animal cell culture – Factors to be considered. Scale-up of suspension cultures Batch reactor, continuous culture, perfusion systems. Scale-up of monolayer cultures – roller bottles, Nunc cell factory, microcarrier cultures, organotypic culture, matrices, factors affecting culture and perspectives.

UNIT 2

Invitro Fertilization & Cloning **10 Hours**

Conventional methods of animal improvement, predominantly selective breeding and crossbreeding. Embryo biotechniques for augumentation of reproductive efficiency and faster multiplication of superior germ plasm. Super ovulation Oestrus synchronization. Embryo collection, evaluation and transfer. *Invitro* maturation of oocytes. *Invitro* fertilisation and embryo culture. Embryo preservation. Micro manipulation and cloning. Artificial insemination, preparation of foster mother, surgical and non-surgical methods of embryo transfer, donor and recipient aftercare. Cloning -concept of nuclear transfer, nuclear reprogramming and creation of Dolly. Stem cells -embryonic and adult stem cells, plasticity and concept of regenerative medicine.

UNIT 3

Human Genome **10 Hours**

Human genome complexicity of the genome, outlines of human genome project, human disease genes. Molecular biological techniques for rapid diagnosis of genetic diseases. Chemical carcinogenesis, transfection, oncogenes and antioncogenes. Cryo preservation and transport of animal germ plasm (i.e. semen, ovum and embryos). Genetherapy *-ex vivo* and *in vivo* gene therapy methods, applications.

Transgenics

Transgenic animals -retroviral, microinjection, and engineered embryonic stem cell method of transgenesis. Application of transgenic animals -biopharming, disease models, functional knockouts.

UNIT 4

Other Applications **10 Hours**

Application of animal cell culture -Vaccine production, specialized cell types. Concepts of tissue engineering -skin, liver, kidney, bladder and heart. Principles and species suitable for aquaculture (Indian major carps and prawns). Genetic status of culture stocks. Chromosome manipulations -Production of all male and sterile populations, Hypophysation in fishes and prawns. Pearl culture -pearl producing mollusks, rearing of oysters, nucleation for pearl formation and harvesting of pearls. Probiotics and their significance in aquaculture. Molecular tools for the identification of diseases in aquatic species.

Total: 40 hours

Text Books

1. Sudha Gangal,Principles and practice of Animal Tissue Culture, Universities press, 2007.
2. B Singh and S K Gautam,Animal Biotechnology,The energy and resources institute TERI,2015.

Reference Books

1. Animal Cell Culture Methods Ed. JP Mather and D Bames. Academic Press,1st Edition,1998.
2. Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications, 7th Edition, 2015

3. Animal Biotechnology by Murray Moo-Young , Pergamon Press,1st Edition,1989.

Course Outcomes

1 Study cell lines and cell culture
2 Study invitro fertilization & cloning.
3 Study human genome and Transgenic animals
4 Know Application of animal cell culture

UBT633 E: Perl Programming
3 Credits (3-0-0)

UNIT-I

Introduction **10 Marks**

An overview of Perl: Getting started, interpreted vs compiled source code, documentation in perl, statement blocks, ASCII and Unicode, Escape sequences, whitespaces, numerical data type, strings in perl, alternative delimiters, conversion between numbers and strings, Arithmetical operators, bitwise operators, Boolean operators, string operators, string comparison, operator precedence, variables, modifying a variable, autoincrement and autodecrement operators, multiple assignments, scoping, special variables, regular expression variables, input/ output variables, filehandle / format variables, error variables and system variables variable interpolation .

Lists, Arrays and Hashes

Introduction to lists, simple lists, complex lists, accessing list values, list slices, ranges, combining ranges and slices, arrays, assigning arrays, scalar vs list context, adding elements to an array, accessing single and multiple elements from an array, running through arrays, array functions (pop, push, shift, unshift, and sort, Introduction to Hashes, creating a hash, working
with hash values, adding, changing and taking values from a hash, accessing multiple values.

UNIT-II

Loops and Decisions **10 Marks**

Introduction, Changing Array Size, Interacting Over an Array by Reference, Extracting Unique Elements from a List, Computing Union, Intersection, or Difference of Unique Lists, Appending One Array to Another, Reversing an Array, Processing Multiple Elements of an Array, Finding All Elements in an Array Matching Certain Criteria, Sorting an Array Numerically

Regular Expression

Introduction to regular expressions, patterns, interpolation, escaping special characters, anchors, character classes, word boundaries, posix and Unicode classes, detecting repeating words, well defined repetition, back reference variables, match operator, substitution operator and transliteration operator, binding operators, meta characters, changing delimiters, modifiers, usage of split and join keywords, inline comments and modifiers, grouping and alternation, grouping with back references,

UNIT-III

Files and References **10 Marks**

Introduction to Filehandles, STDIN, STDOUT, STDERR file handles, reading lines, creating filters, line separator, reading paragraphs, reading entire files, writing to files, writing on a file handle, accessing filehandle, writing binary data, selecting a filehandle, buffering, file permissions, opening pipes, piping in, piping out, file tests, reading directories and globbing, introduction to references, lifecycle of a reference, anonymous reference, dereferencing, reference modification, array and hash referencing, reference counting and destruction.

Subroutines and Modules

Introduction to subroutines, difference between subroutines and modules, defining subroutines, order of declaration, subroutines for calculations, return values, caching, context, subroutine prototypes, scope, global variables, lexical variables, runtime scope, aliases, passing references, arrays, hashes and filehandles to a subroutine, modules, usage of keywords do, require and use, changing @INC, package hierarchies, exporters, standard modules in perl.

UNIT-IV

Running and Debugging Perl **10 Marks**

Examining syntax errors, runaway strings, brackets around conditions, missing semicolons, braces, commas and barewords. Diagnostic modules, use warnings, scope of warnings, use strict, strict on variables, references, subroutines, use diagnostics, perl command line switches, usage of–e, -n, -p, -c, -I, -M, -s, -I, @INC, -a, -F and

–T switches, Debugging techniques, usage of print, comments, context, scope and precedence in debugging, Defensive programming.

Bioperl

Overview, Bioperl Objects, Brief descriptions (Seq, PrimarySeq, LocatableSeq, RelSegment, LiveSeq, LargeSeq, RichSeq, SeqWithQuality, SeqI), Location objects, Interface objects and implementation objects, Representing large sequences (LargeSeq), Representing changing sequences (LiveSeq), Using Bioperl: Accessing sequence data from local and remote databases, Accessing remote databases (Bio::DB::GenBank, etc), Indexing and accessing local databases Bio::Index::*, bp_index.pl, bp_fetch.pl, Bio::DB::*), Transforming sequence files (SeqIO), Transforming alignment files (AlignIO);

Total: 40 Hours

Text Books

1. Harshawardhan P Bal, Perl Programming for Bioinformatics, Tata McGraw Hill, 2003.
2. James Tisdall, Mastering Perl for Bioinformatics, O'Reilly, 1st Edition,2003.

Reference Books

1. D. Curtis Jamison, Perl Programming for Bioinformatics & Biologists, John Wiley & Sons, INC., 2004
2. Michael Moorhouse, Paul Barry, Bioinformatics Biocomputing and Perl, Wiley, 1st Edition 2007.

UBT634E Transport Phenomena
3 Credits (3-0-0)

UNIT 1

Momentum Transfer and Overall Balances **10 Hours**

Fluid Statics, General molecular transport equations for momentum, heat and mass transfer, Viscosity of fluids, Overall balances: mass balance/continuity equation, energy balance, momentum balance, shell momentum balance and velocity distribution in laminar flow, design equation for laminar and turbulent flow in pipes.

Momentum transfer – Principles and Applications: Flow past immersed objects, packed beds, Non-Newtonian fluids, Differential equations of continuity, momentum transfer (motion).

UNIT 2

Steady State Heat Transfer **10 Hours**

Mechanisms of heat transfer, conduction – through solids in series, steady state conduction and shape factors, Forced convection - heat transfer inside pipes, natural convection heat transfer, boiling and condensation, heat exchangers.

Unsteady State Heat Transfer: Derivation of basic equation, simplified case for systems with negligible internal resistance.

UNIT 3

Mass Transfer **10 Hours**

Mass transfer and diffusion, molecular diffusion in gases, liquids and solids. Mass transfer coefficients.

Separation Processes - Evaporation, Drying, Humidification, and Absorption.

UNIT 4

Separation Processes **10 Hours**

Distillation, Adsorption, Ion Exchange, Leaching, Crystallization, Membrane processes.

Total: 40 hours

Text Book

1. Bird, Stewart and Lightfoot, Transport Phenomena, John Wiley, revised 2nd Edition,2006.
2. Biochemical Engineering Fundamentals by James E. Bailey, David F. Ollis, Publisher: Mc Graw Hill, 2nd Edition 1986.

Reference Books

1. Welty, Wicks and Wilson, Fundamentals of Momentum, Heat and Mass Transport, John Wiley,5th Edition 2008.

Course outcomes

1 Able to understand Momentum transfer – Principles and Applications.
2 Mechanisms of heat transferand Mass Transfer.
3 Separation Processes.

UBT608L: Biokinetics & Enzyme Technology Lab
1.5 Credit (0-0-3)

LIST OF EXPERIMENTS

1. Isolation of alpha-amylase from sweet potato or saliva
2. Maltose calibration curve by DNS method
3. Determination of activity of Salivary alpha-amylase
4. Determination of Specific activity of an enzyme
5. Effect of pH and temperature on enzyme activity
6. Determination of Kinetics constants (Km & Vmax)
7. Urea calibration curve
8. Determine the activity of enzyme Urease
9. Effect of inhibitors on enzyme activity
10. Immobilization of enzyme and determination of immobilized enzyme activity
    (Prediction of error percentage, standard deviation need to be calculated from expt. no 5 and 6)

Reference Books

1. Laboratory manual of Biochemistry by Pattabiraman, 4th Edition, International book publishers , India, 2017
2. Sadasivam and Manickam, “Biochemical Methods”, 2nd Edition, New age international Publishers, 2017.

Course outcomes

1 Ability to understand the preparation of enzymes.
2 Ability to determine the activity of enzymes.
3 Ability to estimate the effect of external condition on enzyme activity.
4 Ability to evaluate the action of inhibitors on the enzyme activity.
5 Ability to analyze the kinetic of enzymes.
6 Ability to apply knowledge of immobilization of enzymes

UBT614L: Upstream Processing Lab
1.5 Credit (0-0-3)

LIST OF EXPERIMENTS

1. Callus Induction Technique- Stock preparation, Media preparation.
2. Explants preparation and inoculation technique.
3. Development of suspension culture from callus
4. Animal cell culture techniques
5. Artificial seed production (Auxiliary buds)
6. Production of secondary metabolite by shake flask studies; Comparison of yield in various media
7. Fed batch culture – Assessment of yield
8. Development of inocula; lag time effect
9. Study of operational functions of the fermentor
10. Production of Ethanol in fermentor – Study of Growth, product formation
11. Kinetics and end substrate utilization
12. Single Cell Protein (SCP) production by continuous culture.

Reference Books

1. Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.2nd Edition, 1995
2. Introduction to plant Biotechnology by H.S. Chawla, , Oxford & IBH Publishers, 3nd Edition, 2018.
3. Culture of Animal cells-3rd Edition-R.Ian Freshney.Wiley 2010.
4. Principles of fermentation Technology by P.F. Stanbury and A. Whitaker, Butterworth- Heinemann; 3rd Edition,2016

Course outcomes

1 Able to prepare/reproduce the protocols for the experiments
2 Able to produce callus using plant tissue culture techniques
3 Able to prepare the industrial media and inoculum for the fermentation process
4 Able to operate lab fermenter and prepare the fermentation process to study growth kinetics, substrate utilization and product formation
5 Able to record/observe the experimental data and interpret them in the graph/table
6 Able to calculate the result and to write the conclusion at the end of the experiment

QUESTION PAPER PATTERN OF CIE (Continuous Internal Evaluation):

1. CIE comprises of 3 tests, each of 30 marks and I hr duration, totaling to 90 marks and later is scaled down to 45 mark
2. Each CIE will be covering one and half unit
3. Any two full questions to be answered out of three questions and each question carries fifteen marks
4. Assignment: quiz/ objective tests etc carries five mark

QUESTION PAPER PATTERN of SEE:

1. Total of Eight Questions with Two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four sub questions.
3. Any Five Full questions are to answered choosing at least one from each unit.

Laboratory Assessment:

1) Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)

2) Allocation of 50 marks for CIE

- Performance and Journal write-up: marks for each experiment = 30 marks/No. of proposed experiments.
- One practical test, for 20 marks (5 write-up, 10 conduction, calculation, Result etc., 5 –viva-voce)

3) Allocation of 50 marks for SEE

Major and Minor	: 35 marks (Write-up 25%, conduction 50%, calculation and results 25%)
Spotting	: 08 marks
Viva-Voce	: 07 marks

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF BIOTECHNOLOGY

B.E. VII SEMESTER

2021-22

Sl. No.	Subject Code	Subject Title	Credits	Hours/Week				Exam Marks		
				Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	UBT704C	Economics & Plant Design	3	2	2	0	4	50	50	100
2	UBT716H	Industrial Management & Entrepreneurship	3	3	0	0	3	50	50	100
3	UBT715C	Downstream Processing Technology	3	2	2	0	4	50	50	100
4	UBT72XE	Elective – 4	3	3	0	0	3	50	50	100
5	UBT73XE	Elective – 5	3	3	0	0	3	50	50	100
6	UXX70XN	Open elective -3	3	3	0	0	3	50	50	100
7	UBT710L	Bioseparation Techniques Lab	1	0	0	2	2	50	50	100
8	UBT717L	Food Analysis Techniques Lab	1	0	0	2	2	50	50	100
9	UBT701T	Technical seminar	1	0	2	0	2	50	50	100
10	UBT711I	Industrial Internship	2	0	0	4	4	50	50	100
		Total	**23**	**16**	**6**	**08**	**30**	**500**	**500**	**1000**

Elective - 4	**Elective - 5**
UBT722E: Aquaculture & Marine biotechnology	UBT731E: Nanobiotechnology & Biomaterials
UBT723E: Dairy Biotechnology	UBT732E: Computational biology
UBT724E: Food processing Technology	UBT733E: Bioconjugative technology
UBT725E: Protein Engineering & Drug Design	UBT734E: Food biotechnology

UBT 704C: Economics and Plant Design
3 Credits (3-0-0)

UNIT 1

Process design development **10 Hours**

Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design and equipment design and specialization, safety factors specifications, and materials of construction.

General design considerations

Marketability of the product, availability of technology, raw materials, human resources, land and utilities, site characteristics, plant location, plant layout, plant operation and control, utilities, storage, materials handling, materials and fabrication selection,.Waste disposal community factors. Safety and hazard control measures.

UNIT 2

Capital investments **10 Hours**

Fixed capital investments including land, building, equipment and utilities, installation costs,(including equipment, instrumentation, piping, electrical installation and other utilities),working capital investments.

Manufacturing costs And plant overheads

Manufacturing Costs: Direct Production costs (including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.), fixed charges Plant Overheads: Administration, safety and other auxiliary services, Conceptual numerical.

UNIT 3

Cost analysis **10 Hours**

Cost Analysis: Factors involved in project cost estimation, methods employed for the estimation of the capital investment. Estimation of working capital and

Depreciation: different type of depreciation methods of and calculations, Conceptual numerical.

UNIT 4

Profitability Analysis **10 Hours**

Methods for the evaluation of profitability. Return on original investment, interest rate of return, Cash flow diagrams. Break-even analysis. Conceptual numerical.

Total: 40 hours

Text Books

1. Peters and Timmerhaus, Plant Design and Economics for Chemical Engineers, 5th Edition, McGraw Hill. 2017
2. Rudd and Watson (1987) Strategy of Process Engineering, Wiley.
3. Poornima M C, “Entrepreneurship Development and Small Business Enterprises”, Pearson education,2006

Reference Books

1. Vasanth Desai,”Dynamics of Entrepreneurial Development & Management”, Himalaya Publishing House.4th Edition,2007.
2. Khanka SS ,” Entrepreneurship Development, S Chand & Co.Revised edition,2007.
3. Thomas W. Zimmer, Norman M. Scarborough, Essentials of Entrepreneurship and small Business Management, Pearson education,5th Edition,2008.

Course Outcomes

1 Acquire knowledge in the design of a plant.
2 Conduct preliminary feasibility study of the plant design assigned.

3 Estimate the cost analysis involved in the design of a chemical plant.
4 Analyze the project profitability and alternative investments for the selection of good investment projects
5 Develop entrepreneurs with substantial knowledge in engineering concepts.
6 Apply the knowledge of plant design and cost estimation in actual engineering problems.

UBT716H: Industrial Management and Entrepreneurship
3 Credits (3-0-0)

UNIT 1

Development of management thoughts and its functions **10 Hours**

Concept & definition of Management, Social Responsibilities of Management, and Pioneers in Management: Contributions of Taylor, Henry Taylor, Gilberth& Mayo, Schools of Management thought: Management process school, Empirical School, Human Behavior School, Social system school, Systems approach school and decision theory school. Selection of site for the plant and plant layout, plant operation and control, utilities, structural design, storage, material handling, Sources of capital. Definition and functions of administration. Planning, organizing, staffing, directing and controlling. Concept of authority and responsibility.

UNIT 2

Quantitative techniques in managerial decisions **10 Hours**

Concept of productivity, measuring productivity, concept of budget, effective budgetary control, ABC analysis, break even analysis, product life cycle, promotion of sales, pricing, "EOQ"model. Production costs (including raw materials, and repair, operating supplies, power and other utilities, royalties, etc.), fixed charges (including depreciation, taxes, insurance, rental costs etc.).

UNIT 3

Production And Material Management **10 Hours**

Types of production, types of planning, manufacturing planning, factory planning, production planning, method study, systems of wage payments, bonus, automation, organization of production, planning. Functions of purchasing & materials management, quality, quality standard & inspection, sources of supply, pricing, principles & practices, Inventory management.

UNIT 4

Entrepreneurship& personnel management **10 Hours**

Meaning of entrepreneur, evaluation of the concept, function of entrepreneur, evolution of entrepreneurship, development of entrepreneurship, stages in entrepreneurial process, role of entrepreneurs in economic development entrepreneurship- its barriers. Recruitment and selection. Training of personnel. Employer - Employee relationship. Settlement of disputes.

Total: 40 hours

Text Books

1. O.P. Khanna - "Industrial Engineering & Management", Dhanpat Rai & Sons, 1992.

Reference Books

1. T. R. Banga & s. C. Sharma - "Industrial Engineering & Management Science", 6th. Edn, Khanna Publications, 2003
2. C.B.Mamoria and S.V.Gankar- Personnel Management, Himalaya Pub, 21 st edn,2010
3. Veerabhadra Havinal -Management and Entrepreneurship- New Age International,2009
4. Ramesh Burbure – Management &Entrepreneurship- Rohan Pub.2008
5. Poornima M. Charanthimath – Entrepreneurship Development, Pearson Education-2005

Course Outcomes

1. Ability to recall and recollect the history theories and definition of management and its importance in society
2. To analyze and apply the basic concepts of Quantitative techniques of management
3. Ability to know the difference between production and productivity, measurement and cost analysis
4. Explore the knowledge of production costs, planning and material management
5. Able to make basic economic analysis of project
6. Ability to understand the role and importance of entrepreneurship in economic development

UBT715C: Downstream processing technology
3 Credits (2-2-0 hrs)

UNIT 1

Introduction: **10 Hours**

Role and importance of downstream processing in biotechnological processes. Range and characteristics of bioproducts. Purification process of bio-product. Cell disruption methods for intracellular products; physical, chemical and mechanical methods. Basic principles of distillation,crystallization, centrifugation, ultracentrifugation (preparative and analytical).Types of centrifuges and rotors,centrifugation-differential,density gradient (zonal and isopycnic).

UNIT 2

Primary Recovery Operations **L- 10 Hours**

Process involved in liquid-liquid extraction, solid-liquid extraction, ammonium sulphate precipitation, Precipitation of proteins and nucleic acids by solvents and polyethylene glycol, dialysis, electrodialysis, ultrafiltration (Removal of insolubles by filtration), reverse osmosis, drying and lyophilization. Membrane based separations theory, design and configuration of membrane separation equipment.

UNIT 3

Chromatography **L-10 Hours**

Principles of chromatographic seperations, Classification of chromatography- plain and column chromatography, Paper chromatography - Single dimensional (Ascending and Descending, radial and two dimensional) chromatography, partition coefficient, retention factor, Thin layer chromatography, Gas liquid Chromatography, Adsorption Chromatography: Adsorption column chromatography, Ion Exchange Chromatography: cation Exchange and anion Exchange chromatography. Gel Filtration Chromatography, Affinity Chromatography, High Performance liquid chromatography, NP-HPLC and RP-HPLC.

UNIT 4

Electrophoresis **L- 10 Hours**

Electrophoresis principles, factors affecting electrophoresis mobility, Moving boundary electrophoresis, Zone Electrophoresis, Gel Electrophoresis, Continuous Gel electrophoresis, Disc Gel electrophoresis, Agarose Gel Electrophoresis, Capillary Electrophoresis,Cellulose Acetate, Starch Gel , Native and SDS-PAGE, High voltage electrophoresis, Isoelectric focusing, Immunoelectrophoresis, ELISA, Flow cytometry

Downstream Processes:

Case studies (production)-DSP flowsheets for penicillin, insulin, amino acid, monoclonal antibody.

Total: 40 hours

Text Books

1. Bioseparations-Principles and techniques, by B.Sivasankar, Kindle edition,PHI Publishers,1st Edition, 2009.
2. Biophysical chemistry principles and Technques by Upadhay and Nath,Himalaya Publishing House, 3rd edition, 2010

Reference Books

1. NPTEL Source material
2. Bioseparations - Downstream processing for biotechnology by Belter P.A., Cussier E. and Wei Shan Hu., Wiley Interscience Pub, 1988.
3. Separation Processes in Biotechnology by Asenjo J. and Dekker M, Taylor & Francis,2008.
4. Product Recovery in Bioprocess Technology – biotol Series, VCH, 1992.
5. Rate controlled separations by Wankat P.c., Elsevier, 1990

Course Outcomes

1 Analyse the role and importance of downstream processing and cell disruption techniques.
2 Ability to comprehend and analyse the extraction and precipitation techniques.
3 Identify and analyse the application of different membranes used in purification.
4 Ability to analyse the basic principles and applications of Chromatography.
5 Analyse and apply the electrophoretic techniques in seperation of biomolecules.
6 Ability to understand the downstream processing Technology using unit operations

UBT722E: Aqua culture & Marine Biotechnology
3 Credits (3-0-0)

UNIT 1

Aquatic environment **10 Hours**

Major physical and chemical factors (light, temperature, gases, nutrients). Aquatic biota: phytoplankton, zooplankton, benthos, periphyton, macrophytes, fish and other animals. Production & Nutrient dynamics in lakes, rivers, estuaries and wetlands. Eutrophication and water pollution: monitoring and control conservation and management of lakes, rivers and wetlands. Importance of coastal aquaculture- Design and construction of aqua farms, Criteria for selecting cultivable species. Culture systems – extensive, semi intensive and intensive culture practices

Aqua culture

Classification and Characteristics of Arthropoda. Crustacean characteristic key to important species of Prawns and Shrimps, General biology, of – Shrimp and Prawn, Finfish, Marine and freshwater fish. Preparation, culture and utilization of live food organisms, phytoplankton, zooplankton cultures, quality evaluation of Cyst, hatching and utilization, culture and cyst production.

UNIT 2

Aquaculture engineering and techniques **10 Hours**

Principles and criteria for site selection; multi-design, layout plan for prawn, shrimp and fish hatchery; design, lay-out plan and pond construction for grow- out production, design and construction of feed mill and installation of machineries. Chromosome manipulation in aquaculture - hybridization, ploidy induction, gynogenesis, androgenesis and sex reversal in commercially important fishes. Application of microbial biotechnology in culture ponds, bioaugmentation, bioremediation, nutrient cycling, and biofertilization.Probiotics – imunostimulants. Tools for disease diagnosis in cultivable organisms Enzyme immuno assays - Dot immunobinding assay - Western blotting - Latex agglutination test - Monoclonal antibodies - DNA based diagnosis. Cryopreservation techniques.

UNIT 3

Marine environment **10 Hours**

Biological Oceanography: The division of the marine environment – benthing, pelagic, batuyal, littoral. Ocean waters as biological environment. Distribution and population of plants and animals. Marine ecology and fisheries potential. Effects of pollution on marine life. Geological and geophysical Oceanography: geophysical and geological processes. Ocean basin rocks and sediments.

Marine microbiology

Biology of micro-organisms used in genetic engineering *(Escherichia coil, Rhizobium sp., Agrobacterium tumefaciens, Saccharomyces cerevisiae, phage lambda, Nostoc, Spirulina, Aspergillus, Pencillium and Streptomyces).* Methods of studying the marine micro-organisms collection, enumeration, isolation, culture & identification based on morphological, physiological and biochemical characteristics. Preservation of marine microbes, culture collection centre (ATCC, IMTECH, etc.). Microbial nutrition and nitrogen fixation.Seafood microbiology - fish & human pathogens. Indicator of Pollution - faecai coliforms - Prevention &control.

UNIT 4

Marine biotechnology and pharmacology **10 Hours**

Physical, Chemical and Biological aspects of marine life. Air – Sea interaction – Green house gases (CO2 and Methane). Marine pollution-major pollutants (heavy metal, pesticide, oil, thermal, radioactive, plastics, litter and microbial). Biological indicators and accumulators: Protein as biomarkers, Biosensors and biochips. Biodegradation and Bioremediation. Separation, purification and bioremoval of pollutants. Biofouling - Biofilm formation, Antifouling and Anti boring treatments. Corrosion Process and control of marine structures. Biosafety – special characteristics of marine environment that bear on biosafety. Ethical and moral issues - food health, and environmental safety concerns. Medicinal compounds from marine flora and fauna - marine toxins –antiviral, antimicrobial. Extraction of crude drugs, screening, isolation, purification and structural characterization of bioactive compounds.

Total: 40 hours

Text Books

1. Kirchman, D.L,. Microbial ecology of the oceans. Wiley – liss, New York, 542 pp,2005
2. Kenneth, C. Hingham and Leonard Hill, 1969. The comparative endocrinology of the invertebrates. Edward Arnold Ltd

Reference Books

1. Farming the edge of the sea. Fishing News Ltd. London.
2. Finger man, M.. Recent advances in Marine Biotechnology. Vol. 4,2000
3. Kenneth, B.D., 2000. Environmental impacts of Aquaculture. CRC. pp. 214 ,2000

UBT723E: Dairy Biotechnology
3 Credits (3-0-0)

UNIT 1

Dairy Industry and Microbiology **10 Hours**

Overview of dairy industry, Characteristics of dairy Industry. Manufacturing & processing of dairy products, effect of processing on constituents and methods of evaluation of dairy products. Morphological and biochemical characteristics of important groups of milk microbes and their classification i.e.psychrotrophs, mesophiles, thermodurics, and thermophiles. Impact of various stages like milking, chilling, storage and transportation on microbial quality of milk, Direct and indirect rapid technique for assessment of microbial quality of milk. Food infection, intoxication and toxic infection caused by milk borne pathogens. Microbiological changes in bulk refrigerated raw milk; Mastitis milk: organisms causing mastitis, detection of somatic cell count (SCC). Role of microorganisms in spoilage of milk Significance of antimicrobial substances naturally present in milk (responsible for its nutraceutical properties): immunoglobulin, lactoferin, Lysozymes

UNIT 2

Dairy biotechnology **10 Hours**

Genetic engineering of bacteria and animals intended for dairy-based products: DNA cloning. protoplast fusion & cell culture methods for trait improvement with instances cited. Enzymes in dairy industry & production by whole cell immobilization. Biotechnology of dairy effluent treatment. Ethical issues relating to genetic modification of dairy microbes & milk-yielding animals.

Dairy engineering

Sanitization: Materials and sanitary features of the dairy equipment. Sanitary pipes and fittings, Description, working and maintenance of can washers, bottle washers. CIP cleaning and designing of system. Homogenization, Pasteurization, sterilization septic packaging and equipment. Filling Operation: Principles and working of different types of bottle filters and capping machine, pouch filling machine maintenance.

UNIT 3

Dairy process engineering **10 Hours**

Evaporation: Basic principles of evaporators, Different types of evaporators used in dairy industry, Drying: Introduction to principle of drying, Equilibrium moisture constant, bound and unbound moisture. Fluidization Mechanization and equipment used in manufacture of indigenous dairy products, Butter and Ghee making machine, Ice-cream and Cheese making equipments. Membrane Processing: Ultra filtration, Reverse Osmosis and electro dialysis in dairy processing, membrane construction & maintenance for electro-dialysis & ultra-filtration, Ultra filtration of milk, Effect of milk constituents on operation.

Dairy plant design and layout

Introduction of Dairy Plant design and layout. Type of dairies, perishable nature of milk, reception flexibility. Classification of dairy plants, selection of site for location. Dairy building planning, Process schedule, basis of dairy layout, General points of considerations for designing dairy plant, floor plant types of layouts, service accommodation, single or multilevel design.

UNIT 4

Quality and safety monitoring in dairy industry **10 Hours**

Current awareness on quality and safety of dairy foods; consumer awareness and their demands for safe foods; role of codex alimentations commission (CAC) in harmonization of international standards; quality (ISO 9001:2000) and food safety (HACCP) system National and international food regulatory standards; their role in the formulation of standards for controlling the quality and safety of dairy foods. Good Hygiene Practices (GHP): Rapid assessment of dairy food for microbial and non-microbial contaminants Quality of water and Quality of air & personnel hygiene.

By products technology

Status, availability and utilization of dairy by-products in India and abroad, associated economic and pollution problems. Physico-chemical characteristics of whey, butter milk and ghee residue, by-products from skim milk such as Casein; Whey processing & utilization of products generated from whey.

Total: 40 hours

Text Books

1. Diary Science & Technology Handbook (Vols. 1-3). Ed by Hui, Y.H, Wiley Publishers,2007
2. Handbook of Farm, Dairy & Food Machinery - Myer Kutz- Andrew Publishers,2005

Reference Books

1. Diary Microbiology Handbook (3rd Ed). Robinson, R.K., Wiley Publishers,2001
2. Comprehensive Biotechnology (Vol. 6) Ed N.C Gautam- Shree Pblns,2002.
3. General Microbiology (Vol. 2) – Powar & Daginawala- Himalaya Publishers,2005
4. Milk composition, production & biotechnology (Biotechnology in Agriculture Series). CABI Publishers,2005

UBT724E: Food Processing Technology
3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Constituents of food, soluble fibres, protein rich foods, popular fats and oils in foods, Food flavours, Browning reactions and its effects . Intrinsic and extrinsic parameters of foods, effect of inhibitors, pH and temperature. Minerals in foods. Aroma compounds in foods .Food additives, Vitamins, amino acids, Sweeteners, Food colours. Toxic-trace elements in food.

UNIT 2

Detection of Microorganisms **12 Hours**

Culture, Microscopic and Sampling Methods, Conventional; SPC, Membrane Filters, Microscope colony Counts, Agar Droplets, Dry Films, Most probable Numbers (MPN), Dyereduction, Roll Tubes, Direct, Microscopic Count (DMC), Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms, Enumeration and Detection of Food-borne Organisms. Dairy products: Composition of milk, Sterilization of milk (Pasteurization and UHT), Cheese production, Acidophilus milk Yoghurt, Kumiss and Kefir. Marketing scope of dairy & food products Fruit and vegetable processing: Jam, jelly, Juice, squash, wine, pickles and sauerkraut.

UNIT 3

Food Spoilage & Preservation **10 Hours**

The Role and Significance of Microorganisms, Primary Sources of Microorganisms found in Foods Synopsis of common borne bacteria, Molds& Yeasts. Microbial Spoilage of Vegetables, Fruits, Fresh and Processed Meats, Poultry, and Seafood. Spoilage of Miscellaneous Foods, Food Preservation: Principles Underlying in spoilage and preservation, Application, Effect and Legal Status of Food Irradiation, Food Preservation with Low Temperatures, High Temperatures and Drying. Food Industry: Characteristics of Food Industry.:, nutritional food supplements. Food packaging, New trends in packing, edible films. Factors influencing food product development, marketing, and promotional strategies, risks and benefits of food industry.

UNIT 4

Food Engineering **10 Hours**

Properties of fluid foods, Measurement of rheological parameters .Thermal properties of frozen foods. Food freezing equipment, storage of frozen foods. Food dehydration: Freeze Dehydration Calculation of drying times. Food waste management.

Total: 42 hours

Text Books

1. Food Science & Nutrition, by Sunetra Roady, Oxford University Press, 2007.
2. Food microbiology by William Frazier and Westhoff D.C, 4th edn,TATA McGraw Hill Pub (2005)

Reference Books

1. Modern Food Micro-Biology by James M.Jay, CBS Publishers. (2005)
2. Food Microbiology by K.Vijay Ramesh MJP Publishers(2007)
3. Plant biotechnology In Agriculture by K. Lindsey and M.G.K. Jones, Prentice Hall, USA. (1990),
4. Food Science By Potter N.N. and Joseph Hotchkiss, 5 th edn, CBS Pub,1996

Course Outcomes

1. Able to know about basic constituents of food
2. Able to know the techniques involved in detection of microbes in food industry
3. To have idea about Dairy , fruits and vegetable processed products and production
4. To be aware of different food spoilage and preservation techniques
5. To know the Characteristics of food industry and scope
6. Able to understand Basic concepts in food Engineering for preservation

UBT725E: Protein Engineering and Drug Design

3 Credits (3-0-0)

UNIT 1

Structure of proteins **10 Hours**

Overview of protein structure, PDB, structure based classification, databases, visualization tools, structure alignment, domain architecture databases, protein-ligand interactions.

Protein structure prediction

Primary structure and its determination, secondary structure prediction and determination of motifs, profiles, patterns, fingerprints, super secondary structures, protein folding pathways, tertiary structure, quaternary structure, methods to determine tertiary and quaternary structure, post translational modification.

Protein engineering and design

Methods of protein isolation, purification and quantitation; large scale synthesis of proteins, design and synthesis of peptides, use of peptides in biology, methods of detection and analysis of proteins. Protein database analysis, methods to alter primary structure of proteins, examples of engineered proteins, protein design, principles and examples.

UNIT 2

Molecular modelling **10 Hours**

Constructing an Initial Model, Refining the Model, Manipulating the Model, Visualization. Structure Generation or Retrieval, Structure Visualization, Conformation Generation, Deriving Bioactive Conformations, Molecule Superposition and Alignment, Deriving the Pharmacophoric Pattern, Receptor Mapping, Estimating Biological Activities, Molecular Interactions: Docking, Calculation of Molecular Properties, Energy Calculations (no derivation), Examples of Small Molecular Modeling Work, Nicotinic Ligands, Sigma Ligands, Antimalarial Agents.

UNIT 3

Insilico drug design **10 Hours**

Generation of Rational Approaches in Drug Design, Molecular Modeling: The Second Generation, Conceptual Frame and Methodology of Molecular Modeling, The Field Currently Covered, Importance of the "Bioactive Conformation", Molecular Mimicry and Structural Similarities, Molecular Mimicry, Structural Similarities and Superimposition Techniques, Rational Drug Design and Chemical Intuition, An Important Key and the Role of the Molecular Model, Limitations of Chemical Intuition Major Milestones and Future Perspectives.

COMPUTER ASSISTED NEW LEAD DESIGN

Introduction, Basic Concepts, Molecular Recognition by Receptor and Ligand Design, Active Conformation, Approaches to Discover New Functions, Approaches to the Cases with known and unknown receptor structure.

UNIT 4

Docking methods **10 Hours**

Program GREEN Grid: Three -Dimensional Description of Binding Site Environment and Energy Calculation, Automatic Docking Method, Three-Dimensional Database Search Approaches, Automated Structure Construction Methods, Structure Construction Methods with known Three-Dimensional Structure of the Receptor, Structure Construction in the case of Unknown Receptor Structure. Scope and Limitations, Points for Consideration in Structure, Construction Methods, Handling of X-Ray Structures of Proteins, Future Perspectives, Types of programs available for molecular modeling-scope and limitations-interpretation of results.

Computer - assisted drug discovery

The Drug Development Process, Introduction, The Discovery and Development Process, New Lead Discovery Strategies, Composition of Drug Discovery Teams, The Practice of Computer-Assisted Drug Discovery (CADD), Current Practice of CADD in the pharmaceutical Industry, Management Structures of CADD Groups, Contributions and Achievements of CADD Groups, Limitations of CADD Support, Inherent Limitations of CADD Support, State of Current Computational Models, Software and Hardware Constraints.

Total: 40 hours

Text Books

1. Bioinformatics Methods & Applications: Genomics, Proteomics & Drug Discovery, S C Rastogi, Mendiratta & P Rastogi, PHI,4th Edition, 2013

Reference Books

2. Moody P.C.E. and A.J. Wilkinson Protein Engineering, IRL Press, Oxford, 3rd Edition,2010.
3. Creighton T.E. Proteins, Freeman W.H. Second Edn,1993.
4. Branden C. and Tooze R. Introduction of protein structure, Garland,1993.
5. The molecular modeling perspective in drug design by N Claude Cohen, 2008, Academic Press.

Course Outcomes

1 Ability to study protein structure prediction and protein engineering and design
2 Able to understand molecular modeling
3 Able to know computer assisted new lead design
4 Able to study docking methodsand computer - assisted drug discovery

UBT731E: Nanobiotechnology and Biomaterials

3 credits (3hrs)

UNIT 1

Introduction to Nanotechnology **10 Hours**

A Brief History of the Nano particles ; Bottom-Up versus Top-Down; What Is Nanobiotechnology.Discussions on nanofabrication, nanolithography, nanotubes, buckyballs,structure-property relationships in materials, materials characterization techniques, scanning electron, scanning tunneling and atomic force microscopy(SEM,STM & AFM), biomolecule-surface interactions, quantum dots,

Applications of nanotechnology in the life sciences

Buckyballs and Buckytubes, Diagnostics and Sensors, Drug Delivery Revenues Health Risks and Challenge.

UNIT 2

Biopolymers **10 Hours**

Polymers as biomaterials, microstructure, mechanical properties – effects of environment on elastic moduli,sterilization and disinfections of polymeric materials. Biocompatibility of polymers, chemically modified glycosaminoglycans, heparin like substances from nonglycosaminoglycan polysaccharides and microbial glycosaminoglycan, surface immobilized heparins.

UNIT 3

Synthetic polymers **10 Hours**

Polymers in biomedical use, polyethylene and polypropylene, perfluorinated polymers, acrylic polymers, hydrogels, polyurethanes, polyamides, biodegradable synthetic polymers, silicone rubber, plasma polymerization, micro-organisms in polymeric implants, polymer sterilization.

UNIT 4

Biocompatibility **10 Hours**

Definition, Wound healing process-bone healing, tendon healing. Material response: Function and Degradation of materials in vivo. Host response: Tissue response to biomaterials. Testing of implants: Methods of test for biological performance-In vitro implant tests, In vivo implant test methods.

Medical devices

Polyurethane elastomers, applications of polymers in medicine and surgery. Skin graft polymers, Properties of implant materials, metals and alloys.

Total: 40 hours

Text Books

1. B.Vishwanath “ Nano Materials” Published by Narosa Publishing House Pvt. Ltd., New Delhi, 2014.

Reference Books

1. K Eric Drexler “Unbounding The Future” Quill, 1993.
2. Mark Ratner And Daniel Ratner “Nanotechnology: A Gentle Introduction To Next Gig Idea” Pearson Education Ltd, 2003.
3. Veronique Migonney “Biomaterials” John Wiley 2014

Course Outcomes

1. Ability to explain the characterization techniques of nanotechnology.
2. Ability to understand the importance of nano-particles in drug delivery system.
3. Ability to understand the importance of biopolymers.
4. Ability to differentiate biopolymer and synthetic polymer.
5. Ability to understand the importance of biocompatibility.
6. Ability to apply the methods to test the implants and use in medical devices.

UBT732E: Computational Biology
3Credits (3-0-0)

UNIT 1
Introduction to computational biology and sequence analysis **10 Hours**

Molecular sequences, Genome sequencing: pipeline and data, Next generation sequencing data, Biological databases: Protein and Nucleotide databases, Sequence Alignment,Dynamic Programming for computing edit distance and string similarity, Local and Global Alignment, Needleman Wunsch Algorithm, Smith Waterman Algorithm, BLAST family of programs, FASTA algorithm, Functional Annotation, Progressive and Iterative Methods for Multiple sequence alignment, Applications.

UNIT 2
Phylogenetics **10 Hours**

Introduction to Phylogenetics, Distance and Character based methods for phylogenetic tree construction: UPGMA, Neighbour joining, Ultrametric and Min ultrametric trees, Parsimonous trees, Additive trees, Bootstrapping.

Protein structure, modelling and simulations

Protein Structure Basics, Visualization, Prediction of Secondary Structure and Tertiary Structure, Homology Modeling, Structural Genomics, Molecular Docking principles and applications, Molecular dynamics simulations.

UNIT 3
Machine learning, systems biology and other advanced topics **10 Hours**

Machine learning techniques: Artificial Neural Networks and Hidden Markov Models:Applications in Protein Secondary Structure Prediction and Gene Finding, Introduction toSystems Biology and its applications in whole cell modelling, Microarrays and Clusteringtechniques for microarray data analysis, informatics in Genomics and Proteomics, DNA computing.

UNIT 4
Perl for bioinformatics **10 Hours**

Variables, Data types, control flow constructs, Pattern Matching, String manipulation, arrays,lists and hashes, File handling, Programs to handle biological data and parse output files for interpretation

Laboratory Demonstrations for

Biological Databases, Sequence alignment: BLAST family of programs, FASTA, ClustalW for multiple sequence alignment, Phylogenetics software, Homology Modeling and Model evaluation, AutoDock, GROMACS, Prokaryotic and Eukaryotic Gene finding software, Programs in PERL.

Total: 40 hours

Text Books

1. David W. Mount Bioinformatics: Sequence and Genome Analysis, Cold Spring Harbor Laboratory Press, Second Edition, 2004.
2. Arthur M. Lesk, Introduction to Bioinformatics by Oxford University Press, 2008.

Reference Books

1. Baldi, P., Brunak, S. Bioinformatics: The Machine Learning Approach, 2nd ed., East West Press, 2003
2. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002
3. Durbin, R. Eddy S., Krogh A., Mitchison G. Biological Sequence Analysis: Probabilistic
4. Models of Proteins and Nucleic Acids. Cambridge University Press, 1998.

UBT733E: Bioconjugative Technology
3 Credits (3-0-0)

UNIT 1

Bioconjugative technology **10 Hours**

Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.

UNIT 2

Chemistry of active groups **10 Hours**

Amine reactive chemical reactions – Thiol reactive chemical reactions – carboxylate reactive chemical reactions – hydroxyl reactive chemical reactions – aldehyde and ketone reactive chemical reactions – Photoreactive chemical reactions.

Bioconjugate reagents

Zero length cross linkers – Homobifunctional cross linkers – Heterobifunctional cross linkers – Trifunctional cross linkers – Cleavable reagent systems – tags and probes.

UNIT 3

Enzyme and nucleic acid modification and conjugation **10 Hours**

Properties of common enzymes – Activated enzymes for conjugation – biotinylated enzymes – chemical modification of nucleic acids – biotin labeling of DNA- enzyme conjugation to DNA – Fluorescent of DNA.

UNIT 4

Bioconjugate applications **10 Hours**

Preparation of Hapten-carrier Immunogen conjugates - antibody modification and conjugation – immunotoxin conjugation techniques – liposome conjugated and derivatives- Colloidal – gold-labeled proteins – modification with synthetic polymers.

Total: 40 hours

Text Books

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 2 nd edition 2008
2. Bioconjugate techniques , Greg T Hermanson, academic Press ,Global store , 2016

Reference Books

1. A Text book of biophysics by Dr R.N. Roy,UBS publishers, 2001
2. Bioconjugative Chemistry by Vincent M Rotello, American Chemical society, 2016
3. Bioconjugate techniques , Greg T Hermanson, academic Press ,Global store , 2017

UBT734E: Food Biotechnology
3 Credits (3-0-0)

UNIT 1

Introduction **10 Hours**

Hunger, Technology and World food needs-nutritional problems, approaches to combat world hunger, roles of technology. Recent Developments in food biotechnology, introduction to molecular food biotechnology.

Novel bioprocessing

Biosensors for food quality assessment, cold active enzymes in food processing, biotransformation in food industries.

Nutrigenomics:

Definition of Nutriomics, Nutrigenetics, and its applications, Nutritional genomics and applications in brief. Nutrigenetics and cancer.

UNIT 2

Microbial biotechnology of food **10 Hours**

Metabolic engineering of bacteria for food ingredients (Amino acids, organic acids, vitamins). Introduction to technologies for microbial production of food ingredients. Solid-state fermentation for food applications (enzymes, pigments). Biotechnology of microbial polysaccharides- natural occurrence of microbial polysaccharides in foods, additives (xanthan) and its future, Microbial biotechnology of food flavor, oils and fats. Food applications of algae-nutritional value, source of neutraceuticals and industrial production processes (chlorella, spirulina, Agar, alginate). Genetics of Dairy starter cultures.

UNIT 3

Plant food applications **10 Hours**

Genomic basics for food improvement, molecular design of soybean proteins for enhanced food quality, Genetic modifications of plant starches, plant oils, for food applications. Bioprocessing of starch using enzyme technology. Molecular biotechnology for neutraceutical enrichment of food crops, Biotechnology of nonnutritive sweeteners, metabolic redesign of vitamin -E biosynthesis, production of new metabolites, Engineering of provitamin- A ,biosynthetic pathway into rice(Golden rice), Engineering of carotenoid biosynthesis for antioxidants, approaches to improve nutritional quality and shelf life of fruits and vegetables.

UNIT 4

Transplastomic technology (chloroplast engineering) **12 Hours**

Enhancement of leaf quality protein for ruminant animals. Methods of chloroplast transformation, markers for transformation, engineering chloroplast for the production of edible vaccine, Transplastomic maize- a case study.

Animal food applications: Genetic modification of production traits in farm animals, Foods made from GM animals, applications of transgenic fish technology in sea food production, enzymatic synthesis of oligosaccharides-progress and recent trends.

Food safety: international aspects of the quality and safety, genetically modified food controversies. Regulation of the release of genetic modified organisms,patenting inventions in food biotechnology.

Total: 42 hours

Text Book

1. Kalidas s, Gopinadhan P, Anthony P and Robert E.Levin- " Food Biotechnology"- second edition, CRC press, 2006

Reference Books

1. Gustavo F.G and Gustavo V.B,-" Food Science and Food Biotechnology"- CRC press, 2003
2. Mahesh S.-" Plant Molecular Biotechnology"- first edition, New age international publishers,

, 2008
3. Norman N.Potter and Joseph H. Hotchkiss- Food Science- fifth edition- CBS publishers and distributors, 2007

Course Outcomes

1 Students will be able to know the importance and current status of food biotechnology
2 Students will acquire the knowledge on novel food bioprocessing, nutrigenomics in brief.
3 Explore the applications of microbes in food biotechnology, new sources of food from microbes etc
4 Will be able to learn about plant food biotechnology and transplastomic technology
5 Will get the knowledge on applications of Animal food biotechnology and food safety and its regulation
6 Able to have an overview recent trends in GMOs and food biotechnology

UBT 717L: Food Analysis Techniques Lab
1 Credit (0-0-2)

1. Proximate analysis of foods
2. Nutritional profiling of food samples for labelling (Carbohydrates, protein and fat)
3. Nutritional profiling of food samples for labelling (Vitamins and minerals)
4. Determination of calories in foods.
5. Determination of viscosity and texture of food sample
6. Detection of microbial load in processed food a sample
7. Extraction and detection of active ingredients in foods
8. Extraction of chitin, chitosan and glucosamine from prawn shells/mushrooms
9. Detection of Antioxidant property of Nutraceuticals
10. Sensory evaluation
11. Visit to NABL lab

Reference Books:

1. Food analyses by S Suzanne Nielsen, Fourth edition, Springer publisher, 2010
2. Food Regulation: Law, Science, Policy and Practice, N.D. Fortin, Wiley Publication, 2nd Edition, 2016
3. A Practical Guide to Food Laws and Regulations. Kiron Prabhakar, Bloomsbury Professional India, 1st Edition, 2016
4. Food Safety and Standards Act and Regulations, Food Safety and Standards Authority of India, Ministry of Health and Family Welfare, Government of India, 2006

Course outcomes:

At the end of the course the student will be able to:

1. Analyze different food samples for quality.
2. Evaluate food samples for quality.
3. Evaluate food samples for chemical and microbial safety.
4. Analyze the data for the acceptability of food sample

QUESTION PAPER PATTERN OF CIE (Continuous Internal Evaluation):

1. CIE comprises of 3 tests, each of 30 marks and I hr duration, totaling to 90 marks and later is scaled down to 45 mark
2. Each CIE will be covering one and half unit
3. Any two full questions to be answered out of three questions and each question carries fifteen marks
4. Assignment: quiz/ objective tests etc carries five mark

QUESTION PAPER PATTERN of SEE:

1. Total of Eight Questions with Two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four sub questions.
3. Any Five Full questions are to answered choosing at least one from each unit.

Laboratory Assessment:

1) Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)

2) Allocation of 50 marks for CIE

- Performance and Journal write-up: marks for each experiment = 30 marks/No. of proposed experiments.
- One practical test, for 20 marks (5 write-up, 10 conduction, calculation, Result etc., 5 –viva-voce)

3) Allocation of 50 marks for SEE

Major and Minor	: 35 marks (Write-up 25%, conduction 50%, calculation and results 25%)
Spotting	: 08 marks
Viva-Voce	: 07 marks

B.E. VIII SEMESTER

2021-22

Sl. No.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	UBT82XE	Elective – 6 (Online)	03	3	0	0	3	50	50	100
2	UBT83XE	Elective – 7 (Online)	03	3	0	0	3	50	50	100
3	UBT806P	Project work	15	0	0	30	30	50	50	100
		Total	**21**	**6**	**0**	**30**	**36**	**30**	**35**	**300**

Electives - 6

UBT823E: Chemical Plant utilities & Safety
UBT824E: Metabolic Engineering
UBT825E: Industrial Waste Water Treatment
UBT827E : Pharmaceutical BT

Electives - 7

UBT830E: Clinical Research
UBT832E: Health Diagnostics
UBT833E: Validation & Quality Control
UBT834E: Product Development

UBT823E: Chemical Plant Utilities and Safety
3 Credits (3-0-0)

UNIT 1

Introduction: **10 Hours**

Different utilities. Role of utilities in process plant operations and criteria for selection and estimation of suitable utilities. Water: Water resources. Process water, Cooling water, drinking water and boiler feed water Quality Standards. Water treatment processes for drinking, process and boiler feed. Storage and handling of water. Types and selection of pumps, piping and accessories. Water pre treatment.

Air:

Compressed air, blower air, fan air. Types of compressor and vacuum pumps and selection. Power requirements, performance and related calculations. Booster and receivers. Quality of compressed air for instruments and processes. Compressed air distribution system-piping and accessories. Air-water vapour system: humidification/ dehumidification and evaporative cooling-related calculations.

UNIT 2

Steam And Power: **10 Hours**

Steam generation in chemical plants. Types of boilers and waste heat boilers. Fuels-types, emissions and global warming, green fuels. Calorific value. Proximate and ultimate analysis. HHV, LHV and related calculations. Cogeneration power plants. CHPs and Boiler performance. Related Calculations. Economy of steam generation with different fuels, related calculation. Steam storage and handling-piping and accessories.

Refrigeration:

Different refrigeration systems and their characteristics. Air-conditioning systems. Coefficient of performance. Power requirements and refrigeration effect-related calculations for each type of refrigeration system. Refrigerant properties and selection. Some commonly used refrigerants and secondary refrigerants.

UNIT 3

Insulation: **10 Hours**

Insulation Materials & Selection-Economics of insulation. Insulating factors. Properties & Classification. Cold insulation and cryogenic insulation.

Introduction To Process Safety: Intrinsic & Extrinsic Safety. The Hazards-Toxicity, Flammability, Fire , Explosions. Sources of ignition, Pressure. Hazard and risk assessment methods. MSDS.

UNIT 4

Safety Devices: **10 Hours**

Pressure relief valves. Ruptures discs. Blow down systems. Flare systems. Flame arrestors. Deflagration arrestors and explosion suppression. Personal safety devices.

Process Safety Analysis:

HAZAN and HAZOP comparison.. Risk analysis and estimation. Safety check list. Computer based quantitative risk analysis.

Total: 40 hours

REFERENCE BOOKS:

1 Thermal Engineering, B.K. Sarkar, Tata Mc Graw Hill, 8th Reprint, 1998.
2 Heat Engines, K.P. Roy, Media Promoters and Publishers, 1995.
3 Power Plant Engineering, P.K. Nag, 2nd Edition, Tata Mc Graw Hill, 1998.
4 Water and Waste water engineering-Vol 2, Gordon M Fair, John C. Geyer and Daniel A Okun, Jhon Hutey,1996.

5 Water and waste water Technology, Mark J. Hammer Jr., 4th Edition, Prentice Hall, 1997.
6 Chemical Engineers Handbook, Perry, 8th Edition, 2007.
7 Chemical Engineering-Vol 6, R.K. Sinnot, Coulson and Richardson's, 3rd Edition, BH, Reprint, 2000.
8 Loss prevention in chemical process industries, Vol. 1,2,3, Frank P Lees, Butterworth-Heiremann,1980.

COURSE OUTCOMES:

1. Able to study Different utilities and Role of utilities in process plant operations.
2. Types of compressor and vacuum pumps.
3. Steam generation in chemical plants and Types of boilers.
4. Different refrigeration systems and their characteristics.
5. Process Safety analysis and Insulation Materials & Selection-Economics of insulation.

UBT824E: Metabolic Engineering
3 Credits (3-0-0)

UNIT 1

Introduction: **10 Hours**

Basic concept of metabolic engineering overview of metabolism. Different models for cellular reactions, Mutation, mutagens mutation in metabolic studies.

Metabolic regulation

An overview of Cellular Metabolism, Transport Processes, Passive Transport, Facilitated Diffusion, Active Transport, Fueling Reactions, Glycolysis, ermentative Pathways, TCA Cycle and Oxidative Phosphorylation, AnapleroticPathways, atabolism of Fats, Organic Acids, and Amino Acids, Biosynthetic Reaction, iosynthesis of Amino Acids, Biosynthesis of Nucleic Acids, Fatty Acids, and Other Building Blocks, Polymerization, Growth Energetics.

UNIT 2

Metabolic flux: **10 Hours**

Metabolic flux analysis and its application, Methods for experimental determination of metabolic flux by isotope dilution method.

Applications of Metabolic flux analysis:

Amino Acid Production by Glutamic Acid Bacteria, Biochemistry and Regulation of Glutamic Acid Bacteria, Calculation of Theoretical Yields, Metabolic Flux Analysis of Lysine Biosynthetic Network in C. glutamicum, Metabolic Flux Analysis of Specific Deletion Mutants of C. Glutamicum, Metabolic Fluxes in Mammalian Cell Cultures, Determentation of Intracellular Fluxes., Computational Networks and Systems Biology**.**

UNIT 3

Regulation of Metabolic pathways: **10 Hours**

Regulation of Enzymatic Activity, Overview of Enzyme Kinetics, Simple Reversible Inhibition Systems, Irreversible Inhibition, Allosteric Enzymes: Cooperativity, Regulation of Enzyme Concentration, Control of Transcription Initiation, Control of Translation, Global Control: Regulation at the Whole Cell Level, Regulation of Metabolic Networks, Branch Point Classification, Coupled Reactions and the Role of Global Currency Metabolites.

UNIT 4

Metabolic Engineering in practice: **10 Hours**

Enhancement of Product Yield and Productivity, Ethanol, Amino Acids, Solvents, Extension of Substrate Range, Metabolic Engineering of Pentose Metabolism for Ethanol Production, Cellulose-Hemicellulose Depolymerization, Lactose and Whey Utilization, Sucrose Utilization, Starch Degrading Microorganisms, Extension of Product Spectrum and Novel Products, Antibiotics, Polyketides, Vitamins, Biopolymers, Biological Pigments, Hydrogen, Pentoses: Xylitol, Improvement of Cellular Properties, Alteration of Nitrogen Metabolism, Enhanced Oxygen Utilization, Prevention of Overflow Metabolism, Alteration of Substrate Uptake, Maintenance of Genetic Stability, Xenobiotic Degradation, Polychlorinated Biphenyls (PCBs), Benzene, Toluene, P-Xylene Mixtures (BTX).

Total: 40 hours

REFERENCE BOOKS:

1 Metabolic Engineering – Principles and Methodologies by Gregory N. Stephanopoulos, Aristos
2 Aristidou, Jens Nielsen
3 P.F. Stanbury and A. Whitkar. Principle of Fermentation Technology pergaman press
4 Johnson and Thrins – Scaleup Methods in Chemical Engineering
5 M.L. Shuler and Kargi "Bioprocess Engineering basic concepts"
6 A.C. Bowden and M.L. Cardens "control of metabolic process" Plenum Publisher.
7 Wang D I C Cooney C I Demain, A L "Fermentation and enzyme Technology" John Willey

8 T. Roberts “Metabolism of Agrochemicals in Plants” Willey Int.
9 Zubey. G “Biochemistry” McMillon.
10 David L. Nelson and Michael Cox,“LehningerPrinciples of Biochemistry” –6th Edition,
11 LubertStryer, “Biochemistry” -Freeman & Co., Pub, 2010.

COURSE OUTCOMES:

1 Able to describe the Basic concept of metabolic engineering.
2 Explain Fundamentals of Metabolic flux analysis and its applications.
3 Discuss Regulation of metabolic pathways.

UBT825E: Industrial Waste Water Treatment
3 Credits (3-0-0)

UNIT 1

Water and wastewater engineering an overview **10 Hours**

Water quality, Physical chemical and biological parameters of water, water quality standards,water quality indices. Waste water: Terminology, impact of regulation on waste waterengineering, health and environmental concern in waste water management, waste water characteristics and treatment methods, current status and future trends, waste water reclamation and reuse, biosolids and residual management. Constituents of waste water, physical chemical and biological parameters of waste water, sampling methods, waste water effluent standards, sewage disposal methods.

UNIT 2

Primary and secondary treatment of wastewater **10 Hours**

Screens, oil traps, grit chambers, coagulation, clariflocculation, oxidation ponds and lagoons,Attached growth biological treatment : Activated sludge process and its modifications, trickling filter, biological nitrification and denitrification, anaerobic process, sludge disposal.

Advanced wastewater treatment

Removal of dissolved organic, inorganic constituents and biological constituents, Filtration: modeling and backwashing for slow sand and rapid sand filters, adsorption principle and isotherms, gas stripping, ion exchange, advanced oxidation process. Membrane filtration: RO, UF, MF, NF, electrodialysis. Disinfection: chlorine dioxide, chloramines, ozonation, UV radiation.

UNIT 3

Wastewater reclamation and reuse **10 Hours**

Waste water reuse application, need for water reuse, public health and environmental issues in water reuse, introduction to risk assessment for water reuse, different reuse options: Agriculture and landscape irrigation, industrial reuse, ground water recharge, non-potable uses with case studies.

UNIT 4

Issues related to treatment plant performance **10 Hours**

Need for upgrading treatment plant performance, treatment process reliability and selection of design values, odour management, introduction to automatic process control, energy efficiency, upgrading waste water treatment plant performance by process optimization, important design consideration for new waste water treatment plants: Liquid stream, solid processing, odour control .

Total: 40 hours

COURSE OUTCOMES:

1. Define water quality and explain methods to characterize water quality.
2. Describe water quality standards and their impact.
3. Explain primary and secondary treatment methods of waste water.
4. Apply membrane filtration techniques, and disinfection methods to purify waste water.
5. Analyze the importance of reclamation and reuse of waste water.
6. Describe methods of water reusage.
7. Identify various issues related to the performance of treatment plants and problems associated with them to combat them.

UBT827E: Pharmaceutical Biotechnology
3 Credits (3-0-0)

Prerequisites Biochemistry, Immunology, Microbiology.

UNIT 1

Introduction **10 Hours**

Introduction to pharmaceutical biotechnology, Pharmaceutical Industry. Drug design, development and Economics, Fundamental principles and processes involved in preclinical and clinical development of a chemical or biological entity. Orphan drugs Provisions for and use of unlicensed medicines, Drug abuse and dependence, Prescription and Non-prescription drugs. Regulations & guidelines for pharma ,CDSCO, fda, ichq7, usfdA21 cfr part11.

Drug metabolism:

Evolution of Drug Metabolism as a Science, Phase I Metabolism (microsomal oxidation, hydroxylation, dealkylation) Phase II Metabolism (Drug conjugation pathway) .Pharmacodynamics and Pharmacokinetics of drugs .

UNIT 2

Toxicology **10 Hours**

Basic concepts in toxicology, the mechanism of toxin action, biotransformation of toxins, their inactivation and removal from the body, Reactive intermediates.

Manufacturing principles and formulations:

Definitions, applications, composition, preparation, physicochemical considerations,.Preformulation Testing, Tablets, compressed tablets, tablet granulation, Coatings, Pills, Parental preparations, herbal extracts, Oral liquids, Ointments, short study of current biotech products, herbal medicines. Quality control, storage and stability of biotech products.

UNIT 3

Stem cells in health care **10 Hours**

Introduction to Stem Cell Biology, Fate Mapping of Stem Cells Mesenchymal Stem Cells, Stem Cells and Neurogenesis and its application , Epidermal Stem Cells, Liver Stem Cells, Pancreatic Stem Cells, Stem Cells in the Epithelium of the Small Intestine and Colon.

Application of epidermal stem cell in Tissue engineering, Hematopoietic Stem Cells, Classification and clinical manifestations of hematopoietic stem cell disorders.

Drug delivery system:

Advanced Sustained Release Drug Delivery System, Advanced drug Delivery Systems, Liposomes and Nanoparticles Drug Delivery System, Biodegradable Drug Delivery System, Hydrogel based Drug Delivery System.

UNIT 4

Analysis of biologicals & pharmaceuticals **10 Hours**

Vitamins Cold remedies Laxatives Analgesics, Non-steroidal contraceptives, External antiseptics, Antacids, Antibiotics, Biologicals, Herbal products. Packaging techniques – Glass containers, plastic containers, film wrapper, bottle seals.

Advanced pharmacology:

Introduction to pharmaceutical chemistry, classification of drugs based on therapeutic actions using suitable examples. Antineoplastic agents, Immunomodulators, Heavy metals and heavy metal antagonists, Therapeutic gases. Free radical biology and antioxidants. Quality assurance and control.

Total: 40 Hours

Text books

1. Biopharmaceuticals Biochemistry and Biotechnology 2nd Edition by Gary Walsh, Wiley Pub(2013)
2. Basic & Clinical Pharmacology9th Edition by BartramG.Katzung,McGrawHill,2009

Reference Books

1. The Theory & Practice of Industrial Pharmacy 3rd Edition by Leon Lachman, Herbert A. Lieberman& Joseph &Kanig, Vergese Publishing House Bombay 1987
2. Pharmaceutical Biotechnology by K Sambamurthy & Ashutosh Kar, New Age, 2006.
3. Pharmaceutical Biotechnology by S P Vyas and V K Dixit, CBS Publishers, 2007
4. Developmental Biology, 6thEdition ScottF.Gilbert,2006
5. Molecular Biology of the Cell, 3rd Edition Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson ,2006.
6. Stem Cell Biology by Marshak, Cold Spring Harbar Symposium Publication,2001

Course outcomes

1. Ability to classify various biological sources of pharmaceutical products to retrieve the basic concept of pharmacology, drug metabolism .and their importance in biotechnology
2. Ability to comprehend the toxicological studies of pharmaceutical products
3. Ability to interpret techniques used in the manufacture of pharmaceutical products
4. Ability to discuss the concepts used in production of stem cells and analyse the applications and ethical issues of stem cells in the society
5. Ability to comprehend advanced techniques in drug delivery system.
6. Capable to discuss various other applications to protect the global community from various dreadful diseases.

UBT830E: Clinical Research
3 Credits (3-0-0)

UNIT 1

INTRODUCTION: **10 Hours**

The philosophy behind organization of research. Disease target identification and selection. Patenting new active substances. Receptor-based approaches, agonists, antagonists, enzyme inhibitors. Lead optimization and candidate selection of molecules for exploratory human investigation. In vitro and In vivo testing of new compounds Relationship between animal and human pharmacology.

CLINICAL PHARMACOLOGY:

Pre-clinical development to support testing in humans. Safety testing, Pharmaceutical development - formulations, manufacture and supply of materials, labeling and presentation, stability and storage, purity, compatibility, disposal; Concepts of Pharmacovigilance.

UNIT 2

THERAPEUTICS: **10 Hours**

Clinical importance of Therapeutic Proteins, Antibodies, Enzymes; Hormones and Growth Factors, Interferon's, Interleukins and Additional Regulatory Factors.

MANAGEMENT OF DRUGS

Management of common acute and chronic diseases. Major drug classes including biologicals. Measurement of drug effects Adverse drug reactions (short term & long term). Benefit and risk, Drug interactions; Prescribing for particular populations . Controlled drugs and drug dependence, Over dosage and treatment of poisoning. Patient compliance and information, Therapeutic Drug Monitoring.

UNIT 3

HEALTHCARE MARKETPLACE: **10 Hours**

National and local formularies. Product information (Generic v/s Rx), advertising and claims Product support and promotion Product life-cycle management Product liability Codes of practice including the MHRA Blue Principles of health economics Pharmacoepidemiology Competition, in-licensing, co-marketing.

SOCIAL, ETHICAL ISSUES: patents and copyrights. Social-genetic discrimination: insurance and employment, human cloning, foeticide, sex determination. Ethical: somatic and germ line gene therapy, clinical trials, the right to information, ethics committee function. Preservation and clinical use of blood and blood components.

UNIT 4

CLINICAL RESEARCH: **10 Hours**

Types of Epidemiology study designs, ecological (correlation) studies, Case reports and case series, prevalence surveys or cross-sectional studies, case control studies, Clinical Trials, Small Clinical Trials, Placebo Responses in Clinical Trials, Large Clinical Trials and Registries – Clinical Research Institutes, Data Management in Clinical Research : General Principles and Guide to Sources, Clinical Research from Pharmaceutical Industry Perspective.

Total: 40 hours

Text Books

1. Biochemistry and Biotechnology by Gary Walsh. (2002): John Wiley & Sons Ltd.

Reference Books

1. Principles and Practice of Clinical Research by J. I. Gallin and F. P. Ognibene, 2nd Edition, Elsevier Publication,2007
2. Fundamentals of Clinical Trials by Lawrence M. Friedman 4th Edition, Kindle Edition, 2011

3 The Comprehensive Guide To Clinical Research: A Practical Handbook For Gaining Insight Into The Clinical Research Industry by Dan Sfera , Chris Sauber , Kindle Edition ,2019

4 Designing Clinical Research 4th Edition, by Stephen B. Hulley , Steven R. Cummings ,Warren S. Browner ,Deborah G. Grady , Kindle Edition,2013

5 *"Practical Guide to Clinical Data Management"*, Third Edition, by Susanne Prokscha,2016

Course Outcomes

1 Exploit the knowledge to know the clinical importance of different therapeutic products

2 An integrated understanding of the formulations, manufacturing and supply of materials

3 Ability to study the philosophy behind organization of research Ability to understand control measures uised in drug and its control

4 Ability to elucidate the marketing strategies of pharma products

5 Ability to compare the social and ethical issues

6 Ability to inculcate the epidemiology study designs, case reports and case series

7 Ability to analyse the research principles from pharmaceutical industry perspective

UBT832E: Health Diagnostics
3 Credits: (3-0-0)

UNIT 1

INTRODUCTION: **10 Hours**

Biochemical disorders, Immune disorders, Infectious diseases, Parasitic diseases, Genetic disorders chromosomal disorders, single cell disorders and complex traits. Chromosomal disorders: autosomal; sex chromosomal; karyotype analysis.

DNA BASED DIAGNOSTICS

G-banding, in *situ* hybridization (FISH and on-FISH), and comparative genomic, hybridization (CGH). Cancer cytogenetics: spectral karyotyping. DNA diagnostics: PCR based diagnostics; ligation chain reaction, Southern blot diagnostics, array-based diagnostics, Genome sequencing and Metagenomics, DNA sequencing, genetic profiling, single nucleotide polymorphism. Haemoglobinopathies. Neuro developmental disorders. Neuro degenerative disorders. Dynamic mutations. G-banded chromosomal preparations for detection of autosomes of autosomal/sex chromosomal disorders. (translocation, deletion, Down's syndrome, Klumefelter syndrome, Turner's syndrome, etc.) FISH for detections of: translocations, inversions (using appropriate probes) (e.g., chro 9-22 translocation; X-Y translocation).

UNIT 2

BIOCHEMICAL DIAGNOSTICS: **10 Hours**

Inborn errors of metabolism, haemoglobinopathies, mucopolysaccharidoses, lipidoses, lipid profiles, HDL, LDL, Glycogen storage disorders, amyloidosis

CELL BASED DIAGNOSTICS:

Antibody markers, CD Markers, FACS, HLA typing, Bioassays.

UNIT 3

IMMUNODIAGNOSTICS: **10 Hours**

Introduction, Antigen-Antibody Reactions, Conjugation Techniques, Antibody Production, Enzymes and Signal Amplification Systems, Separation and Solid-Phase Systems, Case studies related to bacterial, viral and parasitic infections. Diagnosis of infectious diseases, respiratory diseases (influenza, etc.) Viral diseases-HIV etc., bacterial diseases, enteric diseases, parasitic diseases and mycobacterium diseases. Phage display, immunoarrays, FACs.

UNIT 4

IMAGING DIAGNOSTICS: **10 Hours**

Imaging Techniques (Basic Concepts), Invasive and Non-Invasive, Electrocardiography (ECG), Uses of ECG, Electroencephalography (EEG), Use of EEG, Computerized Tomography (CT), Uses of CT, Magnetic Resonance Imaging (MRI), uses of MRI, Ultrasound Imaging (US), Uses of Ultrasound, Planning and Organization of Imaging Services in Hospital, Introduction, Planning, Physical Facilities, Layout, Organization, Organization and Staffing, Records, Policies, Radiation Protection.

Total: 40 hours

Text Books

1 The Science of Laboratory Diagnosis, by John Crocker and David Burnett, 2007

Reference Books

1 Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood, Harcourt Brace & Company Asia Pvt. Ltd, 2013
2 Tietz Textbook of Clinical Chemistry, Carl A. Burtis, Edward R. Ashwood, Harcourt Brace & Company Asia Pvt. Ltd, 2013
3 Commercial Biosensors: Applications to Clinical, Bioprocess, and Environmental Samples Graham

Ramsay, John Wiley & Son, INC. (1998)
4 Essentials of Diagnostic Microbiology
5 Bailey & Scott’s Diagnostic Microbiology

Course Outcomes:

1 Ability to studyBiochemical disorders, chromosomal disorders.
2 Able to study Dna based diagnostics.
3 Biochemical diagnostics and cell based diagnostics.
4 Immunodiagnostic and imaging diagnostics.

UBT833E: Validation & Quality Control
3Credits (3-0-0)

UNIT 1

Introduction: **10 Hours**

Validation and Regulatory Affairs in Bio (Pharmaceutical) Manufacturing: An Introduction to FDA Operations & Industry Compliance Regulations, The Fundamentals of Regulatory Compliance with respect to Good Clinical Practice (GCP), Good Manufacturing Practice (GMP) & Good Laboratory Practice (GLP). An Introduction to the Basic Concepts of Process Validation & Qualification (IQ, OQ & PQ) Procedures, A Review of Prospective, Concurrent, Retrospective Validation &Revalidation . Validation of Water, Active Pharmaceutical Ingredients (APIs) & Aseptic Processes. Validation of Non- Sterile Processes (used in the manufacture of Solids, Liquids, & Semisolid Dosage Forms). FDA and ICH guidelines .

UNIT 2

10 Hours

Medical Device, In-Vitro Diagnostics & Packaging Validation Issues, Validation of Analytical Methods, Computerized & Automated Systems under 21 CFR Part 11.

Standards

Introduction, ISO 9000 Series of Standards, Management Responsibility, Quality System, Contract Review, Design Control, Document and Data Control, Preservation and Delivery, Control of Quality Records, Internal Quality Audits, Training, Servicing, Statistical Techniques, ISO-9001-2000, Scope, Normative Reference, Terms and Definitions, Quality Management, System, Documents Requirements, Management's Responsibility, Resource Management, Infrastructure, Product Realization, Measurement, Analysis and Improvement, ISO-14001 - Environmental Management Systems.

UNIT 3

Implementation **10 Hours**

The Influence of Good Automated Manufacturing Practice (GAMP); The FDA's Approach to GMP Inspections of Pharmaceutical Companies.

Quality System, Contract Review, Design Control, Document and Data Control, Purchasing,Control of Customer Supplied Product, Product Identification and Traceability, Process Control, Inspection and Testing, Final Inspection and Testing, Control of Inspection, Measuring and Test Equipment, Inspection and Test Status, Control of Nonconforming Product, Corrective and Preventive Action, Handling, Storage, Packaging, Preservation and Delivery, Control of Quality Records, Internal Quality Audits, Training, Servicing, Statistical Techniques.

Quality Objectives, Quality Planning, Quality Control, Quality Assurance, Quality Improvement

UNIT 4

Quality **10 Hours**

Terminology Relating to Quality, Quality Requirement, Customer Satisfaction, Capability; Terms Relating to Management, Management System, Quality Management System, Quality Policy, Continual Improvement, Effectiveness, Efficiency; Relating to Process and Product, Process, Product, Procedure; Terms relating to Characteristics, Quality Characteristics; Terms Relating to Conformity, Non-Conformity, Defect, Preventive Action, Corrective Action, Correction, Rework, Regrade, Repair, Scrap, Concession, Deviation Permit, Release; Terms Relating to Documentation, Information, Document, Specification, Quality Manual, Quality Plan, Record; Terms Relating of Examination, Objective Evidence, Inspection, Test. Metrological Confirmation.

Total: 40 Hours

Text books

1. Pharmaceutical Process Validation, 3rd Edition, Edited by Robert Nash and Alfred Wachter, Marcel Dekker, 2003
2. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control From Manufacturer to Consumer, Sidney J. Willig, Marcel Dekker, 5th Ed., 2000.
3. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed., 1998.

Reference Books

1. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance,2017
2. Pharmaceutical, Medical Device, and Biotech Industries, Syed Imtiaz Haider, Saint Lucie,2017
3. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press, 1998.
4. Commissioning and Qualification, ISPE Pharmaceutical Engineering Baseline Guides Series, 2001

Course Outcomes

1. Ability to comprehend the validation techniques, process, concepts.
2. Ability to analyse the good practices in lab, clinical and manufacturing practices
3. Capable of understanding the ISO standards and environmental management systems
4. Ability to analyse the analytical methods of validation, issues and automated system and standards
5. Ability to discuss the quality control measures used in industries
6. Ability to analyse the Quality Management System

UBT834E: Product Development
3 Credits (3-0-0)

UNIT I

Essentials of product development **12 HOURS**

The product development process, privacy policies and Knowledge of basic laboratory procedures, Standard Operating Procedure (SOPs), process flows in manufacturing, product life cycle and competitor studies. Stability studies – Stability Testing of new Drug Substances and Products – types and stages of testing, Stress Testing, storage conditions. Manufacturing Process for Recombinant pharma Products. Production of pharmaceuticals by genetically engineered cells- hormones and vaccines. Approved Biotech Drugs.

UNIT II

Interpersonal Skills **10 HOURS**

Understand analyze and apply the techniques and essentials of product development and understand the various guidelines along with techniques in Pharma industries.

Understand work output requirements, company policies, delivery of quality work on time and report any anticipated reasons for the delay, effective interpersonal communication, conflict-resolution techniques, importance of collaborative working, multi-tasking, training the team members, knowledge of project management.

UNIT III

Reporting and formulations **10 HOURS**

Reporting – power point presentations, technical writing, Principal investigator, communication with upstream and downstream teams. Problem Solving and Decision Making. Types of adverse drug reactions (ADR) and their treatment. Activity screening, formulations of energy drinks, bars, sports drinks, fortified products, geriatric products, veterinary products, immune boosters.

UNIT IV

Safety and Security at workplace **10 HOURS**

Different types of occupational health hazards, knowledge of chemical substances -characteristics & safety measures. Use of safety gears, masks, gloves and accessories, evacuation procedures for workers and visitors. Health, safety and security issues – types (illness, fire accidents). Classification of dangerous materials with pictorial symbols, Safety in transportation of dangerous materials by road, rail, ships and pipelines. Safety in bulk storage of hazardous substances.

Text Books

1. Endrenyi, L., Declerck, D. and Chow, S. (2017).
2. Biosimilar Drug Product Development. Boca Raton: CRC Press.
3. Biochemistry and Biotechnology by Gary Walsh. (2002): John Wiley & Sons Ltd.

References

1. Good Manufacturing Practices for Pharmaceuticals: A Plan for Total Quality Control From Manufacturer to Consumer, Sidney J. Willig, Marcel Dekker, 5th Ed., 2000, 723 pp.,
2. Jain, N. (2011). Pharmaceutical product development. New Delhi: CBS Publishers.

Course Outcomes

1. Understand, analyze and apply the techniques and essentials of product development and understand the various guidelines along with techniques in pharma industry
2. Demonstrate the different inter personnel skills and project management skills
3. Ability to comprehend various techniques involved in reporting, decision making process and understand adverse effects of drugs.
4. Describe the formulation of various energy drinks and demonstrate the role of Upstream and Downstream marketing.
5. Analyze and list the various health hazards in industry.
6. Ability to understand importance of safety and implement in various industries.

<u>QUESTION PAPER PATTERN OF CIE (Continuous Internal Evaluation):</u>

1. CIE comprises of 3 tests, each of 30 marks and I hr duration, totaling to 90 marks and later is scaled down to 45 mark
2. Each CIE will be covering one and half unit
3. Any two full questions to be answered out of three questions and each question carries fifteen marks
4. Assignment: quiz/ objective tests etc carries five mark

<u>QUESTION PAPER PATTERN of SEE:</u>

1. Total of Eight Questions with Two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four sub questions.
3. Any Five Full questions are to answered choosing at least one from each unit.

Laboratory Assessment:

1) Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)

2) Allocation of 50 marks for CIE

- Performance and Journal write-up: marks for each experiment = 30 marks/No. of proposed experiments.
- One practical test, for 20 marks (5 write-up, 10 conduction, calculation, Result etc., 5 –viva-voce)

3) Allocation of 50 marks for SEE

Major and Minor	: 35 marks (Write-up 25%, conduction 50%, calculation and results 25%)
Spotting	: 08 marks
Viva-Voce	: 07 marks

Basaveshwar Engineering College (Autonomous), Bagalkot

Department of Computer Science and Engineering (CSE)

Draft Scheme of Syllabus for B. E. (CSE) programme for 175 credits

Revised Scheme and Syllabus of teaching **(2018-19 Onwards Admitted Batches)**

Programme: BE (COMPUTER SCIENCE AND ENGINEERING)

III^rd^ Semester

Sl. No.	Subject Code	Subjects	Hrs/Week			C	CIE	SEE	Total
			L	T	P				
1.	UMA336C	Computational Methods for Computer Science	3	0	0	3	50	50	100
2.	UCS351C	Digital Systems	4	0	0	4	50	50	100
3.	UCS352C	Computer Organization	3	2	0	4	50	50	100
4.	UCS353C	Object Oriented Programming with Java	4	0	0	4	50	50	100
5.	UCS354H	Professional Communication & Ethics	2	2	0	3	50	50	100
6.	UCS355L	Advance C Programming	0	2	2	2	50	50	100
7.	UCS356L	Digital Systems Lab	0	0	2	1	50	50	100
8.	UCS357L	Object Oriented Programming with Java Lab	0	0	2	1	50	50	100
9.	UMA330M**	Bridge course Maths –I**	3**	0	0	0	50	50	100
10.	UBT233M**	Environmental Studies**	2**	0	0	0	50	50	100
			16**	**6**	**6**	**22**	500	500	1000

**Note: Diploma lateral entry students have to additionally register the subjects

UMA336C	**Computational Methods for Computer Science**	**4-CREDITS**
Hrs/Week :3		**CIE Marks:50**
Total Hrs: 48		**SEE Marks:50**

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them

- to understand the method of solving algebraic, transcendental equations .
- to determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
- able to expand the given periodic function defined in the given range in terms of sine and cosine multiple of terms as a Fourier series.
- able to extremise the functional using integration technique.
- to solve different forms of heat and wave equations.

Course outcomes:

On completion of this course, students are able

- to know how root finding techniques can be used to solve practical engineering problems.
- to apply the concept of numerical analysis to find the relative strengths and weaknesses of each computation method and know which are most applicable for given problem.
- to apply the analytical technique to express periodic function as a Fourier sine and cosine series.
- to apply partial differential techniques to solve the physical engineering problems.
- to implement integration technique to determine the extreme values of a functional

UNIT-I

Numerical Analysis-I: **10 Hours**

Introduction to root finding problems, Newton-Raphson method Finite differences, forward and backward difference operators (no derivations on relations between operators). Newton-Gregory forward and backward interpolation formulae (without proof). Lagrange's and Newton's divided difference interpolation formulae (without proof). Numerical differentiation using Newton's forward and backward formulae-problems.

UNIT-II

Numerical Analysis- II: **10 Hours**

Numerical integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems.

Numerical solutions of ODE & PDE:

Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method .

Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using standard five point formula.

UNIT-III

Fourier Series: **10Hours**

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half range series, Practical harmonic analysis.

UNIT-IV

Fourier transform : **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms.

Calculus of Variations:

Variation of a function and a functional, extremal of a functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

Total 40 Hours

Resources:

1. Numerical Methods for Engineers by Steven C Chapra &Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Question paper pattern for SEE

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

UCS351C	**DIGITAL SYSTEMS**	**4-CREDITS**
Hrs/Week :4		**CIE Marks:50**
Total Hrs: 48		**SEE Marks:50**

Course Outcomes At the end of the course the student should be able to,	
CO 1.	Demonstrate the understanding of Boolean algebra.
CO 2.	Describe the working of combinational, sequential circuits and Operational Amplifiers and its applications.
CO 3.	Apply the Boolean theorems, K-Map, Q-M and VEM methods to simplify Boolean expressions.
CO 4.	Design combinational and sequential circuits using MSI digital ICs.
CO 5.	Simulate combinational circuits using HDL programming.

UNIT-I (12 Hours)

Boolean algebra and Combinational Circuits: Boolean algebra definition, principle of duality, Boolean algebra theorems, Boolean formulas and functions, normal forms. Minterm canonical form, m-notation, Maxterm Canonical form, M-notation. Manipulation of Boolean expressions. Gates and combinational circuits. Incomplete Boolean functions and don't care conditions, Additional Boolean operations and Gates, Introduction to HDL.

UNIT-II (12 Hours)

Simplification of Boolean expressions: Karnaugh-maps, Use of Karnaugh-maps to minimize Boolean Expressions. Minimal Expressions of Incomplete Boolean Functions. The Quine-McCluskey and Decimal methods for generating prime implicants and prime implicates. Map Entered Variables(MEV).

UNIT-III (12 Hours)

Logic Design using MSI Components: Binary Adders and Substractor, Comparators, Decoders, Encoders, Multiplexers.

Flip Flops and its Applications: Basic bistable element, Latches, Master Slave SR and JK flip-flops, Edge Triggered flip-flops, Characteristic Equations. HDL implementations of logic circuits.

UNIT-IV (12 Hours)

Registers, **Counters**, Design of synchronous counters. HDL implementation of flip-flop, registers and counters.

Operational Amplifiers and its Applications: Introduction to operational amplifiers., Block diagram representation of a typical Op-Amp, Equivalent Circuits of an Op-Amps, Ideal Voltage Transfer curve, Open Loop Op-Amp Configurations, Digital to Analog – Analog to Digital conversion using Op-Amps:

Text Books:

1. D.D. Givone, 2002, **‘Digital Principles and design’**, McGraw Hill.
2. Ramakant A. Gayakwad, 2008, **‘Op-Amps and Linear Integrated Circuits’**, 4th Edition

Reference Books:

1. Malvino, Leach and Saha **‘Digital Principles and applications’**, 6th Edition, 2007, McGraw Hill.
2. R. D. Sudhakar Samuel, **“Logic Design - A simplified approach”** Revised Edition, 2005, Sanguine Technical Publications.
3. Stephen Brown & Zvonko Vranesic, **“Fundamental of digital Logic with Verilog Design”** Publication Tata McGraw Hill.

UCS352C	**COMPUTER ORGANIZATION**	**4-CREDITS**
Hrs/Week:04	**L:T:P:3:2:0**	**CIE Marks:50**
Total Hrs:40:24:0		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to
CO 1.	Explain the design and function of different units of single and multiprocessors system
CO 2.	Analyze the execution of the program and different organizations of functional units
CO 3.	Compare the performance of single and multiprocessor systems
CO 4.	Develop an assembly programs and micro programs for simple machine instructions
CO 5.	Design the basic functional units of computer

Unit I (10 + 6) Hours

Basic structure of Computers: Computer types, Functional Units, Basic operational concepts, Bus structures

Machine instructions and programs: Numbers, Arithmetic operations and characters, Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes, Assembly language, assembler directives, number notation, , Stacks and Queues, Subroutines, Encoding of machine instructions

Unit II (10 + 6) Hours

Input/output organization: Accessing I/O devices, Interrupts-Interrupt hardware , Enabling and Disabling Interrupts, Handling Multiple devices, controlling device requests, Exceptions, Direct memory access – Bus Arbitrations, Buses- Asynchronous Bus and Synchronous bus , Interface Circuits- Parallel port and serial port, Standard I/O Interfaces –Peripheral component interconnect Bus, SCSI bus, USB.

Unit III (10 + 6) Hours

The memory system: Some Basic concepts, Semiconductor RAM memories, Read only memories, speed, size, and cost, cache memories

Arithmetic Unit: Addition and subtraction of signed numbers, Design of fast adders, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication. Integer Division, Floating point numbers and operations – IEEE standard for Floating point numbers, Arithmetic operations on Floating point numbers. Implementing Floating point operations.

Unit IV (10 + 6) Hours

Basic Processing Unit: Some fundamental concepts, Execution of complete instruction, Hardwired Control, Micro programmed control, Microinstructions,

Pipelining: basic concepts, role of cache memory, pipeline performance
Large computer systems: forms of parallel processing, array processor, the structure of general purpose and multiprocessors
Performance:
Processor Clock, Basic performance equation, pipelining and superscalar operations, Clock rate, Instruction set, compiler, performance measurement.

Text Books:
1. Hamacher, Zvonko Vranesic, Safwat Zaky, 2002. ‘Computer Organization’, Fifth Edition, MGH.
(1.1 to 1.4, 2.1 to 2.5, 2.6.1, 2.6.3, 2.8 to 2.9, 2.12, 4.1, 4.2,4.2.1 to 4.2.5, 4.4, 4.4.1,4.5,4.5.1 to 4.5.2, 4.6 , 4.7, 5.1 to 5.5, 5.5.1, 6.1 to 6.7, 7.1 to 7.5, 7.5.1, 8.1,8.1.1,8.1.2,12.1-12.3, 1.6)

Reference Book:

1. J.P. Hayes, 1998, ’Computer Architecture and Organization ‘ , Third Edition, MGH.
2. William Stallings, 2007 ‘Computer Organization and Architecture’, 7th Edition, PHI.

UCS353C	**Object Oriented Programming with Java**	**4-CREDITS**
Hrs/Week :(4)	L:T:P (4+0+0)	**CIE Marks:50**
Total Hrs:48		**SEE Marks:50**

Course Outcomes

At the end of the course the student should be able to ,

CO 1.	Explain the object-oriented concepts and other features of JAVA.
CO 2.	Identify classes and relationship among them needed for the problem given.
CO 3.	Design and develop standalone applications using Java

Unit I (12 Hours)

Java Programming Fundamentals: Object Oriented programming features
History and evolution of Java: Java's lineage, bytecode, Java Buzzwords**.**
An overview of Java ,Data Types, Variables and Arrays , Operators , Control Statements,
Introducing Classes: Class Fundamentals , Declaring Objects , Introducing Methods , Constructors ,this keyword ,garbage collection, method overloading.

Unit II (12 Hours)

Inheritance ,Packages and Interfaces
String Handling ,Enumerations, Autboxing and Type wrappers, Exception Handling : Exception-Handling Fundamentals – Exception Classes , Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses, Nested try Statements, throw and finally statements.

Unit III (12 Hours)

Lambda Expressions : Fundamentals, Block Lambda expressions, Passing Lambda Expressions as argument, Lambda Expressions and Exceptions ,Method References.
Multithreaded Programming : The Java Thread Model , The Main Thread , Creating a Thread, Creating Multiple Threads, Using isAlive( ) and join() , Thread Priorities , Synchronization , Suspending, Resuming and Stopping Threads

Unit IV (12 Hours)

Files : Byte streams, Character Streams, Serialization, Console Class. **Regular Expressions**: Regular Expressions Processing.
Collections : The Collection Interfaces , The Collection Classes(ArrayList , LinkedList) , Accessing a Collection via an Iterator , Legacy Classes and Interface.

Text Book:

Java The Complete Reference - Herbert Schildt 9th Edition, MGH Education

Reference Books:

1.Core Java Volume 1- Fundamentals, Cay S Horstmann ,Gary Cornell, 8th Edition ,Pearson Education

2.Programming with Java – E Balagurusamy,6th Edition, MGH

UCS355L	**Advance C Programming**	**2-CREDITS**
Hrs/Week : 4(2+2)	**L:T:P:0:2:2**	**CIE Marks:50**
Total Hours:28		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	Explain the C programming language concepts.
CO 2.	Analyze and determine the program requirements
CO 3.	Employ the concepts in designing and developing effective solutions for the problem given

Unit I (07 Hours) Multidimensional arrays, String handling functions , Command line arguments, **preprocessor commands:** file inclusion, macro definition, conditional compilation **Storage classes:** Storage classes**,** object storage attributes, storage class specifiers, **Type qualifiers:** constant, volatile and restricted type qualifiers.
Unit II (07Hours) **Pointers:** Introduction, pointers for Inter- function communication, pointers to pointers, compatibility, **Pointer applications**: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, **Memory allocation functions, Array of pointers, pointers to void and pointers to functions Recursion:** iterative and recursive definition iterative and recursive solution, designing recursive functions, limitations of recursion.
Unit III (07 Hours) **Enumerators, Structures and Union Types:** typedef **,** enumerated types, structure, unions **Bitwise operators**: Exact size integer types, logical bitwise operators, shift operators, masks **Variable argument list functions,**
Unit IV (07 Hours) **Files: Text Input/output** :files, streams, standard library I/O functions, formatting I/O functions, character I/O functions **Binary files**: Text v/s binary stream, standard library function for files, converting file types
Text Book: Computer Science A Structured Programming Approach Using C, Behrouz A,Forouzan & Richard F Gilberg, Third Edition, Cengage Learning India Private Limited (Chapter 6:6.9 Chapter 7,Chapter 9 &10,Chapter 11:11.3,11.4,11.5,Chapter 12,Chapter 13,Chapter 14,Appendix G:G.1,G.2,G.3,Appendix H,I and J)

Reference Books:

1. Let Us C ,Yeshwant Kanetkar,15th Edition, BPB publications
2. Programming with C ,Brian W Kernighan and Dennis Ritchie ,Pearson Education
3. Test your C Skills , Yeshwant Kanetkar, BPB publications
4. Exploring C Yeshwant Kanetkar BPB publications

Assignment Set

Part A:

1. Program to create 3d array regular(rectangular) array
2. Program to create dynamic 2d array of user specified size
3. Program on command line arguments and use of macros
4. Program to implement simple string library functions
5. Develop program to perform the following using recursive function
   i) Print the numbers accepted from keyboard in reverse order
   ii) Obtain sum of array elements, even elements, odd elements
   iii) Obtain length of array, occurrence count, reverse array elements
   iv) Reverse the number; sum the digits of a number, binary to decimal
6. Demonstrate writing and using of variable argument list function
7. Demonstrate nested structure concept, array of structures, array of pointers to structure with dynamic allocation for array elements
8. Program to perform following using bitwise operators on fixed size integers of 8 bit length
   i)display number in 1's and 0's
   ii)use of bitwise or,and ,not and exclusive or operator
   iii)masking ,unmasking,flipping,left shifting ,right shifting,rotation
9. Program to create ,display text file and separate the words and store in another file
10. Merge two files containing integers (that may not be sorted) such that resultant file is sorted
11. Program to create binary file of students and allow following operations
    i)To display in forward and reverse direction
    ii)To modify student record given key value
    iii)To retrieve n^{th} record

Part B: For practice purpose only

1)Debugging exercises
2)Determining the output for given piece of core
3)Finding error in the code given
4)Complete the code
5)Given prototype develop the function
6)Given the code identify the task.

Note:

- In the examination questions must be given on lots. Each student must be given one question only from PART-A.

UCS354H	**Professional Communication and Ethics**	**3 credits (2-2-0)**
Hrs/Week : 4(2+2)	**L:T:P:2:2:0**	**CIE Marks:50**
Total Hours: 28L+24T		**SEE Marks:50**

	Course Outcomes : At the end of the course the student should be able to
CO 1.	Apply communication skills effectively in profession and society.
CO 2.	Recognize the importance of communication, listening, team work and behavior.
CO 3.	Execute ethical and social responsibility as an IT professional.
CO 4.	Express ideas to produce messages suitably tailored for the topic, objective, audience, communication medium and context.
CO 5	Understand corporate culture and perform accordingly.

UNIT I **L – 7 Hrs T- 6 Hrs**

Basics of Technical Communication: Introduction, Process of Communication, Levels of Communication, Flow of Communication, Visual aids in Technical Communication. **Barriers to Communication:** Introduction, Classification of Barriers, **Non-verbal Communication:** Introduction, Kinesics, Proxemics, Chronemics, Correlating Verbal and Non-verbal Communication, Cross-cultural variations,

UNIT II **L – 7 Hrs T- 6 Hrs**

Active Listening: Introduction, Types of Listening, Traits of Good Listener, Active Versus Passive Listener, Implication of Effective Listening, **Conversations and Dialogues:** Introduction, Conversations, Telephonic conversations and Etiquettes, Dialogue writing **Formal Presentations:** Introduction, Planning, Outlining and Structuring, Nuances of Delivery, Controlling Nervousness and Stage, Fright, Visual Aids in Presentation, Application of MS-PowerPoint

UNIT III **L – 7 Hrs T- 6 Hrs**

Group Communication: Introduction, Forms of Group Communication, Use of Body Language, Discussions, Group Discussions, Organizational Group Discussion, Group Discussion as a Part of Selection Process Meeting, Conferences, **Elements of Effective Writing:** Introduction, Right Words and Phrases, Sentences, Writing for the Web

UNIT IV **L – 7 Hrs T- 6 Hrs**

Ethics: An Overview of Ethics, What Are Ethics? Ethics in the Business World, Including Ethics Considerations in Decision Making, Ethics in Information Technology, **Ethics for IT Workers and IT Users:** IT Professionals, IT Users **Software Development:** Strategies of Engineering Quality Software, Software Product Liability, Key Issues in Software Development,

Social Networking: What is a Social Networking Web Site? Social Networking Ethical Issues

Text Books:

Communication:

1. Meenakshi Raman And Sangeeta Sharma –Technical Communication-Principles and Practice, Oxford University Press ,2004(Chapters 1, 2, 3, 4, 6, 7, 9 and 11)

Ethics:

2. George Reynolds –Ethics in Information Technology , Thomson Course Technology,2003(Chapters 1, 2, 7 and 9)

Reference Books:

1. M. Ashraf Rizivi, Effective Technical Communication,2nd Edition, McGraw Hill, 2017
2. Mike W Martin And Ronald Schinzinger, Ethics in Engineering, 2nd Edition, McGraw Hill, 2010
3. Aruna Koneru, Professional Communication, Tata McGraw-Hill Education, 2008
4. Jayashree Suresh and B. C. Raghavan, Human Values and Professional Ethics, S. Chand and Company, 2010

Question paper pattern:

- Total of 8 questions, two from each unit, to be set uniformly covering the entire syllabus.
- No question should have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.
- The questions should cover all the levels of Bloom's taxonomy.
- All COs have to be covered.

	DIGITAL SYSTEMS LABORATORY	
UCS356L **Hours/Week: 02**		**1-CREDITS** **CIE Marks: 50**
Exam Hours:02		**SEE Marks: 50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	This course provides the foundation education in digital electronic circuit analysis and design. Through lecture, laboratory, and out-of-class assignments, students are provided learning experiences that enable them to:
CO 2.	Design, simulate and implement basic combinational and sequential logic circuits. Become proficient with computer skills (eg., VHDL language) for the analysis and design of circuits.
CO3	Acquire teamwork skills for working effectively in groups .

Practice Assignments using digital I C's :

- Implementation of Boolean Expressions of basic logic gates such as 2-input/3-input AND,OR,NAND,NOR, EX-OR gates
- Simplification of simple Boolean Expressions in SOP/POS forms.

PART- A (Hardware Implementation)

1. Design a Binary to Gray Code converter with K map simplification and using basic Gates.
2. Given any 4-variable logic expression, simplify using K-MAP/Quine McCliskey and realize the simplified logic expression using 8:1 multiplexer IC.
3. Realize a full adder using 3-to-8 decoder IC and 4 input NAND gates.
4. Realize a full substractor circuit using 3 to 8 line decoder IC and 4 input NAND gate.
5. Realize a J-K Master/Slave Flip-Flop using NAND gates and verify its truth table.
6. Design and implement a mod-n (n<8) synchronous Up Counter using J-K Flip-Flop and basic gate ICs.
7. Design and implement a mod-n (n<8) synchronous Down Counter using J-K Flip-Flop and basic gate ICs.

8. Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) & display the numbers using 7-segment display.
9. Design a Ring and Johnson Counter using a 4-bit Shift Register IC.
10. Design a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.

Practice Assignments using Simulation package :

- Implementation of Boolean Expressions of basic logic gates such as 2-input/3-input AND,OR,NAND,NOR, EX-OR gates
- Simplification of simple Boolean Expressions in SOP/POS forms.

PART- B (Software Implementation)

1. Write the Verilog/VHDL code for Binary to Gray Code converter and verify its working.
2. Write the Verilog/VHDL code for an 8:1 multiplexer. Simulate and verify its working.
3. Write the verilog/VHDL code for a full adder .Simulate and verify its working.
4. Write the Verilog/VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify its working.
5. Write a verilog/VHDL code for mod-8 up counter. Simulate and verify its working.
6. Write the verilog/VHDL code for switched tail counter. Simulate and verify its working.

Note:

- Any simulation package like MultiSim/Active HDL etc. may be used.
- In the examination questions must be given on lots. Each student must be given one question from PART-A and one from PART-B.
- Practice Assignments are not to be considered for SEE Examination.

UCS357L	**Object Oriented Programming with Java Lab**	**1-CREDIT**
Hrs/Week :02		**CIE Marks:50**
Exam Hrs:03		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	Analyze the problem statement and determine the requirements for solving problem.
CO 2.	Design and develop effective solution for the problem given.

1. Develop simple applications demonstrating the
   i) Use of conditional statements
   ii) Use of loop statements
   iii) Reading & printing different data types in java
   iv) operations on arrays(single & multidimensional)

2. Develop application demonstrating
   i) Inheritance
   ii) Polymorphism
   iii) Packages
   iv) interfaces

3. Develop applications demonstrating exception handling
4. Develop applications demonstrating multithreading concept
   i) Creating threads using extends & runnable technique
   ii) Synchronization
   iii) Interthread Communication
5. Develop application that demonstrates the use of
   i) String library functions
6. Develop applications that allows manipulation of collections
   i) ArrayList ii)Linked List
7. Develop application that allows user to create a file,display and manipulate file

i) using byte stream

ii) character stream

ii) using object stream

Programme: BE (COMPUTER SCIENCE AND ENGINEERING)

IVth Semester

Sl. No.	Subject Code	Subjects	Hrs/Week			C			
			L	T	P		CIE	SEE	Total
1.	UMA436C	Statistics and Probability Theory	3	0	0	**3**	50	50	100
2.	UCS451C	Data Structures using C	3	2	0	**4**	50	50	100
3.	UCS452C	Database Management Systems	4	0	0	**4**	50	50	100
4.	UCS453C	Operating Systems	3	2	0	**4**	50	50	100
5.	UCS454C	Microcontrollers	3	0	0	**3**	50	50	100
6.	UCS455L	Data Structures using C Lab	0	0	2	**1**	50	50	100
7.	UCS456L	Microcontrollers Lab	0	0	2	**1**	50	50	100
8.	UCS457L	Database Management Systems Lab	0	0	2	**1**	50	50	100
9.	UHS001N	Fundamentals Of Quantitative Aptitude And Soft Skills	0	2	0	**1**	50	50	100
10	UMA430M**	Bridge course Maths –II**	3**	0	0	**0**	50	50	100
11	UHS126M**	Constitution of India**	2**	0	0	**0**	50	50	100
12	UHS488/UHS489	Saamskrutika Kannada/Vyavaharika Kannada	2	0	0	**1**	50	50	100
			16**	**6**	**6**	**23**	**600**	**600**	**1200**

Bridge course Maths II is mandatory subject only for students having Diploma and admitted to 4th Semester through lateral entry scheme. Passing the subject is compulsory; however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing /not passing the subject.

** The total lecture hours for students having Diploma and admitted to 4th Semester through lateral scheme is 26 hours.

Note: Diploma lateral entry students have to additionally register for CIP.

UCS436C	**Statistics and Probability Theory**	
Hrs/Week : 03	**L:T:P:3:2:0**	**CIE Marks:50**
Total Hrs: 40		**SEE Marks:50**

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

- To form a specific relation for the given group of data using least square sense method.
- To specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course outcomes:

On completion of this course, students are able

CO1: to apply the least square sense method to construct the specific relation for the given group of data.

CO2: to apply the concept of probability to find the physical significance of various distribution phenomena.

CO3: to apply the concept of probability to perform engineering duties in planning and designing, engines, machines and other mechanically functioning.

CO4: to apply the concept of probability to study the performance of Mechanical systems.

CO5: to apply the concept of Markov Chain for commercial and industry purpose.

UNIT-I

Statistics: **10 Hours**

Curve fitting by the method of least squares : $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$.

Correlation , expression for the rank correlation coefficient and regression.

UNIT –II

Probability: **10 Hours**

Probability: Addition rule, conditional probability, multiplication rule, Baye’s rule. Discrete and continuous random variables-Probability density function, cumulative distribution function.

UNIT –III

Probability distributions: **10 Hours**

Binomial distribution, Poisson distribution and Normal distribution. Concept of joint probability, Joint distributions - discrete and continuous random variables, Independent random variables, problems on expectation and variance.

UNIT –IV

Markov chains: **10 Hours**

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

Total: 40 Hours

Resources:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

UCS451C	**DATA STRUCTURE USING C**	**4-CREDITS**
Hrs/Week : (03+02)	**L:T:P:3:2:0**	**CIE Marks:50**
Total Hrs: 52		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to ,
CO1.	Explain linear and nonlinear data structures concepts, searching and sorting techniques.
CO2.	Analyze and implement different data structures, searching and sorting techniques.
CO3.	Develop solutions for the given problem by using relevant data structures.

Unit I (13 Hours)

Introduction to Data Structures : Basic concepts : Abstract data type: Atomic and composite data, Data type, Data structure, Abstract data type, Model for an abstract data type: ADT operations, ADT data structures, Pointer to void, **Pointer to Function**: Defining pointers to functions, Using pointers to functions.

Stacks: **Basic stack operations**: Push, Pop, Stack top, **Stack linked list**:Implementation, Data structure, Stack head, Stack data node, Stack algorithms, Create Stack, Push Stack, Stack top, Empty Stack, Full Stack, Stack count, Destroy Stack, **C language implantations**: Insert data, Push Stack , Print Stack, Pop character, **Stack ADT**: Data structure, ADT Implementations, Stack structure, Create stack, Push stack, Pop stack, Stack top, Empty stack, Stack count, Destroy stack, **Stack applications**: Reversing data, Reverse a list, Convert decimal to binary, Infix to postfix transformation, Evaluating postfix expressions, Stack Implementation using array.

Unit II (13 Hours)

Queues: **Queue Operations**: Enqueue, Dequeue, Queue front, Queue rear, Queue example, **Queue Linked list design**: Data structure, Queue head, Queue data node, Queue algorithms, Create queue, Enqueue, Dequeue, Retrieving queue data, Empty queue, Full queue, Queue count, Destroy queue, **Queue ADT**: Queue structure, Queue ADT algorithms, Queue Implementation using array, Queue Applications.

Sorting :Selection, Insertion, exchange and quick sorts

Searching: Sequential, binary search, hashed list searches

Unit III (13 Hours)

General Linear lists: Basic operations, Insertion, Deletion, Retrieval, Traversal, **Implementation:** Data structure, Head node, Data node, Algorithms, Create list, Insert node, Delete node, List search, Retrieve node, Empty list, Full list, List count, Traverse list, Destroy list, **List ADT**: ADT functions, Create list, Add node, Internal insertion function, Remove node, Internal delete function, Search list, Internal search function, Retrieve node, Empty list Full list, List count, Traverse, Destroy list,

Circular linked lists and Doubly linked lists: Create list, add node, delete node, retrieve node, search list.

Unit IV (13 Hours)

Non-Linear lists: Trees: Basic tree concepts: Terminology, User representation, **Binary trees**: Properties, Height of binary trees, Balance, Complete and Nearly complete binary trees, **Binary tree traversals:** Depth-first traversals, Breadth-first traversals, **Expression Trees**:Infix traversal, Postfix traversal, Prefix traversal, **Huffman code, General trees, Binary search trees**: Basic concepts, **BST operations**: Traversals, Searches, Insertion Find the smallest and largest node, BST search, Insertion, Deletion, **Binary search tree ADT**, Data structure, Head and node structure, Algorithms, Create a BST, Insert a BST, Internal insert function, Delete a BST, Internal delete function, Retrieve a BST, Internal retrieve function, Traverse a BST, Internal traverse function, Empty a BST, Full BST, BST count, Destroy a BST, Internal destroy function.

Graphs: Basic concepts, **Operations**: Insert vertex, Delete vertex, Add edge, Delete edge, Find vertex, **Graph storage structures**: Adjacency matrix, Adjacency list.

Text Book:

1) Behrouz A. Forouzan and Richard F. Gilberg, 2nd Edition, Cengage Learning Publisher, 2005. **Data Structure A Pseudocode Approach with C**, (Chapter 1(1.2,1.3,1.5), 2,3,4 (4.1-4.4), 5, 6(6.1-6.3)7(7.1-7.3), 11(11.1-11.3),12(12.2-12.4)13(13.1-13.3)Appendix F.

Reference Books:

1) **Data Structures Using C,** Aaron M. Tenanbaum , Yedidyah Langsam, Moshe J Augenstein Pearson Education
2) Data **Structures and Program Design in C,** Robert Kruse, Bruce Leung, C. L. Tondo , Shashi Mogalla, 2nd Edition, Pearson Education
3) **Data Structures with C ,Seymour Lipschutz, Schaum's outlines, MGH Education**
4) **Data Structures Through C ,Yeshwant Kanetkar ,BPB publications**

UCS452C	**DATABASE MANAGEMENT SYSTEMS**	**4-CREDITS**
Hrs/Week :04		**CIE Marks:50**
Total Hrs: 48		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to:
CO 1.	Explain the concepts of database and database management system.
CO 2.	Describe security concepts for multi user database applications.
CO 3.	Design database for given database application.
CO 4.	Apply normalization concepts to refine designed database.
CO 5.	Develop database programming skills.

Unit I (Hours)

Introduction and Entity-Relationship Model L - 12 Hrs

Introduction; Characteristics of Database approach; People with databases; Advantages; Disadvantages of DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Classification of Database Management systems. Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for COMPANY database; ER Diagrams, Naming Conventions and Design Issues; Relationship types of degree higher than two.

Unit II (Hours)

Relational Model and Relational Algebra L - 12 Hrs

Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design using ER- to-Relational Mapping.

SQL-The Relational Database Standard:

SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Schema Change Statements in SQL; Basic Queries in SQL; More Complex SQL Queries; Additional Features of SQL; Views (Virtual Tables) in SQL, Cursors, Triggers and PL/SQL Programming

Unit III (Hours)

Database Design L - 12 Hrs

Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Properties of Relational Decompositions; Algorithms for Relational Database

Schema Design; Multivalued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form;

Unit IV (Hours)

Transaction Management and Recovery Techniques L - 12 Hrs

Introduction to transaction processing; Transaction and System concepts; The ACID Properties; Characterizing Schedules Based on Recoverability; Two-Phase Locking Technique for concurrency Control(2PL); Recovery Concepts; Recovery and backup Techniques Based on Deferred Update and Immediate Update

Text Books:

1. Elmasri and Navathe,2007, **'Fundamentals of Database Systems'**, 5th Edition, Addison-Wesley, 2007

Reference Book:

1. Silberschatz, Korth and Sudharshan: 2006,' **Data base System Concepts'**, 5th Edition, Mc-GrawHill

2. **'Database Management Systems'**, Raghurama Krishnan, Johannes Gehrke, TATA Mc-GrawHill

UCS453C	**Operating systems**	**4-CREDITS**
Hrs/Week :04	**(L:T:P:S):03:02:00**	**CIE Marks:50**
Total Hrs:52		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	List and explain goals, service and functions of different classes of operating systems
CO 2.	Analyze the performances of different process scheduling, memory management, file system implementation, protection and security mechanisms.
CO 3.	Apply scheduling and memory allocation policies for solving scheduling and memory management problems.
CO 4.	Develop simple concurrent applications using processes and threads
CO 5.	Select appropriate mechanisms for deadlock handling, synchronization and interprocess communication.

Unit I (10+6 Hours)

Introduction : Abstract Views of an Operating System , Goals of an Operating System , Operation of an Operating System, Operating System and the Computer System, Efficiency, System Performance and User Convenience, Classes of Operating Systems, Batch Processing Systems, Multiprogramming Systems, Time Sharing Systems, Real Time Operating Systems, Distributed Operating Systems , Modern Operating Systems

Processes and Threads: Processes and Programs, Programmer View of Processes , Operating System View of Processes. Threads,
Scheduling : Preliminaries, Non-preemptive Scheduling Policies, Preemptive Scheduling Policies, Scheduling in Practice , Real Time Scheduling.

Unit II (10+6 Hours)

Synchronisation : Background, The critical section problem,Petersons solution, Synchronisation hardware, Semaphores, Classic Problems of synchronization, Monitors.
Deadlocks: System model, Deadlock Characterization, Methods of Handling deadlocks ,Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery From Deadlock

Unit III (10+6 Hours)
Memory Management : Managing the Memory Hierarchy, Static and Dynamic Memory Allocation, Memory Allocation to a Process, Reuse of Memory, Contiguous Memory

Allocation, Noncontiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging.
Virtual Memory : Virtual Memory Basics, Demand Paging , Page Replacement Policies, Memory Allocation to a Process, Shared Pages, Memory Mapped Files.

Unit IV (10+6 Hours)

File Systems: File System and Input Output control system(IOCS), Files and File Operations, Fundamental File Organizations, Directory Structures, File Protection, Interface between File System and IOCS, Allocation of Disk Space, Implementing File Access, File Sharing Semantics, File System Reliability, Virtual File System .
Security and Protection : Overview of Security and Protection, Goals of Security and Protection, Security Attacks, Formal and Practical Aspects of Security, Encryption, Authentication and Password Security, Access Descriptors and the Access Control Matrix, Protection Structures, Capabilities.
Case Study : The Linux System: Linux History, Design Principles, Kernel Modules, Process Management, Scheduling, Memory Management, File Systems, Input and Output,Interprocess Communication, Security.

Text Books:

1. D. M. Dhamdhere, Operating Systems--A Concept Based Apparoach, Second edition, Tata McGraw-Hill, 2006. (Chapter 1,2,3,4,5,6,7 and 8)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne: Operating System Principles, 7 th edition, Wiley-India, 2006. (Chapter 6,7 and 21)

Reference Book:

1. Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley

2. William Stallings:Operating Systems, 6^{th} Edition, Addison Wesley

UCS454C	**MICROCONTROLLERS**	**3-CREDITS**
Hrs/Week :03		**CIE Marks:50**
Total Hrs: 40		**SEE Marks:50**

	Course Outcomes At the end of the course the student will be able to ,
CO 1.	List different addressing modes and instructions of different types.
CO 2.	Explain the functionalities of serial communication, interrupts and I/O Interfacing.
CO 3.	Develop assembly program and 8051 C program for simple microcontroller based application.
CO 4.	Calculate delays generated by delay routines and timers.
CO 5.	Design address decoder to interface external memory.
CO 6.	Select appropriate mode of operation for programming interface circuits.

Unit I (12 Hours)

The 8051 Microcontrollers: Microcontrollers and Embedded systems, Overview of the 8051 family. Pin description of 8051.

8051 Assembly Language Programming: Inside the 8051, Introduction to 8051 Assembly Programming, Assembling and running an 8051 program, the program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and PSW register, 8051 register banks and stack.

Jump, Loop and Call Instructions: Loop and Jump instructions, Call instructions, Time delay for various 8051 chips.

Unit II (12 Hours)

I/O Port Programming: 8051 I/O programming, I/O bit manipulation programming.

8051 Addressing Modes: Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte-on-chip RAM in 8052.

Arithmetic, Logic Instructions and Programs: Arithmetic Instructions, Signed number concepts arithmetic operations, Rotate instruction and data serialization, BCD, ASCII, and other application programs.

8051 Programming in C: Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data serialization using 8051C.

Unit III (Hours)

8051 Timer Programming in Assembly and C: Programming 8051 timers, counter programming.

8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 serial port programming in Assembly, Serial port programming in C.

Interrupts Programming in Assembly and C: 8051 interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.

Unit IV (Hours)

8051 Interfacing to External Memory: Semiconductor Memory, Memory address decoding, 8031/51 interfacing with external ROM, 8051 data memory space, accessing external data memory in 8051 using C.

8051 interfacing with the 8255: Programming the 8255, 8255 interfacing, 8051 C Programming for the 8255. Stepper motor interfacing, DC motor interfacing and PWM.

Text Books:

1. Muhammad Ali Mazidi, Janice Gillipse Mazidi and Rolin D. Mckinlay, " The 8051 Microcontroller and Embedded Systems" using Assembly and C. Pearson 2nd Edition, 2011.

Reference Book:

4. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", Penram International, 1996 / Thomson Learning 2005, 2nd Edition.
5. Dr. Uma Rao and Dr. Andhe Pallavi, "The 8051 Microcontroller – Architecture, Programming And Applications", Pearson - Sanguine Publishers, Bengaluru, 2009.
6. V Udayshankar, M S Mallikarjunswamy, "8051 Microcontroller: Hardware, Software and Applications", McGrawHill, New Delhi.

UCS455L	**Data Structures Using C Lab**	**1-CREDIT**
Hrs/Week :2		**CIE Marks:50**
		SEE Marks:50

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	Implement various searching and sorting techniques
CO 2.	Analyze, design & develop solutions using appropriate data structures for the problem given

1. Develop linked stack ADT and create stack of integer using the ADT's defined

2. Develop array stack ADT and create stack of students using the ADT's defined

3. Develop linked Queue ADT and create Queue of floats using the ADT's defined

4. Develop array Queue ADT and create Queue of strings using the ADT's defined

5. Create Linked list ADT and use the same to create list of students information

6. Apply following searching algorithm to search the key element
   i) From the list of strings using sequential search
   ii) From the list of integers using binary search
   iii) From the list of integers using Hashed search

7. Apply following sorting algorithm to sort the list of integers in ascending or descending order based on user choice using
   i) Selection
   ii) Insertion,
   iii) exchange
   iv) quick sorts

8. Create binary tree and allow following operations on tree
   i)Search an element
   ii)Insert an element
   iii)Tree is balanced or not
   iv)No of occurrences of key element
   v)No of nodes, no of leaf nodes, no of intermediate node
   vi)Find parent of key node
   vii)Traverse in preorder, postorder,inorder,breadth first order
   viii)To copy tree

9. Create binary search tree of integers and allow following operations on tree
   i)Search an element
   ii)Insert an element
   iii)Tree is balanced or not
   iv)No of occurrences of key element
   v)No of nodes, no of leaf nodes, no of intermediate node

vi)Find parent of key node
vii)Traverse in preorder, postorder, inorder, breadth first order
viii)To copy tree
ix) To print elements in descending order

UCS456L	**MICROCONTROLLERS LAB**	**1-CREDIT**
Hrs/Week :02		**CIE Marks:50**
Total Hrs: 30		**SEE Marks:50**

	Course Outcomes At the end of the course the student will be able to ,
CO 1.	Write Assembly and C Programs for 8051 Microcontroller.
CO 2.	Develop Applications Using Kiel Compiler and Simulator.
CO 3.	Interface I/O Devices using Programmable peripheral interface.
CO 4.	Program 8255 in appropriate mode and interface devices.
CO 5.	Develop programs for simple microcontroller based applications.

Software Part (20 Hours)

1. Write an ALP to find the frequency of occurrence of a key element in a list of N numbers. The key element is stored in memory location 30H.The total number of elements (N) in a list is stored in a memory location 31H and the numbers are stored in consecutive memory locations from 30 to H. Store the results in register in r7.
2. Write an ALP to find smallest of 'n' numbers.
3. Write an ALP to implement decimal up/down counter. Display the count value on port P0.The mode (up/down) of the counter is set at port P1.0 (P1.0=1 up , P1.0=0 down).
4. Write an ALP to read the 10 numbers from the port P1 and store them in to RAM from location 30h.Availability of each numbers is indicated by setting the bit P20.Count the number of elements which are greater than 0fh and display the count values on port P0.
5. Write an ALP to transfer the string stored in external RAM from the location 300h to internal RAM location 30h.
6. Write an ALP to sort number in ascending order.
7. Write a 8051 C program to generate triangular wave.
8. Write an 8051 C program to generate full staircase wave with n number of steps.
9. Write an ALP to compare the list of numbers where one list is available in ROM that is in port 1 space and another is available in RAM. If they are equal send ee to port 0 otherwise 00 to port 0.
10. Write an ALP to count number of zero's in a 8-bit number used from port-0.If number has even number of zero's send it to port-2 otherwise to port-1.

Hardware Part (10 Hours)

1. Write an assembly language program to implement single digit decimal counter using 7-segment display U16 seven-segment table

2. Write an assembly program to raise the interrupt on INT0 pin whenever INT0 interrupt is raised LED24 must glow (LED24 is connected with p1.5, recognize the interrupt on falling edge)
3. Write an ALP to rotate the stepper motor by 180 in clockwise direction
4. Write an ALP to test dc motor by varying off-time and on-time with different values user can observe different speed on dc motor typically the off values are 30,24,18 & 12 on values are 10,16,12 & 28
5. Write an ALP to test Traffic Light Simulator.

UCS457L	**DATABASE APPLICATION AND VISUALIZATION LAB**	**1-CREDITS**
Hours/Week: 03		**CIE MARKS: 50**
Exam Hours: 03		**SEE Marks: 50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	Create and maintain database using SQL.
CO 2.	Query the given database to generate reports.
CO 3.	Design and develop real time database applications.

PART – A

Design the Database for any one of the following Applications and implement the SQL Queries on designed database.

a. Banking System,
b. Employee Organization
c. Inventory Processing System
d. Library Management

1 Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) using CREATE, ALTER, DROP, INSERT statements

2 Implementing the queries for Insertion, Updation, Deletion operations. Use ROLL BACK, COMMIT & SAVE POINTS Concepts with INSERT, UPDATE, DELETE statements.

3 Queries (along with sub Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints.

4 Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING

5 Creation and dropping of Views.

6 Programs development using creation of procedures, passing parameters IN and OUT of PROCEDURES.

7 Program development using creation of stored functions, invoke functions in SQL Statements.

8 Develop programs using features parameters in a CURSOR, FOR UPDATE CURSOR, WHERE CURRENT of clause and CURSOR variables.

9 Develop Programs using BEFORE and AFTER Triggers.

PART – B

Develop **Mini Project** on any application

UHS001N	**FUNDAMENTALS OF QUANTITATIVE APTITUDE AND SOFT SKILLS**	**1-CREDIT**
Hrs/Week :02		**CIE Marks:50**
Total Hrs:13		**SEE Marks:50**

	Course Outcomes At the end of the course the student should be able to ,
CO 1.	Students are able to explain the range of multiplicative strategies when operating on whole numbers.
CO 2.	Students are able to divide large numbers, by using the rules of divisibility
CO3	Students are able to get the common multiples and common factors of three numbers
CO4	Find out the importance of critical thinking; identify the core skills associated with critical thinking.
CO5	Students are able to learn the importance of the skills for successful businesses and for building relationships by influencing interactions either positively or negatively.
CO6	Guide students in making appropriate and responsible decisions, to create a desire to fulfil individual goals and to educate students about unproductive thinking, self-defeating emotional impulses, and self-defeating behaviours

Unit I : Quantitative Aptitude **3 Hours**

Factors and Multiples – Unique Factors, Prime factors, Even factors, Odd factors, Sum of Factors and Product of Factors, Divisibility Rules – Divide the numbers using shortcuts and LCM & HCF – Prime factorization, Division method

Unit II : Verbal Ability **3 Hours**

Sentence Completion – Read the Sentence, hints, pluses and minuses, structure words, visualize, Para Jumbles – noun-pronoun relationship approach, Acronym approach, Impromptu Speaking – On your own, Speak in a group and Fill in the blanks (Grammar) – Delivery style, Question wording, Question blanks.

Unit III : Logical Reasoning **3 Hours**

Puzzles – Analytical Puzzles, Math Puzzles, Venn Diagrams – Basics of Set Theory, Operations of Sets and Problem Solving using Venn Diagrams, Binary Logic – Boolean Logics, Logic Gates.

Unit IV : Soft Skills **4 Hours**

Goal Setting – Types of Settings, SMART Goals, Failure of Goal Settings, Communication Skills – Process of Communication, Levels of Communication, Listening Skills – Steps of Listening, Importance of Listening and why people don't improve listening skills , SWOT Analysis – Strength, Weakness, Opportunity and Threat, Team Work – benefits of team work, effective team work, basic team dynamics and process of team work.

Text Book:

R.S.Aggarwal and Vikas Aggarwal, " Objective General English", S.Chand & Company Ltd.
R.S.Aggarwal " Quantitative Aptitude", S.Chand & Company Ltd.
R.S.Aggarwal " Verbal and Non Verbal Reasoning ", S.Chand & Company Ltd.
Shalini Aggarwal, "Essential Communication Skills", S.Chand & Company Ltd.

Basaveshwar Engineering College (Autonomous), Bagalkot

Department of Computer Science and Engineering (CSE)

Draft Scheme of Syllabus for B. E. (CSE) programme for 175 credits

Revised Scheme and Syllabus of teaching **(2018-19 Onwards Admitted Batches)**

(Effective from the academic year 2020-21)

Programme: B.E. COMPUTER SCIENCE AND ENGINEERING

V SEMESTER

Sl. No	Course and Course code	Course Title	Teaching Hours /Week			Examination				
			Theory	Tutorial	Practical	Credits	CIE Marks	SEE Marks	Total Marks	
			L	T	P					
1	UCS551C	Analysis & Design of Algorithms	3	2	0	4	50	50	100	
2	UCS552C	Finite Automata & Formal Languages	2	2	0	3	50	50	100	
3	UCS553C	Data Communications	3	2	0	4	50	50	100	
4	UCS554C	System Software	2	2	0	3	50	50	100	
5	UCS041E	Artificial Intelligence and Expert Systems	3	0	0	3	50	50	100	
6	UCS065E	Python Application Programming	3	0	0	3	50	50	100	
7	UCS555L	Operating Systems Lab	0	0	2	1	50	50	100	
8	UCS556L	System Software Lab	0	0	2	1	50	50	100	
9	UHS002N	Advanced Quantitative Aptitude and Soft Skills	0	2	0	1	50	50	100	
		TOTAL	**16**	**10**	**04**	**23**	**450**	**450**	**900**	

AICTE activity Points: In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

ANALYSIS AND DESIGN OF ALGORITHMS

Course Code:	UCS551C	CIE Marks	50
TeachingHours/Week (L:T:P)	(3:2:0)	SEE Marks	50
Credits	04	Hours	48

Course objectives: Analyze the asymptotic performance of algorithms.

- Have insight into the basics of various algorithmic design techniques.
- To develop proficiency in algorithmic approaches of Brute Force, Divide and Conquer, Decrease and conquer, Greedy and Dynamic programming.

UNIT -I (12 hours)

Introduction: Notion of Algorithm, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures.

Fundamentals of the Analysis of Algorithm Efficiency: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non-recursive and Recursive Algorithms, Example – Fibonacci Numbers.
Brute Force: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.

Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.L3 –Applying L4-Analysis

UNIT- II (12 hours)

Divide and Conquer: Mergesort, Quicksort, Binary Search, Binary tree traversals and related properties, Multiplication of large integers and Stressen's Matrix Multiplication.
Decrease and Conquer: Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial

Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.L3 –Applying L4-Analysis

UNIT- III (12 hours)

Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction **Space and Time Tradeoffs:** Sorting by Counting, Input Enhancement in String Matching , Hashing, B-Trees **Dynamic Programming:** Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, Optimal Binary Search Trees. The Knapsack Problem and Memory Functions.

Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.L3 –Applying L4-Analysis

UNIT- IV (12 hours)	
Greedy Technique: Prim's Algorithm,Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Limitations of Algorithm Power:** Lower-Bound Arguments, Decision Trees, Problems Coping with the Limitations of Algorithm Power: Backtracking, Branch-and-Bound,	
Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.L3 –Applying L4-Analysis

Course outcomes:

At the end of the course the student will be able to:

- CO1: Analyze the asymptotic performance of algorithms.
- CO2: Demonstrate a familiarity with major algorithms and data structures.
- CO3: Implement the algorithms to ascertain their working.
- CO4: Apply important algorithmic design paradigms and methods of analysis.
- CO5: Synthesize efficient algorithms in common engineering design situations.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to The Design & Analysis of Algorithms	AnanyLevitin	Pearson Education.	3rd Edition, 2017
Reference Books				
1	Introduction to Algorithms	Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest,	PHI	2nd Edition,
2	Computer Algorithms	Horowitz E., Sahni S., Rajasekaran S.,	Galgotia Publications	2001

Web links and Video Lectures:

1. https://nptel.ac.in/courses/106/106/106106131/
2. https://www.classcentral.com/course/swayam-design-and-analysis-of-algorithms-3984
3. VTU EDUSAT PROGRAMME – 20

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V

FINITE AUTOMATA AND FORMAL LANGUAGES

Course Code	UCS552C	CIE Marks	50
Teaching Hours/Week (L:T:P)	26 Teaching + 26 Tutorial (2:2:0)	SEE Marks	100
Credits	03	Hours	40

Course objectives:

- To have an insight into the basic principles of computation including automata, grammars and Turing machines
- To develop the proficiency in theoretical foundations of Computer Science.

UNIT -I (6 hours teaching + 6 hours tutorials)

Introduction To Theory of Computation: Three basic concepts; some applications. (2 Hours)
Finite Automata: Deterministic Finite Accepters; Nondeterministic Finite Accepters; Equivalence of deterministic and Nondeterministic Finite Accepters; Reduction of the number of states in Finite Automata. (4 Hours)

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying

UNIT- II (7 hours teaching + 7 hours tutorials)

Regular Languages and Regular Grammars: Regular expressions; Connection between Regular Expression and Regular Languages; Regular Grammars. (3 Hours)
Properties of Regular Languages: Closure Properties of Regular Languages; Elementary Questions about Regular Languages; Identifying Nonregular Languages. (4 Hours)

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying, L4: Analyzing

UNIT- III (6 hours teaching + 6 hours tutorials)

Context-Free Languages: Context-Free Grammars; Parsing and Ambiguity; (3 Hours)
Simplification of Context-Free Grammars and Normal Forms: Methods of Transforming Grammars; Two Important Normal Forms. (3 Hours)

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying, L4: Analyzing

UNIT- IV (7 hours teaching +7 hours tutorials)

Pushdown Automata: Nondeterministic Pushdown Automata; Pushdown Automata and Context-Free Languages; Deterministic Pushdown Automata and Deterministic Context-Free Languages. (4 Hours)
Turing Machines: The Standard Turing Machine Turing Machine with More Complex Storage: Multitape and Multidimensional Turing Machines (3 Hours)

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying, L4: Analyzing

Course outcomes:

At the end of the course the student will be able to:

1. Demonstrate a fundamental knowledge of the core concepts in automata theory and formal languages.
2. Prove the properties of languages, grammars and automata with formal mathematical methods;
3. Analyze the closure properties of regular and context-free languages.
4. Design finite automata, pushdown automata, Turing machines for solving language pattern recognition problems.
5. Apply mathematical and formal techniques for solving problems in Computer Science.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Introduction to Formal Languages and Automata	Peter Linz	Jones and Bartlett Student Edition	6th Edition, 2016
Reference Books				
1	Introduction to Automata Theory, Languages, and Computation,	Hopcroft, Motwani, and Ullman	Pearson Education India	3rd Edition, 2014
2	Introduction to the Theory of Computation	Michael Sipser	Cengage Learning	3rd Edition, 2012
3	Theory of Computer Sciences	Korral	McGraw-Hill	11th Edition, 2010
4	Automata, Computability and Complexity: Theory and Applications	E Rich	Pearson Education India	1st Edition, 2012
5	Introduction to languages and the theory of computation.	Martin, John C	McGraw-Hill	4th Edition, 2013
6	Theory of Computer Science	K L P Mishra, N Chandrasekaran	PHI Learning Pvt. Ltd.	3rd Edition, 2012
7	Elements of the Theory of Computation	H. R. Lewis, C.H. Papadimitriou	Pearson Education, Asia	2nd Edition, 2001

Web links and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105196/
2. https://nptel.ac.in/courses/106/104/106104028/

3.http://nptel.vtu.ac.in/econtent/courses/CSE/CS44/index.php

B.E (COMPUTER SCIENCE AND ENGINEERING) Outcome Based Education (OBE) and Choice Based Credit System (CBCS) SEMESTER – V			
Data Communications			
Course Code	UCS553C	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:2:0)	SEE Marks	50
Credits	04	Hours	52

Course objectives:

1. Have insight into the fundamental concepts of Data Communication.
2. Develop proficiencyin Computer Networking concepts.

UNIT-I(13 hours)

Introduction: Data Communications; Networks; the Internet; Protocols and Standards.**Network Models:** Layered tasks; The OSI Model, Layers in the OSI model; TCP/IPProtocol Suite, Addressing.**Data and Signals:**Analog and digital signals; Periodic Analog Signals, Digital Signals, Transmission impairment; Data rate limits; Performance.

Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing

UNIT- II (13 hours)

Digital Transmission, Analog Transmission and Multiplexing: Digital-to-Digital conversion Analog-to-Digital conversion: PCM; Transmission modes, Digital - to - Analog conversion Analog - to - Analog conversion; Multiplexing.**Transmission Media:** Guided media, unguided media: Wireless.

Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing

UNIT- III (13 hours)

Error Detection and Correction: Introduction to Error Detection and Correction; Block Coding Linear Block Codes; Cyclic codes, Checksum.**Data Link Control:** Framing; Flow and Error control; Protocols; Noiseless channels; Noisy channels; HDLC; Point-to-point Protocol.

Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing

UNIT- IV (13 hours)

Multiple Accesses: Random Access; Controlled Access; Channelization.Ethernet: EEE standards; Standard Ethernet and changes in the standard; Fast Ethernet; Gigabit Ethernet.**Wireless LANs and Connection of LANs:** IEEE 802.11; Bluetooth. Connecting devices; Backbone Networks, Virtual LANs.

Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing

Course Outcomes:

At the end of the course the student will be able to:

CO1: Identifying various design parameters, and their influence on node/link utilization and performance.

CO2: Explain the concept of Data Communication and networks, layered architecture and their applications.

CO3: Apply the concepts of Digital Transmission, Analog Transmission and Multiplexing.

CO4: Analyze MAC layer protocols and LAN technologies

CO5: Evaluate data communication link considering elementary concepts of data link layer protocols for error detection and correction.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Communications and Networking.	Behrouz A. Forouzan	Tata McGraw-Hill	4th Edition, 2017
Reference Books				
1	Communication Networks - Fundamental Concepts and Key	Alberto Leon-Garcia and	Tata McGraw-Hill	2nd Edition,2004
2	Data and Computer Communication.	William Stallings	Pearson Education	8th Edition,2007
3	Computer Networks A	Larry L.	Elsevier	4th
4	Computer and Communication Networks	Nader F. Mir	Pearson Education	2nd Edition,2007

Web links and Video Lectures:

1. https://nptel.ac.in/courses/106/105/106105082/
2. http://www.nptelvideos.in/2012/11/data-communication.html
3. http://www.nptelvideos.com/course.php?id=399

<table>
<tr><td colspan="4" align="center">B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – V</td></tr>
<tr><td colspan="4" align="center">SYSTEM SOFTWARE</td></tr>
<tr><td>Course Code</td><td>UCS554C</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>TeachingHours/Week (L:T:P)</td><td>(2:2:0)</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Credits</td><td>03</td><td>Hours</td><td>40</td></tr>
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Course Learning objectives(CLO):

At the end of the course student will learn/understand/ think/experience/appreciate:

1. To have insight into types of system softwares, machine architectures, lex and yacc programming
2. To develop the proficiency in Design of assemblers, compilers loaders and linkers , macro processors

UNIT - I (10 hours)

Machine Architecture:
Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples, Traditional (CISC) Machines - VAX Architecture, RISC Machines - Ultra SP ARC Architecture.

Assemblers:
Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation, Machine Independent Assembler Features - Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking.

Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.

UNIT- II (10 hours)

Loaders And Linkers:
Basic Loader Functions - Design of an Absolute loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features - Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader, Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders.

Revised Bloom's Taxonomy Level	L_1 –Remembering,L_2 – Understanding.

UNIT- III (10 hours)
Macro Processor:
Basic Macro Processor Functions - Macro Definitions and Expansion, Macro Processor Algorithm and Data Structures, Machine-Independent Macro Processor Features -

Concatenation of Macro Parameters, Generation of Unique Labels, Conditional Macro Expansion, Keyword Macro Parameters, Macro Processor Design Options - Recursive Macro Expansion	
Lex And Yacc: The Simplest Lex Program, Recognizing Words with LEX, Grammars, Parser-Lexer Communication, A YACC Parser, The Rules Section, Running LEX and YACC, LEX and Hand- Written Lexers, Using LEX - Regular Expression, Examples of Regular Expressions, A Word Counting Program, Using YACC - Grammars, Recursive Rules, Shift/Reduce Parsing, What YACC Cannot Parse, A YACC Parser - The Definition Section, The Rules Section, Symbol Values and Actions, The LEXER, Compiling and Running a Simple Parser, Arithmetic Expressions and Ambiguity, Variables and Typed Tokens.	
Revised Bloom's Taxonomy Level	L_1 −Remembering,L_2 − Understanding.
UNIT- IV (10 hours)	
Compilers: Basic Compiler Function - Grammars, Lexical Analysis, Syntactic Analysis, Code Generation, Machine Dependent Compiler Features Intermediate Form of the Program. Machine-Dependent Code Optimization, Machine Independent Compiler Features - Structured Variables, Machine Independent Code Optimization, Storage Allocation, Block Structured Languages.	
Revised Bloom's Taxonomy Level	L_1 −Remembering,L_2 − Understanding.

Course outcomes:

At the end of the course the student will be able to:

CO1: List and define features/concepts of machine architectures and system softwares.
CO2: Explain characteristics/concepts/basic operations of machines architectures, system softwares and Lex and Yacc tools.
CO3: Write programs to implement simple assembler, loader, linker, macroprocessor, lexical analyzer and syntactic analyzer.
CO4: Compare and contrast types of software, machine architectures, system software and Lexical and syntactic analyzer.
CO5: Analyze, Design and implement system software for different architectures

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				

1	System Software – An Introduction to Systems Programming	Leyland.L.Beck	Pearson Education	3rd Edition, 2012
2	Lex and Yacc	John.R.Levine , Tony Mason and Doug Brown	O'Reilly, SPD.	1999
Reference Books				
1	System Programming and Operating Systems	D.M.Dhamdhere	TMH	2nd Edition, 1999

B.E (COMPUTER SCIENCE AND ENGINEERING) **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **SEMESTER – V**			
Operating Systems Lab			
Course Code	**UCS555L**	**CIE Marks**	**50**
TeachingHours/Week (L:T:P)	**2**	**SEE Marks**	**50**
Credits	**1**	**Hours**	**50**

Course objectives:

- To have insights into design and implementation of resource management policies of operating systems.
- To have proficiency in concurrent programming.

Week Number	Work to be done	
1	Implementation of scheduling policies	
2	Implementation of memory allocation techniques.	
3	Developing solutions for deadlock problems.	
4	Implementation of page replacement policies.	
5	Developing concurrent applications using processes(Petersons algorithm).	
6	Demonstration of synchronization using semaphores.	

SYSTEMS SOFTWARE LABORATORY

Sub Code	**:**	**UCS556L**	**Credits**	**:**	**1**
Hours/Week	**:**	**02**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**03**	**SEE Marks**	**:**	**50**

7	Implementation of Unix like shell commands.	
8	Developing concurrent applications using Threads.	

Course outcomes:

At the end of the course the student should be able

- Simulate and demonstrate different functionalities of operating system
- Implement Unix like Shell commands.
- Develop simple applications using concurrent programming.

i. Course learning Objectives:

At the end of the course student will learn/practice/think/experience/appreciate:

1. To have insight into Design and implement of system software using C or C++.
2. To have proficiency in Design and implementation of scanners using Lex tool And implementation of parser using Yacc tool.

ii. Course outcomes:

At the end of the semester student should be able to:

1. Implement the system software such as assembler, loader and linker etc using C or C++.
2. Design and write Lex program to implement lexical analyzer for given problem statement And Yacc program to implement parser for the given structure recognition
3. Modify the existing design of the algorithm of system softwares to enhance the efficiency.

Part I

1. Write a C program to implement pass one of two pass assembler.
2. Write a C program to implement absolute loader.
3. Write a C program to implement pass one of two pass macroprocessor.
4. Write a C program to implement pass two of two pass macroprocessor
5. Write a C program to generate a lexical analyzer to identify the C keywords
6. Design recursive descent parsers for parsing pascal read and write statements.

Part II

Design lexical analyzers using Lex tool to accomplish the following.

1. Design Lexical analyzer to count the no of occurrences of the words from a given text file.The program should accept the text file and list of words as input.
2. Design Lexical analyzer to count no of positive numbers and negative numbers from the input given.
3. Design Lexical analyzer to count number of printf and scanf statements and replace them by sprintf and sscanf respectively.
4. Design Lexical analyzer to count number of integers , float, double, char variable from C declaration statements
5. Design Lexical analyzer to count number of blank spaces lines, characters, words from a given text file.
6. Design Lexical analyzer to check whether a given simple arithmetic operation is valid or not. If valid print number of positive, negative, multiplication and division operators separately

Part III

Design parsers using Yacc tool to accomplish the following.

1. Design parser using Yacc tool to test the validity of a simple expression involving operators '+','-','/','*'.
2. Design parser using Yacc tool to evaluate the given arithmetic expression involving operators '+','-','/','*'.
3. Design parser using Yacc tool to recognize a valid variable which starts with a letter followed by any number of letters and digits.The length of the identifier should not exceed 15.
4. Design parser using Yacc tool to recognize the grammar a^n b where n>=10.
5. Design parser using Yacc tool to recognize the validity of nested if statements and also display the number of levels of nesting

Note:

Continuous Internal Evaluation (50 marks):

Marks are based on execution of assignments and lab internal test. The marks are distributed as below;
1. 30 marks for lab assignment execution.
2. 20 marks for lab internal test.

Semester End Examination (50 marks):

In semester end examination two questions will be given. One from Part-I and Part-III respectively.

B.E (COMPUTER SCIENCE AND ENGINEERING) **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **SEMESTER – VI**			
ARTIFICIAL INTELLIGNCE AND EXPERT SYSTEMS			
Course Code	UCS041E	CIE Marks	50
TeachingHours/Week (L:T:P)	40 Teaching (3:0:0)	SEE Marks	100
Credits	03	Hours	40

Course Objectives:

- To obtain a thorough knowledge of various knowledge representation schemes.
- To have an overview of various AI applications.
- To study various heuristic search algorithms
- To know about Expert system tools and applications.

Unit -1 (10 hours)

1. What is AI? The AI Problems, Underlying assumptions, AI technique, Level of the model, Criteria for success (1.1 to 1.5 from Rich and Knight) 4 Hours

2. Problems, problem spaces and search Problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search problems, additional problems (2.1 to 2.6 from Rich and Knight) 6 Hours

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding

UNIT- II (10 hours)

3. Knowledge representation issues Representation and mappings, approaches to knowledge representation, (4.1 to 4.2 from Rich and Knight), Syntax and semantics for Propositional logic (4.2 from D. W. Patterson)
4 Hours

4. Using predicate logic Representing simple facts in logic, representing instance and is-a relationships, computable functions and predicates, resolution, natural deduction (5.1 to 5.5 from Rich and Knight)
6 Hours

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying, L4: Analyzing

UNIT- III (10 hours)

5. Search and control strategies Introduction, Generate and Test, Hill Climbing, Simulated annealing, (3.1, 3.2 from Rich and Knight), Informed search, Searching And-Or graphs (9.5, 9.6 from D. W. Patterson)
5 Hours

6. Planning Overview, an example domain: The Blocks world, Components of a planning system, goal stack planning, non-linear planning using constraint posting,(13.1 to 13.5 from Rich and Knight) 5 Hours

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying, L4: Analyzing

UNIT- IV (10 hours)

7. Expert system architectures Introduction, Applications of Expert Systems, Roles of expert systems, Rule-based system architectures, Non-production system architectures, Dealing with uncertainty, Knowledge acquisition and validation, Knowledge system building tools, Expert System Shells, Case studies: MYCIN, RI (15.1 to 15.6 from D. W. Patterson)

Revised Bloom's Taxonomy Level	L1: Remembering, L2: Understanding, L3: Applying

Course outcomes:

At the end of the course, the students will be able to

1. Identify problems that are amenable to solution by AI methods and identify appropriate methods to solve a given problem.
2. Illustrate the representation of knowledge and inference for a variety of problems requiring machine intelligence.
3. Analyze various control strategies and solve problems using search techniques
4. Design intelligent systems for simple AI applications.
5. Demonstrate the knowledge of expert systems and intelligent planning.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar B. Nair	TMH Education (P) Ltd., New Delhi	3rd Edition, 2010
2	Artificial Intelligence and Expert Systems	Dan W. Patterson	PHI Learning (P) Ltd., New Delhi	2008
Reference Books				
1	Artificial Intelligence: A modern approach	Stuart Russell and Peter Norvig	Pearson,	3rd edition, 2016
2	Principles of Artificial Intelligence	Nilson N. J.	Springer Verlag,	1980
3	Introduction to Artificial Intelligence	Eugene Charniak and Drew McDermot	Addison-Wesley	1998
4	Introduction To Expert Systems	Peter Jackson	Pearson Education	3rd Edition, 2007
5	Artificial Intelligence	Deepak Khemani	Tata Mc Graw Hill Education	2013

6	Artificial Intelligence – Structures and Strategies for Complex Problem Solving	George F. Luger	Addison-Wesley	5th Edition, 2005.
7	Artificial Intelligence application programming	M. Tim Jones	Dreamtech Press	2nd Edition,2006
8	Introduction to Artificial Intelligence	RajendraAkerkar,	PHI Learning	2nd Edition,2014
9	Artificial Intelligence	Saroj Kaushik	Cengage Learning India Pvt Ltd	2011

Web links and Video Lectures:

1. https://nptel.ac.in/courses/106105077/ (NPTEL course coordinated by IIT Kharagpur)
2. https://www.mooc-list.com/course/introduction-artificial-intelligence-ai-coursera (by CourseEra)

<table>
<tr><td colspan="4">B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
ELECTIVE</td></tr>
<tr><td colspan="4">Python Application Programming</td></tr>
<tr><td>Course Code</td><td>UCS065E</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>TeachingHours/Week (L:T:P)</td><td>(3:0:0)</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Credits</td><td>03</td><td>Hours</td><td>40</td></tr>
<tr><td colspan="4">Course objectives:
1.To acquire programming skills in core Python.
2.To acquire Object Orientation Skills in Python
3.To develop the skill of designing Graphical user Interfaces and networking in Python
4.To develop the ability to write database applications in python
1. have insight into
2. Have proficiency in</td></tr>
<tr><td colspan="4">Unit -1 (10 hours)</td></tr>
<tr><td colspan="4">Datatypes in python:comments in python, Docstrings, How python sees variables, Datatypes in python, Sequences in python,Literals in python,Determing the data type of a variable, Identifiers and reserved words, Naming conventions in python
Operators in Python: Operator,operator precedence and associativity, Mathematical functions
Input and Output:Output statements, Input statements, Command Line arguments
Control Statements
Strings and Characters</td></tr>
<tr><td>Revised Bloom's Taxonomy Level</td><td colspan="3">L1- Remembering,L2- Understanding,L3-Apply,L4-Analyze</td></tr>
<tr><td colspan="4">UNIT- II (10 hours)</td></tr>
<tr><td colspan="4">Functions:Defining a function,calling a function, Returning Results from a function, Returning multiple values from a function,Formal and actual arguments,local and global variables,passing a group of elements to a function,recursive functions,the special variable __name__
Lists and tuples: lists,tuple
Dictionaries
Exceptions:exceptions,exception handling,types of exceptions,user defined exceptions
Files in python:files,types of files in python,opening a file,closing a file,working with text files containing strings,working with binary files,pickle in python</td></tr>
<tr><td>Revised Bloom's Taxonomy Level</td><td colspan="3">L1- Remembering,L2- Understanding,L3-Apply,L4-Analyze,L5-Evaluate</td></tr>
<tr><td colspan="4">UNIT- III (10 hours)</td></tr>
</table>

Regular Expressions in python **Object Orineted Programming:** Classes and Objects, Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism **Networking in python**	
Revised Bloom's Taxonomy Level	L1- Remembering,L2- Understanding,L3-Apply,L4-Analyze,L5-Evaluate
UNIT- IV (10 hours)	
Threads **Graphical user Interfaces** **How to work with Database**:How to use SQLite Manager to work with a database, How to use python to work with database	
Revised Bloom's Taxonomy Level	L1- Remembering,L2- Understanding,L3-Apply,L4-Analyze,L5-Evaluate,L6-Create

Course Outcomes:

At the end of the course, students are able to:

1. Explain syntax and semantics of different statements and functions in Python.
2. Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications.
3. Write simple applications using regular expressions, multiple threads.
4. Build simple database applications with GUI.
5. Analyze the given problem and select appropriate data types and modules to develop the solution.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Core Python Programming	Dr. R.Nageswawa Rao	Dreamtech press	2nd Edition 2018
Chapter Numbers:3,4,5,6,8,9,10,11,16,17,18,21,22,23,24				
2	Introduction to Python Programming	Gowrishankar S. Veena A.	CRC Press Taylor & Francis Group	1st Edition 2019
Chapter Number: **11**				
3	Python Programming	Michael Urban and Joel Murach	Mike Murach Elizabeth Drake	1st Edition,2016
Chapter Number: **17**				
Reference Books				
1.	Learning Python	B Nagesh Rao Python	Cyberplus Publication	1 edition 17 May 2017

2	Core Python Applications Programming	Wesley J. Chun	Pearson Education India,	Third Edition, 2015.
3	Python Programming for the Absolute Beginner	Michael Dawson	Delmar Cengage Learning	3rd edition (1 January 2010)
4	Python Programming using problem solving approach	Reema Thareja	Oxford university press,	1st Edition 2017
5	Python for Everybody: Exploring Data Using Python 3	Charles R. Severance	CreateSpace Independent Publishing Platform	1st Edition, 2016.

Web links and Video Lecture:

1. http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf
2. https://www.python.org/
3. https://www.pdfdrive.com/introduction-to-python-programming-d176341873.html
4. https://www.pdfdrive.com/python-programming-for-the-absolute-beginner-e34494394.html
5. https://edubookpdf.com/programming/murachs-python-programming.html
6. https://www.youtube.com/watch?v=rfscVS0vtbw
7. https://www.youtube.com/watch?v=vaysJAMDaZw
8. https://www.youtube.com/playlist?list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
9. https://www.youtube.com/playlist?list=PL6gx4Cwl9DGAcbMi1sH6oAMk4JHw91mC_

BASAVESHAWAR ENGINEERING COLLEGE [AUTONOMOUS] BAGALKOT Scheme of Teaching and Examination 2018 – 19 (Effective from the academic year 2020-21)											
Programme: B.E. **COMPUTER SCIENCE AND ENGINEERING**											
VI SEMESTER											
Sl. No	**Course and Course code**	**Course Title**	**Teaching Hours /Week**			**Examination**					
			Theory Lecture	**Tutorial**	**Practical**	**Credits**	**CIE Marks**	**SEE Marks**	**Total Marks**		
			L	**T**	**P**						
1	UCS651C	Computer Networks	2	2	0	3	50	50	100		
2	UCS652C	Computer Graphics & Visualization	2	2	0	3	50	50	100		
3	UCS653C	Software Engineering	2	2	0	3	50	50	100		
4		Elective II	3	0	0	3	50	50	100		
5		Open Elective II	3	0	0	3	50	50	100		
6	UCS654H	Management & Entrepreneurship	2	2	0	**3**	50	50	100		
7	UCS656L	Computer Graphics Lab	0	0	2	1	50	50	100		
8	UHS003N	Career planning and Professional Skills	-	2	-	1	50	50	100		
9	UCS657P	Mini-project	--	--	3	3	50	50	100		
10	--	Internship	To be carried out during the vacation/s of VI and VII semesters								
		TOTAL	**14**	**10**	**5**	**23**	**450**	**450**	**900**		
Open Elective –II											
Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 6 weeks during the vacation of VI and VII semesters . A University examination shall be conducted during VII semester and the prescribed credit shall be included in VII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree.											

Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements. **AICTE activity Points:** In case students fail to earn the prescribed activity Points, Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

B.E (COMPUTER SCIENCE AND ENGINEERING) **Outcome Based Education (OBE) and Choice Based Credit System (CBCS)** **SEMESTER – VI**			
COMPUTER NETWORKS			
Course Code	UCS651C	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	03	Hours	48
Course Objectives			
1. Have insight into the basic taxonomy and terminology of the computer networking area. 2. Develop proficiency in specific areas of networking such as the design and maintenance of individual networks.			
UNIT -I (12 hours)			
Network Layer: IPv4 Addresses, IPv6 Addresses. Internetworking, Packet format of IPv4 and IPv6, Transition from IPv4 to IPv6. Address Mapping, ICMP, Delivery, Forwarding, Unicast Routing Protocols.			
Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing		
UNIT- II (12 hours)			
Transport Layer: Process-to-Process Delivery, UDP, TCP, and SCTP. Data traffic, Congestion, Congestion Control, Two Examples, Quality of Service, Techniques to improve QoS, QoS in Switched			
Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing		
UNIT- III (12 hours)			
Application Layer: Name Space, Domain Name Space, Distribution of Name Space, DNS In The Internet, Resolution. DNS Messages. Remote Logging, Electronic Mail, File Transfer. Architecture of WWW, Web Documents, HTTP.			
Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing		
UNIT- IV (12 hours)			

Network Management and Security: Network Management System. Digitizing Audio and Video, Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Introduction to Cryptography, Symmetric-Key Cryptography, Asymmetric-key Cryptography.	
Revised Bloom's Taxonomy Level	L_1:Remembering, L_2:Understanding, L_3,:Applying, L_4: Analyzing

Course Outcomes

At the end of the course the student will be able to:

CO1: Explain the fundamental concepts of Computer Networks.
CO2: Analyze different network protocols.
CO3: Apply techniques for efficient handling of Computer Networks.
CO4: Formulate Routing and Congestion Control Algorithms.
CO5: Implement Application Layer and Network Security protocols.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Data Communications and Networking.	Behrouz A. Forouzan	Tata McGraw-Hill	4th Edition, 2017
Reference Books				
1	Computer Networking-A top-down approach featuring	James F. Kurose, Keith W. Ross	Pearson Education	3rd Edition, 2018
2	Data and Computer	William Stallings	Pearson Education	8th Edition, 2016
3	Computer Networks A Systems	Larry L. Peterson and Bruce S.	Elsevier	4th Edition, 2017
4	Communication Networks	Garcia Leon And Widjaja	Tata Mcgraw-Hill,.	15th Edition, 2019

Web links and Video Lectures:

1. http://nptel.vtu.ac.in/econtent/CSE.php
2. https://nptel.ac.in/courses/106/105/106105081/
3. https://nptel.ac.in/courses/106/106/106106091/
4. http://nptel.vtu.ac.in/econtent/courses/CSE/CS64/index.php

<table>
<tr><td colspan="4" align="center">B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI</td></tr>
<tr><td colspan="4" align="center">COMPUTER GRAPHICS AND VISUALIZATION</td></tr>
<tr><td>Course Code</td><td align="center">UCS652C</td><td>CIE Marks</td><td align="center">50</td></tr>
<tr><td>TeachingHours/Week (L:T:P)</td><td align="center">(2:2:0)</td><td>SEE Marks</td><td align="center">50</td></tr>
<tr><td>Credits</td><td align="center">03</td><td>Hours</td><td align="center">40</td></tr>
<tr><td colspan="4">Course objectives:
Have insight into concepts of computer graphics hardware architecture and its applications.
Have proficiency in 2D and 3D geometric transformations, visualization and interactive graphics applications using OpenGL API.</td></tr>
<tr><td colspan="4">UNIT -I (10 hours)</td></tr>
<tr><td colspan="4">Overview of Graphics Systems: Video Display Devices, Raster-Scan Displays, GraphicsWorkstations and Viewing Systems, Introduction to OpenGL, Graphics Output Primitives :Coordinate Reference Frames, Specifying A Two-Dimensional World-Coordinate Reference Frame in OpenGL, OpenGL Point Functions, OpenGL Line Functions, Line drawing algorithms:Bresenham's Line-Drawing Algorithm, OpenGL Curve Functions, Circle generating Algorithms: Midpoint Circle Algorithm, Fill-Area primitives, OpenGL Polygon Fill-Area Functions, OpenGL Vertex Arrays, Pixel-Array Primitives, OpenGL Pixel-Array Functions, Character Primitives, OpenGL Character Functions, OpenGL Display Lists, OpenGL Display-Window Reshape Function, Attributes of Graphics Primitives: OpenGL State Variables, Color and Grayscale, OpenGL Color Functions, OpenGL Point-Attribute Functions, OpenGL Line-Attribute Functions.</td></tr>
<tr><td>Revised Bloom's Taxonomy Level</td><td colspan="3">L1: Remembering L2: Understanding L3: Applying L4: Analysing</td></tr>
<tr><td colspan="4">UNIT- II (10 hours)</td></tr>
</table>

Interactive Input Methods and Graphical User Interfaces: Graphical Input Data, Logical Classification of Input Devices, Input Functions for Graphical Data, Interactive Picture-Construction Techniques, OpenGL Interactive Input-Device Functions , OpenGL Menu Functions, Designing a Graphical User Interface

Geometric Transformations-1: Basic Two-Dimensional Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two-Dimensional Composite Transformations, Other Two-Dimensional Transformations, Raster Methods for Geometric Transformations, OpenGL Raster Transformations, Transformations between Two-Dimensional Coordinate Systems.

Revised Bloom's Taxonomy Level	L1: Remembering L2: Understanding L3: Applying L4: AnalysingL5: Evaluating L6: Creating

UNIT- III (10 hours)

Geometric Transformations-2: Geometric Transformations in Three-Dimensional Space, Three-Dimensional Translation, Three-Dimensional Rotation, Three-Dimensional Scaling, Composite Three Dimensional Transformations, Other Three Dimensional Transformations, Transformations between Three Dimensional Coordinate Systems, Affine Tranformations, OpenGL Geometric Transformations Functions.

Two-Dimensional Viewing: The Two-Dimensional Viewing Pipeline, The clipping Window, Normalization and Viewport Transformations, OpenGL Two-Dimensional Viewing Functions, Clipping Algorithms, Two-Dimensional Point Clipping, Two-Dimensional Line Clipping: Cohen-Sutherland line Clipping, Polygon Fill-Area Clipping: Sutherlan-Hodgman Polygon Clipping, Curve Clipping, Text Clipping.

Revised Bloom's Taxonomy Level	L1: Remembering L2: Understanding L3: Applying L4: AnalysingL5: Evaluating L6: Creating

UNIT- IV (10 hours)

Viewing: Classical and Computer Viewing, Viewing with a Computer, Positioning of the Camera, Simple Projections, Projections in OpenGL, Hidden-Surface Removal, Interactive Mesh Displays, Parallel-Projection Matrices, Perspective-Projection Matrices, Projections and Shadows.

Shading: Light and Matter, Light Sources, The Phong Reflection Model, Computation of Vectors, Polygonal Shading, Approximation of a Sphere by Recursive Subdivision, Light Sources in OpenGL, Specification of Materials in OpenGL, Shading of the Sphere Model, Global Illumination.

Revised Bloom's Taxonomy Level	L1: Remembering L2: Understanding L3: Applying L4: AnalysingL5: Evaluating L6: Creating

Course outcomes:

At the end of the course the student will be able to:

- CO1: Explain fundamental concepts of computer graphics and visualization.
- CO2: Implement the graphics algorithms to draw geometric primitives.

- CO3: Develop an interactive 2D and 3D graphics applications.
- CO4: Illustrate the animations of graphics models using geometric transformation functions.
- CO5: Construct the graphical model with lighting and shading patterns.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Computer Graphics with OpenGL	Donald Hearn and Pauline	Pearson Education	3rd Edition ,2004
2	Interactive Computer Graphics A Top-Down Approach using OpenGL	Edward Angel	Addison-Wesley	5th Edition, 2008
Reference Books				
1	Computer Graphics using OpenGL	F.S.Hill Jr.	Pearson Education	2nd Edition, 2001
2	Computer Graphics	James D. Foley, Andries Van Dam, Steven K Feiner, John F.	Addison-wesley	1997

Web links and Video Lectures:

1. Manual - Computer Graphics: Programming approach using Open-GL, Dr. S.V. Saboji
2.https://nptel.ac.in/course.html
3. http://www.cse.iitm.ac.in/~vplab/computer_graphics.html
4. https://www.classcentral.com/course/edx-computer-graphics-548

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

SOFTWARE ENGINEERING

Course Code	**UCS653C**	CIE Marks	50
Teaching Hours /Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	03	Hours	52

Course objectives:

- To have insight in the core principles and practices of software engineering for systematic development of non-trivial software systems.
- To have proficiency in the design, development, validatation, testing and managingof the software systems for its overall efficiency.

UNIT -I (13 hours)

OVERVIEW: Introduction: FAQ's about software engineering, Professional and ethical responsibility. **Socio-Technical systems:** Emergent system properties; Systems engineering; Organizations, people and computer systems; Legacy systems.

CRITICAL SYSTEMS, SOFTWARE PROCESSES: Critical Systems: A simple safety-critical system; System dependability; Availability and reliability. **Software Processes**: Models, Process iteration, Process activities; The Rational Unified Process; Computer-Aided Software Engineering.

Revised Bloom's Taxonomy Level	$L_1 - Remembering, \quad L_2 - Understanding, L_4 - Analysing$

UNIT- II (13 hours)

REQUIREMENTS: Software Requirements: Functional and Non-functional requirements; User requirements; System requirements; The software requirements document. **Requirements Engineering Processes:** Feasibility studies; Requirements elicitation and analysis; Requirements validation; Requirements management.

SYSTEM MODELS: System Models: Context models; Behavioral models; Data models; Object models; Structured methods. **SOFTWARE DESIGN:** Architectural Design. System organization;

Revised Bloom's Taxonomy Level	$L_1 - Remembering,\ L_2 - Understanding,\ L_3 - Applying,\ L_4 - Analysing$

UNIT- III (13 hours)

OBJECT-ORIENTED DESIGN: An Object-Oriented design process; Design evolution.**DEVELOPMENT:** Rapid Software Development: Agile methods; Extreme programming; Rapid application development.

Software Evolution: Program evolution dynamics; Software maintenance; Evolution processes; Legacy system evolution.**VERIFICATION AND VALIDATION:** Verification and Validation: Planning; Software inspections; Automated static analysis; Verification and formal methods.

Revised Bloom's	$L_1 - Remembering,\ L_2 - Understanding,\ L_3 - Applying,\ L_4 - Analysing$

Taxonomy Level	
UNIT- IV (13 hours)	
SOFTWARE TESTING: System testing; Component testing; Test case design; Test automation. **PROJECT MANAGEMENT:** Project Management: Management activities; Project planning; Project scheduling; Risk management. **MANAGING PEOPLE:** Managing groups; The People Capability Maturity Model; **SOFTWARE COST ESTIMATION:** Productivity. **DESIGNING AND DOCUMENTING SOFTWARE ARCHITECTURE:** Architecture in the life cycle; designing the architecture; Forming the team structure; Creating a skeletal system.	
Revised Bloom's Taxonomy Level	$L_1 - Remembering,\ L_2 - Understanding,\ L_3 - Applying,\ L_4 - Analysing$

Course outcomes:

At the end of the course the student will be able to:

- CO1: Explain the existing concepts, models and techniques used in the software development.
- CO2: Write software requirement specification based on the formal specifications for software systems.
- CO3: Design and develop different components of the software product using standard models.
- CO4: Verify and validate the individual components and the whole software product using different testing tools.
- CO5: Demonstrate the management of people, project and software quality during the software development.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Software Engineering	Ian Somerville	Pearson Education	8th Edition, 2007
2	Software Architecture in Practice	Len Bass, Paul Clements, Rick Kazman	Pearson Education	2nd Edition, 2003
Reference Books				
1	Software Engineering: A Practitioners Approach	Roger S. Pressman	McGraw-Hill	6th /7th Edition, 2007
2	Software Engineering Theory and Practice	Shari Lawrence Pfleeger, Joanne M. Atlee	Pearson Education	3rd Edition, 2006
3	Software Engineering Principles and Practice	Waman S Jawadekar	Tata McGraw-Hill	1st Edition, 2004
4	Software Engineering	Ian Somerville	Pearson Education	10th Edition, 2018

Web links and Video Lectures:

1. http://nptel.ac.in/courses/106/101/106101061/
2. http://nptel.ac.in/courses/106/105/106105087/
3. http://nptel.ac.in/courses/106/105/106105182/
4. http://uml.org
5. VTU EDUSAT PROGRAMME

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

MANAGEMENT AND ENTREPRENEURSHIP

Course Code	**UCS654H**	CIE Marks	50
Teaching Hours /Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Hours	40

Course objectives:

- To have insight into the fundamentals of management and entrepreneurship that includes the different types, roles and functions played by the managers / entrepreneurs at different levels etc.
- To have proficiency in managing the activities effectively and efficiently and to be a successful entrepreneur.

UNIT - I (10 hours)

Management: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as art or science, art or profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought - early management approaches - Modem management approaches

Planning: Nature, importance and purpose of planning process objectives - Types of plans (meaning only) - Decision making, Importance of planning - steps in planning & planning premises - Hierarchy of plans

Revised Bloom's Taxonomy Level	$L_1 - Remembering, L_2 - Understanding, L_3 - Applying, L_4 - Analysing$

UNIT- II (10 hours)

Organizing and staffing: Nature and purpose of organization, Principles of organization – Typesof organization-Departmentation Committees-Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE Nature and importance of staffing-- :Process of Selection & Recruitment **Directing:** Meaning and nature of directing Leadership styles, Motivation, Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of coordination.	
Revised Bloom's Taxonomy Level	$L_1 - Remembering, L_2 - Understanding, L_3 - Applying, L_4 - Analysing$
UNIT- III (10 hours)	
Entrepreneur: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. **Concept of Entrepreneurship** - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development. Entrepreneurship in India; Entrepreneurship - its Barriers **Industrial ownership:** Definition and meaning of Partnership, Characteristics of Partnership, Kinds of Partners, Partnership Agreement or Partnership Deed, Registration of Partnership Firm, Rights, Duties and Liabilities of Partners, Advantages and Disadvantages of Partnership, Sole proprietorship, Features, Scope Advantages and Disadvantages of Sole Proprietorship	
Revised Bloom's Taxonomy Level	$L_1 - Remembering, L_2 - Understanding, L_3 - Applying, L_4 - Analysing$
UNIT- IV (10 hours)	
Small scale industries: Definition; Characteristics; Need and rationale; Objectives; Scope; roleof SSI in Economic Development. Advantages of SSI, Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans **Impact of Liberalization, Privatization, Globalization on SSI:** Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry Institutional support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC SingleWindow Agency; SISI; NSIC; SIDBI; KSFC	
Revised Bloom's Taxonomy Level	$L_1 - Remembering, L_2 - Understanding, L_3 - Applying, L_4 - Analysing$

Course outcomes:
At the end of the course the student will be able to:

- CO1. Explain the different levels of management along with the different types of managers, their roles and functions etc.
- CO2. Plan and organize the activities required to complete the project.
- CO3. Create, motivate and manage groups/committees to carry out the assigned tasks.
- CO4. Explain the fundamentals of entrepreneurship and its development process.
- CO5. Establish Small Scale Industries using various types of supporting agencies and financing available for an entrepreneur.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1.	Principles of Management	P. C. Tripathi, P.N. Reddy	Tata McGraw Hill	5th Edition, 2012
2.	Dynamics of Entrepreneurial Development & Management	Vasant Desai	Himalaya PublishingHouse	4th Edition, 2001
Reference Books				
1.	Management Fundamentals - Concepts, Application, Skill Development	Robert Lusier	*Thomson*/South-Western	5th Edition, 2012
2.	Entrepreneurship Development	S. S. Khanka	S. Chand & Co. New Delhi.	1st Revised Edition, 1999
3.	Management	Stephen Robbins	Pearson Education/PHI	17th Edition, 2003

Web links and Video Lectures:

6. https://nptel.ac.in/courses/110/106/110106145/
7. https://nptel.ac.in/courses/110/105/110105146/
8. https://nptel.ac.in/courses/110/105/110105147/
9. https://nptel.ac.in/courses/110/106/110106141/
10. https://nptel.ac.in/courses/110/106/110106134/

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – VI

COMPUTER GRAPHICS LABORATORY

Course Code	**UCS655L**	CIE Marks	50
TeachingHours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	1	Hours/week	2

Course objectives:

- Have insight into graphics application andalgorithmic development of graphical images and pictures.
- Have proficiency in developing graphics software for real time applications.

Part-A

1. Write OpenGL program to implement Bresenham's line drawing algorithm.
2. Write OpenGL program to implement midpoint circle drawing algorithm.
3. Implement OpenGL program to draw bar chart and pie chart.
4. Write the following interactive OpenGL program
   i) Draw a house using mouse to select two end point positions for straight line

   ii) Display string "WEL TO BEC" on display window accepted from keyboard

5. Implement interactive animation programs.
   - Kite flying
   - Rotating wheel
   - Moving car
6. Program to recursively subdivide a triangle to form 2D Sierpinski gasket. The number of recursive steps is to be specified by the user.
7. Program to draw a cube and spin it using OpenGL transformation matrices.
8. Program to create a house like figure and rotate it about a given fixed point using OpenGL functions.
9. Program to implement the Cohen- Sutherland line-clipping algorithm.
10. Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral

Part- B

Develop a suitable graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

Revised Bloom's Taxonomy Level	L3: Applying L4: AnalysingL5: Evaluating L6: Creating

Course outcomes:

At the end of the course the student will be able to:

- CO1: Draw the basic geometrical using OpenGL built in functions
- CO2: Execute the program to implement fundamental graphics algorithms
- CO3: Develop the programs to create animation of objects using graphics functions and Develop graphics applications using OpenGL programming tool.

MINI PROJECT

Sub Code	**:**	**UCS656P**	**Credits**	**:**	**03**
Hours/Week	**:**	**03**	**CIE Marks**	**:**	**50**
Total Hours	**:**	**-**	**SEE Marks**	**:**	**50**

Course objectives:

- Have insight into current state of art and trends in their area of interest and problem defined.
- To have proficiency in design , implementation of different components using appropriate tools

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students. The mentor shall monitor progress of the student/s continuously. The student/s is/are required topresent the progress of the Mini Project work during the semester as per the scheduleprovided by the Department Project Coordinator.

COURSE OUTCOMES

After completion of the Mini Project the student is able to

CO1 Develop the ability to solve real life problems related to software development.
CO2 Identify the issues and challenges in the domain.
CO3 Apply the knowledge and techniques learnt in theoretical classes.
CO4 Explain the deeper understanding in specific functional areas of the real problems.
CO5 Explore career opportunities in their areas of interest.

CIE for Mini-Project:

(i) **Single discipline**: The CIE marks shall be awarded by a committee consisting of the Head of the Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) **Interdisciplinary**: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Mini-Project:

(i) **Single discipline**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department.
(ii) **Interdisciplinary**: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

Scheme of Evaluation for Mini Project

Sl.No.	Course Component	CIE Evaluation (Max. 50 Marks)	SEE Evaluation (Max. 50 Marks)
1	Mini Project	Respective Guide (Project Report, Project Presentation Skill, Interaction in the ratio of 50:25:25)	(Project Evaluation: 30 Marks and Presentation : 20 Marks) Conducted by Departmental Committee consisting of 1. HOD/Nominee 2. Project Coordinator/Guide 3. Examiner
Total Marks			**100**

<u>Rubrics for CIE Evaluation</u>

The following percentage of weightage is assigned to the student based on the performance in the CIE Evaluation

Sl.No.	Performance	Percentage of Weightage
1	Excellent	91 to 100
2	Very Good	81 to 90
3	Good	71 to 80
4	Moderate	61 to 70
5	Poor	40 to 60

B. V. V. Sangha's

Basaveshwar Engineering College (Autonomous), Bagalkot
Department of Computer Science and Engineering

Draft Scheme of Syllabus for B. E. (CSE) programme for 200 credits

Scheme of Syllabus for 7th Semester
(2015-2016 to 2017-2018 Admitted Batches)

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	*SEE	Total
			L	T	P				
1	UCS711C	Object Oriented Modeling and Design	3	0	0	3	50	50	100
2	UCS712C	Web Technologies	3	0	0	3	50	50	100
3	UCS713H	Business communication & Technical Writing	3	0	0	3	50	50	100
	UCS718C	Mobile Computing Systems	3	0	0	3			
4	UCS003E	Cryptography and Network Security	3	0	0	3	50	50	100
5	UCS066E	Internet of Things	3	0	0	3	50	50	100
7	UCS724L	Web Programming Laboratory	0	0	3	1.5	50	50	100
8	UCS725L	Object Oriented Modeling and Design Laboratory	0	0	3	1.5	50	50	100
9	UCS716P	Project Phase-I	0	0	4	4	50	50	100
Total			**18**	**0**	**8**	**25**	**450**	**450**	**900**

L: Lecturer Hours per Week **T: Tutorial hours per week**
P: Practical Hours per Week **C: Credit points**
***CIE: Continuous Internal Evaluation** ***SEE: Semester End Examination**

OBJECT ORIENTED MODELING AND DESIGN

Sub Code	**:**	**UCS711C**	**Credits**	**:**	**03**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

Course Outcomes:

At the end of the course the student should be able to

1. Explain the concepts of Object Oriented Modeling and Design.
2. Analyze user requirements for an application.
3. Design various models using Unified Modeling Language.
4. Comprehend the nature of design patterns by understanding small number of examples from different categories.
5. Develop an application of Object Oriented Modeling and Design practices from software project management perspectives.

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UNIT – I (10 Hours)

INTRODUCTION, MODELING CONCEPTS, CLASS MODELING: What is Object Orientation? What is OO development? OO themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design Technique: Modeling; abstraction; The three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.

ADVANCED CLASS MODELING, STATE MODELING: Advanced object and class concepts; Association ends; N-ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips.State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips.

UNIT – II (10 Hours)

ADVANCED STATE MODELING, INTERACTION MODELING: Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. Interaction Modeling: Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models.

PROCESS OVERVIEW, SYSTEM CONCEPTION, DOMAIN ANALYSIS: Process Overview: Development stages; Development life cycle. System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement. Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis.

UNIT – III (10 Hours)

APPLICATION ANALYSIS, SYSTEM DESIGN: Application Analysis: Application interaction model; Application class model; Application state model; Adding operations. Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example.

CLASS DESIGN, IMPLEMENTATION MODELING, LEGACY SYSTEMS: Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. Implementation Modeling: Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. Legacy Systems: Reverse engineering; Building the class models; Building the interaction model; Building the state model; Reverse engineering tips; Wrapping; Maintenance.

UNIT – IV (10 Hours)

DESIGN PATTERNS – 1: What is a pattern and what makes a pattern? Pattern categories; Relationships between patterns; Pattern description.

Communication Patterns: Forwarder-Receiver; Client-Dispatcher-Server; Publisher-Subscriber.

DESIGN PATTERNS – 2, IDIOMS: Management Patterns: Command processor; View handler. Idioms: Introduction; What can idioms provide? Idioms and style; Where to find idioms; Counted Pointer example.

TEXT BOOKS:

1. **Object-Oriented Modeling and Design with UML** – Michael Blaha, James Rumbaugh, 2nd Edition, Pearson Education, 2005.
2. **Pattern-Oriented Software Architecture: A System of Patterns - Volume 1**– Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, John Wiley and Sons, 2006.

REFERENCE BOOKS:

1. **Object-Oriented Analysis and Design with Applications** – Grady Booch et al, 3rd Edition, Pearson Education, 2007.
2. **Object-Oriented Design with UML and JAVA** – K. Barclay, J. Savage, Elsevier, 2008.
3. **The Unified Modeling Language User Guide** – Booch, G., Rumbaugh, J., and Jacobson I, 2nd Edition, Pearson, 2005.
4. **Design Patterns: Elements of Reusable Object-Oriented Software** – E. Gamma, R. Helm, R. Johnson, J. Vlissides, Addison-Wesley, 1995.

WEB TECHNOLOGIES

Sub Code	**:**	**UCS712C**	**Credits**	**:**	**03**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

Course Outcome:

1. Understand the basic concepts and tools used in web programming.
2. Apply web programming concepts to develop web pages.
3. Analyze the given requirement specification to develop any business applications.
4. Design and implement real time web applications.

UNIT-I (10 Hours)

Fundamentals of Web, XHTML : Internet, WWW, Web Browsers, and Web Servers; URLs; MIME; HTTP; Security; The Web Programmers Toolbox. XHTML: Origins and evolution of HTML and XHTML; Basic syntax; Standard XHTML document structure; Basic text markup. XHTML : Images; Hypertext Links; Lists; Tables; Forms; Frames; Syntactic differences between HTML and XHTML. CSS: Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; CSS: Font properties; List properties; Color; Alignment of text; The Box model; Background images; The <span> and <div> tags; Conflict resolution.

UNIT-II (10 Hours)

JAVASCRIPT: Overview of Javascript; Object orientation and Javascript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errors in scripts; Examples. JAVASCRIPT AND HTML DOCUMENTS: The Javascript execution environment; The Document Object Model; Element access in Javascript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements; DYNAMIC DOCUMENTS WITH JAVASCRIPT: Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements;

UNIT-III (10 Hours)

XML: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; ASP.NET;JSP: Architecture of JSP Page, JSP Page life cycle, JSP elements, JSP expression language, Debugging with JSP Debug, JSP Tag extensions: elements of Tag extensions, Tag extension API, Classic tag Handlers, Simple tag Handlers, JSP Fragments, JSP Slandered tag library: Introducing JSTL, Working with the core Tag library, working with XML Tag, Working with SQL Tag library, Working with Function Tag library.

UNIT-IV (10 Hours)

EJB: EJB Fundamentals, Classifying EJB, Session Bean, Implementing Session Beans, message – Driven Bean, Implementing message Driven Bean, managing transactions in java EE applications, EJB Timer services, Implementing EJB Timer services.

Hibernate: Introduction to Hibernate, Architecture of Hibernate, Hibernate Query Language, Hibernate O/R Mapping, Example on Hibernate, Implementing O/R Mapping with Hibernate, Basics of Jquery, Traversing DOM, DOM manipulation with Jquery.

Text Books:

1. Programming the World Wide Web – Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
2. “Java Server Programming Java EE5” Black Book, Dreamtech Press.
3. Jack Franklin “Beginning Jquery” Apress.
4. References:
5. Andrew Trolsen, 2007, ―C# and the .NET platform”, Second Edition, Dream tech Press,
6. M. Deitel, P.J. Deitel, A. B. Goldberg, ―2004, India Internet & World Wide Web How to program ―, 3rd Edition, Pearson Education / PHI
7. Chris Bates, 2006, ―Web Programming Building Internet Applications‖,3rd edition, Wiley India
8. Xue Bai et al, Thomson, 2003,‖The Web Warrior Guide to Web Programming”

BUSINESS COMMUNICATION AND TECHNICAL WRITING

Sub Code	**:**	**UCS713H**	**Credits**	**:**	**03**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

Course learning Objectives:

At the end of the course student will learn/practice/ think/experience/appreciate:
1. Design and implement of system softwares using C or C++.
2. Design and implement of scanners using Lex tool.
3. Design and implement of parser using Yacc tool.

Course outcomes:

At the end of the semester student should be able to:
1. Implement the system softwares such as assembler, loader and linker etc using C or C++.
2. Design and write Lex program to implement lexical analyzer for given problem statement.
3. Design and write Yacc program to implement parser for the given structure recognition.
4. Modify the existing design of the algorithm of system softwares to enhance the efficiency.

UNIT I (10 Hours)

Communication In The Workplace Role of Communication in Business, characteristics of communication, elements and Process of Communication, principles of communication, Objectives of Communications, Methods of Communication (verbal and Non-Verbal), Media and Mode of Communication, Channels of Communication, Barriers to communication, Exercises.

UNIT II (10 Hours)

Writing For The Effect:
Business Etiquette and need for effect, Conversational Style, You view, Point, Positive, Language, Courtesy
Listening:

Introduction, meaning of listening, poor listening habits, types of listening, Effective and ineffective listening skills, Strategies for effective listening, payoffs of effective listening, barriers of effective listening, active and passive listening, role of listening in Leadership style.

Business Presentation and Public Speaking:

Presentations and Speeches, Exercises

UNIT III (10 Hours)

Constituents of Effective writing:

Sentence Construction, Paragraph development, The art of condensation, Exercises

Written forms of communication:

Letters: Business letters, memos, Emails, Reports: Objectives, Characteristics of a report, Types of reports, importance of reports, Formats, Prewriting, Structure of reports, Writing the reports, Revising, editing and proof reading. Exercises

Technical proposals: Definition, Purposes, types, Characteristics, Elements of structure, Evaluation, Exercises

UNIT IV (10 Hours)

Research paper, Dissertation and Thesis

Instruction manuals and technical description: Instruction manuals, types of instructions, Writing instructions, user's manuals, Technical description, Process description, Exercises.

Text Books:

1. Urmila Rai nad S,M Rai ,Business Communication, Himalaya Publishing House.(chapters 1-7)
2. Lesikar and Fatley , Basics Business communication Skills for Empowering the Internet Generation 10 th edition, Tata McGraw Hill edition,ISBN: 780070599758.(Chapter 4)
3. Meenakshi Raman and Sangeeta Sharma "Technical Communication Principles and practices", Oxford University Press, ISBN13 9780195668049. (Chapters: 9-11, 13-17)
4. Meenakshi Raman and Prakash Singh "Business Communication", Oxford University Press, ISBN13: 9780195676952. (Chapter s 3-4)

MOBILE COMPUTING SYSTEMS

Sub Code	**:**	**UCS718C**	**Credits**	**:**	**03**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

COURSE OBJECTIVES AND OUTCOMES

Student should able to

1. Identify the GSM, GPRS and Bluetooth software model for mobile computing.
2. Explain the principles and theories of mobile computing technologies.
3. Analyze the characteristics and limitations of mobile hardware devices including their user-interface modalities.
4. Analyze security, energy efficiency, mobility, scalability, and their unique characteristics in wireless networks.
5. Apply knowledge of TCP/IP extensions for mobile and wireless networking.

UNIT – I (10 Hours)

Introduction :PCS Architecture, Cellular Telephony, cordless telehony and Low-ties PCS. Mobility management: Handoff, Rooming management. Rooming management under SS7. GSM system overview: GSM Architecture, Location tracking and call set up, Data services, GSM mobility managenent : GSM Location update , Mobility databases, Failure Restoration, VLR Identification algorithm, VRL Overflow control.

UNIT – II (10 Hours)

General packet radio services (GPRS): GPRS functional Groups, Architecture, GPRS network nodes, GPRS interfaces, GPRS procedures, Billing , Wireless application Protocol (WAP): WAP Gateway, WAP protocols, WAP UAprof and caching. Third Generation mobile services: W-CDMA and CDMA 2000. Improvements on core network, QoS in 3G, Wireless OS for 3G Handset, Third generation systems.

UNIT – III (10 Hours)

Cellular communication : In 3G, 3.5G, 4G. Wireless Networks: WLAN standards , Bluetouth, Hiper LAN, Wimax, Logical Mobility : Migrating processes, Physical mobility: Requirements for physical Mobility, Overview of IP4 and IPV6 , Mobile IP, Cellular IP, TCP for mobility, mobile data bases, Mobile handheld devices: Characteristics of PDAS, Palm OS, Windows CE, Nokia handhelds, Symbian OS.

UNIT – IV (10 Hours)

Mobile Internet and Wireless Web: Web programming model, WAP programming model, WAP protocol stack, WAP gateway, Mobile Agents, Characterstics of mobile agents, Requirements for mobile agent systems, Mobile agents plateforms : Aglet ,Aglet Tcl, PMADE, security issuess in mobile

Computing: Security threats to wireless networks, IEEE 802.11 security through WEP.

TEXTBOOKS:

1. Yi-Bing Lin, Imrich chlamtac "Wireless and mobile network architectures" Wiley
2. Kumkum harg "Mobile computing : Theory & Practice" pearson Education India.

REFERENCES:

1. Dr. Ashok Talukder, Ms Roopa Yavagal, Mr. Hasan Ahmed: " Mobile Computing, Technology, Applications and Service Creation" 2d Edition, Tata McGraw Hill, 2010
2. Martyn Mallik: "Mobile and Wireless Design Essentials" Wiley, 2003
3. Raj kamal: Mobile Computing, Oxford University Press, 2007.
4. Iti Saha Misra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

Internet of Things

Sub Code	**:**	**UCS066E**	**Credits**	**:**	**3**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

Course outcomes

Having learnt this course learner should be able to

1. Interpret the impact and challenges posed by IoT networks leading to new architectural models.
2. Compare and contrast the deployment of smart objects and the technologies to connect them to network.
3. Appraise the role of IoT protocols for efficient network communication. Elaborate the need for Data Analytics and Security in IoT.
4. Illustrate different sensor technologies for sensing real world entities and identify the applications of IoT in Industry.
5. Elaborate the need for Data Analytics and Security in IoT.

UNIT-I (10-Hours)

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack. Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

UNIT-II(10-Hours)

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods. Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics.

UNIT-III(10-Hours)

Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices an d Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment IoT Physical Devices and

Endpoints - Arduino UNO: Introduction to Arduino, Arduino UNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout.

UNI- IV(10-Hours)

Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connec
ting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

Text Books:

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete,Robert Barton, Jerome Henry, **"IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things",** Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN:978-9386873743)
2. Srinivasa K G, **"Internet of Things"**,CENGAGE Leaning India, 2017

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014. (ISBN:978-8173719547)
2. Raj Kamal, "Internet of Things: Architecture and Design Principles",1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224)

UCS003E **CRYPTOGRAPHY AND NETWORK SECURITY** **CREDITS: 3**

Hours/Week : 03 **CIE Marks: 50**
Total Hours:40 **SEE Marks: 50**

Course outcomes

At the end of the course, the students will be able to

1. Identity and analyze the existing security vulnerabilities, services and mechanisms in a computer network and develop a security model to prevent, detect and recover from the attacks.
2. Illustrate the basic concept of encryption and decryption for secure data transmission and apply them
3. Analyze and compare various cryptography techniques, authentication and key management protocols
4. Explain the services and mechanisms employed at the different layers of the OSI to provide security.
5. Evaluate the existing computing systems and propose new strategies to secure data communication.

UNIT- I **10 Hours**

Symmetric Ciphers: Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Cipher and the Data Encryption Standard: Simplified DES, Block Cipher Principles.

UNIT- II **10 Hours**

The Data Encryption Standard: The Strength of DES, Differential and Linear Cryptanalysis. Symmetric Ciphers: Triple DES, Blowfish. Confidentiality Using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation. Public-Key Encryption, Digital signatures and Authentication Protocols: Number Theory: Prime Numbers, Format's and Euler's Theorems, Testing for Primality. Public-Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange.

UNIT- III **10 Hours**

Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MDS Message Digest Algorithm. Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standard. Network

Security**:** Authentication Applications: Kerberos, XS09 Directory Authentication Service. Electronic Mail Security: Pretty Good Privacy.

UNIT -IV **10 Hours**

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload. Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Text book:

1. William Stallings, Cryptography and Network Security, $3^{rd}/4^{th}$ Edition, PHI Publications.

References:

1. Michael E. Whitman and Herbert J. Mattord, “Principles of Information Security”, 2^{nd} Edition, Thomson, 2005
2. William Stallings, “Network Security Essentials Applications and Standards”, Pearson Education, 2000.
3. Behrouz A. Forouzan: “Cryptography and Network Security”, Tata McGraw-Hill, 2007

WEB PROGRAMMING LABORATORY

Sub Code	**:**	**UCS724L**	**Credits**	**:**	**1.5**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**03**	**SEE Marks**	**:**	**50**

Course Outcome:

1. Implement static web pages using basic concepts of web programming
2. Implement dynamic web pages using basic concepts of web programming
3. Demonstrate 2-tier dynamic web pages using mysql and jstl,jsp
4. Design and implement real time web applications.

LAB ASSIGNMENT LIST

1. Develop a XHTML document to create bio-data using external style sheet, ordered list, table, borders, padding, color and the <span> tag.

2. A) Develop a XHTML file that includes JavaScript for the following problems: Input: percentage marks of the student Output: Display result.

   B) Develop and demonstrate, using JavaScript, a XHTML document that collects the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two digits followed by two upper-case characters followed by three digits; no embedded spaces allowed) of the user. Event handler must be included for the form element that collects this information to validate the input. Messages in the alert dialog box must be produced when errors are detected.

3. Write a XHTML form for Employee information like Emp_id, Name, Department Name, Phone, Email check the validation for each fields(the first character of Emp_id is followed by number ,name should accept 20 characters, Phone max 8 digits, email) using event handler in JavaScript.

4. Develop and demonstrate, using JavaScript, a XHTML document that contains three short paragraphs of text, stacked on top of each other, with only enough of each showing so that the mouse cursor can be placed over some part of them. When the cursor is placed over the exposed part of any paragraph, it should rise to the top to become completely visible.

5. Develop and demonstrate, using JavaScript, a XHTML that changes the content of XHTML elements by assisting to a user filling out a form associated with text area, called a help box. The content of help box can change, depending on the placement of the mouse cursor. When a cursor is placed over particular input field, the help box can display advice on how field is to be filled.

6. Write an XML file which will display the student information whichincludes the following**:**
    a. USN
    b. Name of student
    c. Banch
    d. CGPA

   Make up sample data for 3 students. Write a Document Type Definition (DTD) to validate the above XML file. Display the XML file as follows. The contents should be displayed in a table. Use XML and CSS for the above purpose.

7. Write program using XSLT and XML for displaying student details based on ranking of CGPA

8. Create a XHTML document which allows user to select the course. Once user selects course, it should display course id,course name,course description information using jsp and javabean.

9. Create a form with Name, USN, three test marks text fields. On submitting, store the values in database table along with total marks scored. Retrieve and display the database (Using Java Server Program). . Event handler must be included for the form element that collects every information to validate the input. Messages in the alert dialog box must be produced when errors are detected.

10. Write dynamic XHTML document to list student names from database and search for a particular student details using JSP.

11. Write a program to demonstrate EJB.

OBJECT ORIENTED MODELING AND DESIGN LABORATORY

Sub Code	**:**	**UCS725L**	**Credits**	**:**	**1.5**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**03**	**SEE Marks**	**:**	**50**

COURSE OBJECTIVES AND OUTCOMES

1. Design the models for real world applications using UML diagrams.
2. Implement the applications using JAVA programming language.
3. Trace the behavior and analyze how various scenarios play out.
4. Describe a set of object oriented concepts and language independent graphical notation that can be used to analyze problem requirements.
5. Use UML as communication and modeling tool.

ASSIGNMENTS

Analyze and design the following Systems with all specifications using the UML diagrams

3. Class Diagram ii) Usecase Diagram iii) Sequence diagram
4. State Chart Diagram v) Activity Diagram

Note: Make appropriate assumptions wherever required.

1. PASSPORT AUTOMATION SYSTEM PROBLEM STATEMENT:

Passport Automation System is used in the effective dispatch of passport to all of the applicants. This system adopts a comprehensive approach to minimize the manual work and schedule resources, time in a cogent manner. The core of the system is to get the online registration form (with details such as name, address etc.,) filled by the applicant whose testament is verified for its genuineness by the Passport Automation System with respect to the already existing information in the database. This forms the first and foremost step in the processing of passport application. After the first round of verification done by the system, the information is in turn forwarded to the regional administrator's (Ministry of External Affairs) office. The application is then processed manually based on the report given by the system, and any forfeiting identified can make the applicant liable to penalty as per the law. The system also provides the applicant the list of available dates for appointment to 'document verification' in the administrator's office, from which they can select one. The system forwards the necessary details to the police for its separate verification whose report is then presented to the administrator. The administrator will be provided with an option to display the current status of application to the applicant, which they can view in their online interface. After all the necessary criteria have been met, the original information is added to the database and the passport is sent to the applicant.

2. HOSPITAL MANAGEMENT SYSTEM PROBLEM STATEMENT:

In hospital, there are many departments like Orthopedic, Pathology, Emergency, Dental, Gynecology, Anesthetics, I.C.U., Blood Bank, Operation Theater, Laboratory, M.R.I., Neurology, Cardiology, Cancer Department, Corpse, etc. There is an OPD where patients come and get a card (that is, entry card of the patient) for check up from the concerned doctor. After making entry in the card, they go to the concerned doctor's room and the doctor checks up their ailments. According to the ailments, the doctor either prescribes medicine or admits the patient in the concerned department. The patient may choose either private or general room according to his/her need. But before getting admission in the hospital, the patient has to fullfill certain formalities of the hospital like room charges, etc. After the treatment is completed, the doctor discharges the patient. Before discharging from the hospital, the patient again has to complete certain formalities of the hospital like balance charges, test charges, operation charges (if any), blood charges, doctors' charges, etc. Next we talk about the doctors of the hospital. There are two types of the doctors in the hospital, namely, regular doctors and call on doctors. Regular doctors are those doctors who come to the hospital daily. Calls on doctors are those doctors who are called by the hospital if the concerned doctor is not available.

3. AIR TRANSPORTATION SYSTEM PROBLEM STATEMENT:

Consider the air transportation system. Many flights land and depart from city's airport. Some of the big cities may have more than one airports. Every flight belongs to specific airline. The planes may have many flights to different airports. Each plane is identified with serial number and model. There are specific pilots for each airline and they fly many flights. Each flight is identified by flight number and date on which flight is scheduled. The passenger reserves a seat for a flight. The seat is identified by a location.

4. RAILWAY MANAGEMENT SYSTEM PROBLEM STATEMENT:

Passengers can book their tickets for the train in which seats are available. For this, passenger has to provide the desired train number and the date for which ticket is to be booked. Before booking a ticket for a passenger, the validity of train number and booking date is checked. Once the train number and booking date are validated, it is checked whether the seat is available. If yes, the ticket is booked with confirm status and corresponding ticket ID is generated which is stored along with other details of the passenger. After all the available tickets are booked, certain numbers of tickets are booked with waiting status. If waiting lot is also finished, then tickets are not booked and a message of non-availability of seats is displayed. The ticket once booked can be cancelled at any time. For this, the passenger has to provide the ticket ID (the unique key). The ticket ID is searched and the corresponding record is deleted. With this, the first ticket with waiting status also gets confirmed.

5. BANK MANAGEMENT SYSTEM PROBLEM STATEMENT:

Bank has many branches, each of which has an address and a branch number. A customer opens accounts at a branch. Each account is uniquely identified by an account number, it has a balance and a credit or overdraft limit. There are many types of accounts including acurrent account and savings account. Bank provides services which include taking deposit from their customers, issuing current and savings account to the individuals and business. Extending loans to individuals and business, cashing cheque. Facilitating money Transactions such as withdraw and deposit.

6. HOTEL MANAGEMENT SYSTEM PROBLEM STATEMENT:

In the Hotel, booking for rooms is done through phone calls or through visit to the hotel booking office. The guest's personal details such as Name, Age, Nationality, and Duration of stay, are input during booking in. The booking office orders for preparation of the guest's room before his/ her check in date. The documents are transferred manually to the filling department for compilation of the guest's file. On the reporting date the file is transferred to the reception. On checking in the guest is given the key to his allocated room, he also specify if he needs room service. The receptionist hands over the guest's file to the accountant on the next table. Here the guest pays accommodation and meals fee. The guest's file is updated on daily basis of his expenditure costs. The accounts department generates the bills on daily basis and delivered to the guests in their rooms at dusk by the service maids. The guest pays at the accounts desk, where the receipts are generated. For a one meal customer the bill is generated immediately after ordering and he pays at the accountant desk before leaving. During checking out of guests, their expenditure outlines are generated a day before check out date. The guests receive their outlines at the accounts desk as they check out, where they pay for bills balances if any.

7. CINEMA THEATRE MANAGEMENT SYSTEM PROBLEM STATEMENT:

An administrator of theatre provides number of tickets to each theatre. Each ticket has ticket number, price. The Administrator manages the operations of the entire theatre. Each theatre has number of seats, theatre id, theatre name, theatre location and staff. Every seat has a seat id and seat name. Customer buys the tickets for a movie (which has details like movie id, movie name, release date, language, director and actor) from the ticket counter. Each movie has different shows which have been scheduled (showid, starttime, endtime) at particular times.

8. BOOK STALL MANAGEMENT SYSTEM PROBLEM STATEMENT:

The book shop contains different types of books of various subjects with various quality according to the customer's needs and requirement. The main thing of the book shop is to maintain lot of records for the daily transactions of the business. It is necessary for every business to maintain all following records which show the profit and loss of the business. Following are some of the inputs to the Book Shop.Book Details, Customer Details, Sales details, employee/Owner Details Following are some of the outputs of the Book Shop. Customer bill receipt, Sales report, Stock Report and customer report. Books are represented by, ISBN, Title, Author, Publisher, Edition, Year of Publication and Price. Customers will request books based on categories. Customers can buy books and receive the receipt from a shop employee/Owner. The store has records of number of copies of the books left in stock. Out of stock books cannot be purchased immediately, but can be ordered. Employee/Owner of the bookstore can give requisition for buying of books to publishers based on the amount of stock remaining. For each book the employee/owner maintains a stock which is at least the number of copies of the book sold over last 3 months. Books ordered by some customer are immediately requisitioned. Requisitions are recorded. The publishers inspect the requisition on the 1^{st} of every month and immediately supply the books.

9. SUPERMARKET ADMINISTRATION AND MANAGEMENT SYSTEM PROBLEM STATEMENT:

Our supermarket management system, a form of grocery store, is a self-service store offering a wide variety of food and household merchandise, organized into departments. We have updated Super Market management System Detailed products, it helps the store keeper to keep records of sold out and intake products details, advanced feature of bar-coding verifications and billing system to the customers. This system is based on the sales transaction of items in a supermarket. The first activity is based on adding the items to the system along with the rate which are present in the supermarket and the name of the items which the supermarket will agree to sell. This authority is given only to admin. Any modifications to be done in the item name or in the rate can be done only by admin. He also has the right to remove any item. As the customer buys the products and comes to the billing counter, the user is supposed to enter the item name he purchased and the quantity of the item he wanted to purchase. The system will display all the items whose name starts with the letter selected by the user. He can select out of those displayed. Finally a separate bill will be generated for each customer. Any periodic records can be viewed at any time. If the stock is not available; the supermarket orders and buys from a prescribed vendor.

10. LIBRARY MANAGEMENT SYSTEM PROBLEM STATEMENT:

The case study titled Library Management System is for the purpose of monitoring and controlling the transactions in a library. This case study gives us the complete information about the library and the daily transactions done in a Library. The following are the brief description on the functions achieved through this case study: End-Users: •Librarian: To maintain and update the records and also to cater the needs of the users. •Reader: Need books to read and also places various requests to the librarian. •Vendor: To provide and meet the requirement of the prescribed books. The following functionalities are required for library management system:

1. Maintain the record of new books and retrieve the details of books available in the library.
2. Adding new member, new books.
3. Searching books and members.
4. Issue of books:
    - A member should be able to issue books.
    - Each member can issue only a single book.
    - The Librarian will note the date of issue and calculates the date of return.
    - The due date for the return of the book is stamped on the book.
5. Return of books:
    - Any person can return the issued books {if they have the member code).
    - The due date is verified and fine is calculated if applicable.

PROJECT PHASE –I

Sub Code	**:**	**UCS716P**	**Credits**	**:**	**04**
Hours/Week	**:**	**4 hours**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**3 hours**	**SEE Marks**	**:**	**50**

Course Outcomes (COs):

At the end of the course, the students should be able to:

1. Review the current state of Art and trends in their area of interest and identify a suitable problem in their chosen subject domain with justification.
2. Survey the available research literature/documents for the tools and techniques to be used.
3. Examine the functional, non-functional, and performance requirements of their chosen problem definition.

Students are expected to submit the list of group members for the project work with consent of the guide. The students who are submitting the list without guide consent for them department will allocate guides. The Phase I include

1. Deciding the broad area for project work
2. Sufficient literature Survey (includes Research papers, technical reports, white papers, manuals and survey reports).
3. Identification of Issues and defining problem.
4. A report containing summary of survey made covering issues and problem definition with print outs of all literature documents.
5. Submission and presentation of term paper by project team.
6. A **term paper** is a research paper written by students over an academic term or semester which accounts for a large amount of a grade and makes up much of the course. Term papers are generally intended to describe an event or concept or argue a point. There is much overlap between the terms "research paper" and "term paper". The phrase "term paper" was originally used to describe a paper (usually a research based paper) that was due at the end of the "term" - either a semester or quarter, depending on which unit of measure a school used. Common usage has "term paper" and "research paper" as interchangeable, but this is not completely accurate. Not all term papers involve academic research, and not all research papers are term papers.

Project Phase I Evaluation:

Survey Report Evaluation : 50 Marks (By Guide)

Term Paper Evaluation : 50 Marks(By Departmental Project Evaluation Committee

(DPEC) including Guide)

B. V. V. Sangha's

Basaveshwar Engineering College (Autonomous), Bagalkot

Department of Computer Science and Engineering

Scheme of Syllabus for 8th Semester
(2015-2016 to 2017-2018 Admitted Batches)

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	*SEE	Total
			L	T	P				
1		elective – 8	3	0	0	3	50	50	100
2		elective – 9 elective – 10	3 3	0 0	0 0	3 3	50 50	50 50	100 100
3	UCS812P	Project Phase-II	0	5	10	15	50	50	100
4	UCS813S	Seminar	0	2	0	1	50	50	100
			9	**7**	**10**	**25**	**250**	**250**	**500**

L : Lecturer Hours per Week
T : Tutorial hours per week
P : Practical Hours per Week
C : Credit points
CIE : Continuous Internal Evaluation
SEE : Semester End Examination

UCS062E
CLOUD COMPUTING
3 CREDITS

Hours/Weeks: 03 **CIE Marks: 50**

Total Hours: 40 **SEE Marks: 50**

Course Outcome:

At the end of the course, the students will be able to

1. Understand the definition of cloud computing, its advantages, characteristics, challenges and platforms.
2. Describe cloud computing architecture, reference model, types of cloud, service models with respect to all service models etc.
3. Deploy cloud instances in Aneka cloud computing platform and threading programming of Aneka.
4. Analyze virtualization technology, Cloud Platforms in Industry and High Throughput and Data Intensive Computing, etc.
5. Evaluate the security related to multi-tenancy and appraise compliance issues that arise from cloud computing.

Unit-I(10 Hours)

Introduction: Cloud Computing at a Glance, Historical Development, Characteristics of Cloud Computing, Building Cloud Computing Environments, Computing Platforms and Technologies.

Cloud Computing Architecture: Introduction, Cloud Reference Model, Types of Clouds, Economics of Cloud, Open Challenges.

Unit- II(10 Hours)

Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Computing and Management.

Concurrent Computing: Thread Programming: Introducing Parallelism for Single Machine Computation, Programming Application with Threads, Multi Applications with Threads, Multithreading with Aneka, Programming Applications with Aneka Threads.

Unit- III(10 Hours)

Virtualization: Introduction and Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing. Pros and Cons of Virtualization, Technology Examples.

Cloud Platforms in Industry: Amazon Web Services, Google AppEngine, Microsoft Azure.

Cloud Applications: Scientific Applications, Business and Consumer Applications.

Unit- IV(10 Hours)

High Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming.

Data Intensive Computing: Map- Reduce Programming: What is Data-Intensive Computing? Technologies for Data-Intensive Computing, Aneka Map Reduce Programming.

Text Books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited.

Reference Book:

1. Cloud Computing by Barrie Sosinsky, Bible, Wiley India.
2. Cloud Computing by Kumar Saurabh, Second Edition, Wiley India.

Big Data Analytics

Sub Code	**:**	**UCS063E**	**Credits**	**:**	**3**
Hours/Week	**:**	**03**	**CIE MARKS**	**:**	**50**
Total Hours	**:**	**40**	**SEE Marks**	**:**	**50**

Course Outcomes:
At the end of the course, student should be able to:
1) List the concepts tools and technologies for big data analytics.
2) Explain the big data and analytics concepts and tools and technologies used for it.
3) Apply the MongoDB, Hive and Pig query language to solve the given problems.
4) Investigate the given real time scenario and use suitable techniques to extract insights from the data.
5) Design a solution for data analytics problems by combining two or more analytics and techniques to enhance the value of the enterprise by extracting knowledge from the big data.

Unit- I **10 Hours**

Types of digital data: Classification of digital data.
Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition and challenges of Big Data, Features and other Characteristics of Big Data, Reason for dealing with Big Data, Traditional Business Intelligence(BI) versus Big Data, A Typical Data Warehouse Environment, A Typical Hadoop Environment, Coexistence strategy, Changes in the Realms of Big Data.
Big data analytics: Transformation of data, Definition and Sudden Hype Around Big Data Analytics, Classification of Analytics, Challenges in Businesses, Top Challenges Facing Big Data, Importance of Big Data Analytics, Technologies to Meet the Challenges Posed by Big Data, Data Science, Data Scientist, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools.

Unit- II **10 Hours**

The big data technology landscape: NoSQL (Not Only SQL), Hadoop. Introduction to Hadoop: Introducing Hadoop, significance of Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem.

Unit- III **10 Hours**

Introduction to MongoDB: Definition and Features of MongoDB, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.

Unit- IV **10 Hours**

Hive: Definition and features of Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-Defined Function (UDF). Pig: Pig and its features, The Anatomy of Pig, Pig on Hadoop, Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview, Data Types in Pig, Running Pig, Execution Modes of Pig, HDFS Commands, Relational Operators, Eval Function, Complex Data Types, Piggy Bank, User-Defined Functions (UDF), Parameter Substitution, Diagnostic Operator, Word Count Example using Pig, uses of Pig, Pig versus Hive.

Text Book:

1. Big Data and Analytics, Seema Acharya and Subhashini Chellappan – Wiley India, First edition (rp) 2016.

Reference Books:

1. Frank J. Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley India Pvt. Ltd., 2012.
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch , James Giles, David Corrigan, "Harness the Power of Big data – The big data platform", McGraw Hill, 2013.

UCS043E DATA MINING 3 CREDITS

Hrs/Week: 3 **CIE Marks: 50**
Total Hrs.: 40 **SEE Marks: 50**

Course outcomes
At the end of the course, the students will be able to

- Anticipate the issues related to data mining process, different data types and apply the preprocessing techniques to improve the data quality.
- Apply the data mining techniques of clustering, classification, association finding and outlier analysis on the real world data
- Display a comprehensive understanding of algorithms for data mining.
- Evaluate the performance of different data-mining algorithms and select an efficient algorithm for solving complex problems.
- Investigate application areas and current research directions in data mining.

UNIT – I **10 Hours**

INTRODUCTION, DATA – 1: What is Data Mining? Motivating Challenges; The origins of data mining; Data Mining Tasks. Types of Data; Data Quality. DATA – 2: Data Preprocessing; Measures of Similarity and Dissimilarity

UNIT – II **10 Hours**

CLASSIFICATION: Preliminaries; General approach to solving a classification problem; Decision tree induction; Rule-based classifier; Nearest-neighbor classifier.
ASSOCIATION ANALYSIS – 1: Problem Definition; Frequent Itemset generation; Rule Generation; Compact representation of frequent itemsets; Alternative methods for generating frequent itemsets.

UNIT – III **10 Hours**

ASSOCIATION ANALYSIS – 2: FP-Growth algorithm, Evaluation of association patterns; Effect of skewed support distribution; Sequential patterns. CLUSTER ANALYSIS: Overview, K-means, Agglomerative hierarchical clustering, DBSCAN, Overview of Cluster Evaluation.

UNIT – IV **10 Hours**

FURTHER TOPICS IN DATA MINING: Multidimensional analysis and descriptive mining of complex data objects; Spatial data mining; Multimedia data mining; Text mining; Mining the WWW. Outlier analysis. APPLICATIONS: Data mining applications; Data mining system products and research prototypes; Additional themes on Data mining; Social impact of Data mining; Trends in Data mining.

TEXT BOOKS:

1. Pang-Ning Tan, Michael Steinbach, Vipin Kumar, 2007, Introduction to Data Mining, Pearson Education,
2. Jiawei Han and Micheline Kamber,2006, Data Mining – Concepts and Techniques, 2nd Edition, Morgan Kaufmann.

REFERENCE BOOK:

1. K. P. Soman, Shyam Diwakar, V. Ajay, 2006, Insight into Data Mining – Theory and Practice , PHI.

PROJECT PHASE II

Sub Code	**:**	**UCS812P**	**Credits**	**:**	**15**
Hours/Week	**:**	**10 hours**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**3 hours**	**SEE Marks**	**:**	**50**

COURSE OBJECTIVES AND OUTCOMES

Course Outcomes (COs):

At the end of the course, the students should be able to:

1. Review the current state of Art and trends in their area of interest and identify a suitable problem in their chosen subject domain with justification.
2. Survey the available research literature/documents for the tools and techniques to be used.
3. Examine the functional, non-functional, and performance requirements of their chosen problem definition.
4. Design system architecture and different components and develop all the system components using appropriate tools and techniques.
5. Work effectively in a team and use good project management practices.
6. Defend the project work carried out in teams orally and in writing.

- Developing the project plan
- Implementing the project
- Controlling, monitoring and evaluating the project
- Closing the project and reporting on the findings
- Develop all the project plans (implementation, risk, evaluation);
- Manage the project from implementation through to closure;
- Implement specific project strategies and activities;
- Evaluate the project;
- Collect and analyze project data; and
- Write up the final project report for the funding body.

Continuous Internal Evaluation Scheme:

Mid Semester Presentation /Demonstration	:	15 Marks
Final Internal Presentation /Demonstration	:	20 Marks
Report Writing	:	15 Marks
SEE Evaluation: Presentation and Demonstration	:	30 Marks
Report Evaluation	:	20 Marks

Note:

1. Demonstration/Presentations are evaluated by the Departmental Project Evaluation Committee (DPEC) comprising of Guide, HOD and Project Coordinator of the Department and reports are evaluated by the Guide.
2. In Semester End Examination (SEE) Project Work is evaluated jointly by Internal, External Examiners and HOD/Nominee.

Seminar

Sub Code	**:**	**UCS813S**	**Credits**	**:**	**1**
Hours/Week	**:**	**2 hours**	**CIE MARKS**	**:**	**50**
Exam Hours	**:**	**3 hours**	**SEE Marks**	**:**	**50**

Seminars are used as course delivery modes to encourage students to gather current trends in technology, research literature, and self-learn topics of their interest. Seminars require students to research a technical topic, make presentations and write a detailed document on their findings individually under the guidance of faculty.

Course outcomes (COs):

The student is expected to:

1. Identify seminar topics based on contemporary technical, societal and environmental issues.
2. Conduct literature survey on complex issues in the selected domain
3. Explore advanced technologies
4. Make good oral and written technical presentations

Basaveshwar Engineering College, (Autonomous)
Bagalkot
Department of Civil Engineering

III SEMESTER
SCHEME OF TEACHING AND EXAMINATIONS
Academic year 2020-21-Odd

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UMA331C	Computational Methods for Civil Engineering	3	3	0	0	50	50	100
2	UCV344C	Mechanics of Materials	4	3	2	0	50	50	100
3	UCV343C	Building Material and Construction Technology	3	3	0	0	50	50	100
4	UCV341C	Engineering Geology	2	2	0	0	50	50	100
5	UCV342C	Surveying	3	2	2	0	50	50	100
6	UCV345C	Concrete Technology	3	3	0	0	50	50	100
7	UCV346L	Surveying Practice I	1	0	0	2	50	50	100
8	UCV347L	Basic Material and Concrete Testing Lab	1	0	0	2	50	50	100
9	UHS388C/ UHS389C	Kannada Language (AK/VK)	1	2*	-	-			
10	UMA330M	*Bridge Course Mathematics -I	-	3*	-	-	50	50	100
11	UBT133M/ UBT233M	*Environmental Studies	-	2*	-	-	50	50	100
		Total	21	16	4	4	400	400	800

Note: UHS388C is for students who speak, read and write kannada
UHS 389C is for Non kannada speaking, reading and writing students
* Mandatory subjects for lateral entry (Diploma) students

COMPUTATIONAL METHODS FOR CIVIL ENGINEERING
UMA331C
3 Credits (3-0-0)

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various engineering fields by making them.

to understand the numerical method of solving algebraic, transcendental equations

to determine the approximate value of the derivative & definite integral for a given data using numerical techniques

to solve the first order first degree ordinary differential equations numerically.

able to extremize the functional using integration technique

Course outcomes:
On completion of this course, students are able to:

know how root finding techniques can be used to solve practical engineering problems.

apply the concept of finding approximate value of the derivative & definite integral for a given data using numerical techniques.

apply numerical techniques to solve the first order first degree ordinary differential equations.

implement integration technique to determine the extreme values of a functional.

UNIT-I

Numerical Analysis-I: 10 Hours
Introduction to find root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

UNIT-II

Numerical analysis-II: 10 Hours
Numerical Integration: Simpson's one third rule, Simpson's three eighth rule(no derivation ofany formulae)-problems. Numerical solution of ODE and PDE: Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula.

UNIT-III

Fourier Series: **10 Hours**

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

UNIT-IV

Fourier transforms: **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms.

Calculus of Variations:

Variation of a function and a functional, external ofa functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.

Reference Books:

1. Numerical Methods for Engineers by Steven C Chapra&Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

MECHANICS OF MATERIALS
UCV344C
4 Credits (3-2-0)

Course Objectives:

Introduction to definitions, basic concepts associated Mechanics of Materials. Analysis of uniform, tapering, composite bars subjected to axial forces. Thermal stresses.

Volumetric strains and relation amongst elastic constants. Introduction to definitions and basic concepts associated with general two-dimensional stress system. Application of solutions to thin cylindrical shells subjected to internal pressure.

Introduction to definitions and basic concepts associated with bending moment and shear forces and distribution of bending stresses and shear stresses in beams.

Introduction to definitions and basic concepts associated with deflection of statically determinate beams and analysis of pin jointed trusses.

Course outcomes:
On completion of this course, students are able to:

Determine the stresses and elongation of bars subjected to axial forces and change in temperatures.

Determine principal stresses and locate principal planes and change in volume and dimensions.

Draw BMD and SFD and stress distribution diagrams for beams of various cross sections and for various loads.

Determine slope and deflection for statically determinate beams and member forces for trusses.

UNIT-I

Simple Stresses and Strains: **16 Hours**
Introduction: Mechanical properties of materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress-Strain Diagram for structural steel and non-ferrous materials, Principle of superposition, Elongation of uniform bars, stepped bars and composite bars. Numerical examples.
Elongation of tapering bars, elongation due to self-weight, thermal stresses:
Elongation of tapering bars of circular and rectangular sections. Elongation due to self-weight, elongation due to thermal stresses including compound bars. Numerical examples.

UNIT-II

Relation between elastic constants, Volumetric strain: **16 Hours**

Elastic constants. Relationship among elastic constants, Volumetric strain, expression for volumetric strain, Numerical examples.

Compound Stresses:

Introduction, Stress components on inclined planes, General two-dimensional stress system, principal planes and stresses, thin cylinders subjected to internal pressure change in length, diameter and volume.

UNIT-III

Bending moment and shear force in beams: **17 Hours**

Introduction, shearing force and bending moment in beams. Relationship between load shear force and bending moment, Expression for shear and bending moment, SFD and BMD with salient values for cantilever, simply supported and overhanging beams considering point loads, UDL, UVL and Couple.

Bending stresses and shear stresses in beams:

Introduction, Bending stress in beam. Assumptions in simple bending theory, Pure bending, derivation of Bernoulli's equation. section modulus, Flexural rigidity, Beam of uniform strength. Expression for horizontal shear stress in beam, Shear stress diagram for rectangular, symmetrical I and T sections.

UNIT-IV

Deflection of beams: **16 Hours**

Introduction, Definitions of slope, Deflection, Elastic curve. Derivation of deferential equation of flexure. Slope &deflection for standard loading cases using Macaulay's method.

Analysis of Trusses:

Introduction, assumptions, analysis of hinged jointed trusses by method of joints and method of sections. Numerical problems.

Text Books:

1. K.V.Rao& Raju, Mechanics of Materials, 5th Edition Subhas Publisher Bangalore 2007.
2. R. Subramanian, Strength of Materias, Oxford University Press 3rd edition 2016.
3. B. C. Punmia, Ashok Jain, Aran Jain, Mechanics of Materials, Lakshmi Publications, New Delhi, Revised edition.2017.
4. Basavarajaiah and Mahadevappa, Strength of Materials, Publishers, University press, Hyderabad India 3rd Edition 2010.
5. S.S.Bhavikatti, Strength of Materials, 2nd Edition Vikas Publications, New Delhi 2006.

Reference Books:

1. Beer & Johnston Mc Grawl hill, Mechanics of Materials, Mc Grawlhil 3rd Edition, New Delhi 2006.
2. Gere &Timshenko CBS Publication,Mechanics of Materials4th Edition CBS Publication New Delhi1987.
3. Timoshenko and Young Affiliated, Elements of strength of Materials, 5th Edition East-West Press.2003
4. James Mc Gee, Mechanics of Materials, Published by Thompson Learing 2008

5. Andrew pytel and Ferdinand Singer, Strength of Materials, Harper and Row Publications 4th Edition 1987. A

Question Paper Pattern For SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

BUILDING MATERIALS & CONSTRUCTION TECHNOLOGY
UCV343C
3 Credits (3-0-0)

Course Objectives:

Describe different building materials and their properties; determine the quality of the materials and method of using them. Assessment of adaptability of foundation type for a particular structure.

Describe masonry, design of stair case, Necessity, types of doors and windows.

Describe and assess the suitability of various scaffolding types, form work types, floor types and repair works for building at super structure and at substructure level

Describe about lintel, chejja and arches, method of construction and stability analysis of arch, method of plastering and application of paints and finishes for different surfaces.

Course outcomes:
On completion of this course, students are able to:

Assess the quality of building materials, describe the method of finding SBC of soil by plate load test and evaluate the suitability of different foundations for different soil conditions.

Classify and describe different types of masonry, design (geometric) dog legged staircase, assessing the suitability of a staircase and classify different doors and windows for buildings.

Classify different types of floors and roofs and form work methods for structural members such as beam, slab and column.

Compare types of lintel, chajja and arches, describe method of construction and stability analysis of arch, method of plastering and application of paints and finishes for different surfaces.

UNIT-I

Building Materials: **08 Hours**
Bricks: Classification of Bricks, Manufacture of bricks, Tests on bricks
Other Building Materials: Reinforcing steel, Structural steel.
Foundations:
Preliminary Investigation of Soil, Safe Bearing Capacity of Soil, Classification of Foundations, Introduction to different types of foundation, Masonry footings, Isolated footings, Combined and strap RCC footings, Raft and Mat foundation, Pile foundations - Friction and load bearing piles.

UNIT-II

Masonry: **10 Hours**

Definition of terms used in masonry, Bonds in Brickwork, Rubble Masonry, Coursed and uncoursed Rubble Masonry, Random rubble masonry, Ashlar Masonry.

Stairs, Doors, Windows and Ventilators:

Technical terms in stairs, Requirements of a good stair, Geometric design of RCC dog legged and open well stairs (plan and sectional elevation of stairs), Doors: Types of doors - Paneled doors, Glazed doors, Flush doors, Collapsible and Rolling shutters, Windows: Panelled windows, dormer windows, sliding windows, glass windows. Ventilators.

UNIT-III

Floors and Roofs: **10 Hours**

Types of flooring (Materials and methods of laying), Granolithic, Ceramic, Marble, Polished Granite flooring, Flat Roof (R.C.C).

Sloped roof:

Lean to roof, Flat terraced roofing, Wooden truss (King post and Queen post truss)

Miscellaneous topics: Plumbing, Form work, slip forming, Damp proof course.

UNIT-IV

Arch, Lintel, Chejja: **10 Hours**

Masonry arches, Classification, Stability of an arch, Lintels, Types and classifications, Functions, Chejja, Functions. Shoring, Scaffolding.

Plastering and Painting:

Purpose of plastering, Materials of plastering, Lime mortar, Cement Mortar, Methods of plastering, Stucco plastering, Lath plastering, Purpose of Painting, Application of paints to new and old surfaces, Distemper, Plastic emulsion, Enamel Powder coated painting to walls and iron and steel surfaces, Polishing of wood surface.

Text Books:

1. Punmia B.C Laxmi Building Construction PubicationsPvt Ltd New Delhi 2008
2. S.C Rangalwala, Building Construction, Character Publishing House, Anad India 25th 2007
3. Sushil Kumar, Building Construction, Standerd Publisher, New Delhi 2008
4. Rangawala P.C Engineering Materials, Chapter Publishing house, Anand India-2014
5. Sushil Kumar, Engineering Materials, Standerd Publication and Distributors, New

Reference Books:

1. S.K. Duggal, “Building Materials”, (Fourth Edition) New Age International (P) Limited, 2016 National Building Code (NBC) of India
2. P C Vergese, “Building Materials”, PHI Learning Pvt. Ltd

3. Building Materials and Components, CBRI, 1990, India

4. M.S. Shetty, “Concrete Technology”, S.Chand and Co. New Delhi.

Question Paper Pattern For SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

ENGINEERING GEOLOGY
UCV341C
2 Credits (2-0-0)

Course Objectives:

To study the basics of geology that are relevant to take the important decisions in Civil Engineering.

To provide essential details of earths materials (Minerals & Rocks) and their engineering applicability.

To Know about rock weathering, geological structures, natural hazards and their impact on Civil Engineering Projects.

To develop ability in students to select ideal sites for important Civil Engineering structures.

Course outcomes:
On completion of this course, students are able to:

Realize the importance of the geological studies for safe, stable and economic design of any Civil Engineering Structures.

Get the basic knowledge and effective usage of earth's materials (Mineral & Rocks) in different Civil Engineering Projects.

Understand the significance of weathering, geological structures (Bedding planes, faults, folds, joints, unconformities, etc) Natural Hazards (Earthquakes and Landslides) in selection of sites for dams and tunnels.

Know about the groundwater, environmental geology and applications of remote sensing, GIS and GPS in Civil Engineering projects.

UNIT-I

Introduction: **06 Hours**
Geology- its branches; Engineering geology, its importance in civil engineering; Work activities of engineering geologist. Internal structure and composition of earth.
Mineralogy:
Definition, importance and general classification of minerals; Study of physical properties, chemical composition and uses of common rock forming and ore forming minerals; Stability of the minerals.

UNIT-II

Petrology: **07 Hours**
Introduction, definitions and general classification of rocks; Rock cycle; Mode of occurrence, structures, textures, classification, descriptions and engineering usage of important igneous,

sedimentary and metamorphic rocks.

Geomorphology and Geo-dynamics:

Epigene and hypogene geological agents; Weathering of rocks, types of weathering; Significance of Weathering in Civil Engineering. Soil – its formation, profile, classification, erosion and conservation. Earthquakes - Causes and effects, plate tectonics and elastic rebound theory; Seismic resistant structures. Stability of slopes- Landslides: Causes, effects and preventive measures.

UNIT-III

Structural Geology: **07 Hours**

Basic definitions - outcrop, inlier, outlier, dip and strike; Use of Clinometer compass and Brunton compass. Study of important Geological structures- Faults, Folds, Joints and Unconformities - definition, classification, recognition in the field and significance in civil engineering. Selection of sites for civil engineering projects - dams, reservoirs and tunnels.

UNIT-IV

Hydrogeology: **06 Hours**

Hydrological cycle, mode of occurrence and sources of groundwater; Water bearing properties of rocks and soils; Aquifers and their types. Influence of groundwater in engineering construction; groundwater exploration by geophysical method; Artificial recharge of groundwater.

Environmental Geology and Remote sensing:

Impact of mining, quarrying and reservoirs on environment. Remote sensing -basic concepts and applications in civil engineering; GIS, GPS-Applications in Civil Engineering.

Text Books:

1. Parbin Singh- AText book of Engineering & General Geology; S.KKataria& Sons, 8th Revised Edn. New Delhi.2008

2. Santoshkumar Garg - Physical and Engineering Geology; Khanna Publishers,3rd revised and enlarged Edn New Delhi. 1999.

3. P.KMukerjee-A Text book of Geology; The World Press, 11 th reviser Edn Pvt Ltd Calcutta.1990.

4. K.M.Bangar - Principals of Engineering Geology; Standard Publishers and Distributors, New Delhi.2004

5. D. Venkat Reddy- Engineering Geology for Civil Engineers; Oxford& IBH Publishers, New Delhi.1997.

6. N.Chennakesavalu - Text Book of Engineering Geology; Macmillan Publishers2ndEdn India Ltd. New Delhi. 2009.

7. Vasudev Kanithi - Engineering Geology; Universities Press (India) Pvt. Ltd. Hyderabad . 2018.

8. Subinoy Gangopadhyay - Engineering Geology; Oxford Universities Press New Delhi. 2013.

9. F.G.H. Blyth, M.H. de Freitas - Geology for Engineers; Elsevier publications7thEdn 1988.

10. KVGK Gokhale - Principles of Engineering Geology; B S Publications, Hyderabad.

Reference Books:

1. N.W. Gokhale - Theory of Structural Geology; CBS Publishers &Distributors,New Delhi 2nd Edn. 2003.

2. H.H.Read - Rutley's, Elements of Mineralogy ;CBS Publishers &Distributors,New Delhi26th Edn 1984.

3. G.W.Tyrrel - Principles of Petrology; BI Publications PvtLtd,New Delhi1stEdn 1987.

4. S.K. Duggal, H.K.Pandey, N.Rawal - Engineering Geology, Mc Graw Hill Education publications 2017

5. K.S.Valdiya – Geology, Environment and Society; University Press (India) Pvt. Ltd., Hyderabad

Question Paper Pattern For SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

SURVEYING
UCV342C
3 Credits (2-2-0)

Course Objectives:

Student will come to know the objects of surveying which is applicable in civil engineering and use of chain, its types for measurements.

Students will come to know use of angle measuring instrument compass and carry out survey using compass.

Student will come to know the use of leveling instrument to find the elevation at different points on earth with respect to datum

Student will find the area and volume by countour surveying technique using leveling instruments, chain and tape.

Course outcomes:
On completion of this course, students are able to:

Students will get the knowledge of basics of surveying and basic instruments used in civil engineering surveys.

Application of compass surveying for measurement of areas, bearing and distance along with the direction.

Finding the elevation, elevation differences and heights of different objects under different conditions.

Finding the volumes of hill and faults, calculations of earth work for railway embankment, canal and roads.

UNIT-I

Introduction: **10 Hours**
Surveying - Definition, Object and Classification. Units of Measurements, Plan& Map, Basic principles of surveying, Precision and Accuracy, Ranging of line - Direct and Indirect methods
Chain Surveying:
Chain and Tape and types, Measurement of distances over sloping ground. Booking of chain survey work, Field Book- entries, conventional symbols. Obstacles in chain survey- Numerical problems.

UNIT-II

Compass Surveying: **10 Hours**
Types of Compass, difference between prismatic compass and Surveyor's Compass. Types of Meridians

and Bearings- Numerical problems. WCB And RB & conversions, Dip and Declination, Determination of true bearings. Computation of included angles of a closed traverse

Traversing:

Local attraction-determination and correction, Latitude and Departure, Checks for Closed traverse and determination of closing error and its direction- Bowditch's graphical method Analytical methods - Bowditch's rule and transit rule.

UNIT-III

Levelling: **10 Hours**

Definition, Objective, Temporary adjustment of dumpy level, Curvature and Refraction corrections, Type of levelling-Differential levelling, Reciprocal levelling, Profile levelling, Cross sectioning, Fly leveling & Fly back leveling, booking of levels, Rise and Fall method and Height of Instrument method and numerical problems, missing data problems.

UNIT-IV

Contouring: **10 Hours**

Contours and their characteristics, Methods of contouring-Direct and indirect, Interpolation techniques, uses of contours.

Areas and Volumes:

Calculation of area from cross staff surveying, Calculation of area of a closed traverse by coordinates method, Planimeter-Principle, working and use, Digital Planimeter, Volume calculation by cross section, Computations of volumes by trapezoidal and Prismoidal rule, determination of volume by contours

Text Books:

1. B.C. Punmia,Surveying,Voll Std. book house, Laxmi Publications, New Delhi.2007
2. A.M. Chandra, Plane Surveying, Vol-1- New age International ® Ltd. New Delhi, 2002
3. K.R. Arora, Plane SurveyingS. Chand and Company Ltd., New Delhi.2016
4. S. S. Bhavikatti, Surveying & Leveling, Vol-I', I. K. International New Delhi, 2008

Reference Books:

1. S.K. Duggal, Surveying Vol. I, Tata McGraw Hill - Publishing Co. Ltd., New Delhi.2nd Edn. 2007
2. S.K. Roy Fundamentals of Surveying -Prentice Hall of India. New Delhi 2007
3. Milton O. Schimidt Wong, Fundamentals of Surveying - Thomson Learning 2005
4. Survey of India Publication on maps.2016

Question Paper Pattern For SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

CONCRETE TECHNOLOGY
UCV345C
3 Credits (3-0-0)

Course Objectives:
To impart Knowledge about:

Define and describe Types and properties of basic building materials, their utility as construction material

Define and describe Physical and chemical properties of cement, aggregates, assessment of suitability of the tests done to confirm quality of these materials.

Description of the Method of manufacture of fresh cement concrete, properties of fresh cement concrete, Mechanical and strength properties of hardened concrete, effect of loading and environmental conditions

Define and describe Types and properties of basic building materials, their utility as construction material

Course outcomes:
On completion of this course, students are able to:

Assess the properties (Physical and chemical) of building materials, describe the method of selecting the building materials based on application and their properties.

Differentiate between types of cement , coarse and fine aggregates and recommend type of cement , coarse and fine aggregates based on application and their properties and apply the procedure to confirm the quality of cement, coarse and fine aggregates.

Evaluate the testing procedure for fresh and hardened concrete to assess it’s fresh and hardened properties.

Assess the properties (Physical and chemical) of building materials, describe the method of selecting the building materials based on application and their properties.

UNIT-I

Cement: **10 Hours**

Cement, Chemical composition, Hydration of cement. Types of cement, Manufacture of cement, Tests on cement - Field tests. Fineness by Sieve test and Blaine's air permeability test, Normal consistency, Setting time and Soundness.

Aggregates:

Fine aggregates-Grading analysis, Specific gravity, Bulking, Moisture content. Deleterious materials.

Coarse aggregates - Importance of size, shape and texture

Grading of aggregates Sieve analysis, Specific gravity. Flakiness and Elongation index. Crushing, Impact and Abrasion tests

UNIT-II

Fresh Concrete: **10 Hours**

Workability - factors affecting workability Measurement of workability -Slump. Flow tests. Compaction factor and Vie-bee consisto meter tests. Segregation and Bleeding, Manufacturing process of concrete - Batching, mixing, transporting, placing, compaction, curing

Chemical admixtures:

Plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures- Fly ash, silica fume and rice husk ash. Water proofing compounds.

UNIT-III

Hardened Concrete: **10 Hours**

Factors affecting strength. w/c ratio, gel-space ratio, aggregate properties. Relation between compressive strength and tensile strength, Bond strength, Modulus of rupture, elasticity. Relation between modulus of elasticity and strength, Poisons ratio. Shrinkage, factors affecting shrinkage Creep - factors affecting creep, effect of creep. Testing of hardened concrete - Compressive strength, Split tensile strength.

Durability:

Definition, significance, Permeability, Sulphate attack, Chloride attack, Carbonation, Freezing and thawing.

UNIT-IV

Concrete Mix Design: **10 Hours**

Concept of mix design, variables in proportioning exposure conditions. Procedure of mix design as per IS 10262-2009 using IS-2009, Numerical examples of mix design on mix design for OPC concrete mixes and Fly-concrete mixes.

Special concretes:

RMC, Self-compaction concrete, light weight and high density concrete, materials, properties, uses.

Text Books:

1. M.S.Shetty Concrete Technology Theory and Practice, S.Chand and Co, New Delhi, 2002.
2. Neivelle A.M and Brooks, Concrete Technology,J.J ELBS Edition,London Delhi, 4th Edition,2004.
3. P.Kumar Mehta & Paul J.M, Concrete Technology, Monterio Indian Concrete Institute USA-1999
4. IS Code 2009 for concrete mix design

Reference Books:

1. A.R. Santha Kumar, “Concrete Technology”, Oxford University Press, New Delhi (New Edition).
2. M.L. Gambhir, “Concrete Technology”, McGraw Hill Education, 2014.
3. N.V. Nayak, A.K. Jain Handbook on advanced Concrete Technology, ISBN: 978-81-8487-186-9

Question Paper Pattern For SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

UCV346L: SURVEYING PRACTICE - I
1 Credits (0-0-2)

Chain surveying

1. Types of Chains and Tapes
2. Setting out Perpendiculars at various points (point on the chain line and outside the chain line)
3. Setting out hexagon, pentagon
4. Over coming from obstacles in Chain Surveying Compass Surveying
5. Types of Compass & Difference
6. Setting out pentagon, hexagon Levelling
7. Differential Levelling
8. Booking and Reducing levels- i) Height of Instrument method and ii) Rise & Fall method
9. Fly levelling and Fly back levelling and Reciprocal levelling
10. Profile and cross section levelling Contouring
11. Block Contouring Demonstration of minor instruments: Instruments

Plane Table and its accessories

Planimeter

REFERENCE BOOKS:

1. B.C. Punmia,Surveying, Vol. 1 Laxmi Publications, New Delhi.2005
2. A.M. Chandra, Plane Surveying, Vol-1,Newage International ® Ltd. 2nd Edn 2006
3. K. R. Arora, Plane Surveying, S. Chand and Company Ltd., New Delhi. Laboratory 1998

ASSESSMENT

Each Laboratory Subject is evaluated for 100 marks (50 CIE and 50 SEE)

1. Allocation of 50 marks for CIEPerformance and Journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks (5 write-up,10 conduction, calculation, results etc 5 viva-voice).
2. 2. Allocation of 50 marks for SEE 25% write-up, 50% conduction, calculation, results etc 25 % viva-voice

UCV347L:BASIC MATERIAL AND CONCRETE TESTING LAB
1Credits (0-0-2)

1. Tension test on mild steel and HYSD bars.
2. Compression test on Wood.
3. Torsion test on mild steel circular sections.
4. Bending test on Wood under two point loading.
5. Tests on bricks.
6. CEMENT: Normal consistency , setting time , soundness by Autoclave method, Compression strength test and Air permeability test for fineness, Specific gravity of cement
7. FRESH CONCRETE: Workability- Slump, Compaction factor and Vee Bee test.
8. HARDENED CONCRETE: Compression strength test, Split tensile test .

REFERENCE BOOKS:

1. Davis, Troxell and Hawk, Testing of Engineering Materials, International Student Edition McGraw Hill Book Co. New Delhi.1982
2. Fenner, Mechanical Testing of Materials, George Newnes Ltd. London.1965
3. Holes K A, English, Experimental Strength of Materials, Universities Press Ltd.London.2010
4. Suryanarayana A K, Testing of Metallic Materials, Prentice Hall of India Pvt. Ltd. New Delhi.2007
5. Methods of test for determination of strength properties of natural building stone.IS 1121-1,1974.
6. Kukreja C B- Kishore K. Ravi Chawla, Material Testing Laboratory Manual,Standard Publishers & Distributors 1996.
7. M.L.Gambhir, Concrete Manual, Dhanpat Rai & Sons- New Delhi.2004.

LABORATORY ASSESSMENT

1. Each Laboratory Subject is evaluated for 100 marks (50 CIE and 50 SEE)

   Allocation of 50 marks for CIEPerformance and Journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks (5 write-up,10 conduction, calculation, results etc 5 viva-voice).
2. Allocation of 50 marks for SEE 25% write-up, 50% conduction, calculation, results etc 25 % viva-voice

BRIDGE COURSE MATHEMATICS-I

UMA330M

Credits: Mandatory

Course Learning Objectives:

This course will enable students to master the basic tools of calculus and vectors to become skilled for solving problems in science and engineering

Course Outcomes:

On completion of this course, students are able to:

Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians

Apply the concept of multiple integrals and their usage in computing the area and volumes.

Apply the knowledge of vector calculus to solve the engineering problems

UNIT-I

Differential Calculus:

15 Hours

Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems

Partial differentiation :

Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions.Jacobians-problems.

UNIT-II

Integral Calculus:

15 Hours

Reduction formula $\int \sin^n x dx$, $\int \cos^n x dx$, $\int \tan^n x dx$ and $\int \sin^n x \cos^n x dx$. Evaluation of double and triple integrals. Area bounded by the curve.

Beta and Gamma functions:

Definitions, Relation between beta and gamma functions-problems.

UNIT-III

Vector Calculus:

10 Hours

Vector Differentiation:

Scalar and vector fields**.**Gradient, directional derivative; curl anddivergence-physical interpretation; solenoidal and irrotational vector fields- problems

TEXT BOOKS:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

REFERENCE BOOKS:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:** Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

QUESTION PAPER PATTERN FOR SEE:

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

IV SEMESTER

SCHEME OF TEACHING AND EXAMINATIONS

Academic year 2020-21-Even

Sl.No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UMA431C	Mathematical Methods for Civil Engineering	3	3	0	0	50	50	100
2	UCV432C	Structural Analysis-I	3	2	2	0	50	50	100
3	UCV433C	Highway Engineering	3	3	0	0	50	50	100
4	UCV434C	Fluid Mechanics	4	4	0	0	50	50	100
5	UCV435C	Building Planning & Drawing	2	2	0	0	50	50	100
6	UCV436C	Advanced Surveying	3	2	2	0	50	50	100
7	UCV43XE	Dept Elective - 1	2	2	0	0	50	50	100
8	UHS001N	Fundamentals of Quantitative , Aptitude and Soft Skills	1	0	0	2	50	50	100
9	UCV431L	Surveying Practice -II	1	0	0	2	50	50	100
10	UCV432L	Engg Geology Lab	1	0	0	2	50	50	100
11	UMA430M	* Bridge Course Mathematics -II	-	3*	-	-	50	50	100
12	UHS226M	* Constitution of India	-	2*	-	-	50	50	100
		Total	**23**	**18**	**4**	**6**	**400**	**400**	**800**

Department Elective - 1

Sl. No.	Subject code	Subject	Credits
1	UCV431E	Air pollution control	2
2	UCV432E	Alternative Building Materials	2

* Mandatory subjects for lateral entry (Diploma) students

MATHEMATICAL METHODS FOR CIVIL ENGINEERING

UMA431C

3 Credits (3-0-0)

Course Objectives:

- To enable the students to apply the knowledge of Mathematics in various engineering fields by making them
- To form a specific relation for the given group of data using least square sense method.
- To specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course outcomes:

On completion of this course, students are able

- To apply the least square sense method to construct the specific relation for the given group of data.
- To apply the concept of probability to find the physical significance of various distribution phenomena
- To apply the concept of probability to perform engineering duties in planning and designing, engines, machines and other mechanically functioning.
- To apply the concept of probability to study the performance of Mechanical systems.
- To apply the concept of Markov Chain for commercial and industry purpose.

UNIT –I

Complex Variables:

10 Hours

Analytic function, Cauchy-Reimann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms)

Complex Integration:

Line integral, Cauchy's theorem – corollaries (without Proof), Cauchy's integral formula. Taylor's and Laurent's series (statements only), singularities, poles, calculation of residues, Cauchy's residue theorem (without proof) – problems.

UNIT-II

Special Function:

10 Hours

Series solution of Bessel's differential equation, recurrence formulae, generating function, orthogonal property, Bessel's integral formula.

UNIT –III

Statistics and Probability **10 Hours**

Statistics:

Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$ and $y = a + bx + cx^2$ Correlation and regression.

Probability:

addition rule, conditional probability, multiplication rule, Baye's rule.

UNIT –IV

Probability distributions: **10 Hours**

Binomial distributions Poisson distributions and Normal distributions(No drivations). Concept of joint probability, Joint distributions - discrete random variables, Independent random variables, Problems on expectation and variance.

Markov chains:

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

BOOKS AND REFERENCES:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

QUESTION PAPER PATTERN FOR SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks:

Ten objective type questions can be prepared from entire syllabus.

STRUCTURAL ANALYSIS –I

UCV432C

3 Credits (2-2-0)

Course Objectives

- Introduction to definitions, basic concepts associated with structural systems. Analysis of statically determinate beams for slopes and deflections.
- Determine slopes and deflections for statically determinate beams and trusses by Castigliano's theorem-I and by unit load method.
- Determine redundant reactions for propped cantilever and fixed beams by Casigliano's theorem-II and consistent deformation method and analyze continuous beams by Clapeyron's theorem of three moments.
- Determine stresses and angle of twist for circular shafts transmitting power, buckling load for long columns from Euler's theory and for short columns by Rankine's theory.

Course Outcomes

After studying the course the students will be able to:

- Compute degree of static and kinematic indeterminacy of structures and determine slopes and deflections for statically determinate beams.
- Analyze statically determinate beams and trusses for deflections.
- Analyze statically indeterminate beams.
- Analyze circular shafts subjected to torsion and columns under compression.

UNIT-I

Introductory Concepts:

13 Hours

Structural Systems; Forms of structures- one, two- and three-dimensional structures, Compatibility and Constitutive relations, material and geometric linearity and nonlinearity, Determinate and indeterminate structures-Degree of Indeterminacy (Static and Kinematic).

Deflection of beams by Moment Area & Conjugate beam methods:

Moment area theorems andconjugate beam theorems. Analysis of statically determinate beams. Numerical problems.

UNIT-II

Strain Energy: **13 Hours**

Strain Energy and Complementary strain energy, Strain energy due to axial load, bending, shear and torque., Principle of virtual work; Castigliano's theorems- I. Numerical problems on deflections of statically determinate beams and trusses using Castigliano's theorem-I and unit load methods.

UNIT-III

Analysis of Fixed beams and Propped cantilevers: **13 Hours**

Castigliano's theorem-II(Proof not included). Analysis of propped cantilever and fixed beams by Castigliano's theorem-II and consistent deformation method.

Analysis of continuous beams:

Clapeyron's theorem of three moments. Analysis of Continuous, Fixed and propped cantilever beams.

UNIT-IV

Torsion of circular shafts: **13 Hours**

Introduction, Pure torsion, assumptions, torsion equationfor circular shafts, Strength and stiffness, Torsional rigidity and polar section modulus. Power transmitted by shaft, solid and hollow circular sections.

Elastic stability of columns:

Introduction, Euler's theory for long columns, Effective length, slenderness ratio, Short and long columns, radius of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for columns for different end conditions, Limitations of Euler's theory, Rankine's formula.

TEXT BOOKS:

1. C S Reddy-Basic Structural Analysis, 2 Edition, Tata Mc Graw Hill, New Delhi-2003.
2. B C Punmia, Ashok Kumar Jain, Aran Kumar Jain Theory of structures Vol-I & II Laxmi Publications, New Delhi-2004
3. Ramamrutham, R Narayan-Theory of structures,Dhanpt Rai Publishing Company,8 Edition New Delhi-2008

REFERENCE BOOKS:

1. R.C.Hibbler, Structural Analysis, 5 Edition, Pearson Education Asia, NewDelhi-2002
2. Norris and Wilbur, Elementary Structural Analysis, Tata McGraw Hill, 4 Edition,New Delhi-2006
3. Devadas Menon, Structural Analysis 1 Edition, Alfa Science International Ltd ,2007
4. C.K. Wang, Intermediate Structural analysis,McGraw-Hill Education - Europe,1984

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one question from each unit.

:

HIGHWAY ENGINEERING

UCV433C

3 Credits(3-0-0)

Course Objectives:

To make students learn:

- The historical developments of roads and study on fixing up of an alignment for roads and engineering surveys
- Design concepts of and elements involved in geometric design of roads.
- Relevant tests to be carried out ensure the quality of materials to be used for road construction and classify the pavements and determine ESWL
- Construction method of different types of roads and importance of highway drainage and Economics analysis of proposed roads.

Course Outcomes:

After studying this course student will be able to

- Review historical development and present scenario of road and road development in India and Propose an ideal alignment for roads.
- Design the geometric elements of the road for the safe movement of traffic with reduced accidents.
- Assess the quality of road materials and classify the pavements and determine ESWL.
- Describe the construction method of different types of roads and drainage and Evaluate Economic viability of proposed roads.

UNIT-I

Introduction: **10 Hrs**

A brief idea about the historical development of road construction in India and abroad. Importance of transportation modes-characteristics-comparison of different modes. Highway development in India-Jayakar committee, recommendations and implementation- Central Road Fund CRF, Indian Roads Congress IRC, Central Road research institute CRRI

Highway planning, alignment and surveys:

Road types and classification, road patterns Planning surveys-master plan-saturation system. Salient features of 3rdtwenty-year road development plan and problems, present scenario of road development in INDIA (NHDP & PMGSY) and in Karnataka (KSHIP &KRDCL) road development plan 2021. Factors controlling alignment-ideal alignment. Engineering surveys for highway locations- problems on phasing

UNIT-II

Highway Geometric design1: **10 Hrs**

Importance, Factors controlling the design of geometric elements, highway cross section elements. Pavement surface characteristics, camber, width of carriage way, shoulder width, formation width, right of way, typical cross section of roads

Highway Geometric design 2:

Sight Distances-Types and importance. Design of horizontal and vertical alignment- Numerical problems on above (No. derivation of formulae)

UNIT-III

Vertical alignment:

10 Hrs

Gradient- Types of gradient- Design criteria of summit & valley curve- Design of vertical curves based on SSD-OSD-Night visibility considerations-Design standards for hilly roads- problems on the above.

Intersection design:

Principle- At grade & Grade separated junctions- Grade seperated intersection- Three legged intersection- Diamond interchange- Half clover leaf- Clover leaf- Advantages- Disadvantages only. Types- Channelization- Features of channelising Island- Median opening- Gap in median at junction.

UNIT-4

Rotary intersections:

10 Hrs

Elements- Advantages- Disadvantages- Design guide lines- problem on above

Highway drainage:

Importance – sub surface drainage- surface drainage- Design of road side drives- Hydrological-Hydraulic considerations and design of filter media, problems on above.

TEXT BOOKS:

1. Khanna, SK , Justo and Veeraraghavan, Highway Engineering- CEG, Nemchand and Bros, Roorkee,9th Edition, 2003
2. Kadiyali, L.R. Highway Engineering Khanna Publishers, New Delhi, 5th Edn. 2008.
3. Subramanyam, K.P. Transportation Engineering- I Scitech publications, Chennai., 2007

REFERENCE BOOKS:

1. Principles of Transportation Engineering- Partha Chakra Borthy, Prentice-Hall.
2. Specifications for Roads and Bridges- MoRT&H, IRC, New Delhi (2001).
3. Relevant IRC codes

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
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3. Any Five Full questions are to be answered choosing at least one from each unit.

FLUID MECHANICS

UCV434C

4 Credits (4-0-0)

Course Objectives:

- To learn the fundamental properties of fluids and basic concepts of fluid mechanics and its applications.
- To understand laws of statics, kinematics and dynamics of fluids and their applications to practical problem solving.
- To learn concepts of flow through pipes along with various head losses and its applications.
- To know various flow measurement devices their concepts and applications.

Course Outcomes:

- Students should possess basic concepts of fluid mechanics and fluid properties.
- Students should be able to know measurements of fluid pressure and apply concepts of hydrostatics to real life problems.
- Should be able to solve problems applying the knowledge of basic concepts of fluid kinematics & dynamics.
- Will be able to compute discharges in pipes and various flow measurement devices.

UNIT-I

11 Hrs

Scope and importance of FM, Definition of fluid, Types of fluids, Difference between fluid and solids, Difference between liquid and gas. Definition-units and Dimensions of Mass, density, Specific volume, specific weight, Relative density, viscosity. Newton's law of viscosity, Newtonian &Non-Newtonian fluids, Ideal and Real fluids. Definitions of surface tension, Equation for stability of bubble, Capillarity, Theory and problems, Problems on Newton's law of viscosity.

UNIT-II

14Hrs

Definition of pressure, units and dimensions, pressure at a point, Pascal's law, Hydrostatic law. Different types of pressure and its measurement, manometers and their classification, simple manometer. Theory and problems Differential manometers- theory and problems, problems on fluid pressure, Mechanical pressure gauges and its use.
Definition of Total pressure, Centre of pressure, centroidal depth, centroid, depth of center of pressure. MI and centroid table for different geometric shapes, Equation for hydrostatic force and depth of CP on a plane surface (vertical and inclined). Problems on hydrostatic force vertically and inclined submerged surface, hydrostatic force on curved submerged surface problem.

UNIT-III

13Hrs

Description of fluid flow by Lagrangian and Eulenian approaches, classification of flow, Definition of Path line, streamline, streak line, stream tube. one, two- and three-dimensional flows, Rotational & irrotational flows. Acceleration and Derivation of continuity equation in differential form. Definition of velocity potential, function, stream functions, stream line equipotential line and relation between them. Laplace equation, problems on continuity equation, velocity potential and stream function.

Definition, concept of force, Equation of motion, Introduction to non-dimensional number. Derivation of Euler's equation and Bernoulli's equation for ideal & real fluid with assumptions and limitations. Problems on Bernoulli's equation Application of Bernoulli's equation to pitottube, venturi meter and problems on these.

UNIT-4

14Hrs

Definition, Reynolds's number classification of flow, HGL and TEL, major and minor losses in pipe flow. Derivation of equation for head loss due to friction (Darcy's equation). Friction factor for commercial pipes, moody diagram, flow through compound pipes, (Series Parallel, Equivalent size). Problems on Darcy's equation for Head loss due to sudden expansion and contraction and problems on minor losses and compound pipe.

Flow through orifice and mouthpieces hydraulic coefficient of an orifice and relation between them. Equation for coefficient of velocity. Coefficient discharge and coefficient contraction relation between them. Flow through notches, classification of notches equation for discharge over V-notch, rectangular and trapezoidal crippoletti notch and problems, on them Broad crested weir Equation for discharge of Broad crested weir and problems.

TEXT BOOKS:

1. P.N. Modi and S.M. Seth Hydraulics and Fluid Mechanics Standard Book House, New Delhi.2006.
2. Dr. R.K. Bansal, Fluid Mechanics and Hydraulic Machines Lakshmi Publications, NewDelhi.2007.
3. Jain, A.K., Fluid Mechanics, Khanna Publishers, New Delhi-2007.

REFERENCE BOOKS:

1. James F Cruise, Vijay P. Singh, Elementary Hydraulics (1st Edition), MohsanM. Sherif,Thomson Learning. April 2006.
2. K.R. Arora Fluid Mechanics, Hydraulic and Hydraulics, Standard Book House, NewDelhi-2007.
3. John F. Douglas Fluid Mechanics. Pearson Education New Delhi, 2011.
4. V.L.Streeter&B.WylieFluid Mechanics Lakshmi Publications, New Delhi.2007
5. H.M. Raghunath Fluid Mechanics CBS Publication New Delhi.2008
6. M.Manohar, Fluid Mechanics. Vol-I Vikas Publishing house Pvt Ltd New Delhi.2008

QUESTION PAPER PATTERN FOR SEE:

1. Any Five Full questions are to be answered choosing at least one from each unit.
2. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
3. Any Five Full questions are to be answered choosing at least one from each unit.

UCV435C: BUILDING PLANNING AND DRAWING

2 Credits (2-0-0)

1. To prepare working drawings for various components of building.
   a. Stepped wall footing
   b. Isolated RCC column footing
   c. RCC dog legged stair
   d. RCC open well stairs

6 Hours

2. Functional design of buildings (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards, bye laws, setback distances and calculation of carpet area, plinth area and floor area ratio.

5 Hours

3. Development of plan, elevation, sectional elevation and schedule of openings from the given line diagram of residential buildings
   a. Single Storied Building with One bed room
   b. Single Storied Building with Two bed room
   c. Two Storied Building

7 Hours

4. Planning and development of line diagrams for following Public buildings
   a. Primary health centre
   b. Primary school building
   c. Office building

6 Hours

5. For a given single line diagram of a building, preparation of water supply and sanitary layouts

6 Hours

REFERENCE BOOKS:

1. Shah.M.H and Kale CM, Building Drawing, Tata Mc Graw Hill Publishing co Ltd., New Delhi, 4th Edi, 2008
2. Gurucharan Singh, Building Construction, Standard Publishers &distributors,New Delhi, 4th Edn. 1989.
3. Sushil Kumar, Building Construction, Standard Publications, New Delhi, 19th Edn. May 2018
4. National Building Code, BIS, New Delhi, Dec 1986.

CIE Marks

30 marks for term work and 20 marks for test conducted at the end of the semester of **FOUR** hours duration on the line of syllabus mentioned above.

Term Works Details

Sheet No :1& 2 from chapter No-1

Sheet No: 3 to 7 from chapter Nos- 2 & 3

Sheet No : 8 & 9 from chapter No-4

Sheet No: 10 from chapter No-5

SCHEME OF EXAMINATION

Part-A: Compulsory question from chapter Nos- 2 & 3 for 60 marks. To draw Plan, Elevation, Sectional Elevation and Schedule of openings for Single storied building.

Part-B : Three questions of 20 Marks per each; from chapters 1, 4 and 5 should be set out of which **Two** questions have to be answered.

SL.No	Course Objectives	Course Outcomes
1	Students will be able to comprehend various components of building such as Stepped wall footing, Isolated RCC column footing, RCC dog legged stair and RCC open well stairs.	After studying the course the student is to prepare the working drawings for various components of the building such as Stepped wall footing, Isolated RCC column footing, RCC dog legged stair and RCC open well stairs.
2	Students will be learn to draw plan, elevation, and sectional elevation of Residential buildings by using the Building bye laws.	Prepare the detailed drawings of Residential buildings including plan, elevation and sectional elevation.
3	Students will be able to draw line diagram for the public buildings.	Prepare the single line diagram for various public buildings like school, health centre and office buildings.
4	Students will be in a position to prepare the single line diagram for water supply and sanitary layouts	To prepare the layouts for water supply and sanitary.

ADVANCED SURVEYING

UCV436C

3 Credits (2-2-0)

Course Objectives

- Student will come to know the measuring and reading of Horizontal and vertical angles in trigonometric surveying.
- Student will come to know the setting of different horizontal curves in roads, railway, canal and terrain using chain tape and angular method.
- Student will come to know the setting of transition and vertical curves.
- To understand the difference of theodolite and tacheometry and also to know the importance of tacheometry. In addition students will learn the advance instruments and their uses.

Course Outcomes

- In finding the elevations of different targets with respect to instruments under different conditions and relative position of different targets with respect to given point.
- Setting of curves by different methods for different alignments.
- Setting of curves by different methods for different alignments in vertical plain and also setting out gradients.
- Determination of distance and elevation under rugged terrain condition which is useful for plotting of contours by radial method and setting of curves digital preparations by using modern surveying instruments

UNIT-I

Theodolite **10 Hours**

–Classification**,** Parts of Vernier Transit Theodolite **(VTT)** , Fundamental lines and their relations, temporary adjustments

Basic Measurements Using VTT:

Measurement of horizontal angle by repetition and reiteration methods , Measurement of Vertical angle. Numerical problems

Trigonometric Surveying:

UNIT-II

Tachometry: Definition, instruments used , Characteristics, Advantages, Applications of Tacheometry.

Types of tacheometry- Stadia method(Fixed Hair and Movable Hair)

Fixed Stadia Hair Method: principle-determination of constant (Horizontal Line Of Sight) , Derivation of height and distance formula-staff held vertical, Analectic lense, Numerical problems.

Movable Hair: working Principle, Numerical problems

Tangential method-Principle, height & distance formula (Derivation of formulae for All 3

Cases), Numerical Problems

10 Hours

UNIT-III

Simple Curves: Definition, Designation-Elements of curves (No Derivations)
Setting out of Simple curves –Linear methods**-**Perpendicular offsets from long chord Chords Produced method , Radial and Perpendicular Offsets form tangent, Instrumental method- Rankine's method, Numerical problems on linear and instrument methods

Compound Curves: Definitions, Elements**,** Derivation, Setting out of compound curve by angular method and Numerical problems on **case-1 type**

Reverse Curves: Definition, Elements, Reverse curve between Parallel Straights (Numerical problems, no derivations)

10 Hours

UNIT-IV

Vertical curve –Definition, Need & Types. Determination of length of vertical curves-summit & valley curves (No Derivations), Geometric considerations of parabolic vertical curves, Numerical Problems on Setting Out of Vertical Curve by Tangent Correction Method, sight distance considerations in vertical curve (No derivations)

Transition Curves: Definition, Need, Requirement of Transition curves, length of cubic parabola transition curve, angular method of setting out of transition curve (Cubic Parabola), Numerical Problems

Aerial Photogrammetry: Introduction, Basic Terms, Aerial Camera (AC), Vertical Photographs-Definition, Determination of Focal length of AC, Scale of aerial photograph, Height of flight, Ground coordinates- Numerical Problems.
Flight Planning for Aerial Photography: Objectives , procedure of flight planning and Numerical Problems.
Advanced Surveying Instruments; Total Station-Defn, need, working principle, applications GPS--Working Principle, segments in GPS, Types and Application.

Remote Sensing and GIS (Geographic Information System): Definition, Basic Principles, Concept, Process, Components, Advantages and Applications.

14 Hours

TEXT BOOKS:

1. B.C. Punmia, Surveying Vol- II - Std. book house LaxmiPublications-, New Delhi. 12thEdn, 2007.
2. A.M. Chandra Higher Surveying New age international (P) Ltd, 2nd Revised Edn, 2005
3. S SBhavikatti- Surveying and Levelling Vol-II IK International Publishing House Pvt.LtdNew Delhi 1stEdn, 2008.

REFERENCE BOOKS:

1. A.M. Chandra, Plane surveying Vol-II New age International Ltd. New Delhi 2005
2. K.R.Arora, Plane Surveying, Standard book house New Delhi,5thEdn. 2003

QUESTION PAPER PATTERN FOR SEE:

1. Any Five Full questions are to be answered choosing at least one from each unit.
2. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
3. Each Question should not have more than four sub divisions.

Sl. No.		
1		
2		
3		
4		

UHS001N: FUNDAMENTALS OF QUANTITATIVE APTITUDE ANDSOFT SKILLS
1 Credit (2-0-0)

<table>
<tr><td>Course Objectives</td><td colspan="2">The course objectives for the semester are as follows:
1. Cover basic to intermediate topics in the following domains:
a. quantitative aptitude,
b. verbal aptitude, and
c. reasoning aptitude.
2. Build confidence and self-esteem through the following:
a. life skills, and
b. soft skills.
3. Hone career skills and industry awareness.</td></tr>
<tr><td>Course Outcome</td><td colspan="2">After the course, the students will be able to:
1. Answer multiple choice questions from topics in:
a. quantitative aptitude,verbal aptitude, and reasoning aptitude.
2. Use tools and techniques learnt in soft skills modules to:
a. build confidence and self-esteem.
3. Speak knowledgeable about career prospects and industry.</td></tr>
<tr><td>Domain</td><td>Hours</td><td>Modules</td></tr>
<tr><td>Quantitative Aptitude (QA)</td><td>6</td><td>3</td></tr>
<tr><td>Reasoning Aptitude (RA)</td><td>6</td><td>3</td></tr>
<tr><td>Verbal Aptitude (VA)</td><td>6</td><td>3</td></tr>
<tr><td>Soft Skills (SS)</td><td>6</td><td>3</td></tr>
<tr><td>Career Skills (CS)</td><td>6</td><td>3</td></tr>
<tr><td>Total</td><td>30</td><td>15</td></tr>
</table>

<table>
<tr><td colspan="4">DETAILS</td></tr>
<tr><td>Sl. No.</td><td>Domain</td><td>Topic</td><td>Hours</td></tr>
<tr><td colspan="4">UNIT I – Quantitative and Reasoning Aptitude Skills Training</td></tr>
<tr><td>1.</td><td>QA</td><td>Factors and Multiples</td><td>2</td></tr>
<tr><td>2.</td><td>QA</td><td>Divisibility Rules</td><td>2</td></tr>
<tr><td>3.</td><td>QA</td><td>LCM and HCF</td><td>2</td></tr>
<tr><td>4.</td><td>RA</td><td>Puzzles</td><td>2</td></tr>
<tr><td>5.</td><td>RA</td><td>Venn Diagrams</td><td>2</td></tr>
<tr><td>6.</td><td>RA</td><td>Binary Logic</td><td>2</td></tr>
<tr><td colspan="4">Unit II – Verbal Aptitude Skills Training</td></tr>
<tr><td>7.</td><td>VA</td><td>Sentence Completion</td><td>2</td></tr>
<tr><td>8.</td><td>VA</td><td>Para Jumbles</td><td>2</td></tr>
<tr><td>9.</td><td>VA</td><td>Fill in the Blanks (Grammar)</td><td>2</td></tr>
<tr><td colspan="4">Unit III – Career Skills</td></tr>
<tr><td>10.</td><td>CS</td><td>Resume Building</td><td>2</td></tr>
<tr><td>11.</td><td>CS</td><td>Group Discussion - Fundamentals</td><td>2</td></tr>
<tr><td>12.</td><td>CS</td><td>Becoming Industry Aware</td><td>2</td></tr>
<tr><td colspan="4">Unit IV – Soft Skills</td></tr>
<tr><td>13.</td><td>SS</td><td>Personal Branding</td><td>2</td></tr>
<tr><td>14.</td><td>SS</td><td>Networking</td><td>2</td></tr>
<tr><td>15.</td><td>SS</td><td>Delivering a Prepared Speech</td><td>2</td></tr>
</table>

UCV431LSURVEYING PRACTICE-II
1 Credits (0-0-2)

1 Measurement of Horizontal angles by reiteration method using Vernier Transit Theodolite (VTT)

2 Measurement of vertical angle using VTT

3 Determination of elevation of an object: Base accessible using VTT.

4. Determination of Distance and Elevation of an object: Base In-accessible- Single Plane Method- A>B and B>A cases only.(using VTT) and Double Plane Method.

5. Tacheometry-
A-Determination of Tacheometric constants –K & C for fixed stadia hair system of tacheometry by field method.
B- Determination of Elevation and Distance of an object , when Line of Sight is Inclined by fixed stadia hair system of tacheometry.

6. Setting out of simple circular curve by:
A Offsets from Long Chord (Exact Method)
B Offsets form long Chord (Approximate Method)
C Chords Produced Method
D Rankine's Method of Deflection Angles.

7-Building Setting Out Works using Chain and Tape only.-
A) Single Base Method
B) Double Base Method.
8- Total Station- Introduction Taking Out Basic Measurements (SHV, REM,MLM)

9- Total Station –Station Orientation, Backsighting, Instrument Synchronization, Data Recording.

10- Works on Total Station:
A) Area Measurement
B) Topographic Surveying
C) Set out Parallel Lines
D) Traversing.

11. Downloading Total Station Data and Map Compilation.(DEMO ONLY)
A) Plotting Contour map
B) Elevation Profile and C/S profile map
C) Plotting topographic details with and without contours.
D) Cutting and Filling volumes estimation.
12. HAND HELD GPS DEMO

TEXT BOOKS

1. B.C.Punmia, Surveying Volume-11, Standard Book House, Laxmi Publications, New Delhi, 12th Edition-2007
2. Bhavikatti, Surveying and Levelling, 3rd Edition,Hubli, 2008
3. A.M.Chandra Higher Surveying New age International (P) Ltd, 2nd Revised Edition, 2005
4. Dr.K.R.Arora, Plane and Advanced Surveying, Standerd Book House, New Delhi, 7th Edition-2009.
5. GIS and Remote Sensing by Angireddi- 3rd Edition, Indian Publications, Hyderabad-2014.

UCV432L:ENGINEERING GEOLOGY LABORATORY
1 Credit (0-0-2)

1. Megascopic Identification of Minerals based on their Physical properties; Quartz and its varieties.
2. Megascopic Identification of Minerals based on their Physical properties; Felspars, Micas, Hornblende, Olivine, Serpentine, Asbestos, Kyanite, Talc, Garnet, Corundumand Barite.
3. Megascopic Identification of Minerals based on their Physical properties Carbonates and Ore minerals.
4. Megascopic Identification of Igneous Rocks based on Geological Properties-Granite, Syenite, Diorite, Gabbro, Dunite, Porphyries, Dolerite, Pegmatite, Basalt and Pumice.
5. Megascopic Identification of Sedimentary Rocks based on Geological Properties-Sand Stone, Lime Stone, Shale, Breccia, Conglomerate and Laterite.
6. Megascopic Identification of Metamorphic Rocks based on Geological Properties-Gneiss, Quartzite, Marble, Slate, Phyllite, Schist and Charnockite.
7. Study and interpretation of standard geological maps.
8. Dip and Strike problems.
9. Borehole Problems (On Level Ground).
10. Thickness Problems.

REFERENCE BOOKS:

1. B.S.Satyanarayanswamy- Engineering Geology lab Manual,Eurasia Publication,NewDelhi.2003.
2. M.T.Maruthesha Reddy- Engineering Geology Practicals,New Age InternationalPvt Ltd ,1st Edn, New Delhi 2002.
3. N.W.Gokhale-Manual of Geological Maps, CBS Publishers & Distributors, 1stEdn, New Delhi.1987.
4. N.W. Gokhale- Exercises on geological Maps & Dip-Strike Problems,CBS Publishers &Distributors, 1st Edn, New Delhi.1996.
5. N.W.Gokhale-AGuide to Field Geology, CBS Publishers & Distributors, 1st Edn.New Delhi.2001

LABORATORY ASSESSMENT:

1. Each Laboratory Subject is evaluated for 100 marks (50 CIE and 50 SEE)

Allocation of 50 marks for CIE Performance and Journal write-up: 30 marks. One Practical test for 20 marks.

2 Allocation of 50 marks for SEE: 50% for identification of minerals and rocks, 40% for problems and maps and 10% for viva voce.

UMA430M : BRIDGE COURSE MATHEMATICS-II

Credits: Mandatory

(Common to all branches)

Ordinary differential equations of first order:
Variable seperable,Homogeneous.Exact form and reducible to exact differential equations.Linear and Bernoulli's equation.

15 Hours

Differential Equations of higher order:
Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters(second order); Cauchy's and Legendre homogeneous equations.
Laplace Transform: Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function
Inverse Laplace transforms –
Properties.Convolution theorem. Solutions of linear differential equations

15 Hours

Partial Differential Equations(PDE's):

Introduction to PDE : Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, method of separation of variables

10 Hours

TEXT BOOKS:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

REFERENCE BOOKS:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:** Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.

6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

Question paper pattern for SEE

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

Sl. No	**Course Learning Objectives**: The purpose of the courseis to facilitate the students withconcrete foundation of differential equations and Laplace transform to acquire the knowledge of these mathematical tools.	**Course Outcomes:** On completion of this course, students are able to:
1		Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.
2		Apply the Laplace transform techniques to solve differential equations.
3		Understand a variety of partial differential equations and solution by exact methods.
4		Solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables

DEPARTMENT ELECTIVE-I

UCV431E: AIR POLLUTION AND CONTROL
02 Credits (2-0-0)

UNIT-I

Introduction: Definition- Classification and Characterization of Air Pollutants, Emission Sources, Behavior and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog. Air Pollution Inventories.

Effects of Air Pollution: On Human Health, Animals, Plants and Materials- Major Environmental Air Pollution Episodes- London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

10 Hrs

UNIT-II

Meteorology: Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose, General Characteristics of Stack Plumes, Meteorological Models. Industrial Plant Location and Planning.

10 Hrs

UNIT-III

Sampling, analysis and control: Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutions, Smoke and Smoke Measurement, Air Pollution Control Methods, Particulates, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers, Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions- Adsorption by Liquids, Adsorption by Solids, Combustion odors and their control.

10 Hours

UNIT IV

Air pollution due to automobiles: Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.
Burning environmental issues: Acid Rain, Global Warming, Ozone Depletion in Stratosphere, Indoor Air Pollution.

Standards and Legislation: Air Quality and Emission Standards Legislation and Regulation, Air Pollution Index.

10 Hrs

TEXT BOOK

1. M.N.Rao and H.V.N Rao, Air pollution, Tata Mc Graw Hill 41st Edition 2012.
2. Santosh Kumar Garg, Sewage disposal and air pollution Engineering, Khanna publisher, Vol. 2 25th edition 2012.
3. Daniel vallero, Fundamentals of air pollution, Elsevier publications, 4th edition 2008.

REFERENCE BOOKS:

1. Henry C , PerkinsAir Pollution: McGraw Hill Ltd 1974
2. AirPollution Sampling and Analysis APHA Dec 2016
3. Harper and Row, Air Pollution Its origin and control.: Wark. K and Warner, F. publishers, New York.1998

QUESTION PAPER PATTERN FOR SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions. Any Five Full questions are to be answered choosing at least one from each unit

Sl .no	Course Objectives	Course outcomes
1	To make the student to identify the sources, causes and effects of air pollution.	Ability to identify sources, causes and effects of air pollution.
2	To make the student to understand the plume behavior. And also to identify meteorological components.	Ability to identify meteorological components and plume behavior necessary for industrial plant planning
3	To make the student to measure the air pollutants and their controlling methods.	Compare of measurement of air pollutants and their control methods.
4	To make the student to gain the knowledge of automobile pollution , environmental issues and standards to be applied for control.	Compare the automobile pollutants, environmental issues, standards and legislation.

UCV432E ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES

02 Credits – (2-0-0)

UNIT- I

Introduction: Energy in Building Materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective technologies, Requirements for building of different climatic regions. Traditional building methods and vernacular architecture- Definition, objectives, Features of different types of Indian Vernacular architecture.

6 Hours

UNIT-II

Alternative Building Materials: Characteristics of building blocks for walls, stones and Laterite blocks, Bricks and hollow clay blocks, Concrete Blocks, Stabilized blocks: mud blocks, steam cured blocks,Fal-G blocks,stone masonry block.

6 Hours

UNIT-III

Lime-Pozzolona Cements: Raw materials, Manufacturing process, properties and uses, Fibre reinforced concretes, Matrix Materials, Fibres: metal and synthetic, properties and applications, Fibre reinforced plastics, Matrix materials, Fibres: organic and synthetic, Properties and applications , Building materials from agro and industrial waste: Types of agrowastes, Types of industrial and mine wastes, properties and applications.

8 Hours

UNIT-IV

Alternative Building Technologies: Ferrocement building components, materials and specifications, properties, construction methods, Applications.

Smart Materials: Introduction to composite and smart materials, classifications & applications.

Cost Effective Building Design: Cost Concepts in building, cost saving techniques in planning.

6 Hours

TEXBOOKS:

1.K.S.Jagadish and B.V.Venkatarama Reddy, Alternate building methodologies for engineers New Age International Publishers 2018

2. M.S.Shetty Concrete Technology S Chand Publications 2018

3.Sidney, M.Johnson Deterioration, Maintenance and Repair structures 1965

4.M.Mukhopadhya , Mechanics of Composite Materials and Repair of Structures University press 2009

REFERENCE BOOKS:

1. Relevant IS Codes

2.Alternative building materials and technologies.

3.Proceedings of workshop on Alternative Building Material and technology 19th to 20th December 2003@ BVB College of Engineering & Tech., Hubli

SI No	Course Objectives	Course Outcomes Student will be able to
01	Learn the fuel requirements for manufacture of building materials, contribution of construction industry for global warming, traditional methods of building construction and their importance.	Differentiate different alternative building materials and recommend materials suitable for different climatic conditions.
02	Impart knowledge about alternative building materials	Characterize different building blocks and their suitability.
03	Educate students about fibre reinforced composites	Describe the method of construction and applications of FRC.
04	Impart knowledge about smart materials and cost effective design.	Appraise the different smart materials and cost effective design.

Basaveshwar Engineering College, (Autonomous)
Bagalkot
Department of Civil Engineering

V SEMESTER SCHEME (2020-21)

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV541C	Design of RC Structures-I	4	4	0	0	50	50	100
2	UCV542C	Structural Analysis-II	3	2	2	0	50	50	100
3	UCV543C	Geotechnical Engg- I	3	3	0	0	50	50	100
4	UCV544C	Hydraulic Engineering	3	2	2	0	50	50	100
5	UCS559/ 659L	Advanced C-Programming lab	2	0	2	2	50	50	100
6	UCV55XE	Dept Elective - 2	3	3	0	0	50	50	100
7	UHS002N	Advanced Quantitative Aptitude & Soft Skills	1	0	0	2	50	50	100
8	UCV541L	Fluid Mechanics Lab	1	0	0	2	50	50	100
9	UCV542L	Computer Applications in Civil Engg Lab	1	0	0	2	50	50	100
10	UCV543L	Highway Material Testing Lab	1	0	0	2	50	50	100
		Total	**22**	**14**	**06**	**10**	**500**	**500**	**1000**

Department Elective –II

Sl. No.	**Subject code**	**Subject**	**Credits**
1	UCV551E	Energy efficient buildings	3
2	UCV552E	Environmental Impact Assessment	3
3	UCV553E	Remote sensing and GIS	3
4	UCV554E	Masonry structures	3
5	UCV555E	Traffic Engineering	3

UCV541C: DESIGN OF RC STRUCTURES - I
4 Credits (4-0-0)

UNIT – I

General features of reinforced concrete: Introduction, Design loads, Materials forreinforced concrete, Code requirements of reinforcements, Elastic theory of RC sections, Moment of resistance of section, Balanced, under reinforced and over reinforced section

Principles of limit state design and ultimate strength of RC section: Philosophy of limit state design, Principles of limit states, Factor of safety, Characteristic and design loads, Characteristic and design strength, General aspects of ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of rectangular sections, Ultimate flexural strength of flanged sections, Ultimate flexural strength of doubly reinforced sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage, Analysis examples for rectangular sections, flanged sections, doubly reinforced, sections, shear strength and development length.

13Hrs

UNIT – II

Serviceability limit state: General aspects, Deflection limits in IS: 456-2000, Calculation of deflection (Theoretical method), Cracking in structural concrete members.

Design of beams: Practical requirements of an RCC beam, Size of the beam, Cover to the reinforcement, Spacing of bars, Design procedure, Critical sections for moments and shear, Anchorage of bars: check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Design examples for simply supported and cantilever beams (rectangular and flanged sections).

14Hrs

UNIT – III

Design of slabs: Introduction, General consideration of design of slabs, Rectangular slabs spanning in one direction, Rectangular slabs spanning in two directions for various boundary conditions, Design of simply supported slabs, cantilever slabs and continuous slabs.

Design of columns: General aspects, Effective length, Loads on columns, Slenderness limits for columns, Minimum eccentricity, Design of short axially loaded columns, Design of column subject to combined axial load and uniaxial moment using SP 16.

13Hrs

UNIT – IV

Design of footings

Introduction, Load for foundation, Design basis (limit state method), Design of isolated rectangular footing for axial load and uniaxial moment, Design of pedestal.

Design of stair case

General features, Types of stair case, Loads on stair cases, Effective span as per IS codal, provisions, Distribution of loading on stairs, Design of stair cases

12Hrs

TEXT BOOKS:

1. N. Krishna Raju, "Design of Reinforced Concrete Structures (IS: 456 2000)", 3rd Edition, CBS Publishers and Distributors, New Delhi. Jan 2009.
2. P.C. Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi. 2008.
3. B.C.Punmia, Ashok kumar Jain &Arunkumar Jain Limit State design of Reinforced concrete- Laxmi Publication, New Delhi. 2016.
4. Design of RCC Structural Elements S.S. Bhavimath, Vol-I, New Age International Publications New Delhi. 2016.

REFERENCE BOOKS:

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI,New Delhi. 2013
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, VidyarthiPrakashan, Pune. 2017
3. A.K. Jain, Limit state method of design, Nemchand and Bros, Roorisee, Jan 2012.
4. Park and Paulay, Reinforced concrete, John Wiley & Sons. 1975.
5. Kong and Evans, Reinforced and prestressed concrete, ELBS, London
6. H.J. Shah, Reinforced concrete Vol. I, Charotor Publishing House, Anand. Jan 2016
7. IS: 456-2000, SP-24, SP-16.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only)

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
01	To make the student to get knowledge of methods of design of RC sections & To make the students to develop the Knowledge of analyses of RC sections	Students will have the knowledge of methods of design of RC sections & student will analyse the different RC sections.
02	Preparing the student for the knowledge of serviceability criteria of RC sections and Preparing the student to design the different beam sections.	Student will be able to solve the problems related to serviceability conditions and student will design different beam sections.
03	Preparing the student to design slab and columns.	Student will design be able to slab and columns
04	To train the student to design stairs and footings.	Student will design be able to stairsand footings.

UCV542C: STRUCTURAL ANALYSIS – II

3 Credits (2-2-0)

UNIT – I

Analysis of Arches: Three and two hinged parabolic arches with supports at same and different levels; determination of thrust, shear and bending moment.

07 Hrs

Analysis of Cables: Analysis of cables under point load and UDL, length of cables, supports at same and different levels.

06 Hrs

UNIT – II

Slope Deflection Method: Development of slope deflection equations: Analysis of continuous beams and rigid frames (non-sway and sway type).
07 Hrs Moment Distribution Method: Development of method, Analysis of continuous beams and rigid frames (non-sway type).

06 Hrs

UNIT – III

Kani's Method: Development of method,Analysis of continuous beams and rigid frames (non-sway type).

06 Hrs

Matrix Methods of Structural Analysis (system approach): Introduction to Flexibility and Stiffness method, analysis of beams (Static and kinematic indeterminacy ≤ 3).

07 Hrs

UNIT – IV

Rolling Loads and Influence Lines: Rolling Loads, Influence line diagram for reaction, shear force and bending moment at a section for simply supported beams due to point loads and uniformly distributed loads. Uses of Influence lines for analysis of simply supported beam for single and several point loads, uniformly distributed loads

07 Hrs

Introduction to unsymmetrical bending : Symmetry and anti-symmetry, concept of unsymmetrical bending. Numerical problems. Concept and definition of shear centre.

06 Hrs

REFERENCE BOOKS:

1. B C Punmia, A K Jain and A K Jain- Theory of structures, 12th edition, Laxmi Publications, New Delhi, 2004.
2. Pandit G S, Gupta S P and Gupta R- Theory of Structures, 2nd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. Negi L S and Jangid R S- Structural Analysis, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2004.

SUGGESTED BOOKS FOR ADDITIONAL READING

1. R C Hibbeler- Structural analysis, 9th edition, Pearson India, New Delhi, 2017.
2. Devdas Menon – Structural Analysis, Alpha Science Internatonal Ltd., New Delhi, 2007.
3. Wang C K – Intermediate Structural Analysis, McGraw-Hill Publishing Company Ltd, London, 1983
4. SenolUtku, Norris C H and Wilbur John B, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 1993.
5. Reddy C S - Basic Structural Analysis, 3rd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one question from each unit.

S.No.	Course Objectives	Course Outcomes
1	Introduction to definitions, basic concepts associated parabolic three, two hinged arches and cables. Analyze under point loads and udl.	Analyze three and two hinged arches and cables for internal forces.
2	Introduction to definitions and basic concepts associated with slope deflection method and moment distribution method. Analysis of continuous beams and rigid frames.	Analyze the statically indeterminate rigid jointed structures by Slope Deflection method and Moment Distribution method.
3	Introduction to definitions and basic concepts associated with kani's method and matrix methods using system approach. Analysis of continuous beams and rigid frames.	Analyze the statically indeterminate rigid jointed structures by Kani's method and statically indeterminate structures by matrix methods using system approach.
4	Introduction to definitions and basic concepts associated with influence lines, rolling loads, unsymmetrical bending. Analysis of simply supported beams under rolling loads. Stresses in beams due to unsymmetrical bending.	Draw influence lines for simply supported beam due to rolling loads and determination stresses for beams subjected to unsymmetrical bending.

UCV543C GEOTECHNICAL ENGINEERING-I

3 Credits (3-0-0)

UNIT- I

Introduction- History of soil mechanics, Origin and formation of soil, Regional soil deposits in India, Phase Diagram, basic definitions and their interrelationships.

Index properties- Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis (sieve and Hydrometer analysis) consistency limits and indices, Plasticity chart. Activity of clay, Field identification tests, BIS soil classification (IS: 1498-1970).

08 Hrs

UNIT- II

Clay Mineralogy- Soil structure- Single grained, honey combed, flocculent and dispersed structures, Valence bonds, Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Isomorphous substitution. Common clay minerals in soil and their structures- Kaolinite, Illite and Montmorillonite and their application in Engineering

Flow through Soils-Darcy's law-assumption and validity, coefficient of permeability and its determination (laboratory and field), factors affecting permeability, permeability of stratified soils, Seepage velocity, superficial velocity and coefficient of percolation, Capillary Phenomena.

10 Hrs

UNIT- III

Seepage Analysis-Laplace equation, assumptions, limitation sand its derivation. Flow nets-characteristics and applications. Flow nets for sheet piles and below the dam section. Unconfined flow, phreaticline (Casagrande's method–with and without toe filter), flow through dams, design of dam filters.

Compaction of Soil-Definition, Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties, Field compaction control-compactive effort & method of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipments and their suitability.

10 Hrs

UNIT- IV

Consolidation of soil- Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption and limitations (no derivation), Normally consolidated, under consolidated and over consolidated soils, pre-consolidation pressure and its determination by Casagrande's method. Consolidation characteristics of soil (C_c, a_v, m_v and C_v), Time rate of consolidation.

Shear strength of soils- Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelops, Total and effective shear strength parameters, Concept of pore pressure, factors affecting shear strength of soils, Sensitivity and Thixotropy of clay. Measurement of shear parameters- Direct shear test, Unconfinedcompression test, Triaxial compression test and vane shear test, Test under different drainage conditions.

12 Hrs

TEXT BOOKS:

1. Alam Singh and Chowdhary G.R. (1994), Soil Engineering in Theory and PracticeCBS Publishers and Distributors Ltd., NewDelhi.
2. Punmia B.C. (2005), 16^{th} Edition Soil Mechanics and Foundation Engg.-Laxmi Publications Co. , New Delhi.

REFERENCES BOOKS:

1. Bowles J.E. (1996), 5th Edition, Foundation Analysis and Design- McGraw Hill Pub. Co. New York.
2. Murthy V.N.S. (1996), 4th Edition, Soil Mechanics and Foundation Engineering- UBS Publishers and Distributors, New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2000), Basic and Applied Soil Mechanics- New Age International (P) Ltd., Newe Delhi.
4. Venkatrahmaiah C. (2006), 3rd Edition Geotechnical Engineering New Age International (P) Ltd., Newe Delhi.
5. Craig R.F. (1987), Soil Mechanics- VanNostrand Reinhold Co. Ltd.
6. Braja M. Das (2002), 5^{th} Edition, Principles of Geotechnical Engineering- Thomson Business Information India (P) Ltd., India.
7. Iqbal H. Khan (2005), 2nd Edition, Text Book of Geotechnical Engineering- PHI, India.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcome
1	Students are exposed to know the history and basic concepts used in soil mechanics and index properties and classification of the soil	Students will use the basic concepts and properties of soil to identify and classify the soil
2	To study the structure of the soil and clay minerals and assess the quantity of permeability of soil	use the clay minerals to identify the expansive soil and Determine the permeability characteristics of soil
3	To draw the flow nets and understand the compaction phenomenon in soil	Determine the quantity of seepage with the help of flow nets and inspect the quality control during compaction of soil
4	Also to analyse the shear strength and consolidation characteristics of the soil	Present the consolidation phenomenon and determine the shear strength of soil

UCV544C: HYDRAULIC ENGINEERING

3 Credits (2-2-0)

UNIT I

Viscous Flow: Reynolds's experiment, Laminar flow through circular pipes. Hagen Poiseuille's equation, derivation and numericals.Relation between pipe friction factor and Reynolds number, numericals.

Elements of Boundary layer theory: Development of boundary layer over a thin plate**,** Derivation of thickness of boundary layer and numericals, Derivation of von Karman's momentum integral equation.

10Hrs

UNIT II

Open Channel Flow: Classification,Derivation and numericals of Chezy'sand Manning's equations. Most economical rectangular, trapezoidal and circular channel sections: derivations and numericals.

Open Channel Flow: Specific energy, specific energy curve, Derivation of critical depth, critical velocity and minimum specific energy, Numericals. Froude's number and its significance. Hydraulic jump: derivation and numerical

10Hrs

UNIT III

Dimensional and Model Analysis: Units and dimensions, Dimensional homogeneity: Rayleigh's method, Buckingham's pi-theorem and examples.Types of similarities and Dimensionless parameters.
Water Hammer in Pipes: Derivation for pressure risedue to gradual and sudden closure of valveand problems.

Pipe Network Analysis: Hardy-cross method and problems.

10Hrs

UNIT IV

Impulse Momentum Principle and Applications: Impact of jeton stationary & moving, flat &curved,symmetric&unsymmetrical vanes. Force exerted bya jet on series of vanes, work done and efficiency. Derivations and problems.

Hydraulic Turbines: General layout of hydroelectric plants, Definitions of Heads and efficiencies of a turbine and Classification.

Centrifugal Pumps: Components, definitions of heads and efficiencies, work done and general principles of working-Work done and Priming of pump and characteristic curves.

10Hrs

TEXT BOOKS:

1. Fluid Mechanics by Dr.R. K. Bansal, Laxmi Publications, New Delhi.
2. Fluid Mechanics and Hydraulic Machines by P.N. Modi and S.M. Seth, Standard Publications, New Delhi.

REFERENCE BOOKS:

1. Elementary Hydraulics (1st Edition) James F Cruse, Vijay P. Singh. Mohsan M. Sherif, Thomson Learning.
2. Fluid Mechanics, Hydraulic and Hydraulics by K.R. Arora, Standard Book House, New Delhi.
3. Fluid Mechanics, John F. Douglas etal, Pearspm Education, India.
4. Thousand solved Problems in Fluid Mechanics by S.Subramanya, Students Mcgraw Hill Publication, New Delhi.
5. Open channel flow by K. Subramanya, Mcgraw Hill Publication, New Delhi.

QUESTION PAPER PATTERN FOR SEE :

1. Total ofEight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objectives	Course Outcomes
	Objective of this course is to make students learn:	**After successful completion of the course student will be able to:**
1.	Basics of viscous flow and boundary layer theory.	Apply concepts of viscous flow and boundary layer theory in solving problems.
2.	Concepts of open channels flow and design of economical cross sections.	Design open channels with economical cross-sections and solve problems related to hydraulic jump.
3.	Principles of dimensional analysis and its applications.	Apply dimensional analysis, water hammer and pipe network analysis concepts to problem solving.
4.	Water hammer principles and pipe network analysis.	Quantify impact of jets on different vanes and design pumps and turbines.
5.	The principles of impact of jets and its applications.	
6	Working principles of turbines and pumps.	

UCS559/659L ADVANCED C PROGRAMMING LAB
Credits 2(0-2-2)

UNIT -1 (6 hours)

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.

Revised Bloom's Taxonomy Level L_1 –Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analyzing, L_5 – Evaluating, L_6 – Creating

UNIT- II (6 hours)

Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

Revised Bloom's Taxonomy Level L_1 –Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analyzing, L_5 – Evaluating, L_6 – Creating

UNIT- III (6 hours)

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.

Revised Bloom's Taxonomy Level L_1 –Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analyzing, L_5 – Evaluating, L_6 – Creating

UNIT- IV (6 hours)

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals;

Revised Bloom's Taxonomy Level L_1 –Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analyzing, L_5 – Evaluating, L_6 – Creating

TEXTBOOKS				
Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Data Structures: A Pseudo-code approach with C	Gilberg&Forouzan	Cengage	2nd Edition, 2014
2	Data Structures through C	YashwantKanetkar	BPB Publications	2017
REFERENCE BOOKS				
1	Data Structures: A Pseudo-code approach with C	Gilberg&Forouzan	Cengage	2nd Edition, 2014
2	Data Structures using C	ReemaThareja	Oxford press	3rd Edition 2012

3	An Introduction to Data Structures with Applications	Jean-Paul Tremblay & Paul G. Sorenson	McGraw-Hill	2nd Edition,2013
Web links and Video Lectures: https://nptel.ac.in/courses/106/106/106106130/ https://www.classcentral.com/course/edx-c-programming-pointers-and-memory-management-11533				

Multidimensional arrays.Self-referential structures and Unions.**Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.

Part A

1. a)Write C program to accept and display 1d array Also write functions
   i) to insert an element based at the specified position
   ii) to delete element based on the position
   iii) to delete based on the value

2 function should take care of invalid data and accordingly display appropriate error messages

Write C program to accept and display 2d array of user specified size.Also write functions to perform the following on the 2d array

i)Functionrow_sum that takes row number as parameter and returns the sum of the row

ii)Functioncol_sum that takes column number as parameter and returns the sum of the column

v)Function secondary _diagonal_sum that returns the sum of secondary diagonal elements if possible else should return -1

vi)Functionprimary_diagonal_sum that returns the sum of primary diagonal elements if possible else should return -1

c)Write C function to accept and display 3d integer array of user specified dimension.Use separate functionsAlso write functions perform the following on the 3d array

i) Function average that invokes one of the above function and returns the average
ii)Function prime_count that computes the total number of prime numbers
iv) Functionoccurrence_count that accepts the key number and determines the occurrence count in entire array

2 Write C program to store information(name,employeeid,designation,date of birth,stay details) about set of employees in a company. Here

designation is an enumerator with values {md, manager,clerk,peon}

date_ of_ birth is a structure for holding birth date with fields day,month,year stay_detail should hold street number and sector number and house number for the employees staying outside company premises else only quarter number(hint use union).Write functions to

i) to display names of all the employees
ii) to display employees staying outside company premises or quarters based on users choice
iii) to return the employee details given the employee_id
iv) to modify specific employee details based on users choice

3. Write C program to allocate dynamic memory to 2d array ,accept and display the array elements. Use separate functions to allocate, load and display the array

Part B

1. Write C program to implement stack of integers using array.
2. Wrte C program to implement circular queue of integers using array
3. Write C program to create a singly linked list of integers and allow following operations on the linked list
   i)to traverse the list
   i)to search the key element
   iii)to insert an element after some key element
   iv)to delete a specific element
4. Write C program to implement stack using linked list
5. Write C program to implement queue using linked list
6. Write program to create a binary tree. Also write functions

   i) to traverse in inorder,preorder,postorder
   ii)to search an element
   iii) number of leaf nodes

Sl. No.	**The objective of the course is to:**	**Course outcomes:** By the end of the course, the student will be able to:
1	Imbibe thorough knowledge in advanced C programming concepts	Define advanced C programming concepts like pointers, data structures
2	Have proficiency in applying advanced C programming concepts to solve any real world problem.	Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
3		Analyze different data structures and use suitable data structure to implement requirement specification
4		Implement, interpret, debug and test any given advanced C program
5		Develop software product using advanced C programming concepts to solve real world problem.

UHS002N: FUNDAMENTALS OF QUANTITATIVE APTITUDE ANDSOFT SKILLS

1 Credit (2-0-0)

Course Objectives	The course objectives for the semester are as follows: 1. Cover advanced topics in the following domains: a. quantitative aptitude, b. verbal aptitude, and c. reasoning aptitude. 2. Build confidence and self-esteem through the following: a. life skills, and b. soft skills. 3. Hone career skills and industry awareness. 4. Develop awareness of career paths and competitive exams.	
Course Outcome	After the course, the students will be able to: 1. Answer multiple choice questions from topics in: a. quantitativeaptitude,verbal aptitude, and reasoning aptitude. 2. Use tools and techniques learnt in soft skills modules to: a. build confidence and self-esteem. 3. Speak knowledgeable about career paths and competitive exams.	
Domain	**Hours**	**Modules**
Quantitative Aptitude (QA)	6	3
Reasoning Aptitude (RA)	6	3
Verbal Aptitude (VA)	6	3
Soft Skills (SS)	6	3
Career Skills (CS)	6	3
Total	30	15

DETAILS

Sl. No.	Domain	Topic	Hours
UNIT I – Quantitative and Reasoning Aptitude Skills Training			
1.	QA	Speed Maths	2
2.	QA	Areas and Volumes	2
3.	QA	Concept Review	2
4.	RA	Number Series and Letter Series	2
5.	RA	Coding and Decoding	2
6.	RA	Concept Review	2
UNIT II –Verbal Aptitude Skills Training			
7.	VA	Reading Comprehension	2
8.	VA	Listening Comprehension	2
9.	VA	Concept Review	2
Unit III – Career Skills			
10.	CS	Orientation to competitive exams, such as GATE, GRE, GMAT, CAT, UPSC, SSC, and Bank PO.	2
11.	CS	Group Discussion – Simulation	2
12.	CS	Orientation to career paths, such as core engineering, IT engineering, public sector, banking, sales and marketing, and entrepreneurship.	2
Unit IV – Soft Skills			
13.	SS	Dressing and Grooming	2
14.	SS	Professional Etiquette	2
15.	SS	E-mail Writing	2

UCV541L: FLUID MECHANICS LABORATORY
1 Credit (0-0-2)

LIST OF EXPERIMENTS:

1. Calibration of Orifice.
2. Calibration of mouth piece.
3. Calibration of triangular notches.
4. Calibration of rectangular notches.
5. Calibration of trapezoidal notches.
6. Calibration of weirs.
7. Calibration of Venturimeter and Orificemeter.
8. Experiments on major and minor losses in the pipes.
9. Impact of jet on the flat and hemispherical vanes.

TEXT BOOKS:

1. R.K Bansal, Fluid mechanics, Laxmi Publications; Tenth edition, 2018.
2. P N Modi and S M Seth Fluid mechanics and Hydraulic Machines by, Standard book house; 22nd edition,2017.
3. Bireshwarmajumdar, Fluid mechanics lab manual by: PHI Learning, 2nd edition 2015.
4. K.L.Kumar. "Engineering Fluid Mechanics" Experiments, Eurasia Publishing House, 1997

LABORATORY ASSESSMENT:

Each laboratory subject is evaluated for 100 marks (50 CIE and 50SEE)

1. Allocation of 50 marks for CIE "Performance and Journal write-up Marks for each experiment= 30 marks/ No of proposed experiments.
2. One pratical test foe 20 marks. (5 write-up, 10 conduction, calculation, results etc 5 viva-voice).
3. Allocation of 50 marks for SEE
   25% write-up, 50% conduction, calculation, results etc 25% viva-voice

UCV542L: COMPUTER APPLICATIONS IN CIVIL ENGINEERING LAB

1 Credit (0-0-2)

INTRODUCTION TO AUTOCAD

Basics of drafting: How to use AUTOCAD for drafting, Basic commands, Draw Modify Tool bars
Coordinate systems, GUI familiarization.

AUTOCAD: application to civil engineering drawingsPreparation of drawings: Foundation cross section, Masonry Wall, Isolated Footing, Lintel, Chejja. Different types of Doors, Windows, Staircases, RCC Beams and Slabs. Building Plan, Elevation and Sections.

ANALYSIS AND DESIGN SOFTWARES: Analysis and Design of structuralEngineering components using commercially available Software's: Cantilevers, Simply supported beams, Propped Cantilevers, Fixed and Continuous Beams. 2D Portal frames - Single and Multistoried.

MICROSOFT EXCEL: APPLICATION TO CIVIL ENGINEERING PROBLEMS SFD and BMD for cantilever and simply supported beams subjected to UDL throughout the span. Design of singly and doubly reinforced beams, Computation of Earthwork, Design of Horizontal Curve by Offset method and Design of Super Elevation.

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE
    - Performance and journal write - up:
    - Marks for each experiment = 30 marks/ No. of proposed experiments.
    - One Practical test for 20 Marks. (5write-ups, 10 conduction, calculation, results etc. 5viva-voce)
3. Allocation of 50 marks for SEE.

- 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

UCV543L HIGHWAY MATERIALS TESTINGLAB

1 Credit (0-0-2)

1. **SAND:** Bulking of sand, Zoning, Specific gravity and water absorption.
2. **AGGREGATES:** Crushing, abrasion, impact and Shape tests (Flaky,Elongation, Angularity number) Specific gravity and water absorption
3. **BITUMINOUS MATERIALS AND MIXES:** Specific Gravity, Penetration,Ductility, Softening point, Flash and fire point, Viscosity Marshall Stability tests.
4. **SUBGRADE SOIL**: CBRTest

REFERENCE BOOKS:

1. Relevant IS Codes & IRC Codes
2. High way Material Testing Lab Manual By New Chand & Brothers

Minimum Ten Experiments are to be completed.

Candidate has to perform two experiments in the Semester Eng Examination

LABORATORYASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50 marks for CIE

* Performance and journal write up:

Marks for each experiment = 30 marks/ No. of proposed experiments.

One Practical test for 20 Marks.(5 write-up, 10 conduction, calculation, results etc., 5 viva-voce)

Allocation of 50 marks for SEE.
* 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

DEPARTMENT ELECTIVE-II

UCV551E: ENERGYEFFICIENTBUILDINGS

3 Credits (3-0-0)

UNITI

Introduction: Conventionalversus Energy efficientbuildings–Historicalperspective,Water–Energy–IAQrequirement analysis–Futurebuildingdesignaspects-Criticalityofresourcesandneedsofmodemliving

Landscapeandbuildingenvelopes: EnergyefficientLandscapedesign- Micro-climates-variousmethods-Shading,waterbodies-Buildingenvelope:Buildingmaterials,Envelopeheatlossandheatgainanditsevaluation,paints, Insulation, Designmethodsandtools.

12 Hours

UNITII

Heating ventilation and air-conditioning: Natural Ventilation, Passive-cooling and heating-Application of wind, water and earth for cooling- evaporative cooling, radiant cooling- Hybrid methods-Energy Conservation measures, Thermal Storage integration in buildings.

10 Hours

UNITIII

Heat transmission in buildings: Surfaceco-efficient: aircavity,internalandexternalsurfaces,overallthermaltransmittance, wall and windows,Heattransferduetoventilation/infiltration,internalheattransfer,SolartemperatureDecrementfactor,Phaselag.Designofdaylighting;
Estimationofbuildingloads:Steadystatemethod, networkmethod,numericalmethod, correlations;
Computerpackagesforcarryingoutthermaldesignofbuildingsandpredictingperformance.

10 Hours

UNIT IV

Passivecooling&renewableenergyinbuildings: Passivecoolingconcepts;: Evaporativecooling,radiativecooling;Applicationofwind,waterandearthforcoolingShading,paintsandcavitywallsforcooling;Roofradiationtraps;Earthair-tunnel.Introductionofrenewablesourcesinbuildings,Solar waterheating,smallwindturbines, standalonePV systems, Hybridsystem-Economics.

08 Hours

TEXT BOOK/REFERENCES:

1. Clarke, Joseph. Energy simulation in building design.Routledge, 2007.

2. Krishan, Arvind, ed. Climate responsive architecture: a design handbook for energy efficient buildings. Tata McGraw-Hill Education, 2001.
3. Krieder, J and Rabi, A., Heating and Cooling of buildings : Design for Efficiency, McGraw Hill, 1994.
4. UrsalaEicker, “Solar Technologies for buildings”, Wiley publications, 2003.
5. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com)
6. Patrick Waterfield “The Energy Efficient Home: A Complete Guide”- The Crowood Press Ltd; New edition,2011.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
01	To make students understand the current energy scenario and the importance of energy-savings.	Evaluate and justify energy-saving measures in existing building stock.
02	To make students learn energy efficiency measures on grounds of engineering and economic feasibility.	Apply energy efficiency measures on grounds of engineering and economic feasibility.
03	To run simple simulation programs of buildings to perform energy calculations, evaluate the relationship between energy use, indoor comfort and users.	Apply simulation programs of buildings to perform energy calculations, evaluate the relationship between energy use, indoor comfort and users.

UCV552E: ENVIRONMENTAL IMPACT ASSESSMENT

03Credits (3-0-0)

UNIT-I

Developmental activity and ecological factors: EIA, EIS, FONSI. Need for EIA Studies, Baseline Information, Step-by-step procedures for conducting, EIA, Limitations of EIA.

10 Hrs

UNIT-II

Frame work of impact assessment: Developmental Projects Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies. Techniques of EIA.Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, Cultural and Socio-economic Environment.

10Hrs

UNIT-III

EIA guidelines for developmental projects: Rapid and Comprehensive EIA. Public Participation in Environmental Decision making.Practical considerations in preparing Environmental Impact Assessment and Statements.

10Hrs

UNIT-IV

Salient features of the project activity: Environmental Parameter Activity Relationships-Matrices EIA for water resource developmental projects, Highway Projects: Nuclear- Power plant project, Mining project (Coal, Iron ore)

Environmental audit: Types objectives and procedures of Environmental Audit.

10Hrs

TEXTBOOKS:

1. Jain R.K., Environmental Impact Analysis, Van Nostr and Reinhold Co.1996.
2. Anjaneyalu Y, Environment Impact Assessment .2nd Edition B. S. publications, 2015

REFERENCE BOOKS:

1. Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI. Jan 2001
2. Larry W. Canter, Environment Impact Assessment .McGraw Hill Higher Education -1977.

QUESTION PAPER PATTERN FOR SEE:

1. Each Question should not have more than four sub divisions.
2. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No	Course Objectives	Course Outcomes:
1.	To impart the basic knowledge of EIA and step by step procedures conducting EIA.	An ability to conduct and assess the impact of pollution.
2.	To make the students understand about the development activities, EIA methodologies and impact on the attributes of air, water, land, noise ecology, soil, cultural and socio economic environments	An ability to compare methods and methodologies of EIA with respect to the attributes of environmental systems.
3.	To make the students familiar with importance of public participation in decision making process and practical consideration in preparing EIA.	An ability in preparing EIA report and involving public in decision making process.
4.	To expose the students to various projects of EIA such as highway, nuclear and mining along with environmental audit.	An ability to conduct EIA for various projects.

UCV553E: REMOTE SENSING AND GEOGRPHIC INFORMATION SYSTEMS

UNIT-I

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Types of reflections, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water, Idealised Remote Sensing System

Sensors: Definition, Sensor Parameters, Types, Choice of sensor, Optical Remote Sensing, Across and Along track scanning systems.

p**latforms:** Definition, Space borne platform attitudes (only definitions, No Problems)

Indian Remote Sensing Programme: Definition and Objectives

Satellite Specifications for IRS-1C, 1D, CARTOSAT-1 & CARTOSAT-2

UNIT-II

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.

Digital Image Processing (DIP): Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), GIS integration –stages & procedure.

GIS:

Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)

Basic Introduction: History, Definition, Components, concept.

GIS functions

Input Functions (Vector and Raster) Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing.

Analysis Functions **(Vector Data-** Buffering & Overlay analysis using overlay operators)

(Raster Data-Local Operations and neighbourhood operations using arithmetic, Logical and Overlay operators)

Output (Vector), Cartography (Defn, techniques,map types, basic map layout-Brief Discussion Only)

UNIT-III

Data Standerds in GIS errors, precision and accuracy-Definition and Types (Only Brief Discussion, No problems)

Advanced Concepts (Brief Discussion Only): LIDAR, VGIS (Definition ,List of components, Advantages) GPS (Definition, Types, Method of point positioning, Principle of working, segments in GPS) (No Problems)

Computer Concepts of GIS: Coding of attribute data in computer (Binary system & Hexadecimal System), coding of vector & Raster data in GIS (No problems or programming)

UNIT-IV

Applications of GISand Remote Sensing :
1) Geomorphology
2) Ground water Vulneribility
3) Geology mapping

Procedure of Compiling: Land Use Land Cover map (LU/LC) with flow chart
Drainage Patterns-Definition, Types, significance

TEXT BOOKS:

1. Remote Sensing & Image Interpretation –Thomas. M.Lillysand& Ralph.W.Keifer-4th Edition.
2. Remote Sensing and Gis-B.Bhatta (Oxford University Press).
3. Remote Sensing and Gis-Angireddy.
4. Geographic Information Systems-C.P.Lo-University Of Georgia, Athens, Georgia, Usa, Albert .K.W.Yeung-Ontario Police College, Aylemer, Ontario, Canada-Preintice Hall Of India Private Limited.
5. Peter A.BurroughReachealAmcDonnel, Principles of Gis (Oxford).

WEB SITES
1. www.gisdevelopment.net
2. www.jsys.org
3. www.nrsc.gov.in
4. NPTEL NOTES

QUESTION PAPER PATTERN:

1. Each Question should not have more than four sub divisions.
2. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objective	Course Outcome
1	Basics of remote sensing (RS) such as physics of Electromagnetic Radiations , need of RS in civil engineering, Use of sensors and platforms in RS, Objectives and Programmes of ISRO.	Collect data and delineate various elements from the satellite imagery using their spectral signature

2	Causes for detoriation of quality of satellite images, digital methods of rectifying and processing of satellite images, Visual interpretation of satellite images for deriving information from Satellite images to achieve specific objectives such as deciding on flood mitigating measures etc	Analyze different features of ground information to create raster or vector data
3	Basics of GIS, application of GIS and the functionalities for civil engineering works. Method of assessing data quality and minimum data standerds required for GIS analyses, concepts of GIS, of Working principle and application of VGIS , LIDAR and GPS	Perform digital classification and create different thematic maps for solving specific problems
	Principles, applications and procedure of preparing Land Use/Land Cover map, Geomorphology and geology map and also open source and Commercial GIS softwares, also utilization of Open Source softwares for civil engineering applications.	Make decision based on the GIS analysis on thematic maps

UCV554E: MASONRY STRUCTURES
Credits 03 (3-0-0)

UNIT-I

MASONRY UNITS, MATERIALS, TYPES & MASONRY CONSTRUCTION: Brick, stone and block masonry units-strength, modulus of elasticity and water absorption of masonry materials, classification and properties of mortars, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking.

05 Hrs

STRENGTH AND STABILITY: Strength and stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

05 Hrs

UNIT-II

PERMISSIBLE STRESSES: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

0**4 Hrs**

DESIGN CONSIDERATIONS: Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion and lintels.

05 Hrs

UNIT-III

LOAD CONSIDERATIONS FOR MASONRY: Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, free standing wall.

04 Hrs

DESIGN OF MASONRY WALLS: Design of load bearing masonry for building up to three storeys using IS: 1905 and SP: 20.

05 Hrs

UNIT-IV

Design of axially loaded unstiffened solid walls, solid wall supported at the ends by cross wall, solid wall with piers, cavity wall and design of cavity wall with cross wall.

05 Hrs

Design of free standing walls with and without staggered, design of masonry tabular structure representing a chimney and design of shear wall under seismic loading.

05 Hrs

TEXT BOOKS

1. Structural Masonry Henry, A.W.: Macmillan Education Ltd, 1990

2. Brick and Reinforced Brick Structures   Dayaratnam P.: Oxford & IBH, 1987

REFERENCE BOOKS:

1. Design of Masonry structures Sinha B.P Davies S.R: E & FN spon 1997
2. IS 1905-1987 Code of practice for structural use of un-reinforced masonry (3rd revision) BIS, New Delhi.
3. SP 20 (S&T)-1991, Hand book on Masonry design and construction (1st revision) BIS, New Delhi.

QUESTION PAPER PATTERN FOR SEE

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.
4. Use of IS: 1905 code is allowed.

Sl. No	**Course Objectives**	**Course Outcomes** After studying the student will be able to
1	Students will be able comprehendmasonry units, materials, types & masonry construction also strength and stability of masonry.	Identify various materials used in masonry, their characteristics and the influence of various parameters on the stability of concentrically loaded masonry walls.
2	Students will belearn permissible compressive stress, stress reduction and shape reduction factors and design considerations.	Summarise the permissible stresses and design considerations
3	Students will be able comprehendload considerations for masonry and design of masonry walls.	Design of masonry up to three storeys
4	Students will be able comprehend design of axially loaded solid walls, cavity walls and free standing walls.	Design of cross wall, solid walls, cavity walls and free standing walls.

UCV555E : TRAFFIC ENGINEERING
Credits 03 (3-0-0)

UNIT-I

Introduction: Definition-Objective Scope of Traffic Engineering. Road User and Vehicle CharacteristicsStatic and Dynamic characteristics- Power performance of vehicles- Resistances to the motion of vehicles- Reaction time of driver- Problems of above.

10 hrs

UNIT-II

Traffic Parameter Studies and Analysis: Various types of traffic engineering studies, datacollection, Objectives and Method of study. Definition of study area- Sample size- Data Collection and Analysis-Interpretation of following Traffic Studies- Volume, Spot Speed study, presentation of spot speed data problems on spot speed, Speed and Delay studyOrigin and Destination.Parking-on Street and off Street Parking, Accidents-Causes, Analysis (collision with parked vehicle only) Measures to reduce Accident, Problems.

10 hrs

UNIT-III

Traffic Flow Theories: Traffic flow theory Green shield theory Goodness of fit correlation and regression analysis (linear only)- Queuing theory Car following theory relevant Problems on above. Traffic Regulation-Driver, Vehicle and Road controls- Traffic Regulations- One Way- Traffic Signs- Traffic Markings-Canalization, Classified traffic volume at intersections, PCU,Traffic Rotary elements, analysis of capacity of rotary

1**0 hrs**

UNIT-IV

Traffic Control: Traffic operation Traffic Signals-Vehicle actuated and synchronized signals Signal Coordination – Intelligent Transport system- Webster's method of signal Design, IRC Method, Street lighting Road Side Furniture- Relevant Problems on above. **10 hrs**

TEXTBOOKS:

1. Khanna and Justo., "Highway Engineering" Nemchand Bros
2. L.R. Kadiyali., " Traffic Engineering and Transport Plankling". Khann Publisher.
3. Matson, Smith and Hurd.," Traffic Engineering ", McGraw Hill and Co
4. Traffic flow theory Drew McGraw Hill Co.,

REFERENCE BOOKS:

1. Pignataro.," Traffic Engineering"., Prentice Hall
2. Highway capacity Manual-2000
3. An Introduction to Transportation Engineering, JotinKhistey and Kent Lall, PHI.
4. Traffic Engineering-Mc Shane and Roess, PHI

Scheme of Examination: Student has to answer five questions selecting at least one question from each UNIT out of eight.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No	Course Objective	Course out come
1.	Students are exposed to scope & objectives of traffic engineering and study the static and dynamic characteristics of vehicles and reaction time of a driver	Able to analyze the vehicles behavior and reaction time of driver
2.	Students will learn traffic flow theory to understand traffic flow behavior and pattern. Learn how to collect the data related to speed of moving vehicles, also learn about different parking patterns, accidents and analysis	Able to interpretate the traffic data in analyzing different vehicular speeds. Able to provide different parking facilities and analyze the accidents and give the remedial measures
3.	Students will learn about traffic flow theory to understand the traffic flow behavior along with traffic regulations. Rotary design and channelization.	Understand the traffic flow behavior able to design rotary and channelization
4.	Study about different traffic controls by traffic signals, intelligent transport system design of signals and road side furniture	Design the signals by different methods and understands ITS

Basaveshwar Engineering College, (Autonomous) Bagalkot
Department of Civil Engineering

VI SEMESTER SCHEME (2018-19 admitted batch)

Sl. No	Subject Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV641C	Design of RC Structures - II	3	2	2	0	50	50	100
2	UCV642C	Geotechnical Engg- II	3	2	2	0	50	50	100
3	UCV643C	Water Supply And Treatment Engineering	3	3	0	0	50	50	100
4	UCV644C	Hydrology and irrigation Engg.	3	3	0	0	50	50	100
5	UCV65XN	Open Elective - 1	3	3	0	0	50	50	100
6	UCV65XE	Dept Elective - 3	3	3	0	0	50	50	100
7	UCV66XE	Dept Elective - 4	3	3	0	0	50	50	100
8	UHS003N	Fundamentals of Quantitative, Aptitude and Soft Skills	1	0	0	2	50	50	100
9	UCV641L	Geotechnical Engg lab	1	0	0	2	50	50	100
10	UCV642L	Environmental Engg lab	1	0	0	2	50	50	100
11	UCV643L	Auto Cad Laboratory for Drawing of RC Structures	1	0	0	2	50	50	100
		Total	**25**	**19**	**04**	**08**	**550**	**550**	**1100**

Department Elective - 3				Department Elective - 4			
Sl. No.	**Subject**	**Subject code**	**Credits**	**Sl. No.**	**Subject code**	**Subject**	**Credits**
1	UCV651E	Numerical techniques	3	1	UCV661E	Elements of earthquake engineering	3
2	UCV652E	Design of Irrigation Structures	3	2	UCV662E	Pavement Materials and Construction	3
3	UCV653E	Ground Improvement Techniques	3	3	UCV663E	Traffic Engineering	3
4	UCV654E	Highway Geometric Design	3	4	UCV664E	Matrix Methods of Structural Analysis	3

Open Elective - 1			
Sl. No.	**Subject code**	**Subject**	**Credits**
1	UCV632N	Remote Sensing and Geographical Information Systems	2
2	UCV653N	Occupational Health and Safety	2

UCV641C: DESIGN OF RC STRUCTURES - II

3 Credits (2-2-0)

UNIT I

1. Design of combined footing:

a) Slab and Beam type - Equal and Unequal loading.

13 Hrs

UNIT II

2. Design of Retaining of Wall(RW):

a) Cantilever RW b) Counter fort RW.

13 Hrs

UNIT III

3. Portal Frames :

a) Fixed Base b) Hinge Base

13 Hrs

UNIT IV

4. Design of Water Tanks:

a) Circular tanks b) Rectangular tanks (Long wall and short wall).

13 Hrs

TEXT BOOKS:

1. N. Krishna Raju, "Design of Reinforced Concrete Structures (IS: 456 2000)", 3rd Edition, CBS Publishers and Distributors, New Delhi. Jan 2009.
2. P.C. Varghese, "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi. 2008
3. B.C. Punmia, Ashok kumar Jain &Arunkumar Jain Limit State design of Reinforced concrete- Laxmi Publication, New Delhi. Jan 2016
4. Design of RCC Structural Elements S.S. Bhavimath, Vol-I, New Age International Publications New Delhi. Jan 2016

REFERENCE BOOKS:

1. Unnikrishnan and Devadas Menon, Design of reinforced concrete structures, PHI, New Delhi. 2013
2. Karve S.R. and Shah V.L, Limit state theory and design of reinforced concrete, Vidyarthiprakashan, Pune. 2017
3. A.K. Jain, Limit state method of design,Nemchand and Bros, Roorisee. Jan 2012

4. Park and Paulay, Reinforced Concrete, John Wiley & Sons. 1975
5. Kong and Evans. Reinforced and prestressed concrete, ELBS, London
6. H.J. Shah, Reinforced concrete Vol. I, Charotor Publishing House, Anand. Jan 2016
7. IS: 456-2000, SP-24, SP-16.

(Note: Use of IS: 456-2000 is permitted and SP-16 to be used in design of columns only)

Question Paper Pattern for SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any four questions are to be answered choosing at least one from each unit, each question carry 25 marks.

Sl. No.	Course Objectives	Course Outcomes
01	To make the student to get knowledge of combined footing and different loads acting on it and designing the same.	Students will analyze and design the combined footing..
02	To Preparing the student to get the knowledge of different cantilever retaining wall and designing of cantilever and counter fort RW.	Student will understand the design and solving technique of retaining walls.
03	To prepare the students for knowing about the portal frames and its forms	Students will analyze and design the portal frames..
04	To train the student to design different water tanks and its design .	Students will design water tanks.

UCV642C GEOTECHNICAL ENGINEERING-II

3 Credits (2-2-0)

UNIT- I

Subsurface exploration- importance of exploration program,methods of exploration: boring, sounding tests, geophysical methods-electrical resistivity and seismic refraction methods.Types of samples-undisturbed, disturbed and representative samples samplers, sampledisturbance, area ratio, recovery ratio, clearance stabilisation of boreholes - typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

Drainage and dewatering- location of ground water table in fine and coarse grained soils. Determination of ground water level by hvorselev's method. Control of ground water during excavation: dewatering- ditches and sumps, well point system, shallow well system, deep well system, vaccum method, electro- osmosis method.

12 Hrs

UNIT- II

Lateral earth pressure- Active and passive earth pressures, earth pressure at rest, earth pressure coefficient. Earth pressure theories - Rankine's and Coulomb's –assumptions and limitations, graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods lateral earth pressure in cohesive and cohesionless soils, earth pressure distribution.

Stability of earth slopes- Types of slopes, causes and type of failure of slopes. Definition of factor of safety, stability of finite and infinite slopes- method of slices, friction circle method, Fellineous method, Taylor's stability number.

13 Hrs

UNIT- III

Lateral earth pressure- Active and passive earth pressures, earth pressure at rest, earth pressure coefficient. Earth pressure theories - Rankine's and Coulomb's –assumptions and limitations, graphical solutions for active earth pressure (cohesionless soil only) –Culmann's and Rebhann's methods lateral earth pressure in cohesive and cohesionless soils, earth pressure distribution.

Stability of earth slopes- Types of slopes, causes and type of failure of slopes. Definition of factor of safety, stability of finite and infinite slopes- method of slices, friction circle method, Fellineous method, Taylor's stability number.

13 Hrs

UNIT- IV

Bearing Capacity of Shallow Foundation- Types of foundations, Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effect of water table and/or eccentricity on bearing capacity of soil, field methods of determining bearing capacity of soil- SPT and plate load test.Foundation settlement-Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).

Pile Foundations- Types and classification of piles, single loaded pile capacity in cohesionless and cohesive soils by static and Dynamic formulas, efficiency of Pile group, group capacity of piles in cohesionless and cohesive soils, negative skin friction, pile load tests, Settlement of piles, under reamed piles (only introductory concepts – no derivation).

14 Hrs

TEXT BOOKS:

1. Alam Singh and Chowdhary G.R. (1994), Soil Engineering in Theory and PracticeCBS Publishers and Distributors Ltd., NewDelhi.
2. Punmia B.C. (2005), 16th Edition Soil Mechanics and Foundation Engg.-Laxmi Publications Co. , New Delhi.

REFERENCES BOOKS:

1. Bowles J.E. (1996), 5th Edition, Foundation Analysis and Design- McGraw Hill Pub. Co. New York.
2. Murthy V.N.S. (1996), 4th Edition, Soil Mechanics and Foundation Engineering-UBS Publishers and Distributors, New Delhi.
3. Gopal Ranjan and Rao A.S.R. (2000), Basic and Applied Soil Mechanics- New Age International (P) Ltd., Newe Delhi.
4. Venkatrahmaiah C. (2006), 3rd Edition Geotechnical Engineering New Age International (P) Ltd., Newe Delhi.
5. Craig R.F. (1987), Soil Mechanics- VanNostrand Reinhold Co. Ltd.
6. Braja M. Das (2002), 5th Edition, Principles of Geotechnical Engineering- Thomson Business Information India (P) Ltd., India.
7. Iqbal H. Khan (2005), 2nd Edition, Text Book of Geotechnical Engineering- PHI, India.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
1	Students are exposed to know the methods of soil exploration, and different types of dewatering systems	In a position to investigate the soil profile and to select the dewatering method during construction
2	To calculate the intensity of vertical stresses and know effective stress	Determine the vertical stresses below different shapes of footing and analysis of the effective stress
3	To determine intensity of lateral earth pressure and to check the slope stability	Check the stability of the slopes and compute lateral earth pressure on retaining wall.
4	To full fill the requirements of a civil engineer like SBC, Proportioning of footing and predict the settlement of the soil and pile foundation	Calculate the bearing capacity of soil and settlement of soil. Also proportionate the footing and know about pile foundation

UCV643C: WATER SUPPLY AND TREATMENT ENGINEERING
3 Credits (3-0-0)

UNIT-I

Introduction: Necessity, planning and execution of modern water supply scheme.
Water Demand and Quantity: Types of water demand - domestic, institutional, commercial, public, and water losses. Estimation of Fire demand and Per-capita demand- factors affecting. Population forecasting, Design period- factors governing.Variations in demand of water and Quantity estimation.

Sources, Collection and Conveyance of water: Factors governing the selection of source for water supply, suitability of surface and subsurface source (quality and quantity).

10 Hrs

UNIT-II

Intake structures: Submerged intake, intake towers, river intake, canal intake, dam intake. Pumps- necessity, power and selection of a pump, economical diameter of rising main.

Quality of Water: Potable and palatable water, waterborne diseases, Physical, Chemical and Microbiological water quality parameters using analytical and instrumental techniques. Indicator organism, MPN, BIS and WHO drinking water standards (BIS 3025 and BIS 1622) using analytical and instrumental techniques. Health significance of Fluoride, Nitrate and heavy metals like mercury, cadmium and Arsenic.Sampling water for examination.

10 Hrs

UNIT-III

Water Treatment: Treatment flow-charts for surface and ground water. Sedimentation- Theory (Newton's and Stoke's Equation) and design concept. Types of Sedimentation tanks. Coagulation-Theory, types of coagulants (Alum, copperas, chlorinated copperas, sodium aluminate and polymers). Constituents of coagulation sedimentation plant. Design of coagulation tanks, clariflocculator.

Filtration-theory, slow-sand, rapid-sand and pressure filters including construction, operation, cleaning and their design (excluding under drainage system). Operational troubles in filters. Disinfection- Theory of disinfection, types of disinfectants, chlorination, chlorine demand, residual chlorine, use of bleaching powder UV irradiation and ozone treatment.

10 Hrs

UNIT-IV

Miscellaneous Treatment Methods: Softening- Definition, lime soda process and zeolite process. Reverse Osmosis & Membrane Filtration. Removal of Iron and Manganese.Colour, odour and Taste removal.Fluoridation, Defluoridation and Desalination.

Distribution Systems: System of supply, service reservoirs and their capacity determination, Design of distribution systems. Pipe appurtances, pipefitting, Layout of water supply pipes in buildings.

10 Hrs

TEXT BOOKS:

1. Santoshkumar Garg, Khanna Publishers, Water Supply Engineering New Delhi. 2006 Edition.
2. B. C. Punmia, Ashok Jain and Arunkumar Jain, Environmental Engineering-I Laxmi Publications, New Delhi. 2007 Edition

REFERENCE BOOKS:

1. Howard S. Peavy, Donald R. Rowe, George TecnoBanoGlous, Environmental Engineering McGraw Hill International Edition. 2013

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objectives	**Course Outcomes:** After completion of this course the student will be able to:
1.	To impart the basic knowledge about the necessity, planning and execution of modern water supply schemes. To expose the students on the types of water demand.	Estimate quantity of water required for a township.
2.	To make the students understand about the sources, collection and conveyance of water to bring the awareness regarding the necessity, power/selection of pumps and economic diameter of rising main	Classify the physical, chemical and bacteriological water quality parameters for drinking purpose.
3.	To make the students familiar with various aspects of physical, chemical and biological quality of water. Testing of water quality, Health significance, Drinking water standards and different types of water treatment units and processes.	Design intake structures for water supply , rising mains, storage, and capacity of service reservoir.
4.	To expose the students to the methods of removal of iron, manganese, color, taste and odor, fluoridation / defluoridation and desalination and layout of water supplies in buildings.	design water treatment units like sedimentation, coagulation, filtration, knowledge of disinfection or chlorination, softening, defluoridation and desalination.

UCV 644C: HYDROLOGY AND IRRIGATION ENGINEERING

3 Credits-(3-0-0)

UNIT-I

Introduction: Practical application of hydrology, Hydrologicalcycle, Concept of catchments and need for planned utilization of water resources.

Precipitation: Definition and forms of precipitation. Weather seasonsinIndia.Measurement of precipitation by rain gauges.Computation of average depth of precipitation, Estimation of missing precipitation record.

Water losses: Infiltration: Factors affecting infiltration. Infiltrometers, infiltration capacity curve, Infiltration indices,

Evaporation: Factors affecting evaporation. Evaporation pans, ISI standard pan, Numericals Evapotranspiration, PET and AET definitions.

10 Hrs

UNIT-II

Run-off: components, factors affecting run off, basin yield. Rainfall-runoffrelationship using simple linear regression Computation of maximum flood discharge, Dicken'sRyve's and rational formulae and problems.

Hydrograph Theory: Components of hydrograph. Separation of base flow.Unit hydrograph theory.Derivation of unit hydrograph.Derivation of UH of different durations, Numericals.

S-curve and its use (Theory only).

Ground water hydrology: Occurrence, aquifers, aquitard, aquifuge, aquiclude, perched aquifer. Aquifer parameters. Darcy's law and its validity and simple problems

10 Hrs

UNIT-III

Irrigation Engineering: Necessity, benefits and ill effects of irrigation, and its history of development,Types of Irrigation, Techniques of water distribution in the farm, quality of irrigation water, Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor.

Canals: Classifications, Regime theory, Design of canals cross sections by Lacey's and Kennedy's method.

Water requirement of Crops: consumptive use, duty, delta and base period, and problems, factors affecting and methods to improve duty, Variation of duty in a canal network, Crop seasons in india, irrigation efficiencies, frequency of irrigation and numericals.

10Hrs

UNIT-IV

Investigation for reservoir site, storage zones, determination of storage capacity using mass curve for specific yield, economical height of dam.
Gravity Dams: Forces acting on gravity dam, Analytical method of Stability analysis and problems, Drainage gallery, types and functions.
Earthen Dams: Types, Construction, Causes of failure of earthen dams, Seepage control measures,

Spillways: Different types of spill ways (theory and equations), types of energy dissipaters. 1**0 Hrs**

TEXT BOOKS

1. Subramannya K. Engineering Hydrology, Tata Mc Grew Hill, 3rd edition, 2008.
2. P. Jayarami Reddy, Text book of Hydrology.Laxmi Publications New Delhi, 3rd edition, 2016.
3. S.K. Garg, Irrigation Engg. and Hydraulic Structures.Khanna Publications, Delhi, 1st edition, 2017.
4. R. K. Sharma and Sharma, Hydrology and water resource Engineering, Revised Edition 2007
5. B.C. Punmia Irrigation Engineering and Design of Hydraulic Structures.Laxmi Publications New Delhi, Sixteenth edition, 2019.

REFERENICE BOOKS:

1. Mutreja K. N., AppliedHydrology.Mc.Graw Hill New Delhi, 1996.
2. H. M. Raghunath, Hydrology.New age international publishers, 2006.
3. G. L. Asawa, Irrigation Engineering. New Age international publications, 2005.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No	Course Objectives	Course Outcomes
	This course will make students to learn:	After completion of this course students will be able to:
1.	Understand concepts of hydrology, Hydrological cycle and its components.	Understand components of hydrological cycle, measure and quantify precipitation, evaporation and infiltration.
2.	Quantify runoff and generate hydrographs.	Estimate runoff and generate hydrographs.
3.	Understand concepts of irrigation, canal classification and design	To be able to compute duty, delta and frequency of irrigation, and design canal cross sections

4.	About Reservoirs dams and spillways	determine storage capacity of reservoirs & understand basics of gravity and earthen dams & spillways

UHS003N: FUNDAMENTALS OF QUANTITATIVE APTITUDE ANDSOFT SKILLS

1 Credit (2-0-0)

Course Objectives	The course objectives for the semester are as follows: 1. Cover fundamental topics in the following domains: a. quantitative aptitude, b. verbal aptitude, and c. reasoning aptitude. 2. Build confidence and self-esteem through the following: a. life skills, and b. soft skills.	
Course Objectives	After the course, the students will be able to: 1. Answer multiple choice questions from topics in: a. quantitativeaptitude,verbal aptitude, and reasoning aptitude. 2. Use tools and techniques learnt in soft skills modules to: a. communicate effectively with others, and to b. build proficiency in speaking English.	
Domain	**Hours**	**Modules**
Quantitative Aptitude (QA)	4	2
Reasoning Aptitude (RA)	4	2
Verbal Aptitude (VA)	4	2
Soft Skills (SS)	12	6
Career Skills (CS)	6	3
Total	30	15

DETAILS			
Sl. No.	**Domain**	**Topic**	**Hours**
UNIT I – Quantitative and Reasoning Aptitude Skills Training			
1.	QA	Number Properties	2
2.	QA	Percentages	2
3.	RA	Linear and Circular Arrangement	2
4.	RA	Order and Rank	2
UNIT II –VerbalAptitude Skills Training			
5.	VA	Parts of Speech	2
6.	VA	Reading Comprehension	2
Unit III – Career Skills			
7.	CS	Introduction to Interview Etiquette	2
8.	CS	Introduction to GD Etiquette	2
9.	CS	Introduction to Resume Writing	2
Unit IV – Soft Skills			
10.	SS	Six-Step Planning Process	2

11.	SS	Problem Solving through Design Thinking	2
12.	SS	Conflict Resolution through Assertiveness and Cooperation Matrix	2
13.	SS	Confidence through Body Language	2
14.	SS	Preparing and Delivering a Presentation	2
15.	SS	Self-Motivation	2

UCV641L :GEOTECHNICAL ENGINEERING LABORATORY
1 Credit (0-0-2)

1. Field identification of soil, Specific gravity test and Water content determination
2. Grain size analysis of soil sample (Sieve analysis)
3. In-situ density tests:
   i. Core-cutter method
   ii. Sand replacement method
4. Consistency limits :
   i. Liquid limit test(Casagrande's and cone penetration method)
   ii. Plastic limit test
   iii. Shrinkage limit test
5. Standard proctor test and Modified proctor test
6. Co-efficient of permeability test:
   i. Constant head test
   ii. Variable head test
7. Shear strength tests
   i. Unconfined compression test
   ii. Direct shear test
   iii. Triaxial test (Undrained test only)
8. Consolidation test : Determination of compression index and Co-efficient of consolidation
9. Laboratory vane shear test
10. Determination of CBR Value
11. Demonstration of:
    i. Miscellaneous equipments such as Augers, Samplers, Rapid Moisture meter and Proctors Needle.
    ii. Hydrometer Test
    iii. Free swell Index and Swell pressure test
    iv. Determination of relative Density of sand

REFERENCE BOOKS:

1. Punmia B C, Soil Mechanics and Foundation Engineering (2017),16th Edition, Laxmi Publications co., New Delhi.

2. Lambe T.W., Soil Testing for Engineers, Wiley Eastern Ltd., New Delhi, 1951.

3. Head K.H., Manual of Soil Laboratory Testing, Vol. I, II, III, Princeton Press, 3rd edition, 2006.

4. Bowles J. E., Engineering Properties of Soil and Their Measurements, McGraw Hill Book Co.New York, 1988.
5. Relevant BIS Codes of Practice: IS-2720 series

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. Allocation of 50marks for CIE: Performance and journal write-up. Marks for each experiment = 30 marks/No of proposed experiment.
3. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voice).
4. Allocation of 50 marks for SEE: 25% write-up. 50% conduction, calculation, results etc., 25% viva-voice.

UCV 642L: ENVIRONMENTAL ENGINEERING LAB
1 Credit (0-0-2)

I) **Tests on Water Quality**

i) Physical Parameters

1) Colour
2) Turbidity
3) Conductivity
4) Temperature

ii) Chemical Parameters

1) Solids-Total, dissolved and suspended
2) pH
3) Acidity
4) Alkalinity
5) Chlorides
6) Hardness- Carbonate and Non carbonate
7) Sulphate
8) Fluoride
9) Iron
10) Chlorine demand & Residual chlorine
11) Nitrate

iii) Bacteriological Parameters

1) MPN
2) Membrane Filter Technique

II) Tests on Sewage

1) Solids-Total, dissolved, suspended, volatile and fixed
2) Biochemical oxygen Demand
3) Chemical oxygen Demand

III) Other Tests

1) Optimum Alum dose (Jar Test)
2) Percentage of chlorine in Bleaching Powder
3) Break Point Chlorination and Residual Chlorine

REFERENCE:

1. Manual of Water and Wastewater Analysis- NEERI Publication 1988.
2. Standard methods for Examination of Water and Wastewater Analysis APHA, AWWA.2011.

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIEand50 SEE).
2. Allocation of 50 marks for CIE

* Performance and journal write up:
Marks for each experiment = 30 marks/ No. of proposed experiments.
* One Practical test for 20 Marks. (5 write-up, 10 conduction, calculation, results etc., 5 viva-voce)

3. Allocation of 50 marks for SEE.
* 25% write-up, 50% conduction, calculation, results etc., 25% viva-voce.

UCV643L AUTO CAD LABORATORY FOR DRAWING OF RC STRUCTURES

Credits 01 (0-0-2)

1. Drawing of combined Footing showing all details.

2. Drawing of Retaining wall (Cantilever and Counter fort) showing all details.

3. Drawing of portal frames (fixed and Hinge base) showing all details.

4. Drawing of water tanks (Circular and Rectangular) showing all details.

5. Drawing of the Lay out plan of Residential Building showing position of the columns.

LABORATORY ASSESSMENT:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).

2. Allocation of 50 marks for CIE

   - Performance and journal write - up:

   - Marks for each experiment = 30 marks/ No. of proposed experiments.

   - One Practical test for 20 Marks. (5write-ups, 10 conduction, calculation, results etc. 5viva-voce)

3. Allocation of 50 marks for SEE.

   25% write-up, 50% conduction, calculation, results etc., 25% viva-voce

ELECTIVES LIST FOR SEMESTER VI

OPEN ELECTIVE -I

UCV652N PROJECT MANAGEMENT

Credits (3-0-0)

UNIT I

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles.

Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

10 Hrs

UNIT II

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organization, coding the WBS for the information system.

Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

10 Hrs

UNIT III

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control.

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kickoff: Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan, using Microsoft Project for project baselines.

10 Hrs

UNIT IV

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management.

Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Network Analysis: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.

10 Hrs.

TEXT BOOKS:

1. Project Management, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2. Project Management, A systems approach to planning scheduling and controlling by Harold kerzner, CBS publication.
3. Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016

REFERENCE BOOKS:

1. Project Management, Pennington Lawrence, Mc Graw hill
2. Project Management, AModer Joseph and Phillips New Yark Van Nostrand, Reinhold.
3. Project Management,Bhavesh M. Patal, Vikas publishing House,

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes After studying this course the students will be able to:
1	Understand the importance of PM in most industries and businesses and to apply specific tools, models and processes.	Discuss complex management situations based on knowledge and facts and respect for differed opinions.
2	Understand the Importance of applying these methodologies and tools at the four distinct stages in the	Define project, plan and schedule the projects.

	Project's life cycle. The Definition, Planning, Execution and Closing Phase.	
3	Understand key levers for measurement and follow up, Management Dash Board and Key Performance Indicators	Appreciate the significance of resource management and proper budget planning.
4	Identify and Analyse factors for successful Projects, as well as reasons for failure based on specific case studies in the context of effective Risk Management.	Identify the risks and analyze their effect on the project.
5	Understand the structure of financial statements relating to Profit and Loss statement, Cash Flow Statement and Balance Sheet. Students should identify positive as well as warning signs within financial statements as indicators of issues for management to address.	Prepare profit and loss statements with the help of available tools.
6	Understand the importance of values and cultural differences, particularly in international projects.	Appraise values and team work for inter-cultural team-work.

UCV653N:OCCUPATIONAL SAFETY AND HEALTH

3 Credits (3-0-0)

UNIT-I

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know.**Accident** – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation .

10 Hrs

UNIT-II

Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.

10 Hrs

UNIT-II

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety. **Health Considerations at Work Place:** Types of diseases and their spread, Health Emergency.

10 Hrs

UNIT-III

Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability. Safety in Construction: Causes, classification, cost and measurement of an accident, safety programme for construction, protective equipment, accident report, safety measure: (a) For storage and handling of building materials.(b) Construction of elements of a building (c) In demolition of buildings Safety lacuna in Indian scenario.

10 Hrs

UNIT-IV

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.

10 Hrs

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

TEXT BOOKS:

1. Goetsch D.L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.

2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991),

3. "Industrial Safety and Pollution Control Handbook

REFERENCE BOOKS:

1. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.

2. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

Sl.No	Course Objectives	Course Outcomes: After completion of this course the student will be able to:
1	To Input the knowledge about occupational safety and OSHA Act.	Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.

2	To make the students to investigate cause for accident and prepare a report.	Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3	To expose the students to various health hazards and controlling methods.	Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.
4	To make a the students to demonstrate the occupational safety measures.	Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.

DEPARTMENT ELECTIVE-III

UCV651E : NUMERICAL TECHNIQUES IN CIVIL ENGINEERING

3 Credit (0-0-3)

UNIT-I

Introduction: Historical development of numerical techniques, Role in investigations, research, and design in the field of Civil Engineering. Application of Solution of Linear System of Equations To Civil Engineering Problems.

Development of simultaneous equations from problems in construction planning, slope deflection method applied to beams frames and truss analysis using Gaussian elimination method, Gauss- Jordan matrix inversion method, Gauss- Siedel method, Cholesky decomposition method.

10 Hrs

UNIT-II

Application of Root Finding To Civil Engineering Problems development of non-linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering using Bisection method and Newton-Raphson method.

Application of Numerical Integration for Solving Simple Beam Problems

i. Computation of area of BMD drawn for statically determinate beams by Trapezoidal rule and Simpson's one third rule. **10 Hrs**

UNIT-III

Application of Solution of Ordinary Differential Equation To Civil Engineering Problems.

Application of solution of ODE by Euler's method and Runge-Kutta 4^{th} order method in statically determinate problems, problems in Environmental engineering, problems in Hydraulics and Geotechnical engineering.

10 Hrs

UNIT-IV

Application of Finite Difference Techniques In Structural Mechanics:

i) Introduction, expression of derivatives by finite difference , backward differences, forward differences and central differences.

ii) Application of finite difference method to analysis of Statically determinate beams, Statically indeterminate beams, Buckling of columns.

10 Hrs

TEXT BOOK

1. N. Krishnaraju and K.U. Muthu- Numerical Methods for Engineering Problems, 2^{nd} edition, Laxmipublications,New Delhi , 2007.

BOOKS FOR REFERENCE

1. J B Scarborough- Numerical Mathematical Analysis, 6th edition, Oxford and IBH New Delhi, 2005.
2. Mario Salvadori- Numerical Methods in Engineering, PHI, 1961.
3. M.K Jain, S R K Iyengar and R.K. Jain- Numerical Methods for Scientific and Engineering computation, New Publications, New Delhi,2012.
4. S SSastry- Introductory Methods of Numerical Analysis, 5th edition, PHI,New Delhi , 2012.
5. E Balagurusamy- Numerical Methods, Tata Mc Graw Hill,2017.
6. H C Saxena- Examples in Finite Differences And Numerical Analysis, S Chand & Co. New Delhi,1975.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

S.No.	Course Objectives	Course Outcomes After studying this course the students will be able to:
1	Introduction to definitions, basic concepts associated numerical techniques in civil engineering. Solution of linear system of equations and application to civil engineering problems.	Solve linear system of equations related to civil engineering problems using Guass elimination, Guass-Siedel, Guass-Jordan matrix inversion, Cholesky's decomposition methods.
2	Introducing to root finding of non-linear algebraic and transcendental equations. Application to civil engineering problems.	Find roots of non-linear algebraic and transcendental equations related to civil engineering problems using bisection and Newton-Raphson method.
3	Introduction to basic concepts associated with differential equations and solution to ordinary differential equations. Application to civil engineering problems.	Solve ordinary differential equations by Euler's method, Euler's modified method and Runge-Kutta method related to civil engineering problems.
4	Introduction to concepts associated with finite difference techniques. Derivation of expression for derivatives by finite differences. Solution to differential equations by	Solve differential equations by finite difference method for beams and buckling of columns.

	finite difference techniques and application to beams and buckling of columns.	

UCV652E: DESIGN OF IRRIGATION STRUCTURES
Credits 03 (3-0-0)

UNIT-I

Canals: Cross section of irrigation canals, Balanced depth, fixing L-section and design considerations and design.
Cross Drainage works: Types, Design considerations, Fluming of canal by Mitra's, and Chaturvedis's formulae. Design problems of aqueduct and super passage only.

10 Hrs

UNIT-II

Gravity Dam-I Profile of the dam and forces acting, Design considerations and fixing the section, Principal stresses, Stability analysis by analytical methods and problems .
Gravity Dam II: Joints, keys and water stops. Drainage galleries, Grouting, Construction of Galleries

10 Hrs

UNIT-III

Earthen Dam: Types, Construction methods, Causes of failures, Design criteria, Preliminary section. Seepage control and slope protection, Rockfill dams.
Spillways: Ogee and broad crested spillways, Discharge computation for simple cases, Design of profile of an Ogeespillway.Energy dissipation below spillways.

10 Hrs

UNIT-IV

Canal Falls: Types, Design of trapezoidal notch fall and Sarda fall.
Canal Regulation works: Types, Design of cross regulator and head regulator.

10 Hrs

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objectives	Course Outcomes
1	To prepare the students for a successful career as civil engineers	Able to classify and design the canals longitudinal sections and cross drainage works
2	To provide students with a sound foundation in the design of irrigation structures	To comprehend various aspects of gravity dam analysis and design
3	To develop the ability among students to synthesize data and technical concepts forapplication in design of irrigation structures	To be able to understand concepts of construction and failure in earthen dams anddesign of major spillways.
4	Students should understand application of theory to experimental and field data in design.	To know concepts canal falls and regulator works and apply the knowledge intheir design
5	To use interdisciplinary knowledge in the application of design concepts	

UCV653E GROUND IMPROVEMENT TECHNIQUES
3 Credits(3-0-0)

UNIT - I

Introduction- Principles and objectives of ground improvement; History of ground improvement developments. Classification of ground improvement techniques, Factors affecting ground improvement.

Mechanical modification- Mechanical modification method of ground improvement; Theory of compaction, moisture-density relationship, optimum moisture content and maximum dry density; Laboratory compaction test using Proctor's mould and modified Proctor Mould, Factors affecting compaction .

10 Hrs

UNIT – II

Field compaction- Dead weight surcharge for compaction;; Equipment for field compaction: smooth wheel rollers, pneumatic rollers, sheep foot rollers, grid rollers, Power rammers. Role of vibrations in dynamic compaction; Dynamic Field Compaction Equipment: Impact type of compaction, Vibratory rollers, Vibratory pneumatic tyre, compaction piles, vibroflotation, vibratory probes, compaction sand columns and sand piles, underground blasts. Specifications for field compaction

Hyd. Modification- Preloading by lowering ground water table, Filters, Control of ground water seepage, Sand drains and wick drains, Well point system, Vertical drains, Electrosmosis and its application in ground improvement.

10 Hrs

UNIT – III

Chemical Modification- Factors affecting chemical modification, Lime stabilization, Cement stabilization, Bitumen stabilization, Chemical Stabilization,Methods of construction- mix in place method, traveling plant and stationary plant methods.

Grouting- Factors affecting grouting, Grout ability, Grouting materials and their properties, Pressure grouting, Compaction grouting, Grouting procedures, Applications of grouting

10 Hrs

UNIT – IV

Applications of Geosynthetics for ground improvementMiscellaneous: Rock cutting, anchoring, heating, soil nailing

10 Hrs

TEXT BOOKS:

1. P. Purushothama Raj., Ground Improvement Techniques, Laxmi Publications Pvt Ltd, 2nd edition, 2016.

REFERENCE BOOKS

1. Manfired R.H. (1990) "Engineering Principles of Ground Modification", McGraw-Hill Pub.

2. Koerner R M. Construction and Geotechnical Methods in Foundation Engineering, McGrawHill Pub Co New York, 1985.
3. Hausmann, M R, “Engineering Principles of Ground Modifications”, McGraw Hill Pub Co NewYork, 1990.
4. Ingles O G and Metcalf J B., “Soil Stabilisation: Principles and practice”, Butterworths, London, 1972.
5. Nelson J D and Miller D J., “Expansive soils”, John Wiley and sons. Inc new, 1992.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course objective	Course outcome
1	Understand the fundamental concepts of ground improvement techniques	Students will know the ground improvement techniques
2	Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures	Able to improve the properties of soil in field by compaction
3	Understand the concepts of chemical compaction and grouting	Able to stabilize the soil
4	Impart the knowledge of geo synthetics and miscellaneous methods of ground improvement	Use of Geosynthetics and other methods of soil modification

UCV654E: HIGHWAY GEOMETRIC DESIGN
3 Credits (3-0-0)

UNIT-1

INTRODUCTION: Geometric control factors like Topography- design speed- design vehicle- Traffic- Capacity- volume- environmental & other factors as per IRC & AASHTO standards & specifications- PCU concepts- factors controlling PCU for different design purpose.

CROSS SECTIONAL ELEMENTS: Pavement surface characteristics- friction- skid resistance- pavement unevenness- light reflecting characteristics-camber-objectives-types of camber- method of providing cambers in the field- problems- carriage way- kerb- median- shoulder- foot path- parking lanes- service roads- cycle tracks- Driveways- Right of way- Factors influencing right of way- Design of Road humps as per latest IRC provision.

10 Hrs

UNIT-2

SIGHT DISTANCE: Importants, types, SSD, OSD & Sight distances at uncontrolled intersections, derivations, factors affecting sight distance, IRC, AASHTO standards, problems on above.

HORIZONTAL ALIGNMENT: Definition, Checking the stability of vehicle, while moving on horizontal curve, Super elevation, Ruling minimum &maximim radius, Assumptions- problems- methods of providing super elevation for different curves- Extra widening of pavement on curves- Objectives- Mechanical widening- Psychological widening- Transition curve- Objectives- Ideal requirments- Types of transition curves- Method of evaluating length of transition curve- Setting the transition curve in the field, set back distance on horizontal curve & problems on above.

10 Hrs

UNIT-3

VERTICAL ALIGNMENT: Gradient- Types of gradient- Design criteria of summit & valley curve- Design of vertical curves based on SSD-OSD-Night visibility considerations-Design standards for hilly roads- problems on the above.

INTERSECTION DESIGN: Principle- At grade & Grade separated junctions- Types- Channelization- Features of channelizing Island- Median opening- Gap in median at junction.

10 Hrs

UNIT-4

ROTARY INTERSECTIONS: Elements- Advantages- Disadvantages- Design guide lines- problem on above- Grade seperated intersection- Three legged intersection- Diamond interchange- Half clover leaf- Clover leaf- Advantages- Disadvantages only

HIGHWAY DRINAGE: Importance – sub surface drinage- surface drinage- Design of road side drives- Hydrological- Hydraulic considerations and design of filter media, problems on above.

10 Hrs

TEXT BOOKS:

1. L.R.Kadiyali&N.B.Lal, Principle & Practice of Highway Engineering, Khanna publications, 2013.
2. Khanna S K & Justo, Highway Engineering, Nemchand& Bros publication, 10^{th} edition 2017.
3. Srinivas Kumar, Highway Engineering, 2018.

REFERENCE BOOKS:

1. Kadiyali L R, Highway Engineering, Khanna publications, 2018.
2. Relavent IRC publications.

QUESTION PAPER PATTERN FOR SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each questions should not have more than four sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit.

SI. No	**Course Objective** Students will be able to learn	**Course Outcome** After studying this course students will be able to
01	Various geometric elements cross sectional elements controlling geometric design of highway.	Describe various geometric elements like speed, topography, traffic volume,Design hourly, traffic volume etc.
02	The various types of Sight distance such as SSD,OVD ISD,HSD and design and setting out super elevation, extra widening, transition curves.	Determine the various sight distances, evaluate extra widening required for horizontal curves
03	The method of design of vertical and summit curves and setting of the same in the field and concepts of at-grade and grade separated intersection.	Design and setting out of Summit and Valley curves and describe different types of at-grade, grade separated intersection and channelization.

04	Design Rotary intersection, surface and subsurface drainage system and filter material.	Design Rotary intersection, surface and subsurface drainage system.

DEPARTMENT ELECTIVE-IV

UCV661E: ELEMENTS OF EARTHQUAKE ENGINEERING

3 CREDITS (3-0-0)

UNIT - I

Earthquake ground Motion, Engineering Seismology, Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India, Magnitude/Intensity of an earthquake-scales-Energy released-Earthquake measuring instruments-Seismologic, Seismograph, accelerator graph-strong ground motions.

6 Hrs

UNIT - II

Seismic Design Parameters. Types of Earthquakes, earthquake ground motion characteristics, response spectra and design spectrum. Seismic design philosophy, Determination of design lateral forces - Equivalent lateral force procedure, dynamic analysis procedure, code based methods. seismic analysis of RC buildings (maximum of 4 storeys, without infills) - Equivalent static lateral force method, response spectrum methods

14 Hrs

UNIT - III

Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings – codal provisions.

12 Hrs

UNIT - IV

Effect of Structural Irregularities on seismic performance of RC buildings.Vertical irregularity and plan configuration problems, Seismo resistant building architecture – lateral load resistant systems, building characteristics.

8 Hrs

TEXT / REFERENCE BOOKS:

1. Pankaj Agarwal, Manish Shrikande, Earthquake resistant design of structures,PHI India, New Delhi, 2011.
2. S.K. Duggal, Earthquake Resistant Design of Structures, Oxford University Press, 2007.
3. Anil Chopra, Earthquake Resistant Design, 2nd edition, Earthquake Engineering Research Institute, 2005.

4. S.F. Borg, Earth Quake Engineering Damage Assessment and Structural design, John Wiley and Sons. 1983.
5. Vinod Hosur , Earthquake Resistant Design of Building structures, Wiley India Pvt. Ltd., 2012.
6. C.V.R. Murthy, Earthquake Tips - Learning Earthquake Design and Construction.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
01	The students will be able to understand the fundamentals of Engineering Seismology Seismology	The students will be able to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure.
02	The students will be able to understand the earthquake ground motion characteristics, response spectra and design spectrum and IS code based methods	The students will be able to analyze and design the structures using response spectra and relevant IS code specifications.
03	The students will be able to apprise the Effect of Structural Irregularities on seismic performance of RC buildings.	The students will be able to evaluate the ductility requirements for RCC and masonry structures.
04	The students will be able to understand Earthquake resistant design of masonry buildings - elastic properties of structural masonry, lateral load analysis, Design of two storied masonry buildings.	

UCV662E: PAVEMENT MATERIALS AND CONSTRUCTION
Credits 03 (3-0-0)

UNIT 1

AGGREGATES: Origin, classification, requirements, properties and testson road aggregates, concepts of size and gradation – design gradation,maximum aggregate size, aggregate blending by different methods to meet specification.
BITUMEN AND TAR: Origin, preparation, properties and chemical constitution of bituminous road binders; requirements.

10 Hrs

UNIT 2

BITUMINOUS EMULSIONS AND CUTBACKS: Preparation,characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion.
BITUMINOUS MIXES: Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No HveemStabilometer&Hubbar – FieldTests) bituminous mix, Design methods using Rothfuch's Method only and specification, Marshal mixed design criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen.Problems on above.

10 Hrs

UNIT 3

EQUIPMENT IN HIGHWAY CONSTRUCTION: Various types of equipment for excavation, grading and compaction – their working principle,advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction.
SUBGRADE : Earthwork grading and construction of embankments and cuts for roads. Preparation of subgrade, quality control tests.

10 Hrs

UNIT 4

FLEXIBLE PAVEMENTS: Specifications of materials, construction method and field control checks for various types of flexible pavement layers.
CEMENT CONCRETE PAVEMENTS: Specifications and method of cement concrete pavement construction (PQC Importance of providing DLCas sub-base and polythene thin layer between PQC and sub-base); Quality control tests; Construction of various types of joints.

10 Hrs

Textbooks

1. Highway Engineering- Khanna, S.K., and Justo, C.E.G., Nem Chand and Bros. Roorkee, 2014
2. Construction Equipment and its Management- Sharma, S.C., Khanna Publishers, 2008.

3. Hot Mix Asphalt Materials, Mixture Design and Construction- Freddy L. Roberts, Kandhal, P.S: University of Texas Austin, Texas. NAPA Education Foundation Lanham, Maryland , 1996.

REFERENCE BOOKS

1. RRL, DSIR, 'Bituminous Materials in Road Construction', HMSO Publication.
2. RRL, DSIR, 'Soil Mechanics for Road Engineers', HMSO Publication.
3. Relevant IRC codes and MoRT&H specifications.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more four sub divisions.
3. Any Five full questions are to be answered choosing at least one from each unit.

Sl No	**Course Objectives**	**Course Outcomes**
01	Impart knowledge about the engineering properties required for different pavement materials.	Evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS,IRC specifications
02	Educate students to perform various types of bituminous mix designs as per the guidelines (MORTH).	Formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
03	Student will get knowledge about different highway construction equipment with their suitability and adaptability in various field conditions.	Competent to adapt suitable modern technique and equipment for speedy and economic construction.
04	Expose students to construction practice and quality control aspects of embankment, flexible and rigid pavement as per the required specifications (MORTH).	Execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

UCV663E : TRAFFIC ENGINEERING
Credits 03 (3-0-0)

UNIT-I

Introduction: Definition-Objective Scope of Traffic Engineering. Road User and Vehicle CharacteristicsStatic and Dynamic characteristics- Power performance of vehicles- Resistances to the motion of vehicles- Reaction time of driver- Problems of above.

10 hrs

UNIT-II

Traffic Parameter Studies and Analysis: Various types of traffic engineering studies, data collection, Objectives and Method of study. Definition of study area- Sample size- Data Collection and Analysis-Interpretation of following Traffic Studies- Volume, Spot Speed study, presentation of spot speed data problems on spot speed, Speed and Delay study Origin and Destination. Parking, on-Street and off-Street Parking, Accidents-Causes, Analysis (collision with parked vehicle only) Measures to reduce Accident, Problems.

10 hrs

UNIT-III

Traffic Flow Theories: Traffic flow theory Green shield theory Goodness of fit correlation and regression analysis (linear only)- Queuing theory Car following theory relevant Problems on above. Traffic Regulation- Driver, Vehicle and Road controls- Traffic Regulations- One Way- Traffic Signs- Traffic Markings-Canalization, Classified traffic volume at intersections, PCU, Traffic Rotary elements, analysis of capacity of rotary

10 hrs

UNIT-IV

Traffic Control: Traffic operation Traffic Signals-Vehicle actuated and synchronized signals Signal Coordination – Intelligent Transport system- Webster's method of signal Design, IRC Method, Street lighting Road Side Furniture- Relevant Problems on above.

10 hrs

TEXTBOOKS:

1. Khanna and Justo., "Highway Engineering" Nemchand Bros, 2014.
2. L.R. Kadiyali., " Traffic Engineering and Transport Plankling". Khanna Publisher. 1st edition, 2018.
3. Matson, Smith and Hurd," Traffic Engineering ", McGraw Hill and Co, 1995.
4. D.R. Drew, Traffic flow theory and control, McGraw Hill Co., 1968.

REFERENCE BOOKS:

1. Pignataro, L. J., Cantilli, E. J., &Falcocchio, J. C,Traffic Engineering, Prentice Hall, 1973
2. Highway capacity Manual-2000
3. JotinKhistey and Kent Lall, An Introduction to Transportation Engineering, , PHI, 3rd edition, 2013.
4. Mc Shane and Roess, Traffic Engineering, PHI, 5th edition, 2019.

Scheme of Examination: Student has to answer five questions selecting at least one question from each unit out of eight.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No	Course Objective	Course outcome After studying this course the students will be able to:
1.	Introduction to definitions, basic concepts associated with matrix methods of structural analysis using element approach. Analysis of continuous beams and frames by flexibility matrix method.	Analyze continuous beams and frames by flexibility matrix method using element approach.
2.	Analysis of trusses by flexibility matrix method. Introduction to concepts associated with stiffness matrix method and analysis of continuous beams by stiffness matrix method.	Analyze member forces for trusses by flexibility matrix method and continuous beams by stiffness matrix method using element approach.
3.	Evaluate member forces for plane frames and trusses by displacement transformation method.	Analyze plane frames and trusses by stiffness matrix method using element approach.
4.	Introduction to concepts associated with direct stiffness method. Analysis of continuous beams and trusses by direct stiffness method.	Analyze continuous beams and trusses by direct stiffness method.

UCV664E : MATRIX METHOD OF STRUCTURAL ANALYSIS
03 credits (3-0-0)

UNIT – I

Definitions and Concepts: Comparison of classical, matrix and approximate methods of structural analysis, , System approach versus Element approach, degrees of freedom, coordinate systems, stiffness and flexibility coefficients, Flexibility and stiffness methods.

05 Hrs

Flexibility Method: Introduction, element flexibility matrix, Principle of contragradience, construction of member and structure flexibility matrix, determination of member forces. Procedure for analysis of indeterminate structures: analysis of continuous beams and plane frames.

08 Hrs

UNIT – II

Flexibility Method Continued: Analysis of indeterminate structures: analysis of plane trusses.

06 Hrs

Stiffness Method: Introduction, element stiffness matrix, Principle of contragradience, construction of member and structure stiffness matrix, determination of member displacements, solution procedure,Analysisofindeterminate structures: continuous beams.

07 Hrs

UNIT – III

Stiffness Method continued: Analysis of indeterminate structures: plane frames and plane trusses

12 Hrs

UNIT-IV

Direct Stiffness Method: Introduction, transformation of variables, transformation of stiffness matrix for member of truss and continuous beams. Global stiffness matrix ,boundary conditions, computation of internal forces, analysis of plane trusses and continuous beams.

14 Hrs

TEXT BOOKS:

1. S Rajasekaran – Computational structural Mechanics, Prentice Hall India Ltd, New Delhi, 2001.
2. Reddy C S - Basic Structural Analysis, 3rd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2010.
3. Pandit G S, Gupta S P and Gupta R- Theory of Structures, 2nd edition, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
4. MukhopadhyayMadhujit and Abdul Hamid Sheikh – Matrix and Finite Element Analysis, Ane Books, New Delhi, 2004

REFERENCE BOOKS

1. William Weaver Jr. and James M Gere – Matrix Analysis of Framed Structures, CBS Publishers and distributors, New Delhi, 2018.

2. Kassimali Aslam – Matrix Analysis of Structures, Cengage Learning Custom Publishing, Boston USA, 2011.
3. Neville A M, Ghali A- Structural Analysis: A Unified Classical and Matrix Approach, CRC Press, 2009.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one question from each unit.

Sl.No.	Course Objectives	Course Outcomes
1	Introduction to definitions, basic concepts associated with matrix methods of structural analysis using element approach. Analysis of continuous beams and frames by flexibility matrix method.	Knowledge of definitions, basic concepts, comparison of classical and matrix methods, force and displacement methods, system and element approach methods. Evaluate member forces for continuous beams and plane frames by force transformation method.
2	Analysis of trusses by flexibility matrix method. Introduction to concepts associated with stiffness matrix method and analysis of continuous beams by stiffness matrix method.	Evaluate member forces for trusses by flexibility matrix method. Knowledge of concepts associated with stiffness matrix method. Evaluate member forces for continuous beams by displacement transformation method.
3	Analysis of plane frames and trusses by stiffness matrix method.	Evaluate member forces for plane frames and trusses by displacement transformation method.
4	Introduction to concepts associated with direct stiffness method. Analysis of continuous beams and trusses by direct stiffness method.	Knowledge of basic concepts associated with direct stiffness method. Evaluate member forces for continuous beams and trusses by direct stiffness method.

Basaveshwar Engineering College, (Autonomous)
Bagalkot
Department of Civil Engineering

VII SEMESTER SCHEME (2021-2022)

l.No	Subject Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV741C	Design of Steel Structures	3	2	2	0	50	50	100
2	UCV742C	Quantity Surveying and Estimation	3	2	2	0	50	50	100
3	UCV743C	Design of Pre-stressed Structures	3	3	0	0	50	50	100
4	UCV744C	Wastewater Treatment Engineering	3	3	0	0	50	50	100
5	UCV75XN	Open Elective - 2	3	3	0	0	50	50	100
6	UCV743P	Extensive Survey Project	2	0	0	4	50	50	100
7	UCV741P	Project Phase –I	4	0	0	8	50	50	100
8	UCV742I	Internship	2	0	0	4	50	50	100
		Total	**23**	**13**	**04**	**16**	**400**	**400**	**800**

Open Elective – 2			
Sl. No.	**Subject code**	**Subject**	**Credits**
1	UCV754N	Process economics and Plant design	3
2	UCV755N	Disaster Management	3

UCV 741C: DESIGN OF STEEL STRUCTURES

3 Credits (2-1-0)

UNIT I

Introduction: Advantages & Disadvantages of steel structures, Loads & Load combinations, Designconsiderations, Limit State method of design, Failure criteria for steel, codes, specifications and section classification.

Bolted Connections: Introduction, Behavior of bolted joints, design strength of ordinary black bolts, design of HSFG bolts, simple connections, moment resistant connections, beam to beam connections.

13 Hrs

UNIT II

Welded Connections: Introduction, welding process, advantages of welding, types and properties ofwelds, types of joints, weld symbols, weld specifications, effective area of welds, design of welds, simple joints, moment resistant connections, and continuous beam to beam connections.

Plastic behavior of structural steel: Introduction, Plastic theory, plastic hinge concept, plastic collapseload, condition of plastic analysis, theorem of plastic collapse, methods of plastic analysis, plastic analysis of continuous beam.

13 Hrs

UNIT III

Design of Tension members: Introduction, Types of tension members, Behavior of tension member,factors affecting the strength of tension member, design of tension member, Axially loaded tension members and their connections, Design of Lug angles, Design of truss ties and joints.

Design of Compression members: Introduction, failure modes, Behavior of compression member,sections used for compression members, effective length, design of compression members, Columns including built up sections Laced and Battened systems, Column splicing.

13 Hrs

UNIT IV

Design of Column Bases: Design of slab base and gusted base.

Design of Beams: Introduction, beam types, factors affecting lateral stability of beams, behavior ofsimple and built up beams in bending(without vertical stiffeners), design strength of laterally supported beams in bending, maximum deflection, design of beams and purlins.

13 Hrs

TEXT BOOKS

1. N. Subramanian , Design of Steel Structures, Oxford Publications, 2008.

REFERENCE BOOK

1. Ramachandra, Design of Steel Structures, Standard Book House, NewDelhi, 2016.

2. Duggal, S. K, Design of Steel Structure, Tata McGraw Hill Publications, 2017.
3. Punmia, B. C, Comprehensive Design of Steel Structures, Laxmi Publications, 2015.
4. Karve, Design of Steel Structures (Limit State Method), Structures Publications, Pune.
5. Bhavikatti S.S, Design of Steel Structures (Limit State Method), I K International Publishing house Pvt. Ltd, 2012

CODE BOOKS

IS-800-2007, Steel tables (to be supplied in examinations)

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

S.No.	Course Objectives	Course Outcomes
1	Students will be able to comprehend Limit state and working state method. Types of loads with their combinations, various steel sections with different types of bolts and their connection details.	Knowledge of Limit state method. Different types of load and their combinations acting on steel structures. Exposure to various steel sections with different types of bolts available in the market highlighting the connections details.
2	Students will be able to understand welds, their types and connection details. Exposure to Plastic behavior of steel structures.	Knowledge of different types of welds and their connections. An approach to plastic analysis will lead in designing the steel sections with limit state approach.
3	Students will be able to learn different types of members in steel structures. Design of tension and compression members	Knowledge to design the tension member, lug angle, compression member, lacings and battens.
4	Students will be able to comprehend different types of column bases. Design of column bases and flexural members.	Knowledge to design different types of column bases including pedestal and also design the beam for given configuration.

UCV742C: QUANTITY SURVEYING & ESTIMATION

3 Credits (2-2-0)

UNIT I

Estimate: Different types pf estimates, study of various drawing attached with estimates. Importantterms, units of measurement, abstract, approximate methods of estimating building, cost from materials and labour equations recommended by CBRI examples.

Estimation: Methods of taking out quantities and costcenter linemethod, long and short wallmethod. Preparation of detailed and abstract estimates for the following Civil Engineering works Buildings Masonry structures and framed structures structures with flat, sloped RCC roofs. Building components (Beams, Columns and Column Footings, RCC Roof Slabs).

13 Hrs

UNIT II

Estimates: Steel truss (Fink and Howe truss), RCC Slab culverts, manhole and septic tanks.

Specifications: Definition of specifications, objective of writing specifications, essentials in specifications, general and details specifications of items.

13 Hrs

UNIT III

Rate analysis: Definition and purpose. Working out quantities and rates for the following standarditems of works earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

Measurement of earthwork for roads : Methods for computation of earthwork crosssections mid section formula, trapezoidal or average end area or mean sectional are formula, prismoidal formula for different terrains.

13 Hrs

UNIT IV

Contracts: Types of contracts essentials of contract agreement legal aspects, penal provisions onbreach of contract. Definition of the terms tender, earnest money deposit, security deposit, tender forms, tender documents and types.

Departmental procedures: comparative statements, acceptance of contract document andissue of work orders. Duties and liabilities, termination of contract, completion certificate, quality control, rights of contractor, refund of deposit. Administrative approval Technical sanction, Nominal Muster roll, Measurement Books procedure for recording and checking measurements preparation of bills of works in buildings, specifications of items of works in building, specifications of aluminum and wooden partitions, false ceiling, aluminum and fiber doors and window, various types of claddings.

Valuation: Definitions of terms used in valuation process, Purpose of valuation,Cost, Estimate, Value and its relationship, Capitalized value. Freehold and leasehold and easement, Sinking fund, depreciation–methods of estimating depreciation, Outgoings, Process and methods of valuation: Rent fixation,valuation for mortgage, valuation of land.

13 Hrs

TEXT BOOKS

1. B. N. Datta, "Estimating & Costing" UBS Publishers and Distributors, New Delhi, Jan 2016.
2. N. Chakraborthy, "Estimating & Costing, Specification & Valuation in Civil Engg",Published by author, Calcutta, Jan 2006.

REFERENCE BOOKS

1. S. C. Rangwala "Estimating & Specifications", Charotar Publishing House, Anand, 17th Edition:(reprint) Jan 2017.
2. G. S. Birdie "Estimating & Costing", Dhanpathi Rai publishing company Pvt., New Delhi. Jan 2014.

QUESTION PAPER PATTERN FOR SEE

1. Question paper consists of 4 units, Unit-I compulsory of 40 marks. Other 3 units consist of 2 questions each carry 20 marks, students have to answer at least one question from remaining 3 units.

Sl. No.	Course Objectives	Course Outcomes
1.	Understand different types of estimates approximate methods of estimates, empirical formulae for estimation of buildings (CBRI equations).	The students at the end of the course will be capable of applying different methods of estimate, CBRI formulae for the building estimate.
2.	Taking out of quantities of different items of structures by long wall/ short wall and central line methods.	Estimating cost of load bearing / framed structures by long wall/ short wall and central line methods.
3.	Interpretation of the plans of load bearing / framed buildings, culverts bridges and also preparegeneral / detailed specifications of the different items including advanced materials like aluminum fiber doors and windows.	Estimating cost of the truss, culverts and septic tanks. Detailed specifications of the different items of civil works.

4.	Method of working out rate analysis for the different items of building/ structure, labor charges and local materials rates including calculating quantity of earth work for the roads using different methods Impart knowledge of PWD procedures for executing the civil works and valuation of buildings.	Finding the item rates of the different items of civil works. Working the earth work for the roads by different methods. Carrying out the civil works as per PWD forms.

UCV743C: DESIGN OF PRE- STRESSED CONCRETE STRUCTURE
CREDIT 03 (3-0-0)

UNIT-I

Materials: High strength concrete and steel, stress-strain characteristics and properties.

Basic Principles of Prestressing : Fundamentals, Load balancing concept, stress concept, centre of thrust, pre-tensioning and post-tensioning systems, tensioning methods and end anchorages.

10 Hrs

UNIT-II

Analysis of sections for flexure: Stresses in concrete due to prestress and loads, stresses in steel due to loads, cable profile.

Losses of prestress: Various losses encountered in pretensioning and post tensioning methods, determination of jacking force. **10 Hrs**

UNIT-III

Deflections: Prediction of short term and long term deflections of un-cracked members.

Limit State of collapse and serviceability: I.S. code recommendations-ultimate flexural and shear resistance of sections, shear reinforcement, Limit state of serviceability-control of deflections and cracking.

10 Hrs

UNIT-IV

Design of End blocks: Transmission of Prestressing pre-tensioned members, transmission length, and anchorage stress in post-tensioned members, bearing stress and bearing tensile stress in end block, Methods, I.S. code provision for the design of end block reinforcement.

Design of Beams: Design of pretensioned and post-tensioned symmetrical sections, permissible stress, design of Prestressing force and eccentricity. **10 Hrs**

REFERENCE BOOKS:

1. N. Krishna Raju , Prestressed Concrete Design, McGraw Hill Publications, 6^{th} edition, 2018.
2. P. Dayaratnam , Prestressed Concrete Design, Medtech publishers, 7^{th} edition, 2017.
3. N. Rajgopalan, Prestressed Concrete Design, Narosa Publishers 2^{nd} edition, 2010.
4. E.G. Nawy , Prestressed Concrete Design, Pearson publication, 2^{nd} edition, 1995.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.

3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No	Course Objectives	Course Outcomes
1.	Students will be able to understand the materials for prestressing and concept of prestressing.	Students will remember and recall materials used in PSC, their characteristics and basic principles of prestressing including pretensioning and post tensioning constructions.
2.	Students will be able to comprehend the process of application of engineering principles to evaluate stresses.	Students will apply basic engineering principles to evaluate stresses due to loads in concrete and steel under flexure and shear.
3.	Students will be able to study various losses including their evaluation.	Students will understand concepts and analyze the different losses and evaluate losses of prestress and deflections.
4.	Students will be able to comprehend the evaluation of ultimate flexural and shear resistance capacity of PSC members.	Students will understand the concepts and apply them to evaluate / estimate the ultimate resistance capacity of PSC members in flexure and shear.
5.	Students will be able to understand the concept of transmission of prestress.	Students will understand the concepts of transmission of prestress in pretensioned and post tensioned members and design of end block.
6.	Students will be able to study the process of designing PSC members for strength, eccentricity and cable profile.	Students will understand process of designing pretensioned and post tensioned members for prestress, eccentricity, cable profile and sectional dimensions.

UCV744C WASTEWATER TREATMENT ENGINEERING

3 Credits (3-0-0)

UNIT-I

Introduction: Necessity for sanitation, Sewerage systems and their suitability.

Estimation of Wastewater flows: Dry weather flow, factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of sewage and storm discharge.

Design of Sewers: Self cleansing and non scouring velocities. Laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

10 Hrs

UNIT-II

Sewer Appurtenances : Catch basin, manholes, flushing tanks, oil and grease traps, Drainage traps. Basic principles of house drainage. Typical layout plan showing house drainage connections, maintenance of house drainage

Sewage Characteristics: Sewage Sampling. Physical, Chemical and Biological characteristics, with emphasis on BOD & COD.

10 Hrs

UNIT-III

Sewage Disposal: Dilution method - self-purification phenomenon. Streeter-Phelps equation, Oxygen sag curve, Zones of purification, Land treatment: Sewage farming, sewage sickness, Numerical Problems on Disposal of sewage.

Sewage Treatment: Flow diagram of municipal wastewater treatment plant. Primary treatment Screening, grit chambers, skimming tanks, primary sedimentation tanks- Theory and Design

10 Hrs

UNIT-IV

Secondary Treatments: Fixed film bioprocess-Trickling filter theory, modifications and design. Suspended growth system-Activated sludge process-Theory and design;

Sludge digestion tanks, Sludge drying beds. Low cost wastewater treatment -Septic tank, Oxidation Pond and Oxidation ditches.

10 Hrs

TEXTBOOKS:

1. Santosh Kumar garg , Sewage disposal and air pollution Engineering, Khanna publisher, Vol. 2 25th edition 2012.
2. B C Punmia, Sanitary Engineering ,Laxmi Publishers New Delhi, 21st 2013.

REFERENCE BOOKS:

1. Howard S. Peavy, Donald R. Rowe, George Techo Banoglous, Environmental Engineering, McGraw Hill Indian Edition, 2013.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No	**Course Objectives:** To Make the student	**Course Outcomes:** At the end of the semester the students will have
1.	To design the sewers and drainage sections.	Ability to estimate sewage and drainage quantity, for the design of sewers and drainage sections.
2.	To understand the characterization of sewage and sewerage appearances.	Knowledge of sewage characteristics and sewer appurtenances.
3.	To Study the impact of sewage disposal on water and land. Minimum treatment need.	Knowledge of impact of sewage disposal on water and land and minimum treatment necessary for sewage.
4.	To design various biological treatment units and sludge disposal.	Ability to design biological treatment units for sewage and knowledge of sludge disposal.

UCV743P: EXTENSIVE SURVEY PROJECT

2 Credits (0-0-4)

1. NEW TANK PROJECTS: The work shall consist of**;**

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Alignment of centre line of the proposed bund, Longitudinal and cross sections of the centre line.
c. Detailed survey required for project execution like Capacity surveys, Details at Waste weir and sluice points, Canal alignment etc. as per requirement
d. Design and preparation of drawing with report.

2. WATER SUPPLY AND SANITARY PROJECT: The work shall consist of**;**

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population.
c. Preparation of village map by using total station.
d. Survey work required for laying of water supply and UGD pipelines
e. Location of sites for water tank. Selection of type of water tank to be provided (ground level, overhead and underground)
f.Design of all elements and preparation of drawing with report.

3. HIGHWAY PROJECT: The work shall consist of;

a. Reconnaissance survey for selection of site and conceptualization of project.
b. Preliminary and detailed investigations to align a new road (min. 1.5 to 2 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Surveying by using conventional instruments and total station.
c. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed.
d. Drawing shall include key plan, alignment, longitudinal section along alignment, typical cross sections of road.

Sl.No	Course Objectives:	Course Outcomes:
1.	To acquire a practical knowledge and application of theory in the field to overcome the difficulties during surveying by using Total station and other measuring equipments.	Apply Surveying knowledge and tools effectively for the projects
2.	To Indentify New tank site and carry out survey to estimate the capacity of new tank and to design the components of new tank which includes Waste weir and sluice points, Canal and other irrigation structures	Understanding Task environment, Goals, responsibilities, Task focus, working in Teams towards common goals, Organizational performance expectations, technical and behavioural competencies in designing New tank project, water supply & sanitary project and Highway projects
3.	To expose the students for doing the survey and design the water supply & sanitary components like Water and waste water treatment plant, water supply pipes and UGD.	Application of individual effectiveness skills in team and at organizational level
4.	To design the connectivity facility of roads between two locations by fixing the most economical alignment, carrying out the profile survey to design the road and geometric elements.	

GENERAL INSTRUCTIONS:

1) To be conducted between 6th & 7th Semester for a period of 2 weeks including training on total station.
2) Viva voce conducted along with 7th semester exams.
3) An extensive project preparation training involving investigation, collection of data is to be conducted. Use of Total Station is compulsory for minimum of TWO projects.

EXAMINATION:

1) The student shall submit a project report consisting of designs and drawings.
2) Drawings should be done using CAD and survey work using total station.

3) Students should learn data download from total station, generation of contours, block levelling, longitudinal and cross sectional diagrams, and capacity volume calculation by using relevant software.

EVALUATION FOR CIE (FOR 50 MARKS):

1. Field work : 12.5 Marks
2. Office work (Design and drawing): 12.5 Marks
3. Presentation of the prepared report: 12.5 Marks
4. Final report submission: 12.5 Marks

EVALUATION FOR SEE (FOR 50 MARKS):

1. Presentation of the prepared report: 37.5 Marks
2. Viva: 12.5 Marks

OPEN ELECTIVES

UCV754N : Process Economics and Plant Design

3 Credits (3-0-0)

UNIT- 1

PROCESS DESIGN DEVELOPMENT: 10 Hours

Design project procedure, design information from the literature and other sources of information, flow diagrams, preliminary design and equipment design and specialization, safety factors specifications, and materials of construction.

GENERAL DESIGN CONSIDERATIONS:

Marketability of the product, availability of technology, raw materials, human resources, land and utilities, site characteristics, plant location, plant layout, plant operation and control, utilities, storage, materials handling, materials and fabrication selection,. Waste disposal community factors. Safety and hazard control measures.

UNIT- 2

CAPITAL INVESTMENTS: 10Hours

Fixed capital investments including land, building, equipment and utilities, installation costs,(including equipment, instrumentation, piping, electrical installation and other utilities),working capital investments.

MANUFACTURING COSTS AND PLANT OVERHEADS:

Manufacturing Costs: Direct Production costs (including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties, etc.), fixed charges Plant Overheads: Administration, safety and other auxiliary services, Conceptual numerical.

UNIT- 3

COST ANALYSIS: 10 Hours

Cost Analysis: Factors involved in project cost estimation, methods employed for the estimation of the capital investment. Estimation of working capital and

DEPRECIATION: different type of depreciation methods of and calculations, Conceptual numerical.

UNIT- 4

PROFITABILITY ANALYSIS: 10 Hours

Profitability Analysis. Return on original investment, interest rate of return, Cash flow diagrams. Break-even analysis. Conceptual numerical.

Text Books:

1. Peters and Timmerhaus (1989) Plant Design and Economics for Chemical Engineers, 4th edn., McGraw Hill.
2. Rudd and Watson (1987) Strategy of Process Engineering, Wiley.

3. Poornima M C (2006) Entrepreneurship Development and Small Business Enterprises", Pearson education.

Reference Books:

1. Vasanth Desai (2007) Dynamics of Entrepreneurial Development & Management", Himalaya Publishing House.
2. Khanka SS (2004) Entrepreneurship Development, S Chand & Co.
3. Thomas W. Zimmer, Norman M. Scarborough.(2007), Essentials of Entrepreneurship and small Business Management

Course Objectives:

The Course objectives are:

1 To understand the process design of plant
2 To study the feasibility survey for the plant design
3 To Identify the cost analysis involved in the design of plant
4 To Calculate the project profitability and alternative investment
5 To recommend for entrepreneurs with good engineering knowledge
6 To evaluate the knowledge of plant design and cost estimation

Course Outcomes:

At the end of the course the student should be able to:

1 Acquire knowledge in the design of a plant.
2 Conduct preliminary feasibility study of the plant design assigned.
3 Estimate the cost analysis involved in the design of a chemical plant.
4 Analyze the project profitability and alternative investments for the selection of good investment projects
5 Develop entrepreneurs with substantial knowledge in engineering concepts.
6 Apply the knowledge of plant design and cost estimation in actual engineering problems.

UCV755N: Disaster Management
3 Credits (3-0-0)
Unit-I

Introduction – Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency and details, capacity, impact, prevention, mitigation.

8 Hours

Unit-II

Disasters classification; natural disaster (floods, draughts, cyclones, volcanoes, earthquakes, Tsunamis etc.); manmade disaster, industrial pollution, artificial flooding, nuclear radiation etc.

9 Hours

Unit-III

Disaster Impacts – Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

11 Hours

Unit-IV

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

11 Hours

Text Books:

1. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
2. Singh B.K., 2008, Handbook of Disaster Management: Techniques and Guidelines, Rajat Publication.
3. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
4. Jagbir Singh, 2007, Disaster Management, I.K International Publishing House, New Delhi

Reference Book:

1. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
2. Inter-Agency Standing Committee (IASC) (Feb. 2007) IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Course Objectives: To Understand –

1. The basic concepts, definitions and terminologies used in disaster management.
2. Types and Categories of disasters and the challenges posed by them.
3. The Impacts of Disasters (environmental, physical, social, ecological, economic, political, etc.,).
4. The role and responsibilities of government and non-government organizations, community, local institutions in disaster risk reduction and management.

Course Outcomes: At the end of the course the student will develop competencies in

1. The application of disaster concepts to management.
2. Analyzing the relationship between the development and disaster.
3. Ability to understand the categories of disasters.
4. Realization of the responsibilities of various government and non-government agencies to the society to mitigate and manage the disasters.

(UCV741P) PROJECT PHASE-I

4 Credits (0-0-8)

SCHEME OF EVALUATION FOR UG PROJECT WORK

I) Project Phase-I

1) CIE- 50 Marks
   CIE Marks to be awarded by Project Coordinator/Faculty incharge/HOD Nominee
2) SEE – 50 Marks
   Departmental Committee (DC) will conduct the examination.

DC Members:

i) HOD or his Nominee ii) Project Coordinator

PEC Members:

i) Internal Examiner ii) External Examiner iii) HOD/ Nominee

(UCV742I) INTERNSHIP

2 Credits (0-0-4)

EVALUATION FOR CIE (FOR 50 MARKS):

1. Field work : 12.5 Marks
2. Office work (Analysis, Design and Drawing etc.,): 12.5 Marks
3. Presentation of the Internship report: 12.5 Marks
4. Internship report submission: 12.5 Marks

EVALUATION FOR SEE (FOR 50 MARKS):

1. Presentation of the Internship report: 37.5 Marks
2. Viva: 12.5 Marks

Basaveshwar Engineering College, (Autonomous)
Bagalkot
Department of Civil Engineering

VIII SEMESTER SCHEME (2018-19)

Sl.No	Subject Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	UCV841H	Construction Management	3	3	0	0	50	50	100
2	UCV85XE	Dept Elective -5	3	3	0	0	50	50	100
3	UCV86XE	Dept Elective - 6	3	3	0	0	50	50	100
4	UCV841P	Project Phase - II	12	0	0	24	50	50	100
5	UCV842S	Seminar	1	-	-	2	50	50	100
		Total	**22**	**09**	**00**	**26**	**250**	**250**	**500**

Department Elective – 5				Department Elective – 6			
Sl. No.	**Subject code**	**Subject**	**Credits**	**Sl. No.**	**Subject code**	**Subject**	**Credits**
1	UCV852E	Advanced Design of RC Structures	3	1	UCV861E	Pile Foundation Design	3
2	UCV853E	Advanced Design of Steel Structures	3	2	UCV862E	Advanced Concrete Technology	3
3	UCV854E	Industrial Waste Water Treatment	3	3	UCV863E	Basics of Soil Dynamics and Earthquake Engineering	3

UCV 841H: CONSTRUCTION MANAGEMENT
Credits 03 (3-0-0)

UNIT-I

Construction industry and Management: Introduction, Value engineering, time management, Labourand material management, Contract and contractor, organization and administration, financial management.

Introduction to Engineering Economics: Basic concepts of economic analysis, Micro and Macroanalysis, project feasibility, economic and financial feasibility, benefit cost ratio, interest formulae, present worth, future worth, annual equivalent, basis for comparison of alternatives, rate of return method, break even analysis, planning methods, problems on above.

13 Hrs

UNIT-II

Construction planning: Introduction, time estimates, planning methods of projects, Bar and Milestonecharts, PERT and CPM network analysis, project feasibility. Cost Model, Direct cost, indirect cost, total cost, optimum cost, optimum duration of project problems, Line of balance technique, resource allocation and updating

13 Hrs

UNIT-III

Construction equipments: Introduction, various earth moving equipments, hoisting equipments, concrete mixer and plants, conveyors and rollers, trenching machines, equipments for highway construction, factors for selecting equipment out, special equipment, standard equipment, economic life.

13 Hrs

UNIT-IV

Work Study in Construction, safety measures bidding.

Transportation Problems: Introduction, mathematical formulation, optimal solution of transportationproblem methods for initial basic feasible solution, summary of methods of initial BFS, Northwest corner method, Lowest cost entry method, Vogel's approximation method, optimality test, Degeneracy in Transportation problems, unbalanced transportation problem.

13 Hrs

TEXT BOOKS

1. R. Panneerselvam Engineering economics, PH1 Publications, 2010, NewDelhi
2. S.C. Sharma, Construction equipment and its management, KhannaPublishers, 5th Ed, Delhi, 2016.
3. S. Seetharaman, Construction engineering and management by, Umesh Publishers, 4th Ed, Delhi, 2008.

4. Peurifoy & Schexnayder Construction planning equipment and methods ,Tata Mc.Graw-hill, 7th Ed, New Delhi, 2010
5. L.S. Srinath, EWP PERT and CPM principles and applications, Affiliated east west press Pvt. Ltd, 3rd Ed, 2001.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No	Course Objectives	Course Outcomes
1.	Students will be able to comprehend about the necessity of construction management in the civil engineering industries, necessity of labors/material's managements. To understand the value of money at different time and use of different formulae.	At the end of course students will understand importance of the construction management, time, labors, materials management. The students will be capable of understanding the value of money at the different time/periods calculate present or future worth of the money.
2.	Students will be able to get the awareness of project planning, different methods of project planning. To study the cost model in civil engineering, proper allocation of resources.	Proper allocation and updating of the resources during construction of the projects.
3.	Students will be able to understand the advantages and application of the different equipments in construction Industries. And know the economical life and replacement of the equipments.	Proper application and management of different construction equipments. A student understands economic life of equipments.
4.	Students will be able to create awareness of safety measures in the construction industries and to understand the concepts of transportation problems and find the initial feasible solution by different methods.	At the end of the course students will understand different safety measures during construction of projects. Students will be able to find the initial feasible solution of transportation problems.

(UCV841P) PROJECT PHASE-II

12 Credits (0-0-24)

I) Project Work Phase-II

1) CIE- 50 Marks
   CIE Marks to be awarded by Project Coordinator/ Faculty In-charge
   Departmental Committee (DC) will conduct the CIE examination.
2) SEE – 50 Marks
   SEE Marks to be awarded by PEC members
   Project Evaluation Committee (PEC) will conduct the SEE examination.
3) Consolidated marks will be signed by Projector Coordinator and HOD

DC MEMBERS:

i) HOD or his Nominee ii) Project Coordinator

PEC MEMBERS:

ii) Internal Examiner ii) External Examiner iii) HOD/ Nominee

ELECTIVE LIST FOR SEMESTER VII

OPEN ELECTIVE-II

UCV751N: GREEN BUILDING TECHNOLOGY

3 Credits (3-0-0)

UNIT I

Introduction of green building, Concept of green building, History of green building, Need of green building in present scenario, Importance of green building Merits and demerits, Classification of green building, Assessment methods Global assessment and certification, Local assessment, LEED India GRIHA (Green Rating for Integrated Habitat Assessment) **06 Hrs**

UNIT II

Principles and elements of design of green building;
i. Sustainability: concept and reality
ii. Climate responsive process of design: Climatic zones, design sequence, shelter or form, land form, vegetation, water bodies, street widths, open spaces, ground character, plan form, orientation, roof form
iii. Shading devices and their effect **10 Hrs**

UNIT III

i. Thermal comfort inside the building: Factors affecting, indices, cooling and heating requirement, Heat transmission through building sections, thermal performance of building sections, simple calculation for U value and insulation thickness
ii. Day lighting
iii. Ventilation **10 Hrs**

UNIT IV

Water conservation: 3 R's for water conservation, rain water harvesting, low flow fixtures, grey water recycling Material conservation: concept of embodied energy, low energy materials, sustainable materials, alternative materials Concept of carbon emission and its reduction.
08 Hrs

UNIT V

Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings Introduction to Energy efficiency softwares, carbon calculators. **06 Hrs**

TEXT BOOKS:

1. Climate responsive architecture (A design hand book for energy efficient buildings), Arvind Krishnana, Simos Yannas, Nick Baker, S V Szokolay, McGraw hill Education, Seventh reprint, 2013.
2. Renewable Energy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha

Rao, B Natarajan, P Monga, Tata McGraw Hill, 2000.
3. Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984.

REFERENCE BOOKS :

1. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987.
2. Energy Conservation building code (ECBC), Bureau of energy efficiency, 2011.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	**Course Objectives**	**Course Outcomes**
01	To make the students understand the importance and necessity of green building.	Students should be able to assess a building on the norms available for green building.
02	To apprise the different norms available for green building.	Students should be able to suggest materials and technologies to improve energy efficiency of building.
03	To understand the significance of materials and technologies to improve energy efficiency of building.	Students should be able to suggest materials and technologies for green building certification.

UCV752N: ENVIRONMENTAL MANAGEMENT

Credits 03 (3-0-0)

UNIT I

Principles of Environmental Management, Ecosystem Concepts, Environmental Concerns in India, Policy and Legal Aspects of EM. Introduction to Environmental Policies, Environmental Laws and Legislations, Environmental Legislations in India, Forecasting Environmental Changes, Environmental Clearance Procedure in India. **10Hrs**

UNIT II

Environmental Auditing, Elements of Audit Process, Waste Audits and Pollution Prevention Assessments, Liability Audits and Site Assessment, Auditing of EM, Life Cycle Assessment (LCA), Stages in LCA of a Product, Procedures for LCA, Different Applications of LCA.

10Hrs

UNIT III

Environmental Management System Standards.EMS Standards: ISO 14000.Implementation of EMS Conforming to ISO 14001.Environmental management techniques.Application of Remote Sensing and GIS in EM, Ecosystem approach to risk assessment,Environmental Design, ED for Developmental Planning. **10Hrs**

UNIT IV

Environmental Economics, Economics and the Environment, Environmental Valuation, Economics of Natural Resources, Environmental and Regional Economics, Ecological Economics. **10Hrs**

REFERENCES:

1. Vijay Kulkarni and Ramachandra T.V., Environmental Management, Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore, 2006.
2. Ramachandra T.V., Management of Municipal Solid Waste, Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore, 2006.
3. Ramachandra T.V., 2006.Soil and Groundwater Pollution from Agricultural Activities,Commonwealth Of Learning, Canada and Indian Institute of Science, Bangalore.

4. Vijay Kulkarni and Ramachandra T.V., Environmental Management, Commonwealth of Learning, Canada and Indian Institute of Science, Bangalore, 2006.

HYPERLINKS:

1. www.ces.iisc.ernet.in/energy
2. www.wgbis.ces.iisc.ernet.in
3. www.ces.iisc.ernet.in/biodiversity
4. www.astra.iisc.ernet.in

QUESTION PAPER PATTERN FOR SEE:

1) Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2) Each Question should not have more than four sub division.
3) Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	**Course Objectives**	**Course Outcomes:** After completion of this course the student will be able to
01	To demonstrate the knowledge of environmental policy issues in diverse geographical and culture situations.	A sound understanding of the principal environmental policy issues confronting Managers in diverse geographical and culture situations.
02	To apply the environmental guidelines in sustainable utilization of resources.	An awareness of the ethical and moral issues involved in seeking the wise and sustainable use of resources.
03	To prepare impact assessment and audit report.	A range of relevant practical skills, particularly in the fields of impact assessment, auditand law.

UCV753N: SUSTAINABLEMATERIALS
Credits 03 (3-0-0)

UNIT I

Introduction: Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements and Protocols - Clean Development Mechanism (CDM), Environmental legislations in India - Water Act, Air Act. **10 Hrs**

UNIT II

Global Environmental Issue: Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS).Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking. **10 Hrs**

UNIT III

Sustainable Design: Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design- Passive solar design technique, Thermal storage, Cooling strategies, high performance insulation. Sustainable cities, Sustainable transport. **10 Hrs**

UNIT IV

Green Engineering: Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.**10 Hrs**

TEXTBOOKS:

1. Allen, D.T. and S Honnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall, 2002.
2. Bradley. A.S; Adebayo, A. O., Maria, P. Engineering applications in sustainable design and development, Cengage learning, 2016.

REFERENCE BOOKS:

1. Mackenthun, K. M.,Basic Concepts in Environmental Management, Lewis Publication, 1st edition, 1998.
2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency PublicationsRating System, TERI Publications - GRIHA Rating System.

3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional, 2010.
4. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS), 2nd edition, 2005.
5. Malcolm Dowden, Climate Change and Sustainable Development: Law, Policy and Practice, 2008
6. Daniel A. Vallero and Chris Brasier, Sustainable Design: The Science of Sustainability and Green Engineering, Wiley-Blackwell, 2008.
7. Sustainable Engineering Practice: An Introduction, Committee on Sustainability, American Society of Civil Engineers, 2016.

QUESTION PAPER PATTERN FOR SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub division.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	**Course Objectives**	**Course Outcomes**
01	To make the students understand the importance and necessity of sustainable materials and building.	Students should be able to assess the building materials depending on the requirement.
02	To apprise the different environmental issues and strategies.	Students should be able to suggest materials and technologies to include sustainability.
03	To apprise the concept of green buildings.	Students should be able to suggest materials, technologies for green buildings

ELECTIVE LIST FOR SEMESTER VIII

DEPARTMENT ELECTIVE -V
UCV852E: ADVANCED DESIGN OF RC STRUCTURES
(BY LIMIT STATE METHOD)
Credit: 03 (3-0-0)

UNIT-I

Design of flat slabs, by direct design method (with and without drops)

Design of Grid floors Rankine Grashoffs method & IS code method **8 Hrs**

UNIT-II

Design of Beams Curved in Plan: Design of circular, semicircular & segmental (circular type) type of curved beams for point load & udl. Design of continuous beams, Redistribution of moments as per IS code provision. **12 Hrs**

UNIT-III

Yield Line Method: Introduction, basic ideas of yield line theory, location of yield lines for standard cases, internal forces in yield lines, methods of yield line analysis (equilibrium approach & by virtual work principle), yield analysis of one way & two way rectangular slab, circular slab & rectangular slab. **12Hrs**

UNIT-IV

Design of bunkers & silos by John son's theory and Airy's theory.

Design of Chimneys. **8 Hrs**

TEXT BOOKS:

1. N. Krishna Raju: Advanced Reinforced Concrete design. 2nd Edition CBS Delhi,2003.
2. B.C. Punmia: Reinforced Concrete Structures. Laxmi Publishers,2016.
3. Advanced RCC Design –Bhavikatti S.S. New Age International Pvt. Ltd, 3rdedition 2016.

REFERENCE BOOKs:

1. H.J.Shah- Reinforced Concrete Structures, Charotar- Publishing house Pvt. Ltd, 2016.

2. P.C.Verghese Advanced Reinforced Concrete, PHI New Delhi, 2005.
3. G.S.Ramaswamy- Design and construction of Concrete shell roof.C.B.S. Publishers, 2005.
4. Is 456-2000, Sp-16.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl.No.	Course Objectives	Course Outcomes
01	Students will be able to comprehend the design of various types of flat slabs.	Students are capable to design all types of flat slab
02	Students will be able to prepare the design of grid floors by Rankine Grashoff's method & IS code method	Students design the grid floors by Rankine Grashoff's method & IS code method
03	To train the student to analyse and design the slabs by yield theory & to train the student to design continuous beam and to get the knowledge of redistribution of moment in continuous beam.	Students analyse slab for different boundary condition also design the slab by yield theory & student will capable to design the continuous beam after redistribution of moment as per IS code.
04	Students will be able to design bunker's& silos & get the knowledge of shells & folded plates and to get the knowledge of design of shells.	Students design bunkers and silos & students get the knowledge of plate & shells and also they design shell by beam method.

UCV 853E:ADVANCED DESIGN OF STEEL STRUCTURES - II

3 Credits (2-1-0)

UNIT - I

Design of welded plate girder: Design of welded plate girder along with stiffeners, connection design, curtailment of flange.

10 Hrs

UNIT - II

Design of gantry girder: Design of gantry girder for electrically and manually operated travelling crane in single bay.

10 Hrs

UNIT - III

Design of roof trusses: Types of roof trusses, design of a typical roof truss (forces in the members to be given), design of joints and end bearing, design of purlins.

10 Hrs

UNIT - IV

Design of Tubular structures – Introduction, permissible stresses, tubular columns, tube tension members. Design of members of tubular roof truss for given member forces and the joints in tubular trusses, design of tubular beams and purlins.

10 Hrs

TEXT BOOKS:

1) Design Of Steel Structures, N.Subramanian, Oxford, 2008
2) Design Of Steel Structures, S.K.Duggal, Mcgraw Hill, New Delhi

REFERENCE BOOKS:

1) Design of Steel structures, T.Y.Lin
2) Comprehensive Design of Steel Structures, Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain, Lakshmi Publications, New Delhi
3) Design of Steel structures, Steeve Inglekirk
4) Bureau of Indian Standards, IS800-2007, IS875-1987
5) SP 6(1) or Steel Table

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Four Full questions are to be answered choosing at least one from each unit.

Sl. No	Course Objectives	Course Outcomes
1.	Introduction to welded plate girder, design and detailing of various components	Knowledge to design and detail welded plate girder including stiffeners, connections and curtailment of flanges.
2.	Introduction to gantry girder, design and detailing for electrically and manually operated travelling crane	Knowledge to design and detail gantry girder including stiffeners, connections and curtailment of flanges.
3.	Introduction to different types of truss, forces acting on them, design of the components	Knowledge to design and detail roof truss, joints and purlins
4.	Introduction to concept of tubular truss, forces acting on them, design of the components	Knowledge to design and detail tubular truss, joints, beams and purlins

UCV854E: INDUSTRIAL WASTE WATER TREATMENT
CREDITS 03 (3-0-0)

UNIT-I

INTRODUCTION: Difference between domestic and industrial wastewater, effect on streams and on municipal sewage treatment plants. Stream quality, dissolved oxygen sag curve in stream, streeter- phelps formulation, stream sampling, effluent and stream standards and legislation to control ater pollution.

10 Hrs

UNIT-II

TREATMENT METHODS: volume reduction, strength reduction, neutralization, equalisation and proportioning. Removal of inorganic suspended solids, removal of organic solids, removal of suspended solids and colloids.Treatment and disposal of sludge solids.

10 Hrs

UNIT-III

COMBINED TREATMENT: feasibility of combined treatment of industrial raw waste with domestic waste, discharge of raw, partiality treated and completely treated wastes to streams.

10 Hrs

UNIT-IV

TREATMENT OF SELECTED INDUSTRIAL WASTES: process flow sheet showing origin sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of waste disposal on water bodies.

The industries to be covered are: cotton textile industry, tanning industry, sugar industry, dairy industry, canning industry, brewery and distillery industry, paper and pulp industry, pharmaceutical industry

10 Hrs

TEXT BOOKS:

1) Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, NewYork, 2010.
2) M N Rao and A K Dutta, Industrial Waste Treatment, English-Oxford & IBH publishing co. Pvt ltd, 3rd edition 2017.

REFERENCE BOOKS:

1. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York 1999 .
2. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968
3. Eckenfelder, W.W., "Industrial Water Pollution Control", McGraw-Hill, 1999.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl No	**Course Objectives**	**Course Outcomes**
1	To make the student to understand the effluent standards for disposal of domestic and industrial discharges.	At the end of the semester the students identify environmental standards and characteristics that apply to the domestic and industrial discharges.
2	To make the student to design the various treatment units for treatment of industrial wastewater.	Students identify physical, Chemical and Biological treatment methods applicable for treatment of industrial wastewater.
3	To make the student to develop and overall treatment unit for various industrial waste streams.	Students develop an overall treatment strategy for various industrial waste streams.
4	To make the student to design joint treatment for domestic and industrial wastewater.	Students identify the feasibility of combined treatment for domestic and industrial wastewater.

DEPARTMENT ELECTIVE-VI
UCV861E: DESIGN OF PILE FOUNDATION
CREDITS 03 (3-0-0)

UNIT 1

Shallow v/s deep foundations; Pile classification basedon their friction, compositionand Method of installation.

Axial load carrying capacity of single pile by different methods: By use of Static bearing capacity equations and dynamic formulae.

10 Hrs

UNIT 2

Pile load test; Pile group: Group efficiency, Problems related to load on each pile: Pile group with vertical and inclined piles (Culman's graphical method).

10 Hrs

UNIT 3

Laterally loaded vertical piles: Pile resistance and deflection under lateral loads, elastic method, Broms method. Under read piles; Structural design of piles

10 Hrs

UNIT 4

Negative skin friction; Influence of pile driving on adjacent structures: some common construction problems and suggested remedial measures in pile foundation.

Pile testing: Integrity of piles, corrosion resistance, and durability, damage protection to wooden and concrete piles.

10 Hrs

REFERENCE BOOKS **:**

1. TomlinsonMj.,"Foundation design and construction"-sir IsacPirman& sons Ltd. London (1963) 1st edition
2. Poulos and Davis. "Pile foundation analysis and design"- Elastic solution for soil & Rock Mechanics. John Wiley sons. (1974)
3. Chellis R.D., " Pile foundation – Theory – Design – Practice"- McGraw Hill (1963)
4. Bowels J.E., "Analytical and computer methods in foundation engineering"(1974)
5. Willkern and Fang., "Foundation engineering Hand Book"-Von No strand and remhold Co(1975)

Sl. No	Course Objectives	Course Outcomes
1	Students will be able to understand the design load carrying capacity of single and group of pile.	Students calculate the load distribution of group of piles consist of vertical piles subjected to eccentric vertical load.
2	Students will be able to analyze bearing capacity and settlement of foundations.	Students analyze and design of deep foundations subjected to different types of loads.
3	Students will be able to design of deep foundation subjected various loads.	Students design the deep foundation subjected various loads.
4	Students will be able to analyze and suggest remedial measures against foundation failures.	Students analyze and suggest remedial measures against foundation failures.

UCV862E: ADVANCED CONCRETE TECHNOLOGY
03 CREDITS (3-0-0)

UNIT I

Importance of Bogue's compounds, Structure of Hydrated cement paste, Volume of hydrated Product, transition zone, Factors affecting strength, Elastic modulus.

Chemical admixtures: Mechanism of chemical admixtures, Plasticizers and superplasticizers, effect on concrete properties, dosage of super plasticizers.

Mineral admixtures: Flyash, Silica fame, GBS and their effect on concrete properties.

10 Hrs

UNIT II

Mix Design: Factors affecting mix design, design of concrete mix by IS 10262:2019 and correct American and British methods.

Durability of current: Introduction, permeability of concrete, chemical attack, efflorescence, Alkali aggregate reaction. IS456-2000 requirements. **10 Hrs**

UNIT III

RMC Concrete- manufacture, concreting, placing, precautions, High volume flash concrete, self-compacting concrete concept, materials, test, properties and applications.

Fiber reinforced concrete- Types of fibers, Properties of fiber reinforced concrete at fresh and hardened state, Light weight concrete-materials, properties and types.

10 Hrs

UNIT IV

High Density concrete and High performance concrete, materials, properties and applications, typical mix.

Test on hardened concrete- Effect of end condition of specimen, capping, H/D ratio, rate of loading, moisture condition, compression tension and flexure tests. NDT tests concepts-Rebound hammer.

10 Hrs

TEXT BOOKS:

1. M.S.Shetty , Concrete Technology, S Chand publication , 2018
2. IS: 10262:2019
3. Concrete Technology A.R.Santha Kumar
4. P.K.Metha& PTM Monteiro Concrete- Microstructures properties and Materials (Special student edition by ICI Chennai) - PH

REFERENCE BOOKS

1. Power T.C. ESFN, Properties of Fresh concrete, London 1969.
2. Concrete Technology by R.S. Varshney, Oxford and IBH 2018.
3. John Newman B S Choo, Advanced Concrete Technology, Elsevier 2003.
4. Zongjin Li. Advanced concrete technology, John Wiley & Sons, Inc. 2011.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	Course Objectives	Course Outcomes
1.	To understand the composition, process and products of hydration, factor affecting strength and modulus.	Students will be able to remember, understand compound composition of cement, hydration and products of hydration, phases in concrete and factor affecting strength and modulus of concrete.
2.	To understand the role of chemical and mineral admixtures.	Students will be able to apply basic knowledge to understand role of chemical and mineral admixtures and their effect on the strength and properties of concrete.
3.	To understand the process of mix design using IS 10262:2019.	Students will be able to understand the process of mix proportioning and designing different grades of concrete as per IS: 10262-2019.
4.	To understand the concept of durability and factors affecting durability.	Students will be able to understand the concepts of producing durable concrete structures by analyzing factors affecting durability.
5.	To understand the advances in concrete viz. RMC, FRC, LWC, HDC, HPC etc.	Students will be able to understand and assess new techniques in concrete production, leading to special concretes like RMC, FRC, LWC, HDC, HPC including materials used and properties.
6.	To understand the testing of hardened concrete.	Students will be able to understand and carryout testing of hardened concrete to get compressive,

		tensile and flexural strength by destructive and nondestructive techniques.

UCV863E: BASICS OF SOIL DYNAMICS AND EARTHQUAKE ENGINEERING
Credits 3 (3-0-0)

UNIT 1

Historical development of soil dynamics and its importance.Effects of vibrations on foundations. Types of dynamic loads encountered in civil engineering.
Occurrence of earthquakes, Types of seismic waves and their properties. And their uses in subsoil exploration.Propagation of wave in elastic medium.Problems on computation of wave velocities.Location of epicenter, Magnitude of earthquake.

10 Hrs

UNIT 2

Vibration Theory: Degrees of freedom; Vibration of Single degree of freedom systems, Undamped and damped free and forced vibrations;Natural frequency and resonance & its effects.

10 Hrs

UNIT 3

Liquefaction of soils: Occurrence of liquefaction and its significance in geotechnical engineering; factors affecting liquefaction; liquefaction analysis; measures for reducing the damage to structures due to liquefaction.

10 Hrs

UNIT 4

Vibration Isolation: Introduction, Active and Passive Isolation and methods of vibration isolation.

Dynamic Soil Properties: Laboratory methods and Field Testing Techniques.

10 Hrs

Textbooks/Reference Books

1. Das, B.M. and Ramana, G. V. (2011) "Principles of Soil Dynamics", 2nd Edition, CENGAGE Learning, USA.
2. Day, R. W.(2002) "Geotechnical Earthquake Engineering Handbook". McGraw-Hill, New York.
3. Kameshwar Rao, (1998) "Vibration Analysis and Foundation Dynamics", Wheeler Publishing.
4. Kramer, S. L. (1996) "Geotechnical Earthquake Engineering", Prentice Hall International Series.
5. Prakash, S. (1981) "Soil Dynamics", McGraw Hill Book Co., New York.
6. Okamoto, S. (1973), "Introduction to Earthquake Engineering", John Wiley & Sons, New York.
7. Richarts, F. E., Hall Jr., J. R. and Woods, R. D. (1970) "Vibrations of Soils and Foundations", Prentice Hall International Series.

8. Barkan, D. D. (1962) “Dynamics of Bases and Foundations”, McGraw Hill Book Co., New York.

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more four sub divisions.
3. Any Five full questions are to be answered choosing at least one from each unit.

Sl No	**Course Objectives**	**Course Outcomes**
01	Students will be able to comprehend the earthquake and its related terminologies	Students acquire basic knowledge of soil dynamics and earthquake engineering.
02	Students will be able to understand the properties and response of soil as a material subjected to the dynamic loading.	Studentsapply theory of vibrations to solve dynamic soil problems.
03	Students will be able to analyze the potential of soil for liquefaction and apply mitigation techniques against it.	Studentsanalyze the potential of soil for liquefaction and apply mitigation techniques against it.
04	Students will be able to analyze the vibration isolation and apply mitigation techniques against them. Calculate the dynamic properties of soils using laboratory and field tests.	Studentsanalyze vibration isolation and apply mitigation techniques against them. Calculate the dynamic properties of soils using laboratory and field tests.

UCV864E: DESIGN OF BRIDGES

Credits 3 (3-0-0)

UNIT 1

Introduction to bridges, classification, computation of discharge, linear waterway, economic span, afflux, scour depth Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.

10 Hrs

UNIT 2

Design of Slab Bridges: Straight and skew slab bridges

8 Hrs

UNIT 3

Design of T beam bridges (up to three girder only) Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.

12 Hrs

UNIT 4

Special Bridges: Design of Box culvert (Single vent only) Design of Pipe culverts.
Substructures - Design of Piers and abutments, Introduction to Bridge bearings, Hinges and Expansion joints.

10 Hrs

TEXT BOOKS:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India

REFERENCES :

1. Krishna Raju N, "Design of Bridges", Oxford & IBH Publishing Co New Delhi, 1998

2. Ponnuswamy . S, “Bridge Engineering”, Tata McGraw Hill, 2007.
3. Raina V.K., “Concrete Bridge Practice”, Tata McGraw Hill, 2002
4. Johnson D, Victor “Essentials of Bridge Engineering”, Oxford & IBH Publishing Co New Delhi, 2010

QUESTION PAPER PATTERN FOR SEE

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions.
3. Any Five Full questions are to be answered choosing at least one from each unit.

Sl. No.	**Course Objectives**	**Course Outcomes**
1.	Students will be able to understand the load distribution and IRC standards.	Students understand the load distribution and IRC standards.
2.	Students will be able to learn design of the slab and T beam bridges.	Students design the slab and T beam bridges.
3.	Students will be able to learn the design of Box culvert, pipe culvert, Piers and abutments.	Students design the Box culvert, pipe culvert, Piers and abutments.

Basaveshwar Engineering College, (Autonomous), Bagalkot
Department of Electronics and Communication Engineering
Teaching and Examination Scheme for
B.E. Electronics and Communication Engineering Course
Academic Year 2018 – 2019

Abstract of Credits Distribution

- I Semester + II Semester = 40 Credits
- III Semester + IV Semester + V Semester + VI Semester + VII Semester + VIII Semester = 135 Credits
- Total = 175 Credits

Detailed Distribution of Total 175 Credits across 1st Semester to 8th Semester

SL. No.	Learning Components	Credits								
		1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total
1	Humanities and Social Science (HSS)	-	-	3	1	1	1	-	3	**09**
2	Basic Science (PCM)	9.5	9.5	3	3	-	-	-	-	**25**
3	Engineering Science	10.5	10.5	-	-	-	-	-	-	**21**
4	Professional Core	-	-	17	19	15	13	5	-	**69**
5	Professional Elective	-	-	-	-	6	3	6	6	**21**
6	Open Elective	-	-	-	-	-	3	3	-	**06**
7	Project/ Internship/Technical Seminar	-	-	-	-	-	3*	5^{+}+ $2^{\square}$	12^{++} $+1^{\circ}$	**23**
8	Online Courses	-	-	-	-	-	-	1	-	**01**
Semester Total		**20**	**20**	**23**	**23**	**22**	**23**	**22**	**22**	**175**

*	Mini Project	++	Final year project phase-II	°	Technical Seminar
+	Final year project phase-I	□	Internship		

SCHEME OF TEACHING AND EXAMINATION									
B.E. I SEMESTER									
2018-19									
(BRANCHES E&C, EE, EI, CS & IS)						PHYSICS GROUP			
SL. NO.	**SUBJECT CODE**	**SUBJECT**	**CREDITS**	**HOURS/WEEK**			**EXAMINATION MARKS**		
				L	**T**	**P**	**CIE**	**SEE**	**Total**
1	UMA161C	Engineering Mathematics -I	4.0	3	2	-	50	50	100
2	UPH162C	Engineering Physics	4.0	3	2	-	50	50	100
3	UME163C	Elements of Mechanical Engineering	3.0	2	2	-	50	50	100
4	UEE164C	Basic Electrical Engineering	3.0	2	2	-	50	50	100
5	UCS165C	Programming with C	3.0	3	-	-	50	50	100
6	UHS126M	Constitution of India*	-	2	-	-	50	50	100
7	UPH166L	Engineering Physics Laboratory	1.5	-	-	3	50	50	100
8	UCS167L	C Programming Laboratory	1.5	-	-	3	50	50	100
9	UHS144K	Kannada Manasu**	-	2	-	-	-	-	-
10	UHS145K	Kannada Kali***	-	2	-	-	-	-	-
		Total	**20**	**17**	**8**	**6**	**400**	**400**	**800**
*	Mandatory subject, Question paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade/Class/Rank.								
**	Only for students who have studied Kannada at Primary level.								
***	For students who have not studied Kannada at primary level.								

SCHEME OF TEACHING AND EXAMINATION										
B.E. II SEMESTER										
ACADEMIC YEAR 2018-19										
(BRANCHES E&C, EE, EI, CS & IS)							**CHEMISTRY GROUP**			
SL. NO.	**SUBJECT CODE**	**SUBJECT**	**CREDITS**	**HOURS/WEEK**			**EXAMINATION MARKS**			
				L	**T**	**P**	**CIE**	**SEE**	**Total**	
1	UMA261C	Engineering Mathematics -II	4.0	3	2	-	50	50	100	
2	UCH268C	Engineering Chemistry	4.0	3	2	-	50	50	100	
3	UEC269C	Basic Electronics	3.0	2	2	-	50	50	100	
4	UCV270C	Engineering Mechanics	3.0	2	2	-	50	50	100	
5	UBT233M	Environmental Studies*	-	2	-	-	50	50	100	
6	UME271L	Computer Aided Engineering Graphics	2.5	1	-	3	50	50	100	
7	UCH272L	Engineering Chemistry Laboratory	1.5	-	-	3	50	50	100	
8	UBE273L	Basic Engineering Laboratory	2.0	-	-	4	-	-	100	
10	UHS243K	English for Engineers	-	2	-	-	-	-	-	
		Total	**20**	**15**	**08**	**10**	**350**	**350**	**800**	
*	Mandatory subject, Question paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade/Class/Rank.									

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH

B.E III SEMESTER

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UMA335C	Computational Methods for Electrical Science	3	3	0	0	50	50	100
2	UEC341C	Electronics Devices and Circuits	3	3	0	0	50	50	100
3	UEC342C	Digital Electronics and Logic Design	3	3	0	0	50	50	100
4	UEC343C	Network Analysis	4	3	2	0	50	50	100
5	UEC344C	Human Resource Management	3	3	0	0	50	50	100
6	UEC345C	Data Structures Using C	4	3	0	2	50	50	100
7	UEC346L	Electronics Devices and Circuits Lab	1.5	0	0	3	50	50	100
8	UEC347L	Digital Electronics Lab	1.5	0	0	3	50	50	100
9	UMA330M	Bridge course Mathematics-I*	-	3*	0	0	50*	50*	100*
10	UBT133M	Environmental studies*	-	2*	0	0	50*	50*	100*
		Total	23	18 23*	02	8	400 500*	400 500*	800 1000*

***Bridge Course Mathematics – I and Environmental Studies** are mandatory subjects only for diploma students admitted to BE 3rd Semester through Lateral Entry scheme. Passing the subject is compulsory, however marks will not be considered for awarding grade/class. PP/NP grade will be awarded for passing/not passing the subject respectively.

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 01 credits during III/IV/V/VI/VII semester and to be evaluated in VII Semester

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH

B.E IV SEMESTER

Sl. No.	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UMA435C	Statistical Methods for Electrical Science	3	3	0	0	50	50	100
2	UEC441C	Signals and Systems	4	3	2	0	50	50	100
3	UEC442C	Linear Integrated Circuits and Applications	3	3	0	0	50	50	100
4	UEC443C	8051 Microcontroller	3	3	0	0	50	50	100
5	UEC444C	Electronic Circuits Design	3	3	0	0	50	50	100
6	UEC445C	Analog Communication	3	3	0	0	50	50	100
7	UHS001N	Fundamentals of Quantitative Aptitude and Soft Skills	1	2	0	0	50	50	100
8	UEC441L	Analog Communication Lab	1.5	-	-	3	50	50	100
9	UEC442L	Microcontroller Lab	1.5	-	-	3	50	50	100
10	UMA430M	Bridge course Mathematics-II*	-	3*	-	-	50*	50*	100*
		Total	23	20 23*	02	6	450 500*	450 500*	900 1000*

***Bridge Course Mathematics – II is** mandatory subject only for diploma students admitted to BE 3rd Semester through Lateral Entry scheme. Passing the subject is compulsory, however marks will not be considered for awarding grade/class. PP/NP grade will be awarded for passing/not passing the subject respectively.

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 01 credits during III/IV/V/VI/VII semester and to be evaluated in VII Semester

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH

B.E V SEMESTER

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UEC541C	Digital Signal Processing	3	2	2	0	50	50	100
2	UEC542C	Digital Communication	3	3	0	0	50	50	100
3	UEC543C	Verilog Programming	3	3	0	0	50	50	100
4	UEC544C	Control System	3	3	0	0	50	50	100
5	UHS002N	Advanced Quantitative Aptitude and Soft Skills	1	2	0	0	50	50	100
Elective-I									
5	UEC545E	Computer Organization	3	3	0	0	50	50	100
6	UEC546E	Electronic Instrumentation							
7	UEC547E	OOPs with C++							
Elective-II									
8	UEC548E	MEMS	3	3	0	0	50	50	100
9	UEC549E	Automotive Electronics							
10	UEC540E	Biomedical Signal Processing							
12	UEC531L	DSP Lab	1.5	0	0	3	50	50	100
13	UEC532L	Verilog Lab	1.5	0	0	3	50	50	100
		Total	**22**	**20**	**02**	**06**	**400**	**400**	**800**

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 01 credits during III/IV/V/VI/VII semester and to be evaluated in VII Semester

Internship: For awarding B.E. (Electronics and Communication Engineering) degree, each student has to complete minimum of 04 weeks or (02 weeks + 02 weeks) of Internship between 4thand 6th semester to earn 02 credits which will be evaluated during 7th Semester.

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engg
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH

B.E VI SEMESTER

Sl. No.	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UEC641C	Field Theory	3	2	2	0	50	50	100
2	UEC642C	Computer Networks	3	3	0	0	50	50	100
3	UEC643C	CMOS Digital VLSI Design	3	3	0	0	50	50	100
4	UHS003N	Career Planning and Professional Skills	1	2	0	0	50	50	100
Elective-III									
5	UEC644E	Embedded System	3	3	0	0	50	50	100
	UEC645E	Operating Systems							
	UEC646E	Digital Verification							
	UEC647E	Mobile Communication							
6	**Open Elective 1***		3	3	0	0	50	50	100
7	UCS659L	Advanced C Lab	2	0	2	2	50	50	100
8	UEC631L	Computer Networks Lab	1	0	0	2	50	50	100
9	UEC632L	VLSI Lab	1	0	0	2	50	50	100
10	UEC633P	Mini Project	3	0	0	6	50	50	100
		Total	**23**	**16**	**04**	**12**	**450**	**450**	**900**

*** Open elective – 1: It is offered by other department to Electronics and Communication Engineering Students.**

Open Elective-1 subjects offered by the Electronics and Communication Engineering department to other department students are
1) UEC634N: Modeling and Simulation of Engineering Systems, 2) UEC635N: Image Processing

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 01 credits during III/IV/V/VI/VII semester and to be evaluated in VII Semester

Internship: For awarding B.E. (Electronics and Communication Engineering) degree, each student has to complete minimum of 04 weeks or (02 weeks + 02 weeks) of Internship between 4th and 6th semester to earn 02 credits which will be evaluated during 7th Semester.

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH
B.E VII SEMESTER

Sl. No.	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UEC741C	Microwaves and Antennas	3	3	0	0	50	50	100
2	UEC742I	Internship	2	0	0	4	50	50	100
Elective-IV									
3	UEC743E	Information Theory and Coding	3	3	0	0	50	50	100
	UEC744E	Multimedia Communication							
	UEC745E	Soft Computing							
Elective-V									
4	UEC746E	Digital Signal Processing with FPGA	3	3	0	0	50	50	100
	UEC747E	Wireless Networks					50	50	100
	UEC748E	Industrial Automation					50	50	100
5	**Open Elective 2***		3	3	0	0	50	50	100
6	UEC731L	Advanced Communication Lab	1	0	0	2	50	50	100
7	UEC732L	Modeling and Simulation Lab	1	0	0	2	50	50	100
8	UEC733P	Project Phase-I	5	0	0	12	50	50	100
9	UEC001O	MOOCS	1	-	-	-	-	-	-
		Total	**22**	**12**	**00**	**20**	**400**	**400**	**800**

*** Open elective – 2: It is offered by other department to Electronics and Communication Engineering Students. Open Elective-2 subjects offered by the Electronics and Communication Engineering department to other department students are**
1) UEC734N: Nanotechnology, 2) UEC735N: Reliability Engineering.
Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 01 credits during III/IV/V/VI/VII semester and to be evaluated in VII Semester

Internship: For awarding B.E. (Electronics and Communication Engineering) degree, each student has to complete minimum of 04 weeks or (02 weeks + 02 weeks) of Internship between 4th and 6th semester to earn 02 credits which will be evaluated during 7th Semester.

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering
SCHEME OF TEACHING AND EXAMINATION FOR 2018-19 (REGULAR) and 2019-20 (LATERAL ENTRY) BATCH

B.E VIII SEMESTER

Sl. No.	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UEC841C	Project Management and IPR	3	3	0	0	50	50	100
Elective-VI									
2	UEC842E	Satellite Communications	3	3	0	0	50	50	100
	UEC843E	Speech Processing							
	UEC844E	Advance Control Systems							
Elective-VII									
3	UEC845E	Wireless Sensor Networks	3	3	0	0	50	50	100
	UEC846E	Machine Learning							
	UEC847E	Optical Fiber Communication							
4	UEC833P	Project Phase-II	12	0	0	24	50	50	100
5	UEC831S	Technical Seminar	1	0	0	2	50	50	100
		Total	**22**	**09**	**00**	**26**	**250**	**250**	**500**

Basaveshwar Engineering College, Bagalkot
Department of Electronics & Communication Engineering

POs satisfied by the course:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

I/II Semester

Basic Electronics

UEC169C/269C

Course Title: Basic Electronics			Course Code: UEC169C/269C
Credits: 03	**L-T-P:2-2-0**	**Contact Hours / Week: 04**	**Total Teaching Hours: 30L+26T**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Core

Course Objectives:

1. To understand the diode applications and transistor characteristics
2. To learn the biasing concepts and applications of transistor (amplifier and oscillator)
3. To impart the knowledge of number system, Boolean algebra and basic digital circuits
4. To provide the knowledge on communication system and modulation techniques

Course Outcomes:

A student who successfully completes this course should be able to

1. Analyze and design diode circuits, configure transistor circuits
2. Distinguish transistor biasing methods and design oscillators
3. Do number system conversions, and implement basic logic circuits
4. Comprehend the necessity of communication systems and need for modulation

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (07 hrs)

Scope and Applications of Electronics, Communication and Instrumentation Engineering. Diode Applications: Half Wave Rectification, Full Wave Rectification, Rectifier with Shunt Capacitor (qualitative analysis), Zener Diode Voltage Regulator, DC Voltage Multipliers, Diode logic Gates. Bipolar Junction Transistors: Transistor operation, Transistor Voltages and Currents, Common-Base Characteristics, Common-Emitter Characteristics and Common-Collector Characteristics.

Unit II (08hrs)

BJT Biasing and Applications: The DC Load Line and Bias Point, Base Bias, Collector to Base Bias, Voltage Divider Bias, Comparison of Basic Bias Circuits. Amplifier: Decibels and half power points, Single-Stage CE Amplifier. Oscillators: Concept of Feedback, Positive and Negative Feedback, Barkhausen criterion, BJT RC Phase Shift Oscillator, Hartley Oscillator, Colpitt's Oscillator and Crystal (qualitative analysis) Oscillator.

Unit III (07hrs)

Number Systems: Introduction, Decimal, Binary and Hexadecimal Number Systems. Addition and subtraction, Binary Coded Decimal Numbers. Digital Logic: Boolean Algebra, Logic Gates, Universal Gates, Half and Full Adder, Parallel Adder. Advantages of Digital systems over Analog systems.

Unit IV (08hrs)

Introduction to Communication System: Basic Communication Block Diagram. Modulation: Need for Modulation, Amplitude and Frequency Modulation & Demodulation (qualitative discussion only). Meaning of Instrumentation System, Generalized block diagram of Instrumentation System- Open loop and Closed loop systems, examples. Sensors and Transducers: Definition, meaning and classification.

Textbooks:

1) David A. Bell, "Electronic Devices and Circuits", 4th edition, PHI, 2006
2) George Kennedy, "Electronic Communication Systems", 4th edition. TMH, 2005

Reference Books:

1) Floyd and Jan, "Digital fundamentals", 8th edition, Pearson, 2006
2) Jacob Milliman, Christos C. Halkies, "Electronics Devices and Circuits", TMH, 2001
3) A.P. Malvino, "Electronic Principles", TMH, 2003

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1: Analyze and design diode circuits, configure transistor circuits	3	2	1	0	1	0	0	0	0	0	0	1	3	0	0
CO2: Distinguish transistor biasing methods and design oscillators.	3	2	1	0	1	0	0	0	0	0	0	1	3	0	0
CO3: Do number system conversions, and implement basic logic circuits.	3	2	1	0	1	0	0	0	0	0	0	1	2	0	0
CO4: Comprehend the necessity of communication systems and need for modulation.	3	2	1	0	0	1	0	0	0	0	0	1	3	0	0
Course Contribution to POs and PSOs	3	2	1	0	0.75	0.25	0	0	0	0	0	1	2.75	0	0

III Semester

Course Title: Computational Methods for Electrical science		**Course Code: UMA335C**
Credits: 03	**Teaching Hours:40 Hrs**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engg.		

Course Objectives:

1. To enable the students to apply the knowledge of Mathematics in various engineering fields by making them.
2. To understand the numerical method of solving algebraic, transcendental equations.
3. To determine the approximate value of the derivative & definite integral for a given data using numerical techniques.
4. Able to expand the given periodic function defined in the range in terms of sine and cosine multiple of terms as a Fourier series.

Course Outcomes:

A student who successfully completes this course should be able to

1. To know how root finding techniques can be used to solve practical engineering problems.
2. To apply the concept of finding approximate value of the derivative & definite integral for a given data using numerical techniques.
3. To apply numerical techniques to solve the first order first degree ordinary differential equations.
4. To apply the analytical technique to express periodic function as a Fourier sine and cosine series.
5. To apply the concept of Fourier transform and Z- transform, to study the performance of electrical systems.

The topics that enable to meet the above objectives and course outcomes are given below.

Unit I (10 hours)

Numerical Analysis-I: Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).

Unit II (10 hours)

Numerical Analysis-II: Numerical differentiation using Newton's forward and backward formulae-problems. Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems.

Unit III (10 hours)

Fourier Series: Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

Unit IV (10 hours)

Fourier transforms and z-transforms: Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems.

Reference Books:

1. Numerical Methods for Engineers by Steven C Chapra&Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSOs satisfied by the course:

m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: To know how root finding techniques can be used to solve practical engineering problems.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO2: To apply the concept of finding approximate value of the derivative & definite integral for a given data using numerical techniques.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO3: To apply numerical techniques to solve the first order first degree ordinary differential equations.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO4: To apply the analytical technique to express periodic function as a Fourier sine and cosine series.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO5: To apply the concept of Fourier transform and Z- transform, to study the performance of electrical systems.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Electronics Devices and Circuits		Course Code: UEC341C
Credits: 3 (3-0-0)	**Teaching Hours: 40 Hrs**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1) To provide the knowledge about construction, operation and characteristics of JFET, MOSFET, Thyristors and design of clipper and clamper circuits.
2) To study the construction, operation and characteristics, application of optoelectronic and other two-terminal devices.
3) To study multistage, negative feedback, and power amplifiers.
4) To study power electronic circuits such as controlled rectifiers, DC choppers and inverters.

Course Outcomes:

A student who successfully completes this course should be able to

1. Design clipper, clamper and amplifier circuits.
2. Differentiate the characteristics and their importance of different optoelectronic and other two-terminal devices.
3. Analyze multistage amplifier circuits, amplifier with negative feedback and power amplifiers.
4. Analyze power electronic circuits such as controlled rectifiers, DC choppers and inverters.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Field Effect Transistors: Introduction, construction, operation and characteristics of JFETs, transfer characteristics, depletion type MOSFET, enhancement type MOSFET, practical applications.
Thyristors: Introduction, construction, operation and characteristics of SCR, TRIAC, UJT, SCR.
Diode applications: clippers and clampers.

Unit II (10 hrs)

Optoelectronic Device: Light units, Light emitting diode (LED), liquid crystal displays (LCD), photo conductive cell, photo diode and solar cells, photo transistors, optocouplers.
Miscellaneous Devices: Schottky diode, varactor diode, power diode, tunnel diode.

Unit III (10 hrs)

Multistage Amplifiers: Classification, distortion in multistage amplifiers, frequency response of an amplifier, RC-coupled amplifier.
Amplifier with Negative Feedback: Introduction, feedback concepts, feedback connection types, general characteristics of negative feedback amplifiers, effect of negative feedback on input and output resistances
Power Amplifiers: Introduction, series fed class A amplifiers, transformer coupled class A amplifier, class B amplifier operation, amplifier distortion

Unit IV (10 hrs)

Power Electronic Circuits: Introduction, Types of power electronic circuits, gate triggering circuits.
Controlled Rectifiers: Introduction, principles of phase controlled converter operation, single-phase semi converters.
DC Choppers: Introduction, principles of step down, step up operation.
Inverters: Introduction, inverter classification, series inverter, parallel inverter.

Textbooks:

1) Nashelesky & Boylestead, “Electronic Devices & Circuit Theory”, Pearson, 10th Edition, 2009.
2) D.A.Bell, “Electronic Devices & Circuit”, 4th Edition, PHI, 2007.
3) M.H.Rashid, “Power Electronics”, Pearson Education 3rd Edition, 2009.

Reference Book:

1) M. D. Singh, K. B. Khanchandani, "Power Electronics", McGraw Hill Publication 2nd Edition 2007.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerate

(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course

(m) Analyse and design systems for electronics, Communication, and Signal Processing Applications.

(n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Understand the basic principle of operation and characteristics of JFET, MOSFET and Thyristors.	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
CO2: Differentiate the characteristics and their importance of different optoelectronic and other two terminal devices.	3	3	3	0	0	1	2	0	0	0	0	0	3	0	0
CO3: Analyze multistage amplifier circuits, amplifiers with negative feedback and power amplifiers.	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
CO4: Acquire knowledge and carryout analysis of power electronic circuits such as controlled rectifiers, DC choppers and inverters.	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**1**	**0.92**	**1**	**0**	**0**	**0.08**	**0.16**	**0**	**0**	**0**	**0**	**0**	**1**	**0.16**	**0**

Course Title: Digital Electronics and Logic Design		Course Code: UEC342C
Credits: 3 (3-0-0)	**Teaching Hours: 40 Hrs**	**Contact Hours: 03 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1. Simplifying given Boolean expressions using Boolean algebra, K-map, Quine McCluskey and map entered variables methods.
2. Design of combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) decoder and gates.
3. Latches and flip flops, convert flips from one form to another form and design of synchronous and asynchronous counters.
4. Design, modelling and analysis of synchronous sequential circuits.

Course Outcomes:

A student who successfully completes this course should be able to

1. Simplify the given Boolean expressions using Boolean algebra, K-map, Quine McCluskey and map entered variables methods.
2. Design and analyze combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) decoder and gates.
3. Design and analyze different types of sequential circuits.
4. Design, model and analyse synchronous sequential circuits.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Principles of combinational logic and design: Review of Boolean algebra, simplification and implementation of Boolean expression using basic gates and universal gates. Definition of combinational logic, canonical forms, generation of switching equations from truth tables, K-maps (up to 5 variables), Quine-McCluskey minimization technique, map entered variables.

Unit II (10 hrs)

Analysis and design of combinational circuit using MSI components: General approach, binary adders and subtractors, cascading full adders, look ahead carry, decimal adders, comparators, decoders, encoders, multiplexers.

Unit III (10 hrs)

Flip-flops: The basic bistable element, latches, timing considerations, master-slave SR flip-flops, master slave JK flip-flop, edge triggered flip-flop, positive edge triggered D flip-flop, negative edge triggered D flip-flop, characteristic equations.

Applications of flip-flops: Registers, counters, binary ripple counters, synchronous binary counters, counters based on shift registers, design of synchronous counters, design of asynchronous counter using clocked JK, D, T and SR flip-flops.

Unit IV (10 hrs)

Sequential circuit Analysis: Introduction to Mealy & Moore models, state machine notation, synchronous sequential circuit analysis, construction of state diagrams.

Sequential circuit design: Modeling clocked synchronous sequential network behavior, state

equivalence, state table reduction, state reduction of incompletely specified state tables, state assignment techniques, algorithm state machines, linked sequential machines, completing the design of clocked synchronous sequential networks.
Textbooks: 1) Donald D Givone, "Digital Principle and Design", Tata McGraw Hill edition, 2002 2) John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning 2001 **Reference Books:** 1) Thomas L. Floyd, "Digital Fundamentals", 9th edition , PHI 2) Charles H Koth, Jr, "Fundamentals of Logic Design", Thomson learning, 2004 3) Meno and Kim, "Logic and Computer Design Fundamentals", Pearson, 2nd edition, 2001 4) Malvino and Leech, "Digital Principles & Applications", 2nd edition PHI

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerate
(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course
(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.
(n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1: Simplify the given Boolean expressions using Boolean algebra, K-map, Quine McClusky and map entered variables methods.	3	1	1	1	1	0	1	0	0	0	0	0	3	1	0
CO2: Design and analyze combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) decoder and gates.	3	3	3	2	1	0	1	0	0	0	0	0	3	1	0
CO3: Design and analyze different types of sequential circuits.	3	3	3	2	1	0	1	0	0	0	0	0	3	1	0
CO4: Design, model and analyse synchronous sequential circuits.	3	2	3	3	2	0	1	0	0	0	0	0	3	1	0
Course Contribution to POs	**3.00**	**2.25**	**2.50**	**2.00**	**1.25**	**0**	**1.00**	**0**	**0**	**0**	**0**	**0**	**3.00**	**1.00**	**0**

Course Title: Network Analysis		Course Code: UEC343C
Credits: 4 (3-2-0)	**Teaching Hours: 40 Hrs Tutorials: 28 Hrs**	**Contact Hours: 5 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

The objectives of the course is to introduce

1. Concept of mesh and node analysis, source transformation and star-delta conversion for network simplification.
2. Fundamentals of network theorems and network topology.
3. Concept of resonance and two port network parameters.
4. Concept of Laplace transformation, attenuators and equalizers.

Course Outcomes:

A student who successfully completes this course should be able to

1. Simplify networks using source transformation, star-delta conversion and determine current, voltage, power using nodal and mesh analysis to AC and DC networks.
2. Apply network theorems and topology for complex networks to find responses.
3. Analyze series and parallel resonant circuits and find different network parameters.
4. Apply concept of Laplace transformation to networks and waveforms, design attenuators and simple equalizers.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (L-10, T-7)

Basic concepts: Concept of voltage, current and power, ideal and practical representation of energy sources, source transformation, network reduction using star-delta transformation, mesh current and node voltage analysis with dependent and independent sources for AC and DC networks, concept of super mesh and super node.

Unit II (L-10, T-7)

Network theorems: Superposition, Reciprocity, Thevenin's, Norton's, Millman's and Maximum power transfer theorems.

Network topology: Graph of a network, concept of tree and co-tree, incidence matrix, tieset matrix, cutset matrix, analysis of networks, network equilibrium equations.

Unit III (L-10, T-7)

Resonance circuits: Series and parallel resonance circuits, frequency of resonance, frequency responses, Q-factor, bandwidth.

Two port network parameters: Z, Y, h, transmission parameters and relationship between parameters.

Unit IV (L-10, T-7)

Laplace transformation: Basic theorems, Laplace transform of periodic functions, application of Laplace transform to RL and RC circuits.

Attenuators: Symmetrical T, PI, bridge T, Lattice attenuators, Asymmetrical T, L, and PI attenuators.

Equalizers: Two terminal series and shunt equalizers.

Textbooks:

1) Roy Choudhary, “Networks and systems”, 2nd Edition, New Age International Publications, 2006
2) G. K. Mithal, “Network Analysis”, Khanna Publishers, 1997

Reference Books:

1) Hayt, Kemmerly and Durbin, “Engineering Circuit Analysis”, 6th Edition, TMH, 2006
2) M.E. Van Valkenberg “Network analysis”, Prentice Hall of India, 3rd Edition, 2000

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PSOs satisfied by the course

(m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Simplify networks using source transformation, star-delta conversion and can be able to apply KVL, KCL, nodal and mesh analysis to AC and DC networks.	3	2	1	2	1	1	0	0	0	0	0	0	3	0	0
CO2: Apply network theorems and topology for complex networks to find response.	3	3	1	2	1	1	0	0	0	0	0	0	3	0	0
CO3: Analyze series and parallel resonant circuits and able to find different network parameters.	3	3	1	2	1	1	0	0	0	0	0	0	3	0	0
CO4: Apply concept of Laplace transformation to networks and waveforms, able to design attenuators and simple equalizers.	3	2	1	2	1	1	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3.0**	**2.5**	**1.0**	**2**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Human Resource Management			**Course Code: UEC344C**
Credits: 03	**L-T-P:3-0-0**	**Contact Hours/ Week:3**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Core

Course Objectives:

1. The purpose of introductory is to emphasis the strategic role of HRM in managing an organization.
2. The HRM tries to clear the fog surrounding the recruitment process and to expose the students to various steps involved in selection process.
3. The purpose of career management is to enable the clear view of the process of human resource planning, as it is currently practiced in most organization.
4. The purpose of IHRM is to bring out the importance of designing an effective compensation plan that takes care of legal stipulations, industry practices, employee expectations, competitive pressure etc. for expatriate.

Course Outcomes:

A student who successfully completes this course should be able to:

1. Comprehend and demonstrate the basic knowledge of HRM concepts.
2. Know and demonstrate the application knowledge of different HRM concepts.
3. Analyze and evaluate various HRM related practical issues.
4. Plan and design HRM strategies for various HRM situations.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Introduction: Nature of Human Resource Management (HRM), importance of human resource management, functions of human resource management, The changing environment of HRM and role of HRM in changing business scenario. **Procurement:** Job, job analysis, job description and job specifications, Man power Planning demand and supply forecasting, recruitment, methods of recruitment, Employees testing and selection, types of psychological tests and interviews, placement and induction.

Unit II (10 hrs**)**

Development: Operative training and management development, methods of training and development. **Performance Appraisal:** Traditional and modern Methods. **Career Development:** career anchors, career development programme and the modern career problems. **Compensation:** Factor affecting compensation policy, job evaluation, methods of job evaluation.

Unit III (10 hrs)

Variable Compensation: Individual & group, supplementary compensation-fringe benefits and current trends in compensation. **Integration:** Human relation, importance of industrial relations, causes and effects of Industrials disputes, Machinery for settlement of industrial disputes in India, Role of trade unions in maintaining relations. **Collective Bargaining:** concept, features, process and advantages. **Maintenance and separation:** Employee safety, health and welfare, Provisions under factory Act, 1948, Turnover, Retirement and Layoff.

Unit IV (10 hrs)

International HRM: The growth of international business, HR and the international business challenge, effect of inter country difference on HRM, international staffing, international compensation and appraisal, international labor relations and Information Technology and HR.

Textbooks :

1. Flippo Edwin B, "Personnel Management", 6th Edition, McGraw Hills 2000.
2. Dresler Garry, "Human Resource Management", 8th Edition, Pearson Education, New Delhi 2002.

Reference Book:

1. Memoria C B, "Personnel Management (Management of HRM)", Himalaya Publication, New Delhi 1999.

POs satisfied by the course:

g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Comprehend and demonstrate the basic knowledge of HRM concepts.	0	0	0	0	0	0	2	3		3	0	0	2	0	0
CO2. Know and demonstrate the application knowledge of different HRM concepts.	0	0	0	0	0	0	2	3	2	2	0	0		0	0
CO3. Analyze and evaluate various HRM related practical issues.	0	0	0	0	0	0	2	3		3	3	0	3	0	0
CO4. Plan and design HRM strategies for various HRM situations.	0	0	0	0	0	0	2	3	2	0	0	0	3	0	0
Course Contribution to POs and PSOs	**0**	**0**	**0**	**0**	**0**	**0**	**2**	**3**	**1**	**2**	**0.75**	**0**	**2**	**0**	**0**

Course Title: Data Structures using "C"		Course Code: UEC345C
Credits: 4 (3-0-2)	**Teaching Hours: 40 Hrs** **Lab hrs: 28**	**Contact Hours: 5 hrs/week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

The students should be able to learn the

1. Fundamentals of data structures and their applications essential for problem solving.
2. Programming concepts of linear data structures: stack, queues and lists.
3. Programming concepts non-linear data structures: trees.
4. Programming concepts sorting & searching algorithms.

Course Outcomes:

A student who successfully completes this course should be able to

1. Demonstrate the concepts of a) various types of data structures, operations and algorithms, b) Sorting and searching operations.
2. Analyze the performance of stack, queue, lists, trees, and searching and sorting techniques.
3. Write the C programs for all the applications of data structures.
4. To solve real world problems by applying data structure concepts.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Introduction: Data structures, classifications (primitive & non primitive), data structure operations, review of arrays with respect pointers, structures, self-referential structures, pointers and dynamic memory allocation Functions: Functions (Passing structure variable as an argument, passing structure variable as a pointer argument, etc)

Unit II (10 hours)

Representation of linear arrays in memory, dynamically allocated arrays, array Operations: traversing, inserting, deleting, searching, and sorting. Stacks: definition, stack operations (push, pop and display. Test: underflow and overflow conditions), array representation of stacks, stacks using dynamic arrays, Stack Applications: infix to postfix conversion, evaluation of postfix expression, program to evaluate postfix expression, program to convert Infix to Postfix expression.

Unit III (10 hours)

Recursion - Factorial, GCD, Fibonacci sequence, tower of Hanoi. Queues: Definition, array representation, queue operations (Insert, delete and display), circular queues (Insert, delete and display), circular queues using dynamic arrays, De-queues, Priority Queues. programming examples. Linked Lists: Definition, representation of linked lists in memory, memory allocation; garbage collection.

Unit IV (12 hours)

Linked list operations: Traversing, searching, insertion, and deletion. Doubly linked lists, lircular linked lists, and header linked lists. Implementation of stack and queue using singly linked list. Programming Examples. Trees: Terminology, binary trees, properties of binary trees, array and linked representation of binary trees, binary tree traversals - inorder, postorder, preorder.

Text Books

1) Ellis Horowitz and Sartaj Sahni,'' Fundamentals of Data Structures in C'', Universities Press, 2nd Edition, 2014
2) Gilberg & Forouzan,'' A Pseudo-code approach with C'', Cengage Learning, 2nd Edition, 2014
3) Seymour Lipschutz, Schaum's Outlines, '' Data Structures'', McGraw Hill, Revised 1st Edition, 2014
4) Behrouz A. Forouzan and Richard F. Gilberg, '' Computer Science A Structured Programming Approach Using C'', Thomson, 2nd Edition

Reference Books

1) A M Tenenbaum, '' Data Structures using C'', PHI, 1989
2) Robert Kruse, '' Data Structures and Program Design in C'', PHI, 2nd edition, 1996

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
(l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

(m) Analyze and design systems for Data Structure Using C and Applications.
(o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**H**	**i**	**j**	**K**	**L**	**m**	**n**	**O**
CO1: Demonstrate the concepts of a) various types of data structures, operations and algorithms. b) Sorting and searching operations.	3	3	0	0	0	2	1	0	0	0	0	1	2	0	2
CO2: Analyze the performance of stack, queue, lists, trees, and searching and sorting techniques.	3	2	0	0	0	1	1	0	0	0	0	2	2	0	2
CO3: Write the C programs for all the applications of data structures.	3	3	0	0	0	1	1	0	0	0	0	3	2	0	2
CO4: To solve real world problems by applying data structure concepts.	3	2	0	0	0	1	2	0	0	0	0	3	2	0	2
Course Contribution to POs	**3**	**2.50**	**0**	**0**	**0**	**1.25**	**1.25**	**0**	**0**	**0**	**0**	**2.25**	**2**	**0**	**2**

Course Title: Electronics Devices and Circuits Lab		**Course Code: UEC346L**
Credits: 1.5 (0-0-3)	**Total Lab Hours: 40 Hrs**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

The objectives of Electronic Devices and Circuits Laboratory are

1) To study the V-I characteristics and working of commonly used electronic devices and their characterization.
2) To understand the working of rectifiers (controlled and uncontrolled), voltage regulators, amplifiers and oscillators.
3) Analysis of applications such as rectifiers, controlled rectifiers, voltage regulators, and design of amplifiers, oscillators.
4) To understand electronic devices and circuits simulation tools.

Course Outcomes:

After completion of Electronic Devices and Circuits Laboratory the students are able to

1) Characterize semiconductor devices based on their characteristics.
2) Realize rectifiers, controlled rectifiers and regulators.
3) Design amplifiers and oscillators for given specifications.
4) Simulate and analyze basic electronic circuits.

The Experiments that enable to meet the above objectives and course outcomes are given below

Sl. No.	**LIST OF EXPERIMENTS**
	HARDWARE EXPIREMENTS:
1	V-I characteristics and analysis of diode.
2	Analysis of diode as a half-wave and full-wave rectifier.
3	V-I characteristics and their analysis of Zener diode.
4	Zener diode as a voltage regulator and its regulation analysis.
5	Input and output characteristics and their analysis of Bipolar Junction Transistor (BJT) in common base, common collector and common emitter configuration.
6	Design, implementation and frequency response of transistor (BJT) as an amplifier
7	Design and implementation of transistor (BJT) as an oscillator.
8	Input and output characteristics and their analysis of field effect transistor (FET).
9	Design, implementation and frequency response of FET as an amplifier.
10	V-I characteristics and analysis of unijunction transistor (UJT).
11	Implementation of UJT as a relaxation oscillator.
12	V-I characteristics and analysis of silicon controlled rectifier (SCR).
13	Study of SCR as half-wave and full-wave controlled rectifier.
14	Simulation and analysis of Amplifiers and Oscillators.
15	Simulation and analysis of DC and AC excited RL and RC circuits.

POs satisfied by the course.

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**I**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Characterize semiconductor devices based on their characteristics	3	2	1	1	2	2	1	2	2	2	2	2	3	0	0
CO2: Realize rectifiers, controlled rectifiers and regulators	3	2	2	2	3	2	2	3	2	2	2	1	3	0	0
CO3: Design amplifiers and oscillators for given specifications	3	2	2	2	2	3	2	3	2	3	2	3	3	0	0
CO4: Simulate and analyze basic electronic circuits	3	2	2	1	3	1	2	3	1	2	1	3	3	0	0
Course Contribution to POs	**3**	**2**	**1.75**	**1.5**	**2.5**	**2**	**1.75**	**2.75**	**1.75**	**2.25**	**1.75**	**2.25**	**3**	**0**	**0**

Course Title: : Digital Electronics Lab		Course Code: UEC347L
Credits: 1.5 (0-0-3)	**Total Lab Hours: 40 Hrs**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engineering.
Designation : Core

Course Objectives:

1. To design combinational circuits and implement the same using a) basic logic gates b) universal gates, c) multiplexers and d) decoder and gates
2. To design and realize latches and flip flops
3. To design and implement asynchronous counters
4. To design and implement synchronous counters and shift registers
5. To simulate combinational and sequential circuits using PROTEUS software

Course Outcomes:

1. Should be able to design combinational circuits and implement it using a) basic logic Gates b) universal gates, c) multiplexers and d) decoder and gates
2. Should be able to design and realize latches and flip flops
3. Should be able to design and implement asynchronous counters
4. Should be able to design and implement synchronous counters and shift registers
5. Should be able to simulate combinational and sequential circuit using PROTEUS software

The Experiments that enable to meet the above objectives and course outcomes are given below

Sl. No.	LIST OF THE EXPERIMENTS
1	Simplification, realization of Boolean expression(s) using basic logic gates.
2	Implementation of Boolean expression(s) using universal gates.
3	Design of full adder and full subtractor implementation using basic logic gates.
4	Realization of a. Parallel adder / subtractor using 7483 chip b. Decoder chip to drive LED display
5	Design and implementation of code converters (any two).
6	Implementation of three variable Boolean expression(s) using a. 8:1 MUX b. 4:1 MUX
7	Implementation of three variable Boolean expression(s) using 3:8 decoder and gates.
8	Design of two-bit comparator using basic logic gates and study of 7485 magnitude comparator.
9	Truth table verification of flip-flops: a. Master Slave JK flip-flop implementation using only NAND gates b. JK flip flop using 7476.
10	Design of a. 4-bit asynchronous up counter using JK flip-flop (7476) b. 4-bit asynchronous down counter using JK flip-flop (7476) c. Mod-n asynchronous counter (7476) (n <= 4)
11	Design of a. UP counter using 74193 b. DOWN counter using 74193
12	Design of shift registers using 7 495 viz. SIPO, SISO, PISO, PIPO shift right, shift left.

	13	Simulate any 6 experiments covering both combinational and sequential circuits using circuit simulator- PROTEUS VSM.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

(i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

(j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSOs satisfied by the course

(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

(n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems

Course Articulation Matrix

Course outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	K	l	m	n	o
CO1: Should be able to design combinational circuits and implement it using a) basic logic Gates b) universal gates, c) multiplexers and d) decoder and gates.	3	2	2	0	0	0	0	0	1	1	0	0	2	3	0
CO 2: Should be able to realize latches and flip flops	2	2	3	0	0	0	0	0	1	1	0	0	2	3	0
CO 3: Should be able to design and implement asynchronous counters	1	2	3	0	0	0	0	0	1	1	0	0	2	3	0
CO 4: Should be able to design and implement synchronous counters and shift registers	2	2	3	0	0	0	0	0	1	1	0	0	2	3	0
Course Contribution to POs	**2**	**2**	**2.75**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**	**0**	**2**	**3**	**0**

Course Title: Bridge Course Mathematics - I		**Course Code: UMA330M**
Credits: Mandatory	**Teaching Hours:40 Hrs**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engg.		

Course Objectives:
This course will enable students to master the basic tools of calculus and vectors to become skilled for solving problems in science and engineering.

Course Outcomes:
A student who successfully completes this course should be able to

1. Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.
2. Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.
3. Apply the concept of multiple integrals and their usage in computing the area and volumes.
4. Apply the knowledge of vector calculus to solve the engineering problems

The topics that enable to meet the above objectives and course outcomes are given below

Differential Calculus: Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only) without proof. Problems
Partial differentiation: Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems **(15 hours)**

Integral Calculus: Evaluation of double and triple integrals. Area bounded by the curve. Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.
(15 hours)

Vector Calculus: Vector Differentiation: Scalar and vector fields. Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems **(10 hours)**

Textbooks:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. Calculus: Early Transcendentals James Stewart
3. C. Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.

6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PSOs satisfied by the course

(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO2: Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO3: Apply the concept of multiple integrals and their usage in computing the area and volumes.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO4: Apply the knowledge of vector calculus to solve the engineering problems	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Environmental studies		**Course Code: UBT133M**
Credits: 0 (2-0-0)	**Teaching Hours: 26 Hrs**	**Contact Hours: 2 Hrs/Week**

Question Paper Pattern for SEE:

1) Question is of Objective type covering all the four units.
2) Students have to pass this subject compulsory for the award of Degree.
3) However, marks will not be considered for awarding Grades/Class/Ranks.

Course Objectives:

1) To give students an understanding of how science and the scientific method work to address environmental problems.
2) To impart the importance of ecosystems and biogeochemical cycles of the nature.
3) To give awareness of human activity (population growth, air, water and soil pollution, ozone depletion, global warming, solid waste disposal) on ecosystem and life cycle on earth.
4) To understand the relationship and interaction of human society with the Earth's systems.

Course Outcomes:

1) Ability to understand basic aspects of environment.
2) Ability to understand impacts of human activities on nature.
3) Ability to know about natural resources.
4) Ability to understand the pollution and its effects on nature.
5) Ability to understand the concept of sustainable development
6) Ability to know about acts regarding environmental protection

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (07 hrs)

Environment & Ecology: Environmental segments, ecosystem and classification of ecosystem. Environmental impacts of human activities: agriculture, transportation, industry, mining, urbanization.
Natural Resources: Forest, water, mineral, food, land resources and biodiversity.
Energy sources: types of energy, renewable and non renewable energy sources.
Renewable energy: Solar, wind, hydropower, tidal energy, ocean & geo thermal energy, biomass energy-biodiesel, bioethanol & biogas; hydrogen as fuel.
Non renewable Energy: coal, petroleum, natural gas & nuclear energy.

Unit II (10 hrs)

Environmental pollution: Water pollution: water quality standards, water borne diseases, fluoride problem; air pollution, noise pollution; effect of electromagnetic waves.
Sustainable future : Concept of sustainable development, threats to sustainability, over exploitation of resources, strategies for sustainable development. Environment education, conservation of resources. Environment economics – concept of green building, clean development mechanism (CDM), carbon crediting.

Unit III (10 hrs)

Current environmental issues of concern: Population growth, greenhouse effect-greenhouse gases and global warming, climate change, ozone layer depletion, acid rain & eutrophication.

Environmental policy legislation rules & regulations: National environmental policy, environment protection act, legal aspects of air & water act. Functions of government agencies.

Unit IV (10 hrs)

Fundamentals of waste management : Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling.

Concept of waste water treatment , Bioremediation.

Industrial waste management (Case studies: cement, chemical, E–waste, food & construction industry waste management.

Textbooks:

1) Benny Joseph "Environmental Studies" Tata McGraw Hill, 2005.
2) Dr. D. L. Manjunath, "Environmental Studies" Pearson Education, 2006
3) Koushik and Koushik "Environmental Science & Engineering" New Age International Publishers, New Delhi, 2006

Reference Books:

1) P. Venugopal Rao "Principles of Environmental Science & Engineering" Pranticce Hall of India, 2006.
2) Meenakshi "Environmental Science & Engineering" " Prentice Hall of India, 2006.
3) S. K. Garg "Environmental Science & Ecological Studies" Khanna Publishers New Delhi, 2007.
4) P.D.Sharma "Ecology and Environment" Rastogi Publications, 2012.

POs satisfied by the course:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	Programme Outcomes												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Ability to understand basic aspects of environment	0	0	0	0	0	1	3	0	0	0	0	3	3	1	1
CO2. Ability to understand impacts of human activities on nature	0	1	0	0	0	2	3	0	0	0	0	3	3	1	1
CO3. Ability to know about natural resources	2	0	0	0	0	0	3	0	0	0	0	3	3	1	1
CO4. Ability to understand the pollution and its effects on nature	0	2	0	0	0	2	2	0	0	0	0	3	3	1	1
CO5. Ability to understand the concept of sustainable development	0	0	0	1	0	2	2	1	0	0	0	3	3	1	1
CO6. Ability to know about acts regarding environmental protection	3	0	2	2	0	0	2	0	0	0	0	3	3	1	1
Course Contribution to POs	0.83	0.5	0.33	0.5	0	1.16	2.5	0.16	0	0	0	3	3	1	1

IV Semester

Course Title: Statistical methods for Electrical science		Course Code: UMA435C
Credits: 03	**Teaching Hours:40 Hrs**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engg.		

Course Objectives:

To enable the students to apply the knowledge of Mathematics in various Engineering fields by making them

1. To form a specific relation for the given group of data using least square sense method.
2. To specify probability is an area of study which involves predicting the relative likely hood of various outcomes.

Course Outcomes:

A student who successfully completes this course should be able to

1. To apply the least square sense method to construct the specific relation for the given group of data.
2. To apply the concept of probability to find the physical significance of various distribution phenomena.
3. To apply the concept of probability to perform engineering duties in planning and designing, engines, machines and other mechanically functioning.
4. To apply the concept of probability to study the performance of Mechanical systems.
5. To apply the concept of Markov Chain for commercial and industry purpose.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Statistics: Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$ Correlation, expression for the rank correlation coefficient and regression.

Unit II (10 hours)

Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution function

Unit III (10 hours)

Probability distributions: Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint distributions - discrete and continuous random variables, Independent random variables, Problems on expectation and variance.

Unit IV (10 hours)

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

Reference Books:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz, Schaum's Series
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig , John Wiley & Sons
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, Wiley India Pvt. Ltd, 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PSOs satisfied by the course

(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: To apply the least square sense method to construct the specific relation for the given group of data.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO2: To apply the concept of probability to find the physical significance of various distribution phenomena.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO3: To apply the concept of probability to perform engineering duties in planning and designing, engines, machines and other mechanically functioning.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO4: To apply the concept of probability to study the performance of Mechanical systems.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO5: To apply the concept of Markov Chain for commercial and industry purpose.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

<table>
<tr><td colspan="2">Course Title: Signals and Systems</td><td>Course Code: UEC441C</td></tr>
<tr><td>Credits: 4
L-T-P: 3-2-0</td><td>Teaching Hours: 40
Tutorial Hours: 25</td><td>Contact Hours: 5 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department : Electronics and Communication Engg.
Designation : Core</td></tr>
</table>

Course Objectives:

1. To understand the representations and methods necessary for the analysis of continuous-time (CT) and discrete-time (DT) signals and systems.
2. To provide knowledge of time-domain analysis of CT and DT systems using convolution.
3. To impart knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools.
4. Concept of z-transform and its applications in analysis of discrete-time signals and systems.

Course Outcomes:

A student who successfully completes this course should be able to

1. Represent, characterize, and analyze CT and DT signals and systems.
2. Analyze CT and DT systems in time domain using convolution.
3. Analyze CT and DT systems in the frequency domain, using Fourier analysis tools like CTFT and DTFT.
4. Apply z-transform and its properties in the analysis of discrete-time signals and systems.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Introduction: Definition of signals and systems, classification of signals, elementary signals, basic operations on signals, interconnection of systems and operations, properties of systems.

Unit II (10 hrs**)**

Time domain representation of LTI systems: Convolution sum, convolution integral, impulse response representation. Properties of impulse response.

Unit III (10 hrs)

Fourier and inverse Fourier representation of signals: Introduction to complex sinusoidal signals and their use in Fourier representation of periodic signals (brief review of CTFS and DTFS). Continuous time Fourier transform, Discrete time Fourier Transform (DTFT), properties of DTFT and applications.

Unit IV (10 hrs)

Z -Transforms: Introduction, properties of ROC, properties of Z-transform and relation of Z -transform with Fourier transforms. Inverse Z-transform, transform analysis of LTI systems, transfer function, stability and causality, and solution of difference equations using Z-transform.

Text Book:

1) Simon Haykin and Barry Van Veen, “Signals and Systems”, 2nd Edition, John Wiley & sons.

Reference Books:

1) Michel J.Roberts, “Signals and Systems”, Tata McGraw Hill, 2003.
2) Allan V. Oppenham, Alan S. Willsky, and Hamid Nawab, “Signals and Systems”, Pearson Education Asia, 2nd edition, 1997.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PSOs satisfied by the course

(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Represent, characterize, and analyze CT and DT signals and systems.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO2 : Analyze CT and DT systems in time domain using convolution.	3	3	1	0	0	0	0	0	0	0	0	0	3	0	0
CO3 : Analyze CT and DT systems in the frequency domain, using Fourier analysis tools like CTFT and DTFT.	3	3	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4 : Apply z-transform and its properties in the analysis of discrete-time signals and systems.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3.00**	**2.5**	**1.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Linear Integrated Circuits and Applications		Course Code: UEC442C
Credits: 03 **L-T-P: 3-0-0**	**Teaching Hours: 40**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1. To introduce the basic building blocks of operational amplifier (μA-741) and infer the DC and AC analysis of op-amp
2. To provide basic foundation of feedback concept, different configurations, and characteristics of op-amp
3. To introduce basic applications of op amp
4. Classify and comprehend the working principle of various waveform generators, comparators, data converters and timers

Course Outcomes:

A student who successfully completes this course should be able to

1. Identify and analyze the different configurations of differential amplifier
2. Analyze the different feedback amplifiers and various parameters of practical op-amp
3. Design of the op amp circuits to performs mathematical operations and active filters
4. Analyze different waveform generators, comparators, data converters and timers

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Differential Amplifiers: Introduction, differential amplifier circuit configurations: dual-input balanced output differential amplifier, dual-input unbalanced output differential amplifier, single input balanced output differential amplifier, single input unbalanced output differential amplifier, constant current bias, current mirror, cascaded differential amplifier stages, level translator.

Introduction to Operational Amplifiers: Introduction, block diagram representation of a typical op-amp, types of integrated circuits, the ideal op-amp, equivalent circuit of an op-amp, ideal voltage transfer curve, open loop op-amp configurations.

Unit II (10 hrs)

An Op-Amp with Negative Feedback: Block diagram representation of feedback configuration, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier.

The Practical Op-Amp: Input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, effect of variation in power supply voltages on offset voltage, common mode configuration and common mode rejection ratio, Power supply rejection ratio.

Unit III (10 hrs)

General Applications: DC and AC amplifiers, the peaking amplifier, summing, scaling and averaging amplifiers, instrumentation amplifier, integrator, differentiator.

Active Filters: First order and second order low pass butter worth filter, first order and second order high pass butter worth filter, higher order filters, band pass filter, band reject filters, all pass filters.

Unit IV (10 hrs)

Oscillators and Waveform Generators: Introduction, phase shift oscillator, Wien bridge oscillator, square wave generator, triangular wave generator, saw tooth wave generators, voltage-controlled oscillator. **Comparators and Converters:** Basic comparator, zero crossing detectors, Schmitt trigger, DAC with R-2R ladder network, ADC using successive approximation type.

Specialized IC Applications: Working of 555 timers, timer as a monostable and astable multivibrator, operating principles of PLL.

Textbook:

1. Ramakanth A Gayakwad, “Operational Amplifiers and Linear Integrated Circuits”, 4th Edition, PHI.

Reference Books:

1. Ramakanth A Gayakwad, “Operational Amplifiers and Linear Integrated Circuits”, 3rd Edition, PHI.
2. James M. Fiore, “Op-amps and Linear Integrated Circuits: Concepts and Applications”, CENGAGE Learning 2009.
3. D. Roy Choudary, “Linear Integrated Circuits”, 2nd Edition.

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course:

(m) Analyze and design systems for Electronics, Communication, and Signal Processing Applications.

(n) Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embedded systems.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**C**	**d**	**e**	**F**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Identify and analyze the different configurations of differential amplifier.	3	2	1	1	0	0	0	0	0	0	0	0	3	1	0
CO2: Analyze the different feedback amplifiers and various parameters of practical op-amp.	3	3	1	0	0	0	0	0	0	0	0	0	3	2	0
CO3: Design of the op amp circuits to perform mathematical operations and active filters.	3	3	2	2	0	1	1	0	0	0	0	0	3	2	0
CO4: Design different types of waveform generators, comparators and converters.	3	2	2	1	0	1	1	0	0	0	0	0	3	2	0
Course Contribution to POs	**3.00**	**2.5**	**1.5**	**0.75**	**0**	**0.5**	**0.5**	**0**	**0**	**0**	**0**	**0**	**3**	**1.75**	**0**

Course Title: 8051 Microcontroller		**Course Code: UEC443C**
Credits: 03 **L-T-P: 3-0-0**	**Teaching Hours: 40**	**Contact Hours: 03 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department : Electronics and Communication Engineering **Designation : Core**		

Course Objectives:

1. To introduce 8051 microcontroller and its architecture.
2. To study the 8051 addressing modes, instructions and to write assembly language programs.
3. To study the different inbuilt peripherals like timer/counter, serial communication, interrupts and use them using assembly language.
4. To impart knowledge of different types of external interfacing devices including LCD, Keypad, DAC, ADC, Stepper motor and PPI 8255. Use/control peripherals using assembly language.

Course Outcomes:

A student who successfully completes this course should be able to

1. Comprehend the architecture of 8051 microcontroller.
2. Write programs in assembly language for 8051 to explore its capabilities.
3. Program inbuilt peripheral like timer/counter, serial and interrupt peripheral in assembly language.
4. Interface devices like LCD, Keypad, DAC, ADC, Stepper motor and PPI 8255 for different applications using assembly language.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Microprocessors and Microcontrollers: Introduction, comparison between microprocessors and microcontrollers, Z80 and 8051, 4-bit to 32-bit microcontrollers. 8051 Architecture: General features of 8051 Microcontroller, 8051 block diagram, programming model, pin description, 8051 oscillator and clock, general purpose and special function registers, internal RAM and ROM, stack, input/output pins, ports and circuits, external memory.

Unit II (10 hrs)

8051 Instructions and Programming: addressing modes, types of instructions: data move instructions, external data move instructions, arithmetic instructions, logical instructions, jump and call instructions, bit-addressable instructions, application programs using assembly language.

Unit III (10 hrs)

Programming peripherals in assembly: Timer and counter programming. Serial Port Programming: Basics of serial communication, 8051 connection to RS232, 8051 serial port programming. Interrupts: 8051 interrupts, Programming timer interrupts.

Unit IV (10 hrs)

Programming external hardware interrupts and serial communication interrupts. Interfacing: Introduction, need for interfacing, interfacing the following devices using assembly -LCD module, ADC808/DAC808, key-pad, stepper motor. Interfacing with the 8255: Programming the 8255, Interfacing the 8255.

Text books:

1. Kenneth J. Ayala, "The 8051 Micro controller Architecture, Programming & Applications", Penram International, Second Edition, 1996.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi, "The 8051 Micro controller and Embedded Systems", Pearsons Education, Second Edition, 2011.

Reference Books:

1. Craig Steiner, "The 8051/8052 Microcontroller: architecture, assembly language, and Hardware interfacing", WP Publishers and Distributors, 200*6*.
2. David Calcutt, Fred cwon, "8051 microcontroller", Elsevier, First Edition, 2004.
3. Dr.Uma Rao and Dr.Andhe Pallavi, "The 8051 microcontroller architecture, programming and applications", Pearson Education,2010

POs satisfied by the course

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

n) Design, analysis, synthesis, and validation of VLSI and embedded systems using domain specific tools.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Comprehend the architecture of 8051 microcontroller.	3	2	1	1	1	1	1	3	1	1	0	0	0	3	0
CO 2: Write programs in assembly language for 8051 to explore its capabilities.	3	2	2	1	1	2	1	3	2	1	1	1	0	3	0
CO 3: Program inbuilt peripheral like timer/counter, serial and interrupt peripheral in assembly language.	3	2	3	2	2	3	2	3	3	3	3	2	0	3	0
CO 4: Interface devices like LCD, Keypad, DAC, ADC, Stepper motor and PPI 8255 for different applications using assembly language.	3	2	2	2	3	2	2	3	2	2	2	2	0	3	0
Course Contribution to POs	3	2	2	1.5	1.75	2	1.5	3	2	1.75	1.5	1.25	0	3	0

Course Title: Electronic Circuits Design		**Course Code: UEC444C**
Credits: 03 **L-T-P: 3-0-0**	**Teaching Hours: 40**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engineering.
Designation : Core

Course Objectives:

1. To understand different BJT biasing techniques and transistor amplifying action.
2. To know different FET biasing techniques
3. To explore FET biasing techniques with respect to small signal amplification
4. To know in detail about power supplies and voltage regulators.

Course Outcomes:

A student who successfully completes this course should be able to

1. Design BJT amplifier using different biasing methods
2. Design and analyze different FET biasing methods used in amplifier
3. Analyze FET amplifier of different configurations
4. Design discrete and IC based regulated power supply

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

DC Biasing–BJTs: Introduction, Operating point, Fixed bias configuration, Emitter bias configuration, Voltage divider bias configuration, Collector feedback configuration, Emitter follower configuration, Common base configuration. Transistor amplifying action, Common- emitter configuration, Common collector configuration.

Unit II (10 hrs)

FET Biasing: Introduction, Fixed bias configuration, Self bias configuration, Voltage divider biasing, Common gate configuration, Special case of VGSQ = 0 V, Design, Troubleshooting, p-Channel FETs, Universal JFET bias curve.

Unit III (10 hrs)

FET Amplifiers: Introduction, JFET small signal model, Fixed bias configuration, Voltage divider configuration, Common gate configuration, Source follower (Common drain) configuration.

Unit IV (10 hrs)

Power Supplies: Introduction, General filter considerations, Capacitor filter, RC filter, Discrete transistor voltage regulation, IC Voltage regulators.

Text Books:

1) Robert L. Boylestad and Louis Nashelsky, “Electronic Devices and Circuit Theory”, Pearson Publications, 10^{th} Edition, 2009.
2) Jim Williams, “The art and science of Analog Circuit Design”, EDN series Elsevier publication, Volume 2, 1995.

POs satisfied by the course

a. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

m. Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Design BJT amplifier using different biasing methods	3	2	2	2	2	2	1	2	2	2	2	2	3	0	0
CO2: Design and analyze different FET biasing methods used in amplifier	3	2	2	2	2	2	1	2	2	2	2	2	3	0	0
CO3: Analyze FET amplifier of different configurations	3	3	2	2	2	2	1	2	2	2	2	2	3	0	0
CO4: Design discrete and IC based regulated power supply	3	2	3	3	2	2	1	2	2	2	2	2	3	0	0
Course Contribution to POs	**3**	**2.25**	**2.25**	2.25	2	2	2	2	2	2	2	2	3	0	0

Course Title: Analog Communication		Course Code: UEC445C
Credits: 3 (3-0-0)	Teaching Hours: 40 Hrs (10 Hrs/Unit)	Contact Hours: 3 Hrs/Week
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

The objective of the course is to introduce the students

1. Concept of communication, amplitude modulation/demodulation in both time and frequency domains
2. Concept of frequency modulation/demodulation in both time and frequency domains
3. Basics of probability, random variables and random processes
4. Different types of noise and predict its effect on various analog communication systems

Course Outcomes:

A student who successfully completes this course should be able to

1. Explain amplitude modulation and demodulation techniques in communication systems
2. Explain angle modulation and demodulation techniques in communication systems
3. Apply the basics of probability to random variables and random processes for communication systems
4. Describe different types of noise and predict its effect on various analog communication systems

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (10 hrs)

Linear modulation: Baseband and carrier communication, time domain and frequency domain description, generation and detection of Amplitude Modulation (AM) waves.
DSB-SC modulation: Time and frequency domain representation, generation and detection of DSB-SC modulated waves.
SSB modulation: Time domain representation of SSB signal, generation and detection of SSB modulated waves, Quadrature Amplitude Modulation (QAM).
Vestigial sideband modulation: Frequency domain representation, generation and detection of VSB, comparison of amplitude modulation techniques, super heterodyne receiver.

Unit II (10 hrs)

Angle modulation: Concept of angle modulation, relation between frequency and phase modulation, bandwidth of angle modulated wave.
Generation of FM: direct and indirect methods, PLL, demodulation of FM, pre-emphasis and de-emphasis, FM radio.

Unit III (10 hrs)

Probability theory: Axioms of probability, properties of probability, conditional probability.
Random variables: Continuous and discrete random variable, statistical averages, distribution and density functions, central limit theorem.
Random processes: Specification of a random process, stationary, ensemble averages, ergodicity, power spectral density, Gaussian processes.

Unit IV (10 hrs)

Noise: Shot noise, thermal noise, white noise, equivalent noise bandwidth, noise figure, equivalent noise temperature
Noise in continuous wave modulation systems: Noise in DSB-SC and SSB receivers, noise in AM receiver, noise in FM receiver.

Reference Books

1) B. P. Lathi "Modern Digital and Analog Communication Systems", 3rd Edition, Oxford University, 2006
2) George Kennedy "Electronic Communication Systems", 3rd Edition, Tata Mc Graw-Hill Publication, 1984
3) B. P. Lathi "Communication Systems", 3rd Edition, B. S. Publications, 2009
4) Simon Haykin "Communication Systems", 3rd Edition, John Wiley and Sons, 2005

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course
m. Analyze and design systems for Electronics, Communication, and Signal Processing Applications.
Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Explain amplitude modulation and demodulation techniques in communication systems	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO2: Explain angle modulation and demodulation techniques in communication systems	3	2	2	0	1	1	1	0	0	0	0	0	3	0	0
CO3: Apply the basics of probability to random variables and random processes	3	3	1	0	1	1	1	0	0	0	0	0	3	0	0
CO4: Describe different types of noise and predict its effect on various analog communication systems	2	2	1	0	1	1	2	0	0	0	0	0	3	0	0
Course Contribution to POs	**2.75**	**2.25**	**1.5**	**0**	**1**	**1**	**1.25**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

<table>
<tr><td colspan="2">Course Title: Analog Communication Lab</td><td>Course Code: UEC441L</td></tr>
<tr><td>Credits: 1.5
L-T-P: 0-0-3</td><td>Total Lab Hours: 40</td><td>Contact Hours: 3 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department : Electronics and Communication Engineering.
Designation : Core</td></tr>
<tr><td colspan="3">Course Objectives:
The objective of the lab is to conduct experiment to
1. Design and obtain the frequency response of second order active filters.
2. Study amplitude and frequency modulation techniques.
3. Verify pre-emphasis and de-emphasis circuits.
4. Study the concept of Pulse modulation techniques (PAM, PWM, and PPM).</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this lab should be able to
1. Design and verify the frequency response of active filters for a given specifications.
2. Design and characterize AM and FM modulation and demodulation circuits.
3. Construct pre-emphasis and de-emphasis circuits.
4. Verify the PAM, PWM & PPM circuits.</td></tr>
</table>

Sl. No	LIST OF EXPERIMENTS
1	Design and verification of second order active low pass filter.
2	Design and verification of second order active high pass filter.
3	Design and verification of band elimination filter.
4	Design and verification of band pass filter
5	Realization of Amplitude Modulation and demodulation for a given modulation index.
6	Realization of Frequency Modulation
7	Realization of Pulse Width Modulation.
8	Realization of Pulse Position Modulation
9	Realization of Pulse Amplitude Modulation.
11	Realization of Pre-emphasis and De-emphasis circuits.
12	Realization of frequency demodulation using PLL.

POs satisfied by the course

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

m. Analyse and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Design and verify the frequency response of active filters for a given specifications.	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO2:Design and simulate modulation and demodulation circuits such as AM, FM	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO3:Construct pre-emphasis and de-emphasis at the transmitter and receiver respectively	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
CO4: Design and simulate the PAM, PWM & PPM circuits and to characterize PLL behavior.	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0
Course Contribution to POs	3	2	2	1	1	0	0	0	2	2	0	1	3	0	0

Course Title: Microcontroller Lab		**Course Code: UEC442L**
Credits: 1.5 **L-T-P: 0-0-3**	**Total Lab Hours: 40**	**Contact Hours: 03 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engineering.
Designation : Core

Course Objectives:

1. To give hands-on experience in using MCS-51 family microcontrollers.
2. To provide practical knowledge of 8051 assembly language programming.
3. To give exposure in using Keil compiler and embedded C programming.
4. To impart knowledge about inbuilt peripherals in MCS-51 family and their interfacing.
5. To encourage the students in building embedded applications.

Course Outcomes:

A student who successfully completes this course should be able to

1. Conduct experiments to understand fundamental concepts of 8051 microcontroller.
2. Write efficient programs in assembly level language of the 8051 microcontroller.
3. Write program to interface different peripherals.
4. Develop the embedded C program to perform a defined task.

The topics that enable to meet the above objectives and course outcomes are given below

List of Experiments

Part-A

Basic 8051 assembly language programs on the trainer kit using in built assembler

- Move an 8-bit data byte to a register/memory using all addressing modes.
- Block of data transfer in internal RAM locations.
- Exchange block of data internal/external memory locations.
- Average of n-eight bit numbers.
- Programs on basic arithmetic operations.
- Programs using logical instructions.
- Search a byte in a given array.
- Find largest/smallest number in an array.
- Sorting the given array of numbers in ascending/descending order.
- Decade/BCD/Hex counters using delay programs.
- Code conversion programs.
- Program on comparator.
- Addition/multiplication of two matrices.
- Determine Fibonacci series of a given number.
- Programs on stack operations.

Part-B

Programs using in-built peripherals like timers/counters, interrupts and serial port using assembly programming in keil cross-compiler

- Input/output port programming.
- Generation of waveform of different duty cycle using internal timers.
- Counting external events using in-built counters.
- Serial transfer/receive of a message at different baud rate, 8-bit data, 1-stop bit and 1-start bit.
- Programs on internal/external interrupts.

Part-C

Developing interfacing Embedded 'C' programs in keil cross-compiler, fusing machine code on flash board/Circuit simulation Software

- Logic controller
- Stepper motor
- LCD
- Keypad
- Digital to Analog Conversion (DAC)
- Seven Segment Display (SSD)

POs satisfied by the course

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
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g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

n) Design, analysis, synthesis, and validation of VLSI and embedded systems using domain specific tools.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Conduct experiments to understand fundamental concepts of 8051 microcontroller.	3	2	1	1	1	1	1	3	1	1	0	0	0	3	0
CO 2: Write efficient programs in assembly level language of the 8051 microcontroller.	3	2	2	1	1	2	1	3	2	1	1	1	0	3	0
CO 3: Write program to interface different peripherals.	3	2	3	2	2	3	2	3	3	3	3	2	0	3	0
CO 4: Develop the embedded C program to perform a defined task.	3	2	2	2	3	2	2	3	2	2	2	2	0	3	0
Course Contribution to POs	**3**	**2**	**2**	**1.5**	**1.75**	**2**	**1.5**	**3**	**2**	**1.75**	**1.5**	**1.25**	**0**	**3**	**0**

Course Title: Bridge Course Mathematics-II		**Course Code: UMA430M**
Credits: Mandatory	**Teaching Hours:40 Hrs**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engg.		

Course Objectives:
The purpose of the course is to facilitate the students with concrete foundation of differential equations and Laplace transforms to acquire the knowledge of these mathematical tools.

Course Outcomes:
A student who successfully completes this course should be able to

1. Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.
2. Apply the Laplace transform techniques to solve differential equations.
3. Understand a variety of partial differential equations and solution by exact methods.
4. Solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables.

The topics that enable to meet the above objectives and course outcomes are given below

Ordinary differential equations of first order: Variable separable, Homogeneous Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.
(15 hours)

Laplace Transform: Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function
Inverse Laplace transforms – Properties. Convolution theorem. Solutions of linear differential equations
(**15 hours)**

Partial Differential Equations (PDE's): Introduction to PDE : Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, method of separation of variables
(10 hours)

Text books:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
2. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference Books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. Calculus: Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PSOs satisfied by the course

(m) Analyze and design systems for electronics, Communication, and Signal Processing Applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO2: Apply the Laplace transform techniques to solve differential equations.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO3: Understand a variety of partial differential equations and solution by exact methods.	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
CO4 : solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables	3	2	2	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3**	**2**	**2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

V Semester

<table>
<tr><td colspan="2">Course Title: Digital Signal Processing</td><td>Course Code: UEC541C</td></tr>
<tr><td>Credits: 3 (2-2-0)</td><td>Teaching Hours: 40 Hrs
Tutorial Hours: 25 Hrs</td><td>Contact Hours: 4 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department: Electronics and Communication Engg.
Designation: Core</td></tr>
<tr><td colspan="3">Course Objectives:
1. Understand the importance, merits, and scope of digital signal processing.
2. To impart the concept of discrete Fourier transforms (DFT) and linear filtering.
3. To explore FFT algorithms for efficient computation of DFT.
4. To study different methods of design and implementation techniques of IIR and FIR digital filters.</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1. Compute and Use DFT for linear filtering applications.
2. Use FFT algorithms for efficient computation of DFT.
3. Design and implement IIR digital filters using Butterworh and Chebysheve approximations.
4. Design and implement FIR digital filters using windowing and frequency sampling techniques.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below</td></tr>
<tr><td colspan="3">Unit I (10hrs)
Discrete Fourier Transform: Frequency domain sampling and reconstruction of discrete time signals, DFT as a linear transformation, its relationship with other transforms, properties: multiplication of two DFTs, circular convolution and additional properties of DFT. Application of DFT in linear filtering: overlap add and overlap save method.</td></tr>
<tr><td colspan="3">Unit II (10hrs)
Fast Fourier Transform Algorithms: Need for efficient computation of DFT, Radix 2 FFT algorithms for computation of DFT and IDFT: Decimation in time and decimation in frequency algorithms. Goertzel algorithm and chirp-Z transform algorithm.</td></tr>
<tr><td colspan="3">Unit III (10hrs)
IIR filter design: Characteristics of commonly used analog filters – Butterworth and Chebyshev filters. Design of IIR filters from analog filters (i.e. Butterworth and Chebyshev), Transformation techniques: Impulse invariance method, Approximation of derivative (Backward difference and Forward difference) method. Bilinear transformation method.</td></tr>
<tr><td colspan="3">Unit IV (10hrs)
FIR filter design: Introduction to FIR filters, Design of FIR filters using windowing (Rectangular, Hamming, Hanning and Bartlet) method, FIR filter design using frequency sampling method. Implementation of discrete time systems - Structures for IIR and FIR systems: Direct form I, Direct form II, Cascade and Parallel realization.</td></tr>
<tr><td colspan="3">Textbook:
1) Proakis and Manolakis, “Digital Signal Processing-Principles Algorithms and Applications”</td></tr>
</table>

PHI Publication, III Edition, 1997.

Reference Books:

1) Oppenheim and Schaffer, "Discrete Time Signal Processing" PHI Publication, III Edition, 2003.

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

PSOs satisfied by the course:

(m) Analyse and design systems for electronics, Communication, and Signal Processing Applications

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Compute and Use DFT for linear filtering applications.	3	2	1	0	1	0	0	0	0	0	0	0	3	0	0
CO2. Use FFT algorithms for efficient computation of DFT.	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0
CO3. Design and implement IIR digital filters using Butterworh and Chebysheve approximations.	3	3	3	0	1	0	0	0	0	0	0	0	3	0	0
CO4. Design and implement FIR digital filters using windowing and frequency sampling techniques.	3	2	3	0	1	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3.00**	**2.5**	**2.00**	**0**	**1.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

<table>
<tr><td colspan="2">Course Title: Digital Communication</td><td>Course Code: UEC542C</td></tr>
<tr><td>Credits: 3 (3-0-0)</td><td>Teaching Hours: 40 Hrs</td><td>Contact Hours: 3 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department: Electronics and Communication Engg.
Designation: Core</td></tr>
<tr><td colspan="3">Course Objectives:
This course will enable the students
1. To understand the building blocks of digital communication system, sampling and line codes of the signals
2. To understand the concept of various waveform coding techniques.
3. To understand and analyze the band pass modulation techniques, performance metrics and parameters for signal processing
4. To analyze error performance of a digital communication system in presence of noise and other interferences.
5. To understand concept of spread spectrum communication system</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1. Design and implement sampling and reconstruction of low pass signals.
2. Design and implement uniform and non uniform quantizer and encoder for analog to digital conversion, representation of signals
3. Design and implement different digital modulation /demodulation techniques.
4. Comprehend the concept of signals estimation detection and spread spectrum communication.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below</td></tr>
<tr><td colspan="3">Unit I (10 hours)
Model of digital communication systems Sampling process: Sampling Theorem, quadrature sampling of Band pass signal, reconstruction of a message from its samples, signal distortion in sampling. Line codes, unipolar, polar and Manchester codes and their power spectral densities.</td></tr>
<tr><td colspan="3">Unit II (10 hours)
Waveform Coding Techniques: PCM, Channel noise and error probability, quantization noise and SNR, robust quantization. DPCM, DM, ADM, Gram-Schmidt ortho-gonolisation procedure, Geometric Interpretation of signals</td></tr>
<tr><td colspan="3">Unit III (10 hours)
Digital Modulation Techniques: Digital Modulation formats, Coherent binary modulation techniques (ASK, PSK, FSK), Probability of error for each ASK, PSK, FSK. Coherent quadrature modulation techniques, MSK, (without derivation of probability of error equation). Non-coherent binary modulation techniques (FSK and DPSK).</td></tr>
<tr><td colspan="3">Unit IV (10 hours)
Model of a spread Spectrum Modulation: Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum communication, (SFH & FFH), Applications effect of dispreading on a narrow bond interference coherent binary PSK, signal space dimensionality & processing gain, frequency hop</td></tr>
</table>

spread spectrum. Applications.

Reference Books:

1) Simon Haykin, "Digital communications", John Wiley, Edition 2014
2) John. G. Proakis, & Masoul salehi" Fundamental of Communication System" Pearson Education, Edition 2014
3) Bernard Sklar and Prabitrakumary Ray, "Digital Communication Fundamentals and Applications", Pearson Publications, 2010
4) K. Sam Shanmugan, "Digital and Analog Communication Systems", John Wiley & Sons, 2006

POs satisfied by the course:

(a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
(e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

PSOs satisfied by the course

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
Design and implement sampling and reconstruction of low pass signals.	3	3	2	0	1	0	0	0	0	0	0	0	3	0	0
Design and implement uniform and non uniform quantizer and encoder for analog to digital conversion, representation of signals	3	2	2	0	1	0	0	0	0	0	0	0	3	0	0
Design and implement different digital modulation /demodulation techniques.	3	3	1	0	1	0	0	0	0	0	0	0	3	0	0
Comprehend the concept of signals estimation detection and spread spectrum communication.	3	3	3	0	1	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3.00**	**2.75**	**2.00**	**0**	**1.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Verilog Programming		Course Code: UEC543C
Credits: 3	Teaching Hours: 40 Hrs (10Hrs/Unit)	(L-T-P: 3-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department: Electronics and Communication Engg.

Course Objectives:

1) To learn and appreciate basics of Verilog Programming.
2) To learn programming using Verilog to describe digital circuits andsystems.
3) To design digital circuits by writing Verilog code using different designstyles.
4) To write test benches using Verilog to automate simulation and verification ofdesign.

Course Outcomes:

A student who successfully completes this course should be able to write.

1) Verilog code for combinational and sequentialcircuits.
2) Verilog code for simple digital system for given specifications using different designstyles.
3) Verilog code using advanced Verilogconcepts.
4) Test benches to automate simulation and verification ofdesign.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (10 hours)

Introduction to Verilog: Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays,

Unit II (10hours)

Introduction to Verilog cont.: Loops in Verilog, Testing a Verilog Model.
Design Examples: Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and De-bouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.

Unit III (10 hours)

Additional Topics in Verilog: Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks.
Hardware Testing and Design for Testability: Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.

Unit IV (10 hours)

Component Test and Verification: Test-bench, Combinational circuit testing, Sequential circuit testing, Test-bench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive test-bench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates.

Reference Books:

1) Charles Roth, Lizy Kurian John, and ByeongKil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016
2) ZainalabedinNavabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed,2008
3) Palnitkar, Samir. “Verilog HDL: a guide to digital design and synthesis” Vol. 1. Prentice Hall Professional,2003.
4) Sagdeo, Vivek. “The complete Verilog book”. Springer Science & Business Media,2007.
5) Smith, Douglas J., and Alex Foreword By-Zamfirescu. “HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog” Doone Publications,1998.
6) Bhasker, Jayaram. “A Verilog HDL Primer”. Star Galaxy Publishing,1999.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Verilog code for combinational and sequential circuits.	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO2: Verilog code for simple digital system for given specifications using different designstyles.	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO3: Verilog code using advanced Verilog concepts.	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO4: Test benches to automate simulation and verification of design.	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
Course Contribution to POs	**1.00**	**0**	**1.00**	**1.00**	**3.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**

Course Title: Control Systems		Course Code: UEC544C
Credits: 03 (3-0-0)	**Teaching Hours: 40 Hours**	**Contact hours: 3 Hrs/week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Course Objectives:
The course is intended to provide the knowledge about
1. The concept of feedback and physical modeling of systems like electrical, mechanical and electromechanical control systems.
2. Time domain analysis of a control system.
3. Stability analysis of a control system through root locus and frequency domain analysis using Bode plotting techniques.
4. Polar and Nyquist plot technique and state space analysis of control systems.

Course Outcomes:
A student who successfully completes this course should be able to
1. Mathematically model electrical, mechanical and electromechanical control systems.
2. Characterize the control systems in time domain.
3. Analyze stability of a control system using root locus technique and frequency domain analysis using Bode plotting techniques.
4. Determine the stability of control systems using polar and Nyquist plotting technique and represent the control systems using state space techniques.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hours)

System modeling: Definition of control system, Concept of feedback and its significance, open loop and closed loop systems, Modeling of Electrical, Mechanical and Electromechanical systems, Differential equations of physical system.
Transfer function, Block diagram representation and Reduction technique, Signal flow graph representation and reduction using Mason's gain formula.

Unit II (10 Hours)

Time domain analysis of control systems: Introduction, standard test signals, Unit step response of a second order system, Steady state error analysis, time domain specifications.
Stability analysis technique: Concept of stability, Location of Roots in the s-plane for stability, methods of determining stability, Routh-Hurwitz stability criterion.

Unit III (10 Hours)

Root-Locus Technique: Introduction, Procedure for constructing Root-locus. Stability analysis using root locus.
Frequency Domain Analysis: Introduction, Bode plots, Gain and Phase cross over frequency, gain margin, phase margin, Frequency domain specifications-resonant peak, resonant frequency, and bandwidth.

Unit IV (10 Hours)

Polar plots, Nyquist stability criterion; Principle of argument, mapping, Nyquist path, Nyquist criterion, Nyquist Plot and stability analysis.

State Space Analysis: Introduction, concept of state and variables, state model, Non-homogeneous solution of a state equation.
Reference Books: 1) Nagrath and Gopal, “Control System Engineering”, New Age publication. 2) K. Ogeta, “Modern control engineering”, Person education, Asia/PHI 4thedition, 2002. 3) Benjamin C.Kuo, “Automatic Control Systems”, PHI 7thedition. 4) Richard C. Dorf and Robert. H. Bishop, “Modern Control Systems”, Person Education, 8th Edition, 2002. 5) M. Gopal, “Control Systems-Principles and Design”, TMH, 2nd Edition, 2002. 6) David. K. Chng, “Analysis of Linear systems”, Narosa publishing house, 1996.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**J**	**k**	**l**	**m**	**n**	**o**
CO1: The concept of feedback and physical modeling of systems like electrical, mechanical and electromechanical control systems.	3	3	3	0	0	0	1	0	0	0	1	0	3	2	0
CO2: Time domain analysis of a control system.	3	3	1	0	0	0	2	0	0	0	0	0	3	0	0
CO3: Stability analysis of a control system through root locus and frequency domain analysis using Bode plotting techniques.	3	2	2	0	1	0	0	0	1	0	1	0	3	0	0
CO4: Polar and Nyquist plot technique and state space analysis of control systems.	3	2	2	0	1	0	0	0	1	0	1	0	3	0	0
Course Contribution to POs	**3**	**2.5**	**2**	**0**	**0.5**	**0**	**0.75**	**0**	**0.5**	**0**	**0.75**	**0**	**3**	**0.5**	**0**

Course Title: Computer Organization		Course Code: UEC545E
Credits: 3	**Teaching Hours: 40 Hrs (10 Hrs/Unit)**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engineering **Designation: Elective**		

Course Objectives:

1. To have thorough understanding of history, architecture, operation and performance of a digital computer.
2. To study the different ways of communicating with I/O devices and standard I/O interfaces in a computer system.
3. To understand memory interfacing and the hierarchical memory system including cache and virtual memory
4. Implementation of different arithmetic operations and multiple bus organization of computer structure and study instruction execution in a processing unit.

Course Outcomes:

A student who successfully completes this course should be able to

1. Have thorough knowledge about structure and performance of a modern digital computer.
2. Analyze the different ways of communicating with I/O devices and standard I/O interfaces in a compute including using interrupt.
3. Analyze memory hierarchy including main memory, cache memory, virtual memory and secondary memory considering cost/performance. Different mapping functions of cache.
4. Implement arithmetic operations like multiplication, division and analyze the process of instruction execution of a complete instruction in the processing unit and its control.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Performance–Processor Clock, Basic Performance Equation, Clock Rate, Performance Measurement, Historical Perspective. **Machine Instructions and Programs:** Numbers, Arithmetic Operations and Characters, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing. Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks and Queues, Subroutines, Additional Instructions, Encoding of Machine Instructions.

Unit II (10 hours)

Input/Output Organization: Handling Multiple Devices, Controlling Device Requests, Exceptions, Direct Memory Access, Buses, Interrupts – Interrupt Hardware, Enabling and Disabling Interrupts, Handling Interface Circuits, Standard I/O Interfaces – PCI Bus and USB.

Unit III (10 hours)

Memory System: Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size and Cost, Cache Memories–Mapping Functions, Replacement Algorithms, Performance Considerations, Virtual Memories, Secondary Storage. **Arithmetic:** Addition and Subtraction of

Signed Numbers, Design of Fast Adders, Multiplication of Positive Numbers
Unit IV (10 hours) **Arithmetic Cont.**: Signed, Operand Multiplication, Fast Multiplication, Integer Division, Floating-point Numbers and Operations. **Basic Processing Unit:** Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hard-wired Control and Microprogrammed Control.
Reference Books: 1) Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”, Tata McGraw Hill, 5th Edition, 2002 2) David A. Patterson, John L. Hennessy, “Computer Organization and Design – The Hardware /Software Interface ARM Edition”, Elsevier, 4th Edition, 2009 3) William Stallings, “Computer Organization & Architecture”, PHI, 7th Edition, 2006

POs satisfied by the course:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and Simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Have thorough knowledge about structure and performance of a modern digital computer.	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO2. Analyze the different ways of communicating with I/O devices and standard I/O interfaces in a compute including using interrupt.	1	1	2	1	3	0	0	0	0	0	0	0	0	0	3
CO3. Analyze memory hierarchy including main memory, cache memory, virtual memory and secondary memory considering cost/performance. Different mapping functions of cache.	1	1	2	1	2	0	0	0	0	0	0	0	0	0	2
CO4. Implement arithmetic operations like multiplication, division and analyze the process of instruction execution of a complete instruction in the processing unit and its control.	1	1	3	1	3	0	0	0	0	0	0	0	0	0	3
Course Contribution to POs and PSOs	**1**	**1**	**2.25**	**1**	**2.5**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2.5**

Course Title: Electronic Instrumentation		**Course Code : UEC546E**
Credits: 3 (3-0-0)	**Teaching Hours: 42 Hrs**	**Contact hours : 3 Hrs/Week**
CIE marks: 50	**SEE marks: 50**	**Total marks: 100**
Department: Electronics and Communication Engineering **Designation: Elective**		

Course Objectives:

1. To understand about system errors, units, dimensions, standards and working principle of wheatstone, Kelvin bridge for measuring resistances.
2. To understand electronic instruments for measuring basic parameters and AC bridges for measuring inductances and capacitances.
3. To demonstrate the working principle of various oscilloscopes such as sampling oscilloscopes, digital storage oscilloscopes and their applications.
4. To provide the knowledge of some different signal generators and signal analysis.

Course outcomes:

A student who successfully completes this course should be able to

1. Comprehend the basic knowledge system errors, units, dimensions, standards and working principle of Wheatstone, kelvin bridges.
2. Use ofelectronic instruments for measuring basic parameters such as voltage, current, power, capacitance and inductance.
3. Use of some special oscilloscopes for different applications.
4. Analysis of different signal generators and signal analysis.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (11 hours)

Measurement and Errors: Definitions, accuracy and precision, significant figures, types of errors, statistical analysis, probability of errors, limiting errors, problems.
Units, dimensions and standards: Introduction, SI mechanical units, scientific notation and metric prefixes, SI electrical units, dimensions, standards, problems.
DC bridges: Introduction, Wheatstone bridge, Kelvin bridge.

Unit II (11 hours)

Electronic instruments for measuring basic parameters**:** Introduction, amplified DC meter, AC voltmeter using rectifiers, true RMS responding voltmeter, electronic multimeter, considerations in choosing an analog voltmeter, digital voltmeter, component measuring instruments, Q-meter, measurement of power at high frequencies, bolometer method of power measurement,
AC Bridges: Maxwells bridge, Hay bridge, Schering bridge, problems.

Unit III (10 hours)

Oscilloscopes: Introduction, cathode ray tube, deflection amplifiers, wave form display, oscilloscope time base, dual trace oscilloscope, measurement of voltage, frequency and phase, pulse measurement, X-Y and Z displays. Storage oscilloscope, sampling oscilloscope, digital storage oscilloscope, DSO applications, high frequency oscilloscope.

Unit IV (10 hours)
Signal generation and signal analysis: The sine wave generator, frequency synthesized generator, frequency divider, function generator, audio frequency signal generation. Wave analyzers, harmonic distortion analyzers, spectrum analyzers, applications of wave and spectrum analysers.
Reference Books: 1) David A. Bell, "Electronic Instrumentation and Measurements", PHI, Second Edition, 2010 2) Albert D. Helfrick and William D. Cooper, "Modern Electronic Instrumentation and Measurements Techniques", PHI, 2007 3) R. K. Rajput, "Electronic Measurements and Instrumentation", S. Chand, First Edition, 2008

POs satisfied by the course

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course

m. Analyse and design systems for electronics, Communication, and Signal Processing Applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Comprehend the basic knowledge system errors, units, dimensions, standards and working principle of Wheatstone, Kelvin bridges.	3	2	1	0	1	1	1	0	0	0	0	0	3	2	0
CO2: Use of electronic instruments for measuring basic parameters such as voltage, current, power, capacitance and inductance	3	2	1	0	0	1	2	0	0	0	0	0	3	0	0
CO3: Use of some special oscilloscopes for different applications.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4: Analysis of different signal generators and signal analysis.	3	1	1	1	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3.00**	**1.75**	**1.00**	**0.25**	**0.25**	**0.5**	**0.75**	0	0	0	0	0	**3.00**	**0.5**	0

Course Title: OOPs with C++			Course Code: UEC547E
Credits: 03	**L-T-P:3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:
It is to provide the knowledge of

1. Functions, class, objects
2. Operator Overloading, Strings
3. Inheritance, Virtual Functions
4. Templates and Exceptions

Course Outcomes:
A student who successfully completes this course should be able to

1. Use Functions, class, and objects
2. Use the concept of Operator Overloading, Strings
3. Write programmes with Inheritance and Virtual Functions
4. Use Templates and handle Exceptions

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Functions: Introduction, The main function, Function Prototyping, Call by Reference, Return by Reference, Inline Functions, Default Arguments, const Arguments, Recursion, Function Overloading, Friend and Virtual Functions.

Classes and Objects: Introduction, Specifying a Class, Defining Member Functions, A C++ program with Class, Making an outside Function Inline, Nesting of Member Functions, Private Member Functions, Arrays within a Class, Memory Allocation for Objects, Static Data Members, Static Member Functions, Array of Objects, Objects as Function Arguments, Friendly Functions, Returning Objects, const Member Functions, Pointers to Members, Local Classes.

Unit II (10 hours)

Constructors and Destuctors: Introduction, Constructors, Parameterized Constructors, Multiple Constructors in a class, Constructors with Default Arguments, Dynamic Initialization of Objects, Copy Constructor, Dynamic Constructors, const Objects, Destructors.

Operator Overloading and Type Conversions: Introduction, Defining Operator Overloading, Overloading Unary Operators, Overloading Binary Operators, Overloading Binary Operators Using Friends, Manipulation of Strings Using Operators, Rules for Overloading Operators, Operator Overloading Examples, Type Conversions.

Unit III (10 hours)

Inheritance: Extending Classes, Introduction, Defining Derived Classes, Single Inheritance, Making a Private Member Inheritable, Multilevel Inheritance, Multiple Inheritance, Hierarchical Inheritance, Hybrid Inheritance, Virtual Base Classes, Abstract Classes, Constructors in Derived Classes, Nesting of Classes.

Pointers, Virtual Functions and Polymorphism: Introduction, Pointers, Pointers to Objects, this Pointer, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions, Virtual Constructors and Destructors.

Unit IV (10 hours)

Templates: Introduction, Class Templates, Class Templates with Multiple Parameters, Function Templates, Function Templates with Multiple Parameters, Overloading of Template Functions, Member Function Templates.

Exceptions: Introduction, Basic of Exception Handling, Exception Handling Mechanism, Throwing Mechanism, Catching Mechanism, Rethrowing an Exception.

Textbooks:

1) Robert Lafore, "Object Oriented Programming in C++", SAMS, 4th Edition
2) E Balagurusamy, "Object Oriented Programming with C++", Mc. Graw Hill , 6th Edition

Reference Book:

1) Stanler B. Lippon, "C++ Primer", Pearson, 4th Edition

POs satisfied by the course:

a. **Engineering Knowledge:** Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

b. **Problem Analysis:** Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

c. **Design/ Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

e. **Modern Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

j. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clearinstructions.

l. **Life-long Learning:** Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSOs satisfied by the course:

m. The ability to understand, analyse and demonstrate the knowledge of human cognition, Class,Objects and Inheritence ,overloading functions ,operators, handling exceptions in terms of real world problems to meet the challenges of the future.

n. The ability to develop computational knowledge and project development skills using innovative tools of C++ and techniques to solve problems in the areas related to OOPs.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Use Functions, class , Objects	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO2. Use the concept of Operator Overloading, Strings	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO3. Write programs with inheritance and Virtual Functions	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO4. Use Templates and handle the exceptions	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
Course Contribution to POs	**3**	**3**	**3**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**0**

Course Title: Micro Electro Mechanical Systems		Course Code: UEC548E
Credits: 03 (3-0-0)	**Teaching Hours: 40 Hours**	**Contact hours: 3 Hrs/week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Course Objectives:

The course is intended to provide the knowledge about

1. Fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.
2. The design and working principle of various microsensing and actuating devices.
3. The modeling and simulation of various types of micro-systems.
4. Microfabrication and micromachining of micro devices, structures and systems.

Course Outcomes:

A student who successfully completes this course should be able to

1. Comprehend the fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.
2. Design and understand the working principle of various microsensing and actuating devices.
3. Mathematically model and simulate the various types of micro-systems
4. Comprehend the various steps involved in microfabrication and micromachining of micro devices, structures and systems.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hours)

Introduction to MEMS Technology: Basic definitions, history and evolution of MEMS. Feynman's vision, microelectronics and MEMS, microsensors, microactuators and microsystems, Types of MEMS, Applications of MEMS in various disciplines. Commercial MEMS products.

Multiphysics-Multiengineering aspects of MEMS: Introduction to design, modeling and simulation, optimization, fabrication, reliability and packaging of MEMS.

Scaling issues in microsystems, examples and numerical problems based on scaling laws.

Unit II (10 Hours)

Design and Working Principles of MEMS: Transduction principles in microdomain- Biomedical sensor & biosensor and DNA sensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces.Mechanical sensors and actuators – beams and cantilevers, accelerometers. Electrostatic sensors and actuators – parallel plate capacitors, comb drive sensor and actuator. Optical MEMS – DLP mirror; construction and working.

Unit III (10 Hours)

Modeling and Simulation of MEMS: Basic modeling elements in mechanical systems, electrical systems, microfluidic systems, thermal systems, magnetic domain and electrostatic systems. Measurement tools in microsystems: AFM, SEM and optical inferometry. Characterization methods. Simulation of MEMS: Need for simulation, FEM, MEMS design and realization tools – ANSYS/Multiphysics, CoventorWare, COMSOL. AFM as a measurement tool in microsystems.

Case Studies: Microcantilever based sensor, electrothermal actuator, electrostatic actuator.
Unit IV (10 Hours) Microfabrication/Micromachining: Overview of micro fabrication, silicon wafer extraction and cleaning, structural and sacrificial materials in microfabrication, lithography, deposition, doping, etching, Introduction to MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.
Reference Books: 1) G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan, K. N. Bhat, V. K. Atre, "Micro and smart systems", Wiley, India, 2010. 2) N. P. Mahalik, "M EMS", Tata McGraw-Hill, 2007. 3) Tai, Ran Hsu,"MEMS and microsystems: design and manufacture", TMH, 2002. 4) James J. Allen, "Micro Electro Mechanical System design", CRC Press, Taylor & Francis Group, 2005. 5) Chang Liu, "Foundations of MEMS", Pearson education international, 2007. 6) Stephen D. Senturia, "Microsystem design", Springer International edition, 2001.

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
(k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Fundamentals of MEMS and expose students to the basic scaling laws as applied to micro domain.	3	3	1	1	0	0	1	0	0	0	2	0	3	3	0
CO2: The design and working principle of various microsensing and actuating devices.	3	3	3	3	0	0	2	0	0	0	3	0	3	3	0
CO3: The modeling and simulation of various types of micro-systems.	3	2	2	2	3	0	0	0	0	0	3	0	3	3	1
CO4: Microfabrication and micromachining of micro devices, structures and systems.	3	2	2	3	0	0	0	0	0	0	3	0	3	3	0
Course Contribution to POs	**3**	**2.5**	**2**	**2.25**	**0.75**	**0**	**0.75**	**0**	**0**	**0**	**2.75**	**0**	**3**	**3**	**0.25**

<table>
<tr><td colspan="2">Course Title: Automotive Electronics</td><td>Course Code: UEC549E</td></tr>
<tr><td>Credits: 03</td><td>Teaching Hours: 40 Hours (10 hrs/unit)</td><td>Contact hours: 3 Hrs/week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department: Electronics and Communication Engg.
Designation: Core</td></tr>
<tr><td colspan="3">Course Objectives:
Students should be able to understand
1. Electronic engine control
2. Sensors, actuators and Vehicle motion controls.
3. Electronic Safety related Systems
4. Electronic Control System Diagnostics</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1. Explain the electronics systems used for control of automobiles
2. Select sensors, actuators and control systems used in automobiles
3. Diagnose the faults in the sub systems and systems used automobile
4. Explain the vehicle to vehicle communication and safety features of the vehicle.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below</td></tr>
<tr><td colspan="3">Unit I (10 Hours)
The basics of Electronic Engine Control: Motivation for Electronic Engine Control, Exhaust Emissions, Fuel Economy, Federal Government Test Procedures, Concept of an Electronic Engine Control System, Definition of Engine Performance Terms, Exhaust Catalytic Converters, Electronic Fuel Control System, Analysis of Intake Manifold Pressure, Idle Speed Control, Electronic Ignition.
Sensors and Actuators: Automotive Control System Applications of Sensors and Actuators, Throttle Angle Sensor, Temperature Sensors, Typical Coolant Sensor, Sensors for Feedback Control, Knock Sensors, Angular Rate Sensor, LIDAR.</td></tr>
<tr><td colspan="3">Unit II (10 hours)
Digital Video Camera, Flex-Fuel Sensor, Automotive Engine Control ActuatorsVariable Valve Timing, Electric Motor Actuators, Stepper Motors, Ignition System.
Digital Power train Control Systems: Introduction, Digital Engine Control, Digital Engine Control Features, Control Modes for Fuel Control, Discrete Time Idle Speed Control,EGR Control,Variable Valve Timing Control, Turbo charging, Direct Fuel Injection, Flex Fuel, Electronic Ignition Control.</td></tr>
<tr><td colspan="3">Unit III (10 hours)
Integrated Engine Control System, Summary of Control Modes.
Vehicle Motion Controls: Representative Cruise Control System, Cruise Control Electronics, Antilock Braking System, Electronic Suspension System, Electronic Suspension Control</td></tr>
</table>

System, Four-Wheel Steering Car.
Unit IV (10 hours) **Vehicle Communications:** IVN, CAN, Local Interconnect Network, FlexRay IVN, MOST IVN, Vehicle to Infrastructure Communication, Vehicle-to-Cellular Infrastructure, Quadrature Phase Shifter and Phase Modulation (QPSR), Short-Range Wireless Communications, Satellite Vehicle Communication, GPS Navigation, The GPS System Structure , Safety Aspects of Vehicle-to-Infrastructure Communication. **Electronic Safety-Related Systems:** Airbag Safety Device, Blind Spot Detection, Automatic Collision Avoidance System, Lane Departure Monitor, Tire Pressure Monitoring System, Enhanced Vehicle Stability.
Reference Books: 1) William B. Ribbens, "Understanding Automotive Electronics", 8^{th} Edition, Elsevier Publishing. 2) Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley & Sons Inc., 2007.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Explain the electronics systems used for control of automobiles	1	1	0	1	0	0	1	0	0	0	1	1	1	0	1
CO2. Select sensors, actuators and control systems used in automobiles	1	1	0	1	1	0	1	0	0	0	1	1	1	0	1
CO3. Explain the vehicle to vehicle communication and safety features of the vehicle.	1	1	0	0	1	0	0	0	0	0	1	1	1	0	1
CO4. Diagnose the faults in the sub systems and systems used automobile	1	1	0	0	1	0	1	0	0	0	1	1	1	0	1
Course Contribution to POs and PSOs	**1**	**1**	**0**	**0.5**	**0.75**	**0**	**0.75**	**0**	**0**	**0**	**1**	**1**	**1**	**0**	**1**

Course Title: Biomedical Signal Processing			**Course Code: UEC540E**
Credits: 03	**L-T-P:3-0-0**	**Contact Hours /Week : 3**	**Total Teaching Hours: 40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engg.
Designation: Elective

Course Objectives:

1) To provide the knowledge about biomedical signal sand processing of neurological signal.
2) To gain knowledge about different types of filters for removal of artifacts.
3) To study different averaging techniques and signal processing of EEG and ECG signals.
4) To learn adaptive filters and data compression techniques.

Course Outcomes:

A student who successfully completes this course should be able to

1) Analyze the nature of Biomedical signals and related concepts.
2) Apply filters to remove noise from biomedical signals.
3) Apply averaging technique on biomedical signals and extract the features of EEG and ECG signals. Also analyze event detection techniques for EEG and ECG signals.
4) Apply different filters for noise cancellation and signal compression techniques on biomedical signals.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hrs)

Introduction to Biomedical Signal: The nature of biomedical signals, objectives of biomedical signal analysis, difficulties encountered in biomedical signal analysis, Computer aided diagnosis.

Neurological Signal processing: Brain and its potentials, Electrophysiological origin of Brain waves, EEG signal and its characteristics, EEG analysis, Linear prediction theory, Autoregressive (AR) method, Recursive Estimation of AR parameters, Spectral error measure, Adaptive segmentation.

Unit II (10 Hrs)

Filtering for Removal of Artifacts: Random noise, structured noise and physiological interference, stationary versus non-stationary processes, typical case study, Time domain filters with application: Synchronized averaging, moving-average filters. Frequency domain filters with examples: removal of high frequency noise by Butterworth low pass filters, removal of low frequency noise by Butterworth high pass filter, removal of periodic artifacts by notch and comb filters. Optimal filtering: Weiner filter.

Unit III (10 Hrs)

Signal Averaging: Basics of signal averaging, Signal averaging as a digital filter, A typical averager, Software for signal averaging, Limitations of signal averaging.

Data Acquisition and classification of sleep stages, The Markov model and Markov chains,

Dynamics of Sleep-wake Transitions, Hypnogram Model Parameters. **Cardiological Signal Processing:** ECG Parameters and their estimation
Unit IV (10 Hrs) **Adaptive Interference/Noise Cancellation:** A review of wiener filtering problem, Principle of an adaptive filter, the steepest descent algorithm, Adoptive noise canceller, Cancellation of 60Hz Interference in ECG, Cancelling Donor heart Interference in Heart-transplant ECG, Cancellation of Electrocardiographic signals from the electrical activity of chest muscles, Cancelling of maternal ECG in Fetal ECG, Cancellation of higher frequency noise in electro-surgery. **ECG Data Reduction Techniques:** Direct data compression techniques, Direct ECG data compression techniques, Transformation compression techniques, Other data compression techniques, Data compression techniques comparison.
Textbooks: 1) Rangaraj M Rangayyan, "Biomedical signal analysis- A case- study approach", Wiley 2009. 2) D. C. Reddy, "Biomedical Signal Processing- Principles and Techniques", Tata McGraw-Hill, 2008. 3) Willis J. Tompkins, "Biomedical Digital Signal Processing", PHI, 2006. **Reference Book:** 1) Akay M, "Biomedical Signal Processing", Academic: Press 1994.

POs satisfied by the course

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Analyze the nature of Biomedical signals and related concepts.	3	3	3	3	3	3	2	1	1	1	1	2	3	0	0
CO2. Apply filters to remove noise from biomedical signals.	3	3	3	3	3	3	1	0	0	0	0	2	3	0	0
CO3. To study different averaging techniques and signal processing of EEG and ECG signals	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0
CO4. Apply different filters for noise cancellation and signal compression techniques on biomedical signals	3	3	3	3	3	3	0	0	0	0	0	2	3	0	0
Course Contribution to POs and PSOs	**3**	**3**	**3**	**3**	**3**	**3**	**0.75**	**0.25**	**0.25**	**0.25**	**0.25**	**2**	**3**	**0**	**0**

Course Title: Digital Signal Processing Laboratory		**Course Code: UEC531L**
Credits: 1.5		**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering
Designation : Laboratory Course

I. Course Objectives:
The objectives of this course are to

1. Learn the generation of different analog and digital signals.
2. Understand different operations on analog and digital signals.
3. Know the transformation of time domain signals into frequency domain.
4. Gain the knowledge of IIR and FIR filter design techniques.

II. Course Outcomes:
A student who successfully completes this course should be able to

1. Generate different analog and digital signals of given amplitude, frequency, phase and duration.
2. Implement different operations on digital and analog signals.
3. Convert given time domain signal into frequency domain and vice versa.
4. Design and implement IIR and FIR filters to meet the given specifications.
5. Implement simple DSP algorithms on DSP processor.

III. List of Experiments

1. Generation of different analog and digital signals (impulse, step, ramp, sine, cosine, square, rectangular and triangular) with given amplitude, frequency, phase and duration.
2. Verification of sampling theorem.
3. Implementation of amplitude scaling, time scaling, time reversal and time shift operations on given signal.
4. Response of continuous time and discrete time LTI systems to a given input.
5. Fourier series of given continuous time and discrete time periodic signal.
6. Fourier transform of given continuous time and discrete time aperiodic signal
7. N point DFT of a given sequence of length L when (a) $N < L$ (b) $N = L$ and (C) $N > L$ and their corresponding IDFT.
8. Verification of conjugate symmetry property of DFT
9. Implementation of linear convolution using DFT and IDFT.
10. Design and implementation of IIR filter to meet given specifications.
11. Design and implementation of FIR filter using different windows to meet given specifications.
12. Implementation of linear and circular convolution of given two sequences using DSP processor.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m). Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Generate different analog and digital signals of given amplitude, frequency, phase and duration.	3	2	1	0	1	0	0	0	0	0	0	1	3	0	0
CO2. Implement different operations on digital and analog signals.	3	2	2	0	1	0	0	0	0	0	0	1	3	0	0
CO3. Convert given time domain signal into frequency domain and vice versa.	3	2	1	0	1	0	0	0	0	0	0	1	3	0	0
CO4. Design and implement IIR and FIR filters to meet the given specifications.	3	2	3	0	1		0	0	0	0	0	1	3	0	0
CO5. Implement simple DSP algorithms on DSP processor.	3	2	3	0	1	0	0	0	0	0	0	1	3	0	0
Course Contribution to POs and PSOs	**3**	**2**	**2**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**0**

Course Title: Verilog Lab		Course Code: UEC532L
Credits: 1.5	**Lab Hours: 42 Hrs**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engg.		

Course Objectives:

1. To simulate and synthesize combinational and sequential circuits by writing Verilog code using Altera Quartrus II Software.
2. To program industry standard FPGAkits.
3. To write Verilog code for interfacing different hardware modules.

Course Outcomes:

A student who successfully completes this course should be able to

1. Write Verilog code for combinational circuits, sequential circuits and implement it on FPGAKits.
2. Write test benches using Verilog code to automate simulation and verification of designs.
3. Write Verilog code for interfacing modules like IR remote/LCD/seven segment displays/USB/RS 232/Memory card.

Sl. No.	LIST OF XPERIMENTS
1	Write Verilog code using a) concurrent signal assignment statement and b) operators for the following and test it on FPGA kit. • Fulladder • 3:8 decoder with active lowoutput • 4:1 MUX • For given Booleanexpressions o F1(abc) = $\Sigma(0,1,3,4,5)$; F2(abc) = $\pi(1,2,3,5,7)$
2	Write Verilog code using (a) conditional signal assignment statement and (b) sequential statements and test it on FPGA kit. • Fullsubtractor • 3:8 decoder with active lowoutput • 4:1 MUX • For given Booleanexpressions o F1(abc) = $\Sigma(0,1,3,4,5)$; F2(abc) = $\pi(1,2,3,5,7)$
3	Write Verilog code and test it on FPGA kit • for 8-bit signed and unsignedadder • 1-bit magnitudecomparator • 8-bit magnitudecomparator • T flipflop • D flipflop

4	Write Verilog program for the following using component statements and test it on FPGA kit. • Parallel adder using full adder as component. • 4-bit asynchronous up counter using T flip flop as component • 3-bit Johnson counter using D flip flop as component
5	Write Verilog code for the following and test it on FPGA kit. • BCD to seven segment display decoder • To display message on LCD display, Line 1 : BEC Line 2 : ECE • To run message from left to right on LCD display, Line 1 : BEC Line 2 :ECE • To run message from right to left on LCD display, Line 1 : BEC Line 2 :ECE • To display and blink message every one second on LCD display, Line 1 : BEC Line 2 : ECE
6	Write Verilog code for the following and test it on FPGA kit • 4-bit up counter and display result on LEDS • BCD up counter and display the result on seven segment displays • 00 to 99 up counter and display result on LCD • 6-bit SISO shift register display result on LEDs
7	Draw the state diagram and write Verilog code for Sequence Detector to detect the sequence 1010. Consider the overlapping of the sequence. System takes one bit as input and produces one bit output.
8	Write Verilog test bench to automatesimulation and verification for follow programs/design using • Full adder • 3:8 decoder with active lowoutput • 4:1 MUX • for 4-bit upcounter
9	Write Verilog code to interface IR remote.
10	Write Verilog code for interfacing either mouse or USB.
11	Write a Verilog program to write and read data from memory card.
12	Write Verilog code to interface RS232.

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Write Verilog code for combinational circuits, sequential circuits and implement it on FPGA Kits.	1	0	2	1	3	0	0	0	0	0	0	0	0	3	0
CO2: Write test benches using Verilog code to automate simulation and verification of designs.	1	0	1	1	3	0	0	0	0	0	0	0	0	3	0
CO3: Write Verilog code for interfacing modules like IR remote/LCD/seven segment displays/USB/RS 232/Memory card.	1	0	2	1	3	0	0	0	0	0	0	0	0	3	0
Course Contribution to POs	**3.00**	**0**	**1.66**	**0.75**	**3.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**

VI Semester

<table>
<tr><td colspan="2">Course Title: Field Theory</td><td>Course Code: UEC641C</td></tr>
<tr><td>Credits: 3
L-T-P: 2-2-0</td><td>Teaching Hours: 40 Hrs
(10 Hrs/Unit)</td><td>Contact Hours: 3 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department: Electronics and Communication Engg.
Designation: Core
Prerequisites: Engineering Mathematics</td></tr>
<tr><td colspan="3">Course Objectives:
The objective of the course is to introduce students,
1. To study concepts on scalars and vector, coulombs law, Electric filed intensity, Gauss law and its applications, divergence
2. To gain knowledge on potential due to charges, potential gradient, continuity equation, boundary conditions and capacitance
3. To study poison’s, Laplaces equation and its application, Uniqueness theorem and concepts about magnetic fields like biot-savart’s law, ampere’s law, stokes theorem, curl
4. To study about time varying fields, Maxwell’s equation for electromagnetic wave, retarded potential, wave propagation in free space, Poynting’s theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR).</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1. Understand the concept of scalar, vectors, Coulombs law, Electric filed intensity, Gauss law and its applications, divergence and analyze the problems based on the mentioned laws
2. Understand potential due to charges, potential gradient, continuity equation, boundary conditions and capacitance and Analyze the problems based on the mentioned laws
3. Understand Poisson’s, Laplaces equation and its application, Uniqueness theorem, Biot-savart’s law, ampere’s law, stokes theorem and Curl with respect to magnetic fields and analyze the problems related to the mentioned laws
4. Understand about time varying fields, Maxwell’s equation, retarded potential, wave propagation in free space, Poynting’s theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR) and analyze the problems based on the mentioned laws.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below</td></tr>
<tr><td colspan="3">Unit I (10 hours)
Coulomb’s Law and electric field intensity: Introduction to coulomb’s law, field intensity, field due to continuous volume charge distribution, Field of a line charge & field of sheet charge, Electric flux density Gauss law and divergence: Electric flux density, Gauss law, Application of Gauss law for symmetrical charge distribution (point charge, Coaxial cable) and differential volume element, Divergence, Maxwell’s first equation, vector operator dell and divergence theorem.</td></tr>
<tr><td colspan="3"></td></tr>
</table>

Unit II (10 hours)
Energy and potential: Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential, the potential field of a point charge, potential field of system of charges, potential gradient, Energy density in an Electrostatics filed. Conductors, dielectrics and capacitance: Current and current density, continuity of current, conductor properties and boundary conditions, boundary conditions for perfect dielectrics, capacitance and examples(Parallel plate capacitor, Dielectric boundary normal to plates).
Unit III (10 hours)
Poisson's and Laplace's equations: Poisson's and Laplace's equations. Uniqueness theorem, examples of the solution of Lapalce and poisson's equations. The steady magnetic field: Biot-savart's law, Ampere's circuital law, curl, stokes theorem, magnetic flux density, scalar and vector magnetic potentials.
Unit IV (10 hours)
Time varying fields and Maxwell's equations: Faraday's law, Displacement current, Maxwell's equation in point and integral form, retarded potentials. Uniform plane wave: Wave propagation in free space and dielectrics, Poynting's theorem and wave power, Plane wave in boundaries and in dispersive media: Reflection of uniform plane waves at normal incidence, SWR.
Reference Books: **1)** William H HaytJr, John A Buck, "Engineering Electronics", Tata McGraw-Hill, 7th edition, 2006 **2)** John Krauss and Daniel A Fleisch, "Electromangetics with application", McGraw-Hill, 5th edition, 1999 **3)** David K Cheng, "Filed and wave Electromangetics" Pearson education Asia, 2nd edition,-1989, Indian Reprint-2001.

POs satisfied by the course:

a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Understand the concept of scalar, vectors, Coulombs law, Electric filed intensity, Gauss law and its applications, divergence and analyze the problems based on the mentioned laws	3	3	3	2	2	2	2	1	0	0	0	0	3	0	0
CO2. Understand potential due to charges, potential gradient, continuity equation, boundary conditions and capacitance and Analyze the problems based on the mentioned laws	3	2	3	2	1	2	2	1	0	0	0	0	3	0	0
CO3. Understand Poisson's, Laplaces equation and its application, Uniqueness theorem, Biot-savart's law, ampere's law, stokes theorem and Curl with respect to magnetic fields and analyze the problems related to the mentioned laws	3	2	3	2	2	2	2	1	0	0	0	0	3	0	0
CO4. Understand about time varying fields, Maxwell's equation, retarded potential, wave propagation in free space, Poynting's theorem, uniform plane waves, Polarization of plane waves, Standing Wave Ratio (SWR) and analyze the problems based on the mentioned laws.	3	3	3	3	3	3	3	1	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	**3**	**2.5**	**3**	**2.25**	**2**	**2.25**	**2.25**	**1**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Computer Networks		Course Code: UEC642C
Credits: 3 (3-0-0)	Teaching Hours: 40Hrs	Contact Hours: 3Hrs/Week
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Course Objectives

1) Build an understanding of the fundamental concepts of computer networking
2) Familiarize the student with the basic taxonomy and terminology of the computer networking
3) Analyze Data link, Network, Transport and Application layer protocols of the Internet
4) Analyze connection-oriented and connectionless transport protocols.

Course Outcomes

A student who successfully completes this course should be able to

1) Master the terminology and concepts of the OSI reference model and the TCP/IP reference model
2) Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks
3) Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.
4) Become familiar with widely- used Internet protocols such as TCP/IP, UDP, etc.

The topics that enable to meet the above objectives and Course Outcomes are given below

Unit I

Layered tasks, OSI Model, Layers in OSI model, TCP/IP Suite, Addressing, Data Link Control: Framing, Flow and error control, Protocols, Noiseless channels and noisy channels, HDLC, PPP.

Unit II

Multiple Accesses: Random access, Controlled access, Channelization, Wired LAN, Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Connecting LANs, Backbone and Virtual LANs

Unit III

Network Layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 Transition from Ipv4 to Ipv6, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing protocols.

Unit IV

Transport layer Process to process Delivery, UDP, TCP, Application Layer: Domain name system, Name Space, Domain Name Space, Distribution of Name Space, DNS in the Internet, Resolution, DNS messages, Types of Records, Registrars, Dynamic Domain Name System, Encapsulation.

Text Book:

1) Data Communication and Networking, "Behrouz A. Forouzan", 4thEdition, TMH, India, 2006.

Reference Books:

1) Andrew S. Tanenbaum, "Computer networks", Prentice-Hall, 2010.
2) William Stallings, "Data and Computer Communications", Prentice-Hall, 2007.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Master the terminology and concepts of the OSI reference model and the TCP/IP reference model	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2: Master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3: Identify, compare and contrast different techniques and design issues of core functions such as addressing, routing, internetworking, switching, multiplexing, error and flow control, medium access and coding.	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4: Become familiar with widely- used Internet protocols such as TCP/IP, UDP, etc.	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3
Course Contribution to POs	**3**	**2.5**	**2.75**	**2**	**1**	**1**	**1.25**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**1**	**0**	**3**

<table>
<tr><td colspan="2">Course Title: CMOS Digital VLSI Design</td><td>Course Code: UEC643C</td></tr>
<tr><td>Credits: 3 (3-0-0)</td><td>Teaching Hours: 40 Hrs</td><td>Contact Hours: 3 Hrs/Week</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department: Electronics and Communication Engineering
Designation: Core</td></tr>
<tr><td colspan="3">Course Objectives:
1. To understand the basics of MOSFETs and VLSI Design.
2. To understand VLSI fabrication process.
3. To design CMOS / TG based standard digital cells.
4. To draw RC equivalent circuit of CMOS circuits and estimate delay and power.
5. To draw the layout / stick diagram of CMOS standard cells.</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1. Appreciate the importance and scope of VLSI, Fabrication & MOSFET transistors.
2. To draw RC equivalent circuit of CMOS circuits and estimate delay and power.
3. To model & design of interconnects in chips, design of combinational circuits.
4. To Design basic buildings of sequential and memory blocks using MOSFET transistors.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below:</td></tr>
<tr><td colspan="3"> Unit I (10 hours) Introduction: A Brief History, Preview, MOS Transistors, CMOS Logic, CMOS Fabrication and Layout, Design Partitioning. MOS Transistor Theory: Introduction, Long-Channel I-V Characteristics, C-V Characteristics (simple MOS capacitance models), Non ideal I-V Effects, DC Transfer Characteristics. CMOS Processing Technology: Introduction, CMOS Technologies.</td></tr>
<tr><td colspan="3"> Unit II (10 hours) Delay: Introduction, Transient Response, RC Delay Model, Linear Delay Model (Logical effort, parasitic delay, delay in logic gate, drive), Logical Effort of Paths, Power: Introduction, Dynamic Power, Static Power.</td></tr>
<tr><td colspan="3"> Unit III (10 hours) Interconnect: Introduction (wire Geometry), Interconnect Modeling, Interconnect Impact (Delay, Energy, Cross talk). Combinational Circuit Design: Introduction, Circuit families, Silicon-On-Insulator Circuit Design.</td></tr>
<tr><td colspan="3"> Unit IV (10 hours) Sequential Circuit Design: Introduction, Circuit Design of Latches and Flip Flops (conventional CMOS latches, conventional CMOS flip flops, pulsed latches, resettable latches</td></tr>
</table>

and flip flops, enabled latches and flip flops, incorporating logic into latches, dual edge triggered flip flops. **Array Subsystems:** Introduction, SRAM (SRAM cells, ROW circuitry, column circuitry), Read-Only Memory, Serial Access Memories, Content Addressable Memory, Programmable Logic Arrays.
Text Book: 1) Neil H. E. Weste, David Harris "CMOS VLSI Design A Circuits and Systems Perspective" Pearson Education Publisher, Fourth Edition, 2015. **Reference Books**: 1) Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic "Digital Integrated Circuits A Design Perspective" Pearson Education Publisher, Second Edition. 2010. 2) John P Uyemura "Introduction to VLSI Circuits and Systems" Wiley Publication 2002. 3) R. Jcob Baker, Harry W. Li and David E Boyce "CMOS Circuit Design, Layout, and Simulation" PHI, 1998.

POs satisfied by the course

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
f. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course
m. Analyse and design systems for electronics, Communication, and Signal Processing Applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Appreciate the importance and scope of VLSI, Fabrication & MOSFET transistors.	3	3	3	0	0	0	0	0	0	0	0	0	3	1	0
CO2: To draw RC equivalent circuit of CMOS circuits and estimate delay and power.	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO3: To model & design of interconnects in chips, design of combinational circuits.	3	3	3	0	0	0	0	0	0	0	0	0	3	2	0
CO4: To Design basic buildings of sequential and memory blocks using MOSFET transistors.	3	3	3	0	0	1	2	0	0	0	0	0	3	2	0
Course Contribution to POs	**3**	**3**	**3**	**0**	**0**	**0.25**	**0.5**	**0**	**0**	**0**	**0**	**0**	**3**	**1.75**	**0**

Course Title: Embedded Systems			Course Code: UEC644E
Credits: 03	**L-T-P: 3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engineering. **Designation: Elective**			

Course Objectives:

1) To provide knowledge of embedded systems, applications, purpose and study the characteristics and quality attributes of embedded systems.
2) To provide background knowledge of ARM-32 bit Microcontroller, its architecture and other internal details.
3) To study hardware software co-design, firmware design and programming in embedded 'C'.
4) To impart knowledge of Real Time Operating System (RTOS) based embedded system design.

Course Outcomes:

A student who successfully completes this course should be able to

1) Gain comprehensive knowledge about embedded systems, major application area of embedded systems and system components like memory, sensors and actuators.
2) Gain comprehensive knowledge about ARM-32 bit Microcontroller, architecture and other internal details.
3) Develop embedded applications on IDE environment and programming in embedded 'C'.
4) Explore one open source RTOS and demonstrate the basic concepts of RTOS.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Introduction to embedded systems, embedded system vs. general computing system, classifications, purpose of embedded system, major application areas including some novel applications. The typical embedded system: Core of embedded system, memory, sensors and actuators, communication interface, Characteristics and quality attributes of embedded systems.

Unit II (10 hrs)

ARM-32 bit Microcontroller: Thumb-2 technology and applications of ARM, architecture of ARM Cortex M3, various units in the architecture, debugging support, general purpose registers, special registers, exceptions, interrupts, stack operation, reset sequence.

Unit III (10 hrs)
Hardware software co-design and program modeling: fundamental issues in hardware software co-design, computational models in embedded system, hardware software trade-offs. Embedded firmware design and development: design approaches, Mixing assembly and high level language, Programming in embedded C.
Unit IV (10 hrs)
Real-time operating system based embedded system: operating system basics, need for RTOS, types of operating system, tasks, process and threads, multiprocessing and multitasking, task scheduling, threads, processes and scheduling : putting altogether, task communication, task synchronization, device drivers.
Textbook: **1.** Joseph Yiu, "The definitive guide to the ARM CORTEX-M3", Newnes, Second edition. **2.** Shibu K V, "Introduction to embedded systems", Tata McGraw Hill private limited, 2010. **Reference Book:** **1.** Rajkamal, "Embedded systems: architecture, programming and design", Tata McGraw Hill private limited, second edition. 2. Frank Vahid, Tony Givargis, "Embedded system design: A unified hardware/software introduction", John Wiley and Sons, 2001.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PSOs satisfied by the course:

n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Gain comprehensive knowledge about embedded systems, major application area of embedded systems and system components like memory, sensors and actuators.	3	1	1	0	1	1	0	0	0	0	0	0	0	3	0
CO2. Gain comprehensive knowledge about ARM-32 bit Microcontroller, architecture and other internal details.	3	2	2	0	1	1	0	0	0	0	0	0	0	3	0
CO3. Develop embedded applications on IDE environment and programming in embedded 'C'.	3	3	3	0	3	3	0	0	0	0	0	0	0	3	0
CO4. Explore one open source RTOS and demonstrate the basic concepts of RTOS.	3	3	3	0	3	2	0	0	0	0	0	0	0	3	0
Course Contribution to POs and PSOs	**3**	**2.25**	**2.25**	**0**	**2**	**1.75**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**

Course Title: Operating Systems		**Course Code: UEC645E**
Credits: 3 (3-0-0)	**Teaching Hours: 40 Hrs**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1. To present operating system fundamentals, structure, services, design, various features of process and notion of thread.
2. To discuss various CPU scheduling algorithms, software and hardware solutions of the critical section problem and methods to prevent deadlocks.
3. To know various ways to manage memory and file system.
4. To study file system implementation, mass storage structure, protection.

Course Outcomes:

A student who successfully completes this course should be able to

1. Describe the operating system structure, operations, services, design, thread and various features of process including scheduling, creation, termination, communication and explore inter process communication .
2. Discuss various CPU scheduling algorithms , several tools used to solve process synchronisation problems and also number of different methods for preventing or avoiding deadlocks.
3. Explore various memory management techniques and aspects related to file system.
4. Describe file system implementation, mass storage structure and protection.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Introduction: What Operating System Do, User View, System View, Operating-System Structure, Operating-System Operations, Process Management, Memory Management, Storage Management, Protection and Security.
System Structures: Operating-System Services, User and Operating-System Interface, System Calls, Types of System Calls, System Programs, Operating-System Design and Implementation, Operating-System Structure.
Process Management: Process Concept, Process Scheduling, Operations on Processes, Inter-process Communication.
Multithreaded Programming: Overview, Multicore Programming, Multithreading Models.

Unit II (10 hrs)

Process Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Thread Scheduling.
Process Synchronization: Background, The Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Mutex Locks, Semaphores, Classic Problems of Synchronization, Monitors.
Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock.

Unit III (10 hrs)

Memory-Management Strategies: Background, Swapping, Contiguous Memory Allocation, Segmentation, Paging, Structure of the Page Table.
Virtual-Memory Management: Background, Demand Paging, Page Replacement, Allocation of Frames.
File system: File Concept, Access Methods, Directory and Disk Structure, File System Mounting, File Sharing.

Unit IV (10 hrs)

Implementing File-Systems: File-System Structure, File-System Implementation, Directory Implementation, Allocation Methods, Free-Space Management.
Mass-Storage Structure: Overview of Mass-Storage Structure. Disk Structure, Disk Attachment, Disk Scheduling, Disk Management, Swap-Space Management.
System Protection and Security: Goals of Protection, Principles of Protection, Domain of Protection, Access Matrix, The Security Problem, Program Threats.

Textbook:

1. Abraham Silberschatz , Peter B. Galvin, Greg Gagne," **Operating System Concepts**", 9 th edition, Wiley India, 2016 .

Reference Books:

1. Dhananjay M. Dhamdhere," **Operating Systems-A Concept Based Approach**", 3rd edition, Tata McGraw-Hill, 2012.
2. P.C.P.Bhatt," **Operating Systems**",2nd edition, PHI,2007.
3. William Stallings," **Operating Systems: Internals and Design Principles**",6th edition, Pearson, 2009.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Describe the operating system structure, operations, services, design, thread and various features of process including scheduling, creation, termination, communication and explore inter process communication .	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2: Discuss various CPU scheduling algorithms, several tools used to solve process synchronisation problems and also number of different methods for preventing or avoiding deadlocks.	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3: Explore various memory management techniques and aspects related to file system.	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4: Describe file system implementation, mass storage structure and protection.	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3
Course Contribution to POs	**3**	**2.5**	**2.75**	**2**	**1**	**1**	**1.25**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**1**	**0**	**3**

Course Title: Digital Verification		Course Code: UEC646E
Credits: 3	**Teaching Hours:40 Hrs (10 Hrs/Unit)**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engg.

Course Objectives:

1. To introduce concepts and fundamentals of digital verification.
2. To learn verification features of the SystemVerilog language.
3. To learn and write testbenches using SystemVerilog language.
4. To automate verification using SystemVerilog and UVM.

Course Outcomes:

A student who successfully completes this course should be able to

1. Appreciate the importance and scope of digital verification and UVM.
2. Write testbench using SystemVerilog and OOPs concept.
3. Write testbench using on SystemVerilog and UVM.
4. Write automated testbench using SystemVerilogand UVM.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Verification Guidelines: The Verification Process, The Verification Methodology Manual, Basic Testbench Functionality, Directed Testing, Methodology Basics, Constrained-Random Stimulus, What Should You Randomize, Functional Coverage, Testbench Components, Layered Testbench, Building a Layered Testbench, Simulation Environment Phases, Maximum Code Reuse, Testbench Performance.

Procedural Statements and Routines: Procedural Statements, Tasks, Functions, and Void Functions, Task and Function Overview, Routine Arguments, Returning from a Routine, Local Data Storage, Time Values.

Connecting the Testbench and design: Separating the Testbench and Design, The Interface Construct, Stimulus Timing, Interface Driving and Sampling, Program Block Considerations, Connecting It All Together, Top-Level Scope, Program–Module Interactions, SystemVerilog Assertions, The Ref Port Direction.

Unit II (10 hours)

Basic OOP: Introduction, Think of Nouns, not Verbs, Your First Class, Where to Define a Class, OOP Terminology, Creating New Objects, Object Deallocation, Using Objects, Class Methods, Defining Methods Outside of the Class, Static Variables vs. Global Variables, Scoping Rules, Using One Class Inside Another, Understanding Dynamic Objects, Copying Objects, Public vs. Local, Straying Off Course
Building a Testbench.

Randomization: Introduction, What to Randomize, Randomization in SystemVerilog, Constraint Details, Solution Probabilities, Controlling Multiple Constraint Blocks, Valid Constraints, In-Line Constraints, The pre_randomize and post_randomize Functions, Random Number Functions, Constraints Tips and Techniques, Common Randomization Problems, Iterative and Array Constraints, Atomic Stimulus Generation vs. Scenario Generation, Random Control, Random Number Generators, Random Device Configuration.

Threads and Interprocess communication: Working with Threads, Disabling Threads, Interprocess Communication, Events, Semaphores, Mailboxes, Building a Testbench with Threads and IPC, Basic Transactor, environment class.

Unit III (10 hours)

UVM Introduction: A Conventional Testbench for the TinyALU, SystemVerilog Interfaces and Bus

Functional Models, Static Methods and Variables, Parameterized Class Definitions,The Factory Pattern,An Object-Oriented Testbench, UVM Tests, UVM Components,UVM Environments, A New Paradigm, Talking to Multiple Objects,

Unit IV (10 hours)

UVM Contd..: Using Analysis Ports in a Testbench, Interthread Communication, Put and Get Ports in Action, UVM Reporting, Class Hierarchies and Deep Operations, UVM Transactions, UVM Agents,UVM Sequences, onward with the UVM.

Reference Books:

1) Chris Spear and Greg Tumbush "SystemVerilog for Verification: A Guide to Learning the Testbench Language Features" Third Edition, Springer, 2012
2) Ray Salemi "The UVM Primer: A Step-by-Step Introduction to the Universal Verification Methodology"Boston Light Press; First Edition, 2013
3) Donald Thomas "Logic Design and Verification Using Systemverilog" Createspace Independent Pub, 2016
4) Mark A. Azadpour "SystemVerilog for Design and Verification using UVM" 2015
5) Ashok B. Mehta "ASIC/SoC Functional Design Verification: A Comprehensive Guide to Technologies and Methodologies" Springer, 2017

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1:Appreciate the importance and scope of digital verification and UVM.	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO2: Write testbench using SystemVerilog and OOPs concept.	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO3: Write testbench using on SystemVerilog and UVM.	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO4: Write automated testbench using SystemVerilog and UVM.	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
Course Contribution to POs	**1.00**	**0**	**1.00**	**2.00**	**3.00**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**

Course Title: Mobile Communications			Course Code: UEC647E
Credits: 03	L-T-P:3-0-0	Contact Hours / Week:03	Total Teaching Hours:40
CIE Marks: 50		SEE Marks: 50	Total Marks: 100

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:

1. To give the knowledge of wireless and mobile communications in different generations and different channel accessing techniques.
2. To study different telecommunication systems and overview of satellite and broadcast system support in mobile communications.
3. To study the different network architectures and layers for mobile system.
4. To study the concept of mobile network layer, transport layer, and mobility support system

Course Outcomes:

A student who successfully completes this course should be able to :

1. Explain and compare different generations of mobile communications and different channel accessing techniques.
2. Examine different telecommunication systems and explain interface between satellite communications, digital broadcast systems
3. Interpret different network architectures and layers for mobile system
4. Analyze network layer protocol; transport layer protocol and mobility support system

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Introduction to: Evolution and Deployment of Cellular Telephone Systems, Different generations of wireless cellular networks,1G,2G,2.5G,3G,4G cellular systems and beyond, wireless standard organizations. Wireless transmission: Frequencies for radio communication, signals, antennas, signal propagation. Medium access control: Motivation for specialized MAC, SDMA, FDMA, TDMA, CDMA.

Unit II (10 hours)

Telecommunication systems: GSM, UMTS and IMT2000, 4G LTE networks, 5G networks overview. Satellite systems: History, applications, basics, routing, localization and handover. Broadcast system: Overview, cyclical repetition of data, digital audio broadcasting, and digital video broadcasting.

Unit III (10 hours)

Wireless LAN: IEEE 802.11- system architecture, protocol architecture, physical layer, medium access control layer, MAC management, 802.11b, and 802.11a, HIPERLAN, Bluetooth: user scenarios, architecture, radio layer. Mobile network layer: Mobile IP.

Unit IV (10 hours)

Dynamic host configuration protocol, mobile Ad hoc network. Mobile transport layer: Traditional TCP, classical TCP improvement, TCP over 2.5/3G wireless network, performance enhancing proxies. Support for mobility: world wide web, wireless application protocol.

Textbooks:

1) Jochen Schiller, “Mobile Communications”, second edition Pearson Education, 2003.
2) Gary J Mullett, ”Introduction to wireless telecommunication systems and networks”, Cengage learning,2006.

Reference Books:

1) Dr. Sunilkumar S Manvi and Dr. Mahabaleshwar S Kakkasageri, ”Wireless and Mobile Networks,” second edition,Wiley,2016
2) William Stallings, “Wireless Communication and Networks”, Pearson Education, 2002.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Explain and compare different generations of mobile communications and different channel accessing techniques.	1	0	0	0	3	0	0	0	1	3	0	2	1	0	3
CO2. Examine different telecommunication systems and explain interface between satellite communications, digital broadcast systems	1	0	0	0	3	0	0	0	1	3	0	2	1	0	3
CO3. Interpret different network architectures and layers for mobile system	1	0	0	0	3	0	0	0	1	3	0	2	1	0	3
CO4. Analyze network layer protocol; transport layer protocol and mobility support system	1	0	0	0	3	0	0	0	1	3	0	2	1	0	3
Course Contribution to POs and PSOs	**1**	**0**	**0**	**0**	**3**	**0**	**0**	**0**	**1**	**3**	**0**	**2**	**1**	**0**	**3**

Course Title: Advanced C Programming Lab			Course Code: UCS659L
Credits: 03	**L-T-P: 0-2-2**	**Contact Hours / Week:02**	**Total Teaching Hours:24**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Computer Science and Engineering.
Designation: Laboratory

Course Objectives:

1) Imbibe thorough knowledge in advanced C programming concepts.
2) Have proficiency in applying advanced C programming concepts to solve any real world problem.

Course Outcomes:

A student who successfully completes this course should be able to

1) Define advanced C programming concepts like pointers, data structures.
2) Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
3) Analyze different data structures and use suitable data structure to implement requirement specification.
4) Implement, interpret, debug and test any given advanced C program.
5) Develop software product using advanced C programming concepts to solve real world problem.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (6 hrs)

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers.

Unit II (6 hrs)

Pointer Applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples. Data Structures, Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks.

Unit III (6 hrs)

Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

Unit IV (6 hrs)

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists. Implementation of stack and queue using linked list.

Textbooks:

1. Gilberg&Forouzan, "Data Structures: A Pseudo-code approach with C", Cengage Learning, 2nd Edition, 2014.
2. Yashwant Kanetkar, "Data Structures through C", BPB Publications, 2017.

Reference Books:

1. Gilberg & Forouzan, “Data Structures: A Pseudo-code approach with C”, Cengage Learning, 2^{nd}Edition, 2014.
2. ReemaThareja, “Data Structures using C”, Oxford press, 3^{rd}Edition 2012.
3. Jean-Paul Tremblay & Paul G, ”An Introduction to Data Structures with Applications”, McGraw-Hill, 2^{nd}Edition, 2013.

	Part - A
1	Write C program to accept and display 1D array Also write functions. • to insert an element based at the specified position • to delete element based on the position • to delete based on the value function should take care of invalid data and accordingly display appropriate error messages.
2	Write C program to accept and display 2d array of user specified size.Also write functions to perform the following on the 2d array • Function row_sum that takes row number as parameter and returns the sum of the row • Function col_sum that takes column number as parameter and returns the sum of the column • Function secondary _diagonal_sum that returns the sum of secondary diagonal elements if possible else should return -1 • Function primary_diagonal_sum that returns the sum of primary diagonal elements if possible else should return -1
3.	Write C program to swap two integers using function.
4.	Write C program to accept and display 1d array.Use external pointer to process the array.Use separate functions to • Accept the array elements • Display the array elements in forward direction • Display the array elements in reverse diretion • To compute the average of the elements in the array
5.	Write C program to store information(name,employee_id,designation,date of birth,stay details) about set of employees in a company. Here designation is string that can take one of these values {md, manager,clerk,peon} date_ of_ birth is a structure for holding birth date with fields day,month, yearstay_detail is a structure that contains street number and sector number and house number details. Write separate functions to accept & display the employees
	Part - B
6.	Write C program to implement stack of integers using array.
7.	Write C program to implement linear queue of integers using array
8.	Write C program to create & display singly linked list of integers
9.	Write C program to implement stack using linked list
10.	Write C program to implement queue using linked list

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PSOs satisfied by the course:

o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Define advanced C programming concepts like pointers, data structures.	3	2	1	1	0	1	0	0	0	0	0	0	0	0	3
CO2. Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.	3	3	3	3	0	2	0	0	0	0	0	0	0	0	3
CO3. Analyze different data structures and use suitable data structure to implement requirement specification.	3	3	3	3	0	2	0	0	0	0	0	0	0	0	3
CO4. Implement, interpret, debug and test any given advanced C program.	3	3	3	3	0	3	0	0	0	0	0	0	0	0	3
CO5. Develop software product using advanced C programming concepts to solve real world problem.	3	3	3	3	0	3	0	0	0	0	0	0	0	0	3
Course Contribution to POs and PSOs	**3**	**2.8**	**2.6**	**2.6**	**0**	**2.2**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**

Course Title: Computer Networks Lab		**Course Code: UEC631L**
Credits: 01	**Total Lab Hours: 25 Hrs**	**Contact Hours: 2 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Department : Electronics and Communication Engg. **Designation : Laboratory** **Prerequisites : ---**		
Course Objectives: 1. To explore the packet tracer in real time mode 2. To explore the logical work space 3. To know the devices operation and configuration		
Course Outcomes: A student who successfully completes this course should be able 1. To apply the concepts of Data Communication and Networking 2. To do Internetworking & devices 3. To develop new routing techniques 4. Practically know the functionality of devices using RIP, OSPF, DHCP, and NAT		

Sl. No	LIST OF EXPERIMENTS
1	Study of different types of network cables and practically implement the cross-wired cable and straight through cable using clamping tool
2	Study of network components/devices: i) NIC ii) Hub iii) Switch
3	Connecting computers on Local Area Network (LAN)
4	Study of packet tracer
5	Configuration of different network topologies using packet tracer
6	Configuration of switch and establishing LAN using packet tracer
7	Creation of Virtual LAN (VLAN) using packet tracer
8	Configuration of basic routing using packet tracer
9	Configuration of a network using Routing Information Protocol (RIP) using packet tracer
10	Configuration of a network using Open Shortest path First (OSPF) using packet tracer
11	Configuration of DHCP using packet tracer
12	Configuration of NAT using CISCO packet tracer

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: To apply the concepts of Data Communication and Networking	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2: To do Internetworking & devices	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3: To develop new routing techniques	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4: Practically know the functionality of devices using RIP, OSPF, DHCP, and NAT	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3
Course Contribution to POs	**3**	**2.5**	**2.75**	**2**	**1**	**1**	**1.25**	**0.5**	**0.5**	**0.5**	**0.5**	**0.5**	**1**	**0**	**3**

Course Title: VLSI Lab		**Course Code: UEC632L**
Credits: 1.5	**Lab Hours: 42**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engg.

Course Objectives:

The objective of the course is to introduce the students to

1) Understand and experience VLSI design flow.
2) Design CMOS / TG based circuit for standard cells.
3) Draw the standard cell layouts.
4) Run the transient and DC analysis

Course Outcomes:

A student who successfully completes this course should be able to

1) Design CMOS/ TG based gates, MUX, flipflops, counters and shift register.
2) Draw the layout, run DC and transient analysis for designed CMOS standard cells.

NAME OF THE EXPERIMENT

Design following CMOS/TG based circuits with given specifications* and complete the VLSI design flow mentioned below using appropriate tool:

a) Draw the schematic and verify thefollowing
   i) DC Analysis
   ii)TransientAnalysis
b) Draw the Layout and verify the DRC,ERC
c) Check forLVS
d) Extract RC and back annotate the same and verify thedesign.

1) CMOS inverter
2) CMOS two input NANDgate
3) CMOS two input NORgate
4) CMOS two input ORgate
5) CMOS two input ANDgate
6) TG based two input XOR and XNORgates
7) Negative edge triggers D flip flop using TGs andinverters
8) 4:1 MUX using TGs andinverters
9) 3- Bit up counter
10 3-Bit SISO shift register

**An appropriate constraint should be given*

POs satisfied by the course:

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

(m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Design CMOS/ TG based gates, MUX, flipflops, counters and shift register.	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0
CO2: Draw the layout, run DC and transient analysis for designed CMOS standard cells.	1	0	2	0	3	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**1.00**	**0**	**2.00**	**0**	**3.0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title : Modeling and Simulation of Engineering Systems		**Course Code: UEC634N**
Credits: 03 (3-0-0)	**Teaching Hours: 40**	**Contact Hours: 3 Hrs/Week**
Semester: VI	**CIE Marks: 50**	**SEE Marks: 50**

Department: Electronics and Communication Engineering
Designation: Open Elective
Prerequisites: Engineering mathematics
Eligibility: Any engineering branch excluding E & CE

Gist of the subject: As an introductory course for modeling, simulation and analysis of real life physical systems containing individual or mixed mechanical, electrical, thermal and fluid elements. Simulate and Analyze the developed models using modeling and simulation tools.

Course Objectives:

1. To visualize the real life physical systems and make a simple mathematical model of them using first principles
2. To analyze behavior of the engineering systems using built mathematical models
3. To simulate the developed model using software tools
4. To analyze the results of the simulation

Course Outcomes:

On completion of this course, the students should be able to

1. Build a reduced order model of any engineering system and obtain its mathematical model
2. Visualize various factors to be considered in any engineering system design
3. Simulate the developed model Use software tools (e.g. SCILAB/XCOS) for modeling, simulation, and analysis
4. Analyze the system using simulation results

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hours)

Introduction to Systems: Introduction, types, properties of systems, LTI Systems, Stability of systems. Non linear systems

Mathematical Modeling: Introduction, types of modeling, Abstraction, Linearity and superposition, balance and conservation laws and the system, boundary approach. Basic system elements in mechanical, electrical, fluid, magnetic and thermal systems

Unit II (10 Hours)

Mathematical Modeling of Basic Engineering Systems: Introduction, Differential equations of basic engineering systems, Transfer functions, Block diagram algebra, Signal flow graphs.

Lumped Parameter Models: Mechanical systems (automobile suspension system, accelerometer), translational, rotational (simple rotational system). hydraulic systems (two tank hydraulic system), thermal systems (simple thermal system). Electrical Systems (capacitor microphone).

Unit III (10 Hours)

Analysis of Systems: Introduction, time domain analysis of first order and second order systems**,** frequency response of Linear Time invariant systems: Bode plots, phase margin and gain margin, stability analysis: Routh Hurvitz criteria. Introduction to State space representation of systems.

Unit IV(10 Hours)

Modeling and Simulation tools: Introduction, familiarization with modeling and simulation software, Simulation and analysis of mathematical models developed. Introduction to non-linear systems and linearization. Curve fitting in system modeling.

Reference Books:

1. Mukherjee A. and Karmakar R. - 'Modeling and Simulation of Engineering Systems through Bondgraphs' - Narosa – 2000
2. I J Nagrath, M Gopal – Control Systems Engineering, New Age International Publishers, Fifth Edition, 2007
3. O. Beucher and M. Weeks - Introduction to MATLAB and Simulink a project based Approach, Infinity Science Press LLC, 2006
4. Chi Tsong Chen – Linear System Theory and Design, Oxford University Press, 1999
5. Ken Dutton, Steve Thompson, Bill Barraclough – The Art of Control Engineering, Addison – Wesley, 1997
6. J N Kapur – Mathematical modeling, New Age International (P) Ltd. New Delhi
7. S. C. Chapra, R. P. Canale – Numerical methods for Engineers, 4th Ed., TMH, New Delhi
8. Woods Robert L. and Kent L.- 'Modeling and Simulation of Dynamic Systems'- Prentice Hall – 1997
9. Frederick C. - 'Modeling and Analysis of Dynamic Systems' - Wiley - 2001 - 3rd Edition

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	Pos												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1. Build a reduced order model of any engineering system and obtain its mathematical model	3	2	3	0	0	0	0	0	0	0	0	0	3	2	0
CO 2. Visualize various factors to be considered in any engineering system design	3	3	3	0	0	1	2	0	0	0	0	0	3	0	0
CO 3. Simulate the developed model Use software tools (e.g. SCILAB/XCOS) for modeling, simulation, and analysis	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
CO 4. Analyze the system using simulation results	3	3	3	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs	**3**	**3**	**3**	**0**	**0**	**0.25**	**0.5**	**0**	**0**	**0**	**0**	**0**	**3**	**0.5**	**0**

Course Title: Image processing		Course Code: UEC635N
CREDITS: 3 (3-0-0)	**Teaching Hours: 40 Hrs (10 Hrs/Unit)**	**L-T-P: 3-0-0**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**
Course Type: Open Elective		**Semester: VI sem**
Department: Electronics and Communication Engineering		

COURSE PRE-REQUISITES: Linear Algebra, Differential Equations, Probability and Statistics, Calculus, Signals and systems, Digital Electronics (just basic) and Basic Programming skills (MATLAB or any).

ELIGIBILITY: CSE, ISE, EIE,EEE

About Image Processing:

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.

Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too. Its helps for students to implement their final year projects.

Course Objectives:

1. To familiarize the basic principles of digital image processing and its components.
2. To understand the process of image transformation, histogram processing and spatial filter application.
3. To understand the significance of image restoration and colour image processing.
4. To understand the needs of image compression and various image compression techniques.

Course Outcomes:

A student who successfully completes this course should be able to

1. Articulate the fundamentals of Digital image processing including the simple image formation and relationship between pixels
2. Application of different types of Image transformation techniques, histogram processing and application of spatial filters.
3. Analyse the significance of image restoration and processing of colour images.
4. Illustrate the image compression like lossy and loss less image compression techniques.

The topics that enable to meet the above objectives and course outcomes are given below:

UNIT I (10 Hours)

Introduction to Image processing: Fundamental steps in image processing; Components of image processing system; image sensing and acquisition; sampling and quantization; representation of digital images, image interpolation, Basic relationship between pixels; arithmetic and logic operations.

UNIT II (10 Hours)

Transformation and spatial filtering: Basics of intensity transformation and functions, Histogram Processing, equalization and histogram matching. Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters. Image Restoration: Image Restoration: Image Degradation/Restoration Process, Noise Models.

UNIT III (10 Hours)

Restoration in the Presence of Noise Only-Spatial Filtering, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering,Color image processing: fundamentals, color models pseudo colour image processing, colour transformations.

UNIT IV (10 Hours)

Image Compression: Fundamentals, Image Compression Models and methods: Huffman coding, Golomb coding, arithmetic coding, LZW coding JPEG, predictive coding. Digital watermarking Applications in satellite, sonar, radar, medical areas and process industries.

Text Book:

1. R. C. Gonzalez, R. E. Woods, "Digital Image processing", Addison Wesley/ Pearson education, New Delhi, India, 3rd edition, 2002.

Reference Books:

1. K. Jain, "Fundamentals of Digital Image processing", Prentice Hall of India, New Delhi, 2nd Edition, 1997.
2. Rafael C. Gonzalez, "Digital Image processing using MATLAB", Richard E. Woods and Steven Low price Edition, Pearson Education Asia, India, 2nd Edition, 2004.
3. William K. Pratt, "Digital Image Processing", John Wiley & Sons, New Delhi, India, 3rd edition, 2004.
4. Arthur R. Weeks, Jr., "Fundamentals of Electronic Image Processing", SPIE Optical Engineering Press, New Delhi, India, 2nd Edition, 1996.
5. S. Jayaraman, Esakkirajan, T.Veerakumar, "Digital Image Processing", Tata McGraw-Hill Education.

Web Resources:

1) http://www.cse.iitd.ernet.in%2F~sak%2Fcourses%2Fcdp%2Fslides.pdf&ei=xl4xUsWwI8n_rQe24YD oAQ&usg=AFQjCNFeZnxu6BwhgXtl0FMEDQFq9FECzw&bvm=bv.52109249,d.bmk
2) http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/compiler-desing/
3) http://www.diku.dk/~torbenm/Basics/basics_lulu2.pdf
4) http://www.antlr.org/wiki/display/ANTLR3/Tutorials
5) http://javacc.java.net/
6) http://www.engr.mun.ca/~theo/JavaCC-Tutorial/javacc-tutorial.pdf

POs satisfied by the course:

(a) **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(c) **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
(e) **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

(f) **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
(i) **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
(l) **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes
(m) Analyse and design systems for electronics, Communication, and Signal Processing Applications.
(n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
(o) Demonstrate the conceptual knowledge with respect to architecture, design, analysis, and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Understand the fundamentals of Digital image processing including the simple image formation and relationship between pixels.	2	0	0	0	0	3		0	0	0	0		3	3	3
CO 2: Understand the different types of Image enhancement techniques in spatial and frequency domain.	1	0	3	0	2	3	2	0	0	0	0	2	0	2	0
CO 3: Understand the different types of image degradation like linear image restoration techniques and nonlinear image restoration techniques.	1	0	3	0	0	0	0	0	2	0	0	3	1		3
CO 4: Understand the image compression like lossy and loss less image compression techniques and also understand the need of image segmentation.	1	0	3	0	3	0	0	0	3	0	0	3	3	3	3
Course Contribution to POs	**1.25**	**0**	**2.25**	**0**	**1.25**	**1.5**	**0.5**	**0**	**1.25**	**0**	**0**	**2**	**1.75**	**2**	**2.25**

VII Semester

Course Title: Microwaves and Antennas			Course Code: UEC741C
Credits:	L-T-P:3-0-0	Contact Hours / Week:3	Total Teaching Hours:40
CIE Marks: 50		SEE Marks: 50	Total Marks: 100

Department: Electronics and Communication Engineering.
Designation: Core

Course Objectives:

1. To provide the knowledge about transmission line theory, rectangular waveguide, and demonstrate the working principle of a microwave vacuum tube device.
2. To introduce scattering parameters, its properties and to give a comprehensive analysis of various microwave passive devices based on scattering parameters and to impart the knowledge of microwave radar systems.
3. To introduce basic terminology and concepts of antennas to analyze and differentiate the antennas, various types of antenna arrays.
4. To introduce antenna aperture characteristics, different antennas operation and their usage in real time field.

Course Outcomes:
A student who successfully completes this course should be able to

1. Acquire the knowledge of transmission line theory, rectangular waveguides and describe microwave vacuum tube device.
2. Analyze microwave passive devices with scattering parameters, and apply microwave application in radar systems.
3. Compute basic antenna parameters using radiation patterns, analyze and design antenna arrays.
4. Analyze the importance of antenna aperture, explain working principle of different antennas and their usage in real time field.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10hrs)

Introduction to microwaves: Microwave frequencies, IEEE microwave frequency bands. **Microwave transmission lines and rectangular waveguides**: Introduction, transmission line equations, characteristic and input impedances, reflection and transmission coefficients, standing wave and SWR. Introduction to rectangular waveguides, TE and TM modes in rectangular waveguides.
Microwave vacuum tube device: Introduction, reflex klystron oscillator (mechanism of oscillation, mode of oscillation, power output and efficiency, mode curve), two cavity klystron amplifier (mechanism of operation).

Unit II (10hrs) **Microwave network theory and passive devices:** Introduction, S-matrix representation of multi-port network, properties of S-matrix, matched terminations, rectangular to circular waveguide transition, attenuators, precision phase shifter, wave guide tees, E-plane tee, H-plane tee, magic tee, applications of magic tee, faraday rotation isolator, four-port circulator, 2-hole directional coupler. **Microwave application**: Microwave radar systems (radar equation, pulsed radar, CW doppler radar, FMCW radar).
Unit III (10hrs) **Fundamental Parameters of Antennas**: Introduction, radiation pattern, radiation power density, radiation intensity, beam width, directivity, antenna efficiency, gain, beam efficiency, bandwidth, polarization, effective height, input impedance, antenna radiation efficiency, maximum directivity and maximum effective area, Friis transmission equation. **Antenna arrays**: Array of two point sources, broad side array, end fire array, n-isotropic array, pattern multiplication. binomial and Chebysheve arrays, phased array.
Unit IV (10hrs) **Antenna as an aperture**: aperture concept, types of aperture, maximum effective aperture of short dipole and half wave dipole. **Antenna practice:** Yagi-Uda antenna, turnstile antenna, log periodic antenna, helical antenna, rhombic antenna, horn antenna, parabolic reflector antennas, micro strip antenna and their feed systems.
Textbooks: 1. Annapurna Das, Sisir K. Das, **“Microwave Engineering”,** TMH,2ndEd, New Delhi, 2009. 2. Samuel Y. Liao, **“Microwave Devices and Circuits”,** Pearson Education,3rdEd, New Delhi, 2003. 3. John D. Krauss, Ronald J. Marhefka, Ahmad S Khan, **“Antennas and Wave Propagation”,** McGraw-Hill, 5thEd, New Delhi, 2017. 4. Constantine A. Balanis, **“Antenna Theory: Analysis and Design”**, John Wiley,4thEd, New Delhi, 2016. 5. K. D. Prasad, **“Antenna & Wave Propogation”,** Satyaprakshan, 5thEd, New Delhi 2009. **Reference Books:** 1. Merrill I. Skolnik, **“Introduction to Radar Systems”,** TMH, 3rdEd, New Delhi,2001. 2. P. E. Collins, **“Antennas and Radio Propagation”,** McGraw-Hill, New Delhi,1985 3. Edward C. Jordan, Keith G. Balmain, **“Electromagnetic waves and Radiating systems”,** PHI New Delhi, 1993.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Acquire the knowledge of transmission line theory, rectangular waveguides and describe microwave vacuum tube device.	3	2	1	0	0	1	1	0	0	0	0	0	3	0	0
CO2. Analyze microwave passive devices with scattering parameters, and apply microwave application in radar systems	3	2	1	0	0	1	1	0	0	0	0	0	3	0	0
CO3. Compute basic antenna parameters using radiation patterns, analyze and design antenna arrays.	3	2	2	0	0	1	1	0	0	0	0	0	3	0	0
CO4. Analyze the importance of antenna aperture, explain working principle of different antennas and their usage in real time field.	3	2	2	0	0	1	1	0	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	**3**	**2**	**1.5**	**0**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Information Theory and Coding			**Course Code: UEC743E**
Credits: 3	**L-T-P:3-0-0**	**Contact Hours/ Week: 3**	**Total Teaching Hours: 40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:

1. To explain how the quantitative measure of information may be used to build efficient solution for engineering problems.
2. To understand the need of coding, entropy and different types of source coding techniques.
3. To get an insight into the concept of mutual information, discrete communication channels.
4. To be familiar with the different error control coding algorithms.

Course Outcomes:

A student who successfully completes this course should be able to

1) Demonstrate the basic information theory concepts, entropy, and need of coding and working of different types of source coding techniques.
2) Derive channel capacity expression for different types of discrete communication channels and describe entropy functions, equivocation, mutual information of communication channel.
3) Design an encoder, decoder and error correction circuit for linear block code.
4) Design an encoder, decoder and error correction circuit for cyclic code and demonstrate encoding of convolutional codes, also verify its structural properties using code tree and trellis diagram.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10hrs)

Information theory: Introduction, measure of information, average information content of symbols in long independent sequences, average information content of symbols in long dependent sequences, Markov statistical model for information source, entropy and information rate of Markov source. **Source Coding:** Properties, Shannon's encoding algorithm, Shannon-Fano encoding algorithm, Huffman Coding.

Unit II (10hrs**)**

Communication channels: Discrete communication channels, entropy functions and equivocation, mutual information, properties of mutual information, rate of information transmission over a discrete channel, capacity of a discrete memory less channel, Shannon's theorem on channel capacity, channel efficiency and redundancy, symmetric/uniform channel, binary symmetric channel, binary erasure channel. Shannon-Hartley law and its implications.

Unit III (10hrs) **Error control coding:** Introduction, types of errors, examples of error control coding, methods for controlling errors, types of codes. **Linear Block Codes:** Matrix description of LBC, encoding circuit for (n, k) linear block codes, syndrome and error correction, syndrome calculation circuit, Hamming weight, Hamming distance and minimum distance of LBC, error detection and correction capability of LBCs, standard array.
Unit IV (10hrs) **Binary Cyclic Codes:** Algebraic structure of cyclic codes, encoding using (n, k) bit shift register, syndrome calculation, error detection and correction. **Convolution codes:** Connection pictorial representation, time and transform domain approach, systematic convolution codes, **Structural properties of convolution codes:**State diagram, code tree, trellis diagram.
Reference Books: 1. P.S. Sathyanarayana, "**Concepts of information theory and coding"** Dynaram**,** 2nd edition, 2004. 2. Bernard Sklar, "**Digital communication fundamentals and applications"** Pearson education, 2nd edition, 2002. 3. K. Sam Shanmugam,**"Digital and analog communication systems"** John Wiley, 1996. 4. Simon Haykin,**"Digital communication"** John Wiley, 2003.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Demonstrate the basic information theory concepts, entropy, and need of coding and working of different types of source coding techniques	3	2	1	0	1	1	1	0	0	0	0	0	3	0	0
CO2. Derive channel capacity expression for different types of discrete communication channels and describe entropy functions, equivocation, mutual information of communication channel	3	2	1	0	0	1	0	0	0	0	0	0	3	0	0
CO3. Design an encoder, decoder and error correction circuit for linear block code	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0
CO4. Design an encoder, decoder and error correction circuit for cyclic code and demonstrate encoding of convolutional codes, also verify its structural properties using code tree and trellis diagram	3	3	2	0	1	1	1	0	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	**3**	**2.5**	**1.5**	**0**	**0.75**	**1**	**0.75**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Multimedia Communication			Course Code: UEC744E
Credits:	**L-T-P: 3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Core / Elective / Open Elective

Course Objectives:

The students should be able to understand

(1) Concepts of multimedia information representation and its communication using mark uplanguages.
(2) Fundamentals of digital audio and video signals.
(3) Different types of compression techniques and their significance in multimedia communication.

Course Outcomes:

A student who successfully completes this course should be able to

(1) Explain the concepts multimedia information representation and use the different markup language for its communication.
(2) Explain the needs of video and audio signal processing in multimedia communication.
(3) Apply the different information coding techniques in image and video compression techniques.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hours)

Introduction to Multimedia: Introduction, Multimedia and hypermedia, World Wide Web, overview of multimedia software tools, Graphics and Image Data Representations: Graphics image data types, popular file formats, color in image and video: color science, color models in images, color models in video.

Unit II (10 Hours)

Fundamental Concepts in Video and Digital Audio: Types of video signals, analog video, digital video, digitization of sound, quantization and transmission of audio. Basics of Digital Audio: Digitization of sound, Musical Instrument Digital Interface, quantization and transmission of audio.

Unit III (10 Hours)

Lossless compression algorithm: Run-Length coding, variable length coding, dictionary based coding, arithmetic coding, lossless image compression, Lossy compression algorithm: Quantization, transform coding, Wavelet-based coding, embedded zero tree of Wavelet coefficients Set Partitioning in Hierarchical Trees (SPIHT). Basic Video Compression Techniques: Introduction to video compression, video compression based on motion compensation, search for motion vectors, MPEG, Basic Audio CompressionTechniques.

Unit IV (10 Hours)

Multimedia Networks: Basics of Multimedia Networks, Multimedia Network Communications and Applications: Quality of multimedia data transmission, multimedia over

IP, multimedia over ATM networks, transport of MPEG- 4, Media-on Demand (MOD).
Textbook: 1. Ze-NianLi , Mark S. Drew, ‘’Fundamentals of Multimedia’’, PHI/ PEA. **Reference Books:** 1. ParagHavaldar, Gerard Medioni, ‘’Multimedia Systems’’, Cengage, 2009. 2. Colin Moock, SPD O, ‘’Essentials Action Script 3.0’’, Reilly,2007. 3. Steinmetz, Nahrstedt, ‘’Multimedia Applications’’, Springer. 4. Chapman, Jenny Chapman Nigel, ‘’Digital Multimedia’’, Wiley Dreamtech. 5. Steve Heath, ‘’ Multimedia & Communications Technology’’, Elsevier.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Explain the concepts multimedia information representation and use the different markup language for its communication	0	1	0	0	1	0	1	0	0	1	1		1		1
CO2. Explain the needs of video and audio signal processing in multimedia communication.	0	1	0	1	1	0	0	0	1	1	1		1		1
CO3. Apply the different information coding techniques in image and video compression techniques.	1	1	0	0	1	0	0	0	0	1	1	1	1	1	1
CO4. Explain the various standard protocols used for multimedia communication	1	1	0	0	1	0	1	0	0	1	1		1		1
Course Contribution to POs and PSOs	**0.5**	**1**	**0**	**0.25**	**1**	**0**	**0.5**	**0**	**0.25**	**1**	**1**	**0.25**	**1**	**0.25**	**1**

<table>
<tr><td colspan="3">Course Title: Soft Computing</td><td>Course Code: UEC745E</td></tr>
<tr><td>Credits: 3</td><td>L-T-P: : 3-0-0</td><td>Contact Hours / Week: 3Hrs/Week (10Hrs/Unit)</td><td>Total Teaching Hours: 40Hrs</td></tr>
<tr><td colspan="2">CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="4">Department: Electronics and Communication Engineering.
Designation: Elective</td></tr>
<tr><td colspan="4">Course Objectives:
1. To impart knowledge about soft computing techniques.
2. Application and analyzation of various techniques in neural networks.
3. Knowledge representation of fuzzy logic technique and its application.
4. To learn genetic programming and techniques used in different applications.</td></tr>
<tr><td colspan="4">Course Outcomes:
A student who successfully completes this course should be able to

1. Apply different soft computing design techniques for different applications.
2. Design and analyze neural network system for different applications.
3. Apply fuzzy logic techniques and fuzzy mathematics for the suitable systems.
4. Program genetic algorithms for different applications.</td></tr>
<tr><td colspan="4">The topics that enable to meet the above objectives and course outcomes are given below</td></tr>
<tr><td colspan="4">Unit I (10hrs)
Introduction: Neural networks, application scope of neural networks, fuzzy logic, genetic algorithm, hybrid systems, soft computing, Artificial neural networks: Fundamental concept, evolution of neural networks, basic models of artificial neural networks, important terminologies of ANNs, McCulloch-Pitts neuron, linear separability, Hebb network. Supervised learning networks: Introduction, perceptron networks, adaptive linear neuron (Adaline), multiple adaptive linear neuron , back- propagation network</td></tr>
<tr><td colspan="4">Unit II (10hrs)
Unsupervised Learning Networks: Introduction, fixed weight competitive nets, Kohonen self-organizing feature maps, learning vector quantization, counter propagation networks, adaptive resonance theory network.</td></tr>
<tr><td colspan="4">Unit III (10hrs)
Introduction to Fuzzy Logic, Classical Sets and Fuzzy Sets: Introduction to fuzzy logic, classical sets (Crisp Sets), fuzzy sets. Classical relations and fuzzy Relations: Introduction, Cartesian product of relation, classical relation, fuzzy relation, tolerance and equivalence relations, noninteractive fuzzy Sets. Membership Functions: Introduction, features of the membership functions, fuzzification, methods of membership value assignments. Defuzzification: Introduction, lambda-cuts for fuzzy sets (Alpha-Cuts), lambda-cuts for fuzzy relations, defuzzification methods. Fuzzy arithmetics, fuzzy measures</td></tr>
<tr><td colspan="4">Unit IV (10hrs)
Genetic Algorithm: Introduction, biological background, traditional optimization and search</td></tr>
</table>

techniques, genetic algorithms and search space, genetic algorithm vs. traditional algorithms, basic technologies in genetic algorithm, simple GA, general genetic algorithm, operators in genetic algorithm, stopping condition for genetic algorithm flow, constraints in genetic algorithm, problem solving using genetic algorithm, the schema theorem, classification of genetic algorithm Genetic programming

Textbook:

1) S. N. Sivanandam, S. N. Deepa, Principles of Soft Computing, Wiley Publications, Second Edition-2011.
2) Rajasekaran S. And Vijayalakshmi Pai G A, “Neural Networks, Fuzzy logic and Genetic Algorithms: Synthesis and Applicatins”, PHI Learning, New Delhi, 2006

Reference Book:

1) LaureneFausette, “Fundamentals of Neural Networks”, Pearson Education, New Delhi, 2007.
2) EijiMizutani, Chuen Tsai Sun, JyhShing Roger Jang, “Neuro-Fuzzy and Soft Computing: A Computaional Approach to Learning and Machine Intelligence”, Pearson Educaion, New Delhi, 2008.
3) Bart Kosko, “Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence”, PHI Learning, New Delhi, 2008.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.
Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Apply different soft computing techniques for different applications.	3	3	3	2	2	2	0	0	0	0	0	3	3	2	2
CO2. Design and analyze neural network system for different applications.	3	3	3	2	2	2	0	0	0	0	0	1	2	2	2
CO3. Apply fuzzy logic technique for the suitable systems.	3	3	3	2	2	2	0	0	0	0	0	1	2	2	2
CO4. Program genetic algorithms for different applications.	3	3	3	3	3	2	0	0	0	0	0	1	2	2	2
Course Contribution to POs and PSOs	**3**	**3**	**3**	**2.25**	**2.25**	**2**	0	0	0	0	0	**1.5**	**3**	**2.6**	**2.6**

Course Title: Digital Signal Processing with FPGA		Course Code: UEC746E
Credits: 3	**Teaching Hours: 40 Hrs (10 Hrs/Unit)**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering
Designation: Elective
Pre-requisites: ---

Course Objectives:

1. To learn how to implement DSP algorithms using FPGA specifically by writing VHDL codes.
2. To implement the signal processing algorithms such as various forms of transforms, IIR and FIR filters on FPGAs.
3. To predict the performance (speed, size, and power) of an implemented design.
4. To learn different Number systems/arithmetic concepts Suitable for implementation on FPGA
5. To learn and compare pipeline strategies for FIR and IIR filters

Course Outcomes:

A student who successfully completes this course should be able to

1. Understand the working of FPGA
2. Design and implement the various DSP algorithms on FPGA, such as DSP transforms, IIR and FIR Filters
3. Compare the DSP transforms, FIR and IIR filters on the basis of performance
4. Use different number system suitable for implementation on FPGA

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (10 hours)

Introduction: Overview of Digital Signal Processing (DSP), FPGA Technology, Classification by Granularity, Classification by Technology, Benchmark for FPLs, DSP Technology Requirements, FPGA and Programmable Signal Processors, Design Implementation, FPGA Structure, The Altera EP4CE115F29C7. **Computer Arithmetic:** Number Representation; Fixed-Point Numbers, Unconventional Fixed-Point Numbers, Binary Adders; Pipelined Adders

Unit II (10 hours)

Computer Arithmetic: Binary Multipliers: Multiplier Blocks. Multiply-Accumulator (MAC) and Sum of Product (SOP): Distributed Arithmetic Fundamentals, Signed DA Systems, Modified DA Solutions. **Fourier Transforms:** The Discrete Fourier Transform Algorithms, Fourier Transform Approximations Using the DFT, Properties of the DFT, The Goertzel Algorithm, The Bluestein Chirp-z Transform, The Rader Algorithm The Fast Fourier Transform (FFT) Algorithms: The Cooley–Tukey FFT Algorithm, The Good–Thomas FFT Algorithm, Comparison of DFT and FFT Algorithms

Unit III (10 hours)

Infinite Impulse Response (IIR) Digital Filters: IIR Theory, IIR Coefficient Computation, Summary of Important IIR Design Attributes, IIR Filter Implementation, Finite Word length Effects. Optimization of the Filter Gain Factor, Fast IIR Filter : Time-domain Interleaving, Clustered and Scattered Look-Ahead Pipelining, IIR Decimator Design, Parallel Processing, IIR Design Using RNS. Narrow Band IIR Filter: Narrow Band Design Example,

Cascade Second Order Systems Narrow Band Filter Design, Parallel Second Order Systems Narrow Band Filter Design.
Unit IV (10 hours) **Finite Impulse Response (FIR) Digital Filters:** Digital Filters, FIR Theory3.2.1 FIR Filter with Transposed Structure, Symmetry in FIR Filters, Linear-phase FIR Filters, Designing FIR Filters, Direct Window Design Method, Equiripple Design Method. Constant Coefficient FIR Design: Direct FIR Design, FIR Filter with Transposed Structure, FIR Filters Using Distributed Arithmetic, Comparison of DA- and RAG-Based FIR Filters.
Reference Books: 1. Uwe Meyer-Baese, "Digital Signal Processing with Field Programmable Gate Arrays", 4th Edition, Springer Publications, 2007 2. Roger Woods, John McAllister, Gaye Lightbody, Ying Yi "FPGA-based Implementation of Signal Processing Systems", A John Wiley and Sons, Ltd., Publication 3. Volnei A. Pedroni "Circuit Design and Simulation with VHDL", 2nd Edition, PHI Publication. 4. Proakis & Monalakis "Digital Signal Processing – Principles Algorithms & Applications", PHI, 3rd Edition, New Delhi, 1997.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PSOs satisfied by the course:

n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Understand the working of FPGA	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO2: Design and implement the various DSP algorithms on FPGA, such as DSP transforms, IIR and FIR Filters	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO3: Compare the DSP transforms, FIR and IIR filters on the basis of performance	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
CO4: To learn and compare pipeline strategies for FIR and IIR filters	1	0	1	2	3	0	0	0	0	0	0	0	0	3	0
Course Contribution to POs	**1**	**0**	**1**	**2**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**

Course Title: Wireless Networks			Course Code: UEC747E
Credits: 03	**L-T-P: 3-0-0**	**Contact Hours / Week: 03**	**Total Teaching Hours: 40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:
This course will enable students to:
1. Understand concepts of wireless networks and its applications
2. Appreciate the contribution of wireless networks to overall technological growth
3. Explain the various terminology, schemes, concepts, components, algorithms and different methodologies used in wireless networks
4. Compare and contrast various types of wireless networks

Course Outcomes:
A student who successfully completes this course should be able to:
1. Understand fundamentals of wireless networks
2. Analyze unique characteristics and various design issues in wireless networks
3. Demonstrate basic skills for different types of wireless networks design
4. Apply knowledge of various TCP/IP protocols for wireless networking

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Wireless networks: Wireless network architectures, classification of wireless networks, wireless switching technology, wireless communication problems, wireless network reference model, wireless networking issues, wireless networking standards. Wireless Body Area Network (WBAN): Properties, network architecture, network components, design issues, network protocols, WBAN Technologies, WBAN Applications. Wireless Personal Area Network (WPAN): Wireless Personal Area Network, network architecture, Piconet and Scatternet, WPAN components, WPAN technologies and protocols, WPAN Applications.

Unit II (10 hrs)

Wireless Local Area Network (WLAN): Network components, design requirements of WLAN, network architecture, WLAN standards, WLAN protocols, IEEE 802.11p, WLAN Applications

Unit III (10 hrs)

Wireless Metropolitan Area Network (WMAN): Wireless Metropolitan area networks, WMAN network architecture, network protocols, broadband wireless networks, WMAN Applications. Ad-hoc Networks: Introduction, Issues in Ad hoc wireless networks, Ad hoc wireless internet.

Unit IV (10 hrs)

MAC Protocols for ad hoc wireless networks: Introduction, issues in designing a MAC protocol for Ad hoc wireless networks, design goals of a MAC protocol for Ad hoc wireless networks, classification of MAC protocols, contention based protocols with reservation mechanisms. Contention-based MAC protocols with scheduling mechanism, MAC protocols that use directional antennas, Other MAC protocols. Overview of ad hoc routing protocols.

Textbooks:

1) Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, "Wireless and Mobile Networks: Concepts and Protocols", Wiley-India, First Edition, 2010
2) C. Siva Ram Murthy, B. S. Manoj "Ad hoc wireless Networks", Pearson Education, 2nd Edition, 2005

Reference Books:

1) Kaveh Pahlavan, P. Krishnamurthy, "Principles of Wireless Networks", Pearson Education, First Edition, 2002
2) Yi-Bing Lin, Imrich Chlamtac, "Wireless and Mobile Network Architectures", John Wiley, First Edition, 2001
3) Marlyn Mallick, "Mobile and Wireless Design Essentials", Wiley, First Edition, 2003
4) William C. Y. Lee, "Mobile Cellular Telecommunication – Analog and Digital Systems", McGraw Hill, 2nd Edition, 1995

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Understand fundamentals of wireless networks	3	2	3	2	1	1	1	0	0	0	0	0	1	0	3
CO2: Analyze unique characteristics and various design issues in wireless networks	3	3	2	2	1	1	1	1	0	0	0	0	1	0	3
CO3: Demonstrate basic skills for different types of wireless networks design	3	2	3	2	1	1	1	0	1	1	1	0	1	0	3
CO4: Apply knowledge of various TCP/IP protocols for wireless networking	3	3	3	2	1	1	2	1	1	1	1	1	1	0	3
Course Contribution to POs	3	2.75	2.75	2	1	1	1.25	0.5	0.5	0.5	0.5	0.25	1	0	3

Course Title: Industrial Automation		**Course Code: UEC748E**
Credits: 3 **L-T-P: 3-0-0**	**Teaching Hours: 40Hrs (10Hrs/Unit)**	**Contact Hours: 3Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication
Engg.Designation : Elective
Prerequisites : ---

Course Objectives:

1. To learn details of elements of automation, PLC.
2. To impart ladder programming concepts.
3. To introduce the Supervisory Control and Data Acquisition (SCADA), Distributed Control System(DCS), industrial buses such as CAN, field bus, Profibus, HART bus.

Course Outcomes:

1. Student will be able to explain the importance and benefits of Industrial automation.
2. Student will be able to demonstrate industrial process using PLC.
3. To do different ways of programming of PLC and analyze the programs.
4. To do SCADA and DCS programming for automating a process.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (10 hours)

Introduction to industrial automation: Utility of automation, General structure of automated process, Examples of some simple automated systems. Introduction to programmable logic controllers(PLC): Introduction to PLC operation- The digital concept, Analog signals, The input status file, The output status file, Input and output status files, Sixteen point I/O modules, PLC memory. Introduction to Logic: The logic, Conventional ladder v/s LPLC ladder, Series and parallel function of OR, AND, NOT, XOR logic, Analysis of rung. Input modules - Discrete type, Discrete AC and DC type. Output Modules - Discrete type, Solid-state type, Switching relay type.

Unit II (10 hours)

PLC Instructions: The basic relay instructions normally open and normally closed instructions, Output latching instructions, Understanding relay instructions and the programmable controller input modules, Interfacing start stop pushbutton and motor to PLC, Developing ladder diagram with analytical problems.

Unit III (10 hours)

Timer and counter Instructions: On delay and off delay and retentive timer instructions, PLC counter up and down instructions, Combining counters and timers, Developing ladder diagram with analytical problems. Comparison and data handling instructions: Data handling instructions, Sequencer instructions - Programming sequence output instructions, Developing ladder diagram with analytical problems.

Unit IV (10 hours)
Supervisory Control And Data Acquisition (SCADA): Introduction as applied to process control systems. Distributed Control System (DCS): Evolution of digital controllers, Advantages of digital control, Process control requirements of digital control, Computer network, Interconnection of networks and communication in DCS. Different bus configurations used for industrial automation: RS232, RS485, CAN, HART and OLE protocol, Industrial field bus- FIP (Factory Instrumentation protocol), PROFIBUS (Process field bus), Bit bus.(Fundamentals only).

Reference Books

1) Garry Dunning, "Introduction to Programmable Logic Controllers", 2nd Edition Thomson
2) MaduchandraMitra, SamarjitsenGupta,"Programmable Logic Controllers and IndustrialAutomation: An Introduction", Penram International Publishing India Pvt Ltd.
3) M. Chidambaram, "Computer control of Processes", Narosa Publishing.
4) Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India.
5) Bela G. Liptak,"Instrumentation Engineers Hand Book – Process Control", Chilton Book Company, Pennsylvania.

POs satisfied by the course

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

Program Specific Outcomes

n) Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embedded systems.

Course Title: Nanotechnology			Course Code: UEC734N
Credits: 03	L-T-P: 3-0-0	Contact Hours/ Week: 3	Total Teaching Hours:40
CIE Marks: 50		SEE Marks: 50	Total Marks: 100

Department: Electronics and Communication Engineering.
Designation: Open Elective

Course Objectives:

1. To introduce fundamentals of Nanotechnology and related fields.
2. To introduce various nano materials, nano structures and their synthesis procedures.
3. To introduce different characterization methods for nontechnology.
4. To make students understand the societal implications of nanotechnology and its management.

Course Outcomes:

A student who successfully completes this course should be able to :

1. Comprehend the fundamentals of nontechnology and develop an understanding of various nanomaterials and synthesis technology.
2. Understand quantum dots, nano shells, design and development of Nano sensors
3. Comprehend the knowledge of molecular nano mechanics & Nanotribology
4. Analyze and characterize nanodevices, nanostructures and comprehend the societal implications of nontechnology.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Introduction: The Canvas of nanoscience and nanotechnology: - Nano and nature, Evolution of various technologies of the 20th century, Beginning of Nano. Introduction to Fullerenes: Introduction to fullerenes, Synthesis & purification of fullerenes, Conductivity & superconductivity in Fullerenes, Introduction, synthesis & purification of CNT's, filling & mechanism of growth of CNT's, Electronic structure, mechanical and physical properties of CNT's, applications of CNT's.

Unit II (10 hours**)**

Semiconductor quantum dots: Introduction, synthesis of quantum dots, electronic structure of nanocrystals. Nano shells: Introduction, types of nanoshells, properties and characterization. Nano sensor's: Introduction, Nano sensors, Nano sensors based on quantum size effects, electrochemical sensors, Nano biosensors and smart dust.

Unit III (10 hours)

Molecular Nanomachines: Introduction, covalent and non-conventional approaches, molecular motors and machines, molecular devices, single molecule devices. Nanotribology: Introduction, studying tribology t the nanoscale, nanotribology applications. Case study: design and development of CNT based nano piezoresistive pressure sensor, Silicon nanowire-based sensors.

Unit IV (10 hours)

Investigation & characterization methods in the nanoscale: Electron Microscopies, Scanning Probe Microscopies, optical microscopes for nontechnology, other microscopies, X-ray diffraction, AFM. Societal implications of nanoscience & nontechnology: From first industrial revolution to the nano revolution, implications of nanoscience and nontechnology on society, nanotech and war, public perception and involment in the nano discourse, harnessing nontechnology for economic and social development.
Textbook: 1. T. Pradeep,“NANO: The Essentials”, McGraw-Hill Education, 2007 Edition. **Reference Book:** 1. Rainer Waser, “Nanoelectronics and Information Technology”, Wiley-VCH, 3rd Edition, 2012 Year

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Comprehend the fundamentals of nontechnology and develop an understanding of various nanomaterials and synthesis technology.	3	2	0	0	0	0	0	0	0	3	0	2	3	1	0
CO2. Understand quantum dots, nano shells, design and development of Nano sensors.	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO3. Comprehend the knowledge about molecular nano mechanics & Nanotribology.	3	0	2	0	2	0	0	0	0	3	0	2	3	2	0
CO4. Understand various characterization methods in nanotechnology and comprehend the societal impactions of nontechnology.	3	3	1	2	3	3	3	3	0	2	2	3	3	3	0
Course Contribution to POs and PSOs	**3**	**1.25**	**1.25**	**0.5**	**1.7.5**	**0.75**	**0.75**	**0.75**	**0**	**2.25**	**0.5**	**2.25**	**3**	**2**	**0**

Course Title: Reliability Engineering			Course Code: UEC735N
Credits:	**L-T-P: 3-0-0**	**Contact Hours/ Week: 3**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Open Elective

Course Objectives:

1) To introduce fundamentals of Reliability engineering
2) To introduce the basic concepts of reliability, various models of reliability
3) To analyze reliability of various systems
4) To introduce techniques of reliability evaluation of repairable systems.

Course Outcomes:

A student who successfully completes this course should be able to:

1) model various systems applying reliability concepts
2) evaluate the reliability of simple and complex systems
3) model and estimate the failure rates and enhance reliability of systems
4) apply various mathematical models for evaluating reliability of systems

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Reliability: Definition, Importance, History, Failure pattern of complex product, Factor of safety and reliability, Reliability analysis procedure, Reliability management Some examples of system failures.

Basic probability theory: Set theory, Laws of probability, Probability theorem Random variables and probability distributions, Central limit theorem,

Unit II (10 hours**)**

Failure Density and Distribution functions – Bernoulli's trials – Binomial distribution – Expected value and standard deviation for binomial distribution.

Random Variables: Functions of random variables, Single, two and several random variables, Probability distribution functions, density functions for different types of discrete and continuous variables, mean, mode and median, Numerical solutions, Extremal distributions.

Unit III (10 hours)

Modeling of geometry, strength and loads, Fatigue strength, Time dependent reliability of components, Failure rate versus time, reliability and hazard functions and different distributions, Estimation of failure rate, Expected residual life, Series, parallel and mixed systems, complex systems, Reliability enhancement.

Unit IV (10 hours)

Reliability based design, Optimization problems, Failure modes and effect analysis, Event tree and fault tree analysis, Reliability testing, Reliability data and analysis, measurement of reliability, Monte Carlo Simulation, Computation of reliability

Textbook:

1. Balagurusamy, “Reliability Engineering”, T.M.H. 2003.

Reference Books:

1 Singiresu S. Rao, Reliability Engineering, Pearson 2.
2 Grant E. L. & Leave Worth, Statistical Q. C., T.M.H.
3 Mahajan , Statistical Q.C. 5. Juran and Grayan, Quality Planning Analysis, T.M.H.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

Course Articulation Matrix

Course Outcomes	**POs**												**PSOs**		
	a	**b**	**C**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Comprehend the fundamentals of nontechnology and develop an understanding of various nanomaterials and synthesis technology.	3	2	0	0	0	0	0	0	0	0	0	2	3	1	0
CO2. Understand quantum dots, nano shells, design and development of Nano sensors.	3	0	2	0	2	0	0	0	0	0	0	2	3	2	0
CO3. Comprehend the knowledge about molecular nano mechanics & Nanotribology.	3	0	2	0	2	0	0	0	0	1		2	3	2	0
CO4. Understand various characterization methods in nanotechnology and comprehend the societal impactions of nontechnology.	3	3	1	2	3	3	3	3	0	1	2	3	3	3	0
Course Contribution to POs and PSOs	**3**	**1.25**	**1.25**	**0.5**	**1.75**	**0.75**	**0.75**	**0.75**	**0**	**0.5**	**0.5**	**2.25**	**3**	**2**	**0**

Course Title: Advanced Communication Lab		**Course Code: UEC731L**
Credits: 1.0		**Semester: VII**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Course objectives: This laboratory course enables students to

1. Design and demonstrate the digital modulation techniques
2. Demonstrate and study the radiation pattern of different antennas
3. Demonstrate and measure the characteristics of microwave source, directional couplers and magic tee
4. Demonstrate Characteristics of microstrip devices and measurement of its parameters

Course Outcomes: On the completion of this laboratory course, the students will be able to

1. Design and test the digital modulation techniques and analyze the waveforms
2. Determine the radiation pattern of different antennas
3. Determine the characteristics and response of microwave devices
4. Determine the characteristics of micro strip antennas and devices and compute the parameters associated with it

LIST OF EXPERIMENTS

1. Verification of the sampling theorem
2. Generation and detection of ASK signal
3. Generation and detection of FSK signal
4. Generation and detection of PSK signal
5. Study of radiation pattern of DIPOLE antenna
6. Study of radiation pattern of HORN antenna
7. Study of radiation pattern of YAGI-UDA antenna
8. Measurement of frequency and wave length of a microwave source
9. Study the mode characteristics of Reflex klystron
10. Measurement of coupling factor, insertion loss and directivity of a Directional Coupler
11. Study of Magic Tee and its characteristics
12. Study of V-I characteristics of Gunn diode and Gunn diode as an oscillator
13. To Study the characteristics of low pass and high pass micro strip filter
14. To Study the characteristics of band pass and band stop microstrip filters
15. To study the characteristics of ring resonator in micro strip
16. To study and plot the radiation pattern of microstrip patch antenna

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Design and test the digital modulation techniques and display the waveforms	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO2: Determine the radiation pattern of different antennas	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO3: Determine the characteristics and response of microwave devices	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0
CO4: Determine the characteristics of micro strip antennas and devices and compute the parameters associated with it	2	2	3	1	2	0	0	1	2	2	1	0	3	0	0

Course Title: Modeling and Simulation Lab		Course Code: UEC732L
Credits: 1 **L-T-P: 0-0-2**	**Teaching Hours: 26 Hours**	**Contact Hours: 2 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Laboratory
Prerequisites : ---

Course Objectives:

1. To familiarize the student in introducing and exploring MATLAB &LabVIEW software's.
2. To understand and practice the modelling , simulation and implementation of physical systems using Simulink.
3. To enable the student on how to approach for solving engineering problems using simulation tools.
4. To prepare the students to use MATLAB/LabVIEW in their project works.

Course Outcomes:

1. Ability to express and apply what they have learnt theoretically in the field of engineering throughprogramming & simulation.
2. Ability to find importance of these software's for lab experimentation.
3. Articulate importance of software's in research through simulation.
4. In-depth knowledge of providing virtual instruments on LabVIEW Environment.
5. Ability to write basic mathematical, electrical mechanical problems in Simulink.

LIST OF EXPERIMENTS

MATLAB:

1. Introduction to Simulink
2. Build a Second Order System Model and Simulate the Step Response
3. Implementation of Root locus, Bode and Nyquist plots
4. Mathematical modelling of simple electrical, mechanical systems
5. Amplitude modulation and demodulation
6. Analog filters design

LabVIEW:

1. Introduction to LabVIEW
2. Basic arithmetic and Boolean operations
3. Building Arrays Using For Loop And While Loop
4. Programming Exercises for Clusters and Graphs
5. Programming Exercises on case and sequence structures, file Input/output
6. To use the Format of String, Concatenate Strings, and String Length functions
7. Signal analysis using Express VIs
8. Water level monitoring system
9. Manually and Automatically controlled heating and cooling system

POs satisfied by the course

a. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
i. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

Program Specific Outcomes

m. Analyse and design systems for Electronics, Communication, and Signal Processing Applications.
n. Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embedded systems.

Course Articulation Matrix															
Course Outcomes	**POs**												**PSOs**		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO 1: Ability to express and apply what they have learnt theoretically in the field of engineering through programming & simulation.	3	3	3	1	3	0	0	0	1	1	1	0	3	2	0
CO2: Ability to find importance of these software's for lab experimentation.	0	0	1	1	3	0	0	0	0	0	0	0	2	3	0
CO3: Articulate importance of software's in research through simulation.	0	1	1	0	3	0	0	0	0	0	0	0	3	1	0
CO4: In-depth knowledge of providing virtual instruments on LabVIEW Environment.	0	0	0	0	3	0	0	0	0	0	0	0	0	2	0
CO5: Ability to write basic mathematical, electrical mechanical problems in Simulink	3	3	3	1	3	0	0	0	0	0	0	0	3	2	0
Course Contribution to POs	**1.20**	**1.4**	**1.6**	**0.6**	**3**	**0**	**0**	**0**	**0.2**	**0.2**	**0.2**	**0**	**2.2**	**2**	**0**

VIII Semester

Course Title: Project Management and IPR			**Course Code:**UEC841C
Credits: 3	**L-T-P:3-0-0**	**Contact Hours/ Week: 3**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Core

Course Objectives:

1. To provide the framework of capital budgeting and generation and screening of project ideas.
2. To provide knowledge and understanding of market and demand analysis, technical analysis, project risk analysis and financial estimates and projections.
3. To expose students to special decision situations, social cost benefit analysis, qualitative analysis and environmental appraisal of projects.
4. To introduce fundamental aspects of IPR to students who are going to play a major role in development and management of innovative projects in industries.

Course Outcomes:

A student who successfully completes this course should be able to:

1. Demonstrate an understanding of various phases of Project Management i.e. planning as well as implementing.
2. Demonstrate the use of various tools available for Risk analysis in Capital budgeting to measure the financial feasibility of the project.
3. Demonstrate an understanding of various means of project financing and their merits and demerits. Demonstrate a systematic project implementation and review.
4. The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Concepts of Project Management: Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management. **Project Planning and Estimating:** Capital Expenditures: Importance and difficulties, Phases of capital Budgeting, Levels of decision making, Facets of Project Analysis, Feasibility Study: A schematic diagram, Objectives of Capital Budgeting. Preparation of cost estimation, evaluation of the project profitability.

Unit II (10 hrs)

Generation and Screening of Project Ideas: Generation of Ideas, Monitoring the Environment, Corporate Appraisal, Scouting for project ideas, Preliminary Screening, Project rating index, Sources of positive net present value, On being a Entrepreneur. **Organizing and staffing the project team:** Skills / abilities required for project manager Authorities and responsibilities of project manager, Project organization and types accountability in project, controls, tendering and selection of contractors.

Unit III (10 hrs) **Tools & Techniques of Project Management**: Bar (GANTT) chart, bar chart for combined activities, logic diagrams and networks, Project evaluation and review Techniques (PERT) Planning, Computerized project management. **Project Scheduling:** Project implementation scheduling, effective time management, different scheduling techniques, resources allocation method. PLM concepts.
Unit IV (10 hrs) **Introduction:** Concept of Property, History of IPR, Different forms of IPR, Role of IPR in R & D. **Patents:** Meaning of Patent, Object & Value of Patent law, Advantages of patent to the invertors, Criteria for Patentability, Patents on computer programme, Govt. use of inventions, infringement of Patents & remedies for infringement, Patent (Amendment Act) 2005.
Textbooks: 1) Prasanna Chandra, Projects Planning Analysis Selection Implementation and Review, Tata Mc Graw Hill Publication, 7th Edition, 2009 2) Intellectual Property Law, P. Narayan, 3rd edition, Eastern Law House, 2001 **Reference Book:** 1) Jack R. Meredith, Samuel J. Mantel, Jr. , "Project Management – A managerial approach" 6thedition Wiley India 2) Chaudhry S., Project Execution Plan: Plan for project Execution interaction, 2001 3) Intellectual Property Rights and Law – G.B. Reddy, 7th Edition, Gogia Law Agency

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

n. Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Students will understand the basics of project management, planning, analysis and various facets of PM	1	1	0	0	0	0	0	0	0	0	1	0	1		
CO2. Develop skills of generation and screening of project ideas, organizing, staffing, accountability, controlling and selection of contractors	2	2	1	0	1	1	0	1	1	0	2	1	1	0	0
CO3. Introduced to the use of various tools and techniques of PM, project scheduling, resources allocation methods and PLM	3	2	2	1	2	1	0	0	1	2	3	1	1	0	0
CO4. The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works.	0	0	0	0	0	0	1	3	0	0	3	0	1	0	0
Course Contribution to POs and PSOs	**1.5**	**1.25**	**0.75**	**0.25**	**0.75**	**0.50**	**0.25**	**1**	**0.50**	**0.50**	**2.25**	**0.5**	**1**	**0**	**0**

Course Title: Satellite Communication			**Course Code: UEC842E**
Credits: 03	**L-T-P:3-0-0**	**Contact Hours/ Week:3**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:

1. To understand the basic concept of satellite communication.
2. To get a knowledge about the earth,space segment & calculate the link power budget.
3. To gain knowledge about the satellite multiple access schemes.
4. To gain knowledge about the satellite systems and mobile services.

Course Outcomes:

A student who successfully completes this course should be able to:

1. How to describe the motion of satellite in the orbit.
2. Describe the concepts of subsystems, link design, rain fading and link availability.
3. Explain modulation techniques and the performance of satellite communication systems
4. Analyze the design requirements and the performance of satellite communication systems.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hrs)

Overview of Satellite Systems:Frequency Allocations for Satellite Services. INTELSAT 4, U. S. Domsats 9 , Polar Orbiting Satellites 12, Argos System 18, Cospas-Sarsat.

Orbits and Launching Methods: Kepler's First Law, Kepler's Second Law, Kepler's Third Law, Definitions of Terms for Earth-Orbiting Satellites, Orbital Elements, Apogee and Perigee Heights, Orbit Perturbations, The subsatellite point, Predicting satellite position, Local Mean Solar Time and Sun-Synchronous Orbits, Problems. Launches and Launch Vehicles, Expendable Launch Vehicles (ELVs),Placing Satellites into Geostationary Orbit, Orbital Effects in Communications Systems Performance.

Unit II (10 hrs)

The Geostationary Orbit: Antenna Look Angles, The Polar Mount Antenna, Limits of Visibility, Near Geostationary Orbits, Earth Eclipse of Satellite, Sun Transit Outage, Problems.

Radio Wave Propagation: Atmospheric Losses, Ionospheric Effects, Rain Attenuation, Other Propagation Impairments,

Polarization: Antenna Polarization, Polarization of Satellite Signals, Cross-Polarization Discrimination, Ionospheric Depolarization, Rain Depolarization, Ice Depolarization.

Unit III (10 hrs)

The Space Segment: The Power Supply, Attitude Control, Spinning satellite stabilization, Momentum wheel stabilization, Station Keeping, Thermal Control, TT&C Subsystem, Transponders, The wideband receiver, The input demultiplexer, The power amplifier

Communications Subsystems: Description of the Communications System, Transponders, Satellite Antennas, Basic Antenna Types and Relationships, Example Global Beam Antenna Example Regional Coverage Antenna, Satellite Antennas in Practice, Equipment Reliability and Space Qualification, Reliability, Redundancy.

Unit IV (10 hrs)
Low Earth Orbit and Non-Geostationary Satellite Systems: Orbit Considerations, Coverage Frequency & Considerations, Delay Throughput Considerations, System Considerations Operational NGSO Considerations Designs, Satellite Navigation and the Global Positioning System: Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers and Codes, Satellite Signal Acquisition, GPS Navigation Message, GPS Signal Levels, Timing Accuracy, GPS C/A Code Accuracy, Differential GPS.
Textbook: 1) Dennis Roddy, “Satellite Communications”, 4th edition, McGraw-Hill international edition, 2010. **Reference Books:** 1) Timothy Pratt, Charles Bostian and Jeremy Allnutt, “Satellite Communications”, 2nd edition, John Wiley & Sons, 2003. 2) Wilbur L.Pritchard, Hendri G. Synderhoud, Rober A.Nelson, “Satellite Communication System Engineering”, Prentice Hall, Second edition 1993.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. How to describe the motion of satellite in the orbit.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO2. Describe the concepts of subsystems, link design, rain fading and link availability.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO3. Explain modulation techniques and the performance of satellite communication systems.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
CO4. Analyze the design requirements and the performance of satellite communication systems.	3	2	1	0	0	0	0	0	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	**3**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	3	**0**	**0**

Course Title: Speech Processing			Course Code: UEC843E
Credits: 03	**L-T-P: 3-0-0**	**Contact Hours / Week:40**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives

1) To understand speech production and perception mechanism along with basic knowledge of phonetics.
2) To acquire knowledge of time-domain representation and analysis tools for speech analysis
3) To know the frequency-domain representation and analysis concepts using Short-time Fourier analysis tools.
4) To know the concept of homomorphic analysis of speech signal along with elementary knowledge of LPC.

Course Outcomes:

A student who successfully completes this course should be able to

1) Explain the speech production and perception mechanism
2) Characterize and analyze speech signals in Time domain
3) Characterize and analyze speech signals in Frequency domain
4) Analyze speech signal using homomorphic transformation and LPC

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10hrs)

Digital representation of speech signal. Waveform representation and parametric representation. Sampling rate conversion.

Introduction, the process of speech production and classification and basics of phonetics, phonetic description of phonemes, the acoustic theory of speech production, digital models for speech – vocal tract, radiation, excitation the complete model.

Unit II (10hrs)

Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero crossing rate, voiced/unvoiced/silence detection. Pitch period estimation (Rabiner and Gold method), short time autocorrelation function, short time average magnitude difference function, u/v/speech/silence detection.

Unit III (10hrs)

Introduction, definitions and properties of short time Fourier transform (STFT), Fourier transform interpretation of STFT, linear filtering interpretation of STFT, sampling of STFT, speech analysis and synthesis systems (Vocoders), phase vocoder, channel vocoder.

Unit IV (10hrs)

Introduction, homomorphic transformation, frequency domain representation of homomorphic systems, inverse cepstum transformation, the complex cepstrum of speech, cepstral vocoder, processing applications of cepstral analysis.

Textbook:

1) L. R. Rabiner and R. W. Schafer**,** “Digital Processing of Speech Signals," Pearson Education (Asia) Pte. Ltd., 2004.

Reference Book:

1) D. O’Shaughnessy, “Speech Communications: Human and Machine,” Universities Press, 2001.
2) B. Gold and N. Morgan, “Speech and Audio Signal Processing: processing and perception of speech and music’ Pearson Education, 2003.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Explain the speech production and perception mechanism	3	2	1	0	1	1	0	0	0	0	0	0	3	0	0
CO2. Characterize and analyze speech signals in Time domain	3	3	2	0	1	1	0	0	0	0	0	0	3	0	0
CO3. Characterize and analyze speech signals in Frequency domain	3	2	1	0	1	1	0	0	0	0	0	0	3	0	0
CO4. Analyze speech signal using homomorphic transformation and LPC	3	3	1	0	1	1	0	0	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	**3**	**2.5**	**1.25**	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**0**

Course Title: Advanced Control Systems			Course Code: UEC844E
Credits: 03	**L-T-P: 3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours: 40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives: The course is intended to provide the knowledge about

1. Fundamentals of state variable design and analysis.
2. Fundamentals of state space analysis and state transition matrix.
3. Pole placement techniques and various controllers and compensators.
4. Behavior of non-linear systems and examination of stability criteria.

Course Outcomes:

A student who successfully completes this course should be able to

1. Comprehend the fundamentals of state variable design and analysis.
2. Solve the state equations and state transition matrix.
3. Describe the pole placement techniques and also design and analyse various controllers and compensators.
4. Analyse the behaviour of non-linear systems and examine the stability criteria of a given control system using various techniques.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hrs)

State Variable Analysis and Design- Introduction, state space representation using physical variable, phase variable and canonical variables.
Derivation of Transfer Function from State Model- Diagonalization, Eigen values, Eigen vectors, generalized Eigen vectors.

Unit II (10 Hrs)

State Space Analysis- Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Clay Hamilton method, concept of controllability and observability methods.

Unit III (10 Hrs)

Pole Placement Techniques- Stability improvements by state feedback, necessary and sufficient condition for arbitrary pole placement, state regulator design and design of state observer.
Controllers- Introduction and design of Proportional (P), Integral (I), Differential (D), PI, PD and PID.
Compensators- Introduction, lead, lag and lag-lead compensators.

Unit IV (10 Hrs)

Non-Linear Systems- Introduction, behavior of non-linear systems, common physical non linearity- saturation, friction, backlash, dead zone, relay, multivariable non-linearity. Phase plane method, singular points, stability of non-linear systems, limit cycles, construction of phase trajectories.

Liapunov Stability Criteria – Liapunov function, direct method of Liapunov and the linear system, Hurwitz criterion and Liapunov's direct method, construction of Liapunov functions for non-linear system by Krasvskii's method.

Textbook:

1) M. Gopal, "Digital control and state variable methods", 4th edition, THM, 2012.

Reference Books:

1) J. Nagarath, M. Gopal, "Control system engineering", 5th edition, New age international Ltd., 2007.
2) Nagoor Kani, "Advanced control theory", 2nd edition, RBA publications.
3) Katsuhiko Ogata, "State space analysis of control systems", 5th edition, Prentice Hall Inc., 2000.
4) Benjamin C Kuo , Farid Golnaraghi, "Automatic control systems", 8th edition, John Wiley and Sons,2003.
5) R V Parvatikar, 'Modern control theory', Prism books Pvt. Ltd., 2015.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

k) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:

m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1. Comprehend the fundamentals of state variable design and analysis.	3	3	2	3	1	0	0	0	0	0	1	1	3	0	0
CO2. Solve the state equations and state transition matrix.	3	3	2	2	1	0	0	0	0	0	1	1	3	0	0
CO3. Describe the pole placement techniques and also design and analyse various controllers and compensators.	3	3	1	1	1	0	0	0	0	0	1	1	3	0	0
CO4. Analyse the behaviour of non-linear systems and examine the stability criteria of a given control system using various techniques.	3	3	1	1	1	0	0	0	0	0	1	1	3	0	0
Course Contribution to POs and PSOs	**3**	**3**	**1.5**	**1.75**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**3**	**0**	**0**

Course Title: Wireless Sensor Network			Course Code: UEC845E
Credits: 03	**L-T-P: 3-0-0**	**Contact Hours / Week:03**	**Total Teaching Hours:40**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**

Department: Electronics and Communication Engineering.
Designation: Elective

Course Objectives:

(1) Networked wireless sensor devices, applications and network deployment.
(2) Concepts and issues of sensor node localization and synchronization.
(3) Wireless characteristics and MAC protocols.
(4) The principles of data transmission, clustering algorithm, different routing protocols and reliability.

Course Outcomes:

A student who successfully completes this course should be able to

(1) Familiar with the principle of sensor nodes, network deployment and architectures.
(2) Identify the issues of wireless sensor networks and propose the solution for conservation of sensor node energy.
(3) Analyze or compare the performance of different routing and MAC protocols.
(4) Compare the performance of various routing protocols of WSN.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hours)

Introduction: the vision, networked wireless sensor devices, applications, key design challenges. Network deployment: Structured versus randomized deployment, network topology, connectivity using power control, coverage metrics, and mobile deployment.

Unit II (10 Hours)

Routing: Metric-based approaches, routing with diversity, multi-path routing, lifetime-maximizing energy-aware routing techniques, geographic routing, routing to mobile sinks. Data-centric networking: Data-centric routing, data-gathering with compression, querying, data-centric storage and retrieval, the database perspective on sensor networks. Reliability and congestion control: Basic mechanisms and tunable parameters, reliability guarantees, congestion control, real-time scheduling.

Unit III (10 Hours)

Wireless characteristics: Basics, wireless link quality, radio energy considerations, SINR capture model for interference. Medium-access and sleep scheduling: Traditional MAC protocols, energy efficiency in MAC protocols, asynchronous sleep techniques, sleep-scheduled techniques, and contention-free protocols. Sleep-based topology control: constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms.

Unit IV (10 Hours)

Routing: Metric-based approaches, routing with diversity, multi-path routing, lifetime-maximizing energy-aware routing techniques, geographic routing, routing to mobile sinks.

Data-centric networking: Data-centric routing, data-gathering with compression, querying, data-centric storage and retrieval, the database perspective on sensor networks. Reliability and congestion control: Basic mechanisms and tunable parameters, reliability guarantees, congestion control, real-time scheduling.
Textbook: 1) Bhaskar Krismachari, “Networking Wireless Sensors”, Cambridge University Press **Reference Books:** 1) Kazem Sohraby, Daniel Minoli, Taieb Znati , “Wireless Sensor Networks: Technology, Protocols, and Applications”, Wiley Inter Science. 2) Edgar H. Callaway, Jr, “Wireless Sensor Networks: Architectures and Protocols”, 3) Auerbach Publications, CRC Press. 4) C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati, “Wireless Sensor Networks”, Springer.

POs satisfied by the course:

a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PSOs satisfied by the course:

m. Analyze and design systems for Electronics, Communication, and Signal Processing applications.
o. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Networked wireless sensor devices, applications and network deployment.	0	1	1	1	0	1	0	0	0	1	0	0	1	0	1
CO2. Concepts and issues of sensor node localization and synchronization.	1	1	0	0	0	0	1	0	1	1	0	0	1	0	1
CO3. Wireless characteristics and MAC protocols.	1	1	1	0	0	0	1	0	1	1	0	0	1	0	1
CO4. The principles of data transmission, clustering algorithm, different routing protocols and reliability.	1	1	1	0	0	0	1	0	1	1	0	0	1	0	1
Course Contribution to POs and PSOs	**0.75**	**1**	**0.75**	**0.25**	**0**	**0.25**	**0.75**	**0**	**0.75**	**1**	**0**	**0**	**1**	**0**	**1**

<table>
<tr><td colspan="3">Course Title: Machine Learning</td><td>Course Code: UEC846E</td></tr>
<tr><td>Credits: 03</td><td>L-T-P:3-0-0</td><td>Contact Hours / Week:3</td><td>Total Teaching Hours:</td></tr>
<tr><td colspan="2">CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
</table>

Department: Electronics and Communication Engineering.
Designation: Core / Elective / Open Elective

Course Objectives:

1. Appreciate the underlying mathematical relationships of learning models from data
2. Understand a wide variety of machine learning algorithms
3. Read and comprehend state-of-the-art approaches to deep learning from current research articles and identify a real-world problem
4. Understand how to evaluate models generated from data

Course Outcomes:

A student who successfully completes this course should be able to

1. Understand Supervised and Unsupervised learning techniques
2. Analyze the state of art techniques applied in deep learning research
3. Develop machine learning models for the problem identified
4. Evaluate the different deep learning models used for different applications

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10hrs)

Introduction: Basic definitions, Machine learning: what and why? Supervised learning, Unsupervised learning.
Probability- A brief review of probability theory.
Linear Models for Regression: Linear Basis Function Models, Bayesian Linear Regression, TheEvidence Approximation.

Unit II (10hrs**)**

Linear Models for Classification - Discriminant Functions, Probabilistic Generative Models, Probabilistic Discriminative Models, Bayesian Logistic Regression.
Generative models for discrete data: Introduction, Bayesian concept learning, The beta-binomial model, The Dirichlet-multinomial model, Naive Bayes classifiers.

Unit III (10hrs)

Neural Networks: Feed-forward Network Functions, Network Training, Error Back propagation, The Hessian Matrix, Regularization in Neural Networks, Bayesian Neural Networks.
Kernel Methods: Dual Representations, Constructing Kernels, Gaussian Processes.
Sparse Kernel Machines: Maximum Margin Classifiers, Relevance Vector Machines

Unit IV (10hrs)

Deep learning: Introduction, Deep generative models, Deep neural networks, Applications of deep Networks .
Convolutional Networks: The Convolution Operation, Motivation, Pooling, Variants of the BasicConvolution Function, Data, Efficient Convolution Algorithms.

Textbooks:

1. Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006
2. Kevin Murphy, “Machine Learning - a Probabilistic Perspective”, MIT Press, 2012.

Reference Books:

1. Joachims, “Learning to Classify Text using Support Vector Machines”, Kluwer, 2002
2. Ian Goodfellow and YoshuaBengio and Aaron Courville, “Deep Learning”, An MIT Press book.

E-Resources:

1. Introduction to Machine Learning (IIT Madras) https://nptel.ac.in/courses/106106139/
2. Introduction to Machine Learning (IIT Kharagpur) https://nptel.ac.in/courses/106105152/

POs satisfied by the course:

a. Engineering Knowledge: Apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

b. Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

c. Design/ Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

e. Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

j. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clearinstructions.

l. Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

PSOs satisfied by the course:

m. The ability to understand, analyse and demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data engineering in terms of real world problems to meet the challenges of the future.

n. The ability to develop computational knowledge and project development skills using innovative tools and techniques to solve problems in the areas related to Deep Learning, Machine learning, Artificial Intelligence.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**O**
CO1. Understand Supervised and Unsupervised learning techniques	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO2. Analyze the state of art techniques applied in deep learning research	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO3. Develop machine learning models for the problem identified	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
CO4. Evaluate the different deep learning models used for different applications. Apply knowledge of Kernel Methods and Sparse Kernel Machine.	3	3	3	0	2	0	0	0	0	2	0	2	2	2	0
Course Contribution to POs and PSOs	**3**	**3**	**3**	**0**	**2**	**0**	**0**	**0**	**0**	**2**	**0**	**2**	**2**	**2**	**0**

Course Title: Optical Fiber Communication		Course Code: UEC847E
Credits: 3 (3-0-0)	**Teaching Hours: 40 Hrs (10 Hrs/Unit)**	**Contact Hours: 3 Hrs/Week**
CIE Marks: 50	**SEE Marks: 50**	**Total Marks: 100**

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

This course will enable students to learn:

5. The basic principle of optical fiber communication with different modes of light propagation, the transmission characteristics and losses in optical fiber.
6. The optical sources and their characteristics, fiber connectors and different splicing techniques
7. The optical detectors and their characteristics, receiver operation and configuration
8. Various techniques for coherent transmission and system performance factors in optical Communication system.

Course Outcomes:

A student who successfully completes this course should be able to

5. Distinguish between the various modes of operation of optical fibers and identify the various causes for signal degradation
6. Categorize the types of sources of light on basis of physical construction and principle of operation
7. Classify the optical detectors on the basis of ability to efficiently detect
8. Generalize the optical fiber system performance for shorter/longer distance transmission

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (10 hours)

Overview of optical fiber communication: Optical Spectral Bands, Basic Principles, Fiber Modes and Configuration, Step-index and Graded index structures, Fiber Materials, Fiber Fabrication.
Signal degradation in optical fibers: Attenuation, Signal Distortion in Optical Waveguides, Characteristics of Single Mode Fibers.

Unit II (10 hours)

Optical sources: Characteristics of Light Sources for Communication, LED and LASER diode sources. **Power launching and coupling:** Source to Fiber Power Launching, Lensing Schemes for Coupling Improvement, Fiber-to-Fiber joints, LED Coupling to Single Mode Fibers, Fiber Splicing, Optical Fiber Connectors.

Unit III (10 hours)

Photo detectors: Physical Principles of Photo Diodes, PIN Photodiode, Avalanche Photo Diode
Optical receiver operation: Fundamental Receiver Operation, Digital Receiver Performance Calculation, Analog Receivers.

Unit IV (10 hours)

Digital links: Point-to-Point Links, Power Penalties. **Analog Links:** Overview of Analog Links, Carrier – to-Noise Ratio, Multichannel Transmission Techniques, RF over Fiber, Radio –over –Fiber Links
Textbooks: 1) Gerd Keiser, "Optical Fiber Communications”, MGH, 4th edition, 2008 2) John M. Senior, "Optical Fiber Communications", Pearsont, 2nd edition, 2006

POs satisfied by the course

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems

(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

(c) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations

(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PSOs satisfied by the course

m. Analyze and design systems for Electronics, Communication, and Signal Processing Applications

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1:Distinguish between the various modes of operation of optical fibers and identify the various causes for signal degradation	3	3	2	2	1	1	1	0	0	0	0	0	3	0	0
CO2: Categorizes the types of sources of light on basis of physical construction and principle of operation	3	2	2	2	1	1	1	0	0	0	0	0	3	0	0
CO3: Classify the optical detectors on the basis of ability to efficiently detect	3	3	2	2	1	1	1	0	0	0	0	0	3	0	0
CO4: Generalize the optical fiber system performance for shorter/longer distance transmission	3	3	3	2	2	1	2	0	0	0	0	0	3	0	0
Course Contribution to POs and PSOs	3	2.75	2.5	2	1.25	1	1.25	0	0	0	0	0	3	0	0

Course Title: Technical Seminar			Course Code: UEC831S
Credits: 1	**L-T-P:0-0-2**	**Contact Hours / Week:2**	**Total Teaching Hours: 13**
CIE Marks: 50		**SEE Marks: 50**	**Total Marks: 100**
Department: Electronics and Communication Engineering. **Designation: Core**			
Course Objectives: 1. To develop skills in doing literature survey, technical presentation and report writing 2. To enable seminar topic identification and execution of preliminary works			
Course Outcomes: A student who successfully completes this course should be able to 1. Acquire the basic skills for performing literature survey 2. Identify and analyze a current topic of professional interest 3. Provide better communication skills by preparing slides and presenting before the audience 4. Prepare the report			
The topics that enable to meet the above objectives and course outcomes are given below			
Course Plan Each student shall identify current topic relevance to his/her branch of Engineering, get approval of concern faculty, collect sufficient literature on the topic, study it thoroughly, prepare own report and present in the class individually.			

POs satisfied by the course:

(a) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
(b) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
(d) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
(e) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
(f) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
(g) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
(h) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

(i) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
(j) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
(l) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PSOs satisfied by the course:
(m) Analyze and design systems for Electronics, Communication, and Signal Processing applications.

(n) Use domain specific tools for design, analysis, synthesis, and Validation of VLSI and embedded systems.

(o) Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulation of computer networking and applications.

Course Articulation Matrix

Course Outcomes	POs												PSOs		
	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Acquire the basic skills for performing literature survey	1	2	0	1	2	1	0	0	1	0	0	0	1	1	1
CO2; Identify and analyze a current topic of professional interest	2	3	0	1	0	1	0	0	0	0	0	1	1	1	1
CO3: Provide better communication skills by preparing slides and presenting before the audience	0	0	0	0	2	0	0	1	1	3	0	0	1	1	1
CO4; Prepare the report	1	1	0	1	2	0	0	0	2	3	0	1	1	1	1
Course Contribution to POs and PSOs	1	1.5	0	0.75	1.5	0.5	0	0.25	1	1.5	0	0.5	1	1	1

Rubrics for Evaluation:

POs	Criteria	Poor	Fair	Good	Outstanding
a, b, d, h, l	Understand problems and select topic from Scopus indexed journal/transaction papers	Obsolete, Irrelevant, Out of scope	Old but relevant to the subject, Significance of the topic is not justified properly	Relevant and latest topic, Significance of the topic is justified properly, No research scope	Relevant and latest topic, Significance of the topic is justified properly, It has research scope and chance for doing project
f, g, h	Societal/ Environmental/ Ethical relevance of the topic	No Societal/ Environmental/Ethical relevance	Socially relevant but no Environmental/ Ethical relevance	Socially and Environmentally relevant but not Ethical	Socially and Environmentally relevant and also Ethical
a, b, d, e, i, l	Ability to collect required number of back ground materials	Information is gathered from a single source	Information is gathered from 2 number of sources	Information is gathered from a limited number of sources	Information gathered from multiple and research- based sources
a, b, d, e, i, l	Ability to select papers with latest technical knowledge and tools	Select papers published before 8 years	Select papers published before 5 years	Select papers published within 2 to 5 years	Select recent papers. (published within two years) with latest techniques
e, h, j	Preparation of slides	Content not clear and insufficient, Has irrelevant contents unable to convey the idea, No graphics used	Has more text than bullet points, No uniformity across slides, Limited use of Graphics	Content relevant but not precise, Has uniformity across slides	Precise and relevant contents, Able to convey the idea clearly, Used graphics wherever necessary
j	Presentation	Unable to convey the idea and poor Communication skills. Hard to follow	Good communication skills but idea not conveyed properly. No proper sequencing of contents	Idea conveyed properly, good communication skills but poor nonverbal communication skill, Has good logical sequencing of presentation	Idea conveyed properly and has good non-verbal and verbal communication skills, Has good logical sequencing of presentation.
a, b, d	Knowledge on the topic	Not able to answer any of the questions, Subject knowledge not adequate	Answered a few questions, Subject knowledge is not adequate	Answered most of the questions, Failed to elaborate some f the concepts	Answered all questions with elaboration, Has excellent understanding of the topic
e, j	Report	Copied work and a lot of spelling mistakes, Copied from slides, No modern tool used	Own work, alignments are not proper, Content not sufficient, Have less mistakes, Conventional tools are used.	Own work, Alignment is Proper, Proper use of figures and tables, Conventional tools with graphs/plots/charts are used	Own work with no mistakes, Alignments are Proper, Proper use of figures and Tables, Modern tools used

Evaluation Sheet:

Department of Electronics and Communication Engineering

Name of the Student:

USN:

Sl. No.	Criteria	Poor	Fair	Good	Outstanding	Score
1	Understand problems and select topic from Scopus indexed journal/transaction papers					
		(1 Mark)	**(2 Marks)**	**(4 Marks)**	**(6 Marks)**	
2	Societal/ Environmental/ Ethical relevance of the topic					
		(1 Mark)	**(2 Marks)**	**(3 Marks)**	**(4 Marks)**	
3	Ability to collect required number of back ground materials					
		(1 Mark)	**(2 Marks)**	**(4 Marks)**	**(6 Marks)**	
4	Ability to select papers with latest Technical knowledge and tools					
		(1 Mark)	**(2 Marks)**	**(4 Marks)**	**(6 Marks)**	
5	Preparation of slides					
		(4 Marks)	**(6 Marks)**	**(8 Marks)**	**(10 Marks)**	
6	Presentation					
		(15 Marks)	**(20 Marks)**	**(25 Marks)**	**(30 Marks)**	
7	Knowledge on the topic					
		(3 Marks)	**(6 Marks)**	**(7 Marks)**	**(8 Marks)**	
8	Report					
		(15 Marks)	**(20 Marks)**	**(25 Marks)**	**(30 Marks)**	
					Total Marks	

BASAVESHEAR ENGINEERING COLLEGE (A), BAGALKOT
DEPARTMENT OF ELETRONICS AND COMMUNICATION ENGINEERING

Academic year: xxxx-xx **Class:**
Date: **Division:**

Seminar Approval Form

USN	Roll No.	Name of the Student	Signature of student

Seminar Title with a very small description (By the student**):**

Guide Name: ______________________________

Guide Suggestion (if any):

Guide **Seminar Coordinator** **HOD**

Scheme of Teaching & Evaluation and detailed Syllabus for B.E Electrical and Electronics Engineering for batch admitted in 2020-21

(based on Joint Board Meeting held on 04.06.2018 and 09-05-2020)

Semester-3 CAY 2021-22 (175 Credits 2020-21 admitted batch)

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UMA335C	Computational Methods for Electrical Science	3	3	0	0	50	50	100
02	UEE351C	Analog and Digital Electronics	4	4	0	0	50	50	100
03	UEE352C	Network Analysis	4	3	2	0	50	50	100
04	UEE353C	Electrical and Electronic Measurements	4	4	0	0	50	50	100
05	UEE354C	Transformers and Induction Machines	4	4	0	0	50	50	100
06	UEE355L	Transformers and Induction Machines Laboratory	1	0	0	2	50	50	100
07	UEE356L	Electrical and Electronic Measurements Laboratory	1	0	0	2	50	50	100
08	UEE357L	Network Analysis Laboratory	1	0	0	2	50	50	100
09	UMA330M	Bridge Course Mathematics-I*	0	3	0	0	50	50	100
10	UBT133M	Environmental Studies**	0	2	0	0	50	50	100
Total			22	23	02	06	500	500	1100

*Bridge Course Mathematics-I	:	is a mandatory subject only for students admitted to 3rd Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.
**Environmental Studies	:	is amandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class / Rank.

Legend for Scheme	L	Lecturer	T	Tutorial	P	Practical	M	Mandatory
Legend in Subject	C	Core	E	Elective	C	Credits		

Question paper pattern for Theory SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than 4 sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit

Laboratory Assessments for SEE:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

ANALOG AND DIGITAL ELECTRONICS	
Subject Code: UEE351C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes

At the end of this course,

1. Student shall be able to analyze and explain different types of clipping, clamping and full wave rectifier circuits, and drive expressions for efficiency and ripple factors.
2. Students shall be able to explain different types of biasing circuits, single stage and multistage amplifier, analyze hybrid model and derive h - Parameters.
3. Student shall be able to explain JFET & MOSFET construction and characteristics and drive important relation
4. Student shall be able to simplify boolean algebra equations by using K. map and Quine Mcclusky and MEV techniques.
5. Student shall be able to design combinational circuits like Code converters adders, comparators, decoders, mux etc.
6. Student shall be able to design Flip-Flop, sequential circuit Registers and Counters.

Unit-I
Diode Circuits: L-08 Hrs Introduction, clipping circuits, Clipping at two independent levels, Clamping Circuits, Comparators, Full wave rectifier with C filter **Transistor Biasing** : L-**05 Hrs** Introduction, Operating point, DC load line, Bias stability, voltage divider bias, Derivation of stability factors, Bias compensation.
Unit-II
BJT Low Frequency Analysis : L-04 Hrs Introduction, two port devices. Hybrid model, transistor hybrid model. h - Parameters, Analysis of transistor amplifier circuit using h- parameters (CE amplifier only) **Multistage Amplifiers& Power Amplifier : L-04 Hrs** Introduction, Classification of Amplifiers, , Frequency response of R-C coupled amplifier, Class A large signals amplifier, Transformer coupled power amplifier, Class B (Push pull) amplifiers **Field Effect Transistor: L-05 Hrs** Introduction, construction & characteristics of JFETs, transfer characteristics, Important relationships, Depletion &Enhancement type MOSFETs
Unit-III
Number system & Combinational Logic : L-05 Hrs Number system Definition of combinational logic, canonical forms, Karnaugh maps - 3

and 4 variables, incompletely specified functions (Don't Care terms), simplifying minterm and maxterm equations **Minimization Techniques**: L-**05 Hrs** Quine- McClusky minimization technique, Quine- McClusky using Don't Care terms, Map entered variables **Analysis and Design of Combinational Logic** : L-**03 Hrs** Adders and subtractors, Cascading full adders, look ahead carry adders, binary comparators, Codes &Code converter.
Unit-IV
Analysis and Design of Combinational Logic : L-**05 Hrs** Decoders -BCD Decoders, encoders. Digital multiplexers, multiplexers as Boolean function generators. **Sequential Circuits 1 : L-04 Hrs** Basic bistable element, latches, SR latch, Application of SR latch, gated D latch, Master - Slave SR flip - flops (pulse-triggered flip-flops). Master slave JK flip -flop. Conversion of flip-flop from one type to another **Sequential Circuits 2** : L-**04 Hrs** Characteristic equations, registers, counters - binary ripple counters, synchronous binary counters, counter based on shift registers, design of synchronous counters, design of synchronous mod-6 counter using clocked D, T, JK and SR flip- flops

Reference Books:

1. Boylestead and Nashelesky, "Electronic Devices and Circuit theory" 11th edition, Pearson, 2013.
2. Jacob Millman and Christos C. Halkias, "Integrated Electronics", TMH, 2010.
3. Albert Malvino and David J Bates, "Electronic Principles", 8th edition, TMH, 2016.
4. David A. Bell, "Electronic Devices and Circuits", 5th edition, Oxford University Press, 2008.
5. S.Samuel, Mahadevaswamy and V. Nattarasu, "Electronic Circuits", 2nd edition, Sanguine Technical Publishers, 2012.
6. John M Yarbrough, "Digital Logic Application and Design", Cengage Learning India Pvt, Ltd, 2006.
7. Donald D Givone, "Digital Principles and Design", Tata McGraw Hill, 2003.

NETWORK ANALYSIS	
Subject Code: UEE352C	**Credits: 04**
Contact Hours: 05 (3L-2T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to **list** different types of electric circuits and active & passive elements and **recall** the statements of network theorems
2. Students shall be able to **demonstrate** source transformation, star-delta conversion, mesh & node analysis, network topology concepts and Laplace transforms in electric circuits
3. Students shall be able to **solve** eclectic circuits by applying network theorems and Laplace transforms
4. Students shall be able to **analyze** behavior of R, L & C elements in the electric circuits, their frequency response and determine resonance related parameters
5. Students shall be able to **determine** and **establish** the relation between the various parameters in electric circuits
6. Students shall be able to **build** expressions for mesh currents and node voltages by employing the network topology for solving large power system networks.

Lecture –Theory/Derivations 3 Credits (13x3=39 Hrs)	**Lecture Hours**	**Tutorials –Numerical 1 Credit (13x2=26 Hrs)**	**Tutorial Hours**
UNIT-I (10 Hrs)		**UNIT-I (06 Hrs)**	
Mesh and Node Analysis: Practical source transformation, network reduction using star delta transformation, Loop and node analysis with linearly dependent and independent source for DC and AC networks. Concept of super node and super mesh.	**05**	• Transformation of practical current and voltage sources to obtain single equivalent source • Determination of equivalent resistance using star-delta transformation • Assessment of current and voltage by mesh and node analysis for DC and AC circuits • Identification and solving Super node and Super mesh	**04**
Network Topology: Graph of network, concept of tree and co-tree, incidence matrix, Tie-set & cut-set schedules, Formulation of equilibrium	**05**	• Drawing the graphs, tree and co-tree of electrical circuits • Writing incidence matrix, tie	**02**

equations in matrix form, solution of resistive network, Principles of duality.		set and cut set matrix for circuits • Developing the equilibrium equation for mesh and node analysis in power system networks • Drawing the dual networks of electrical circuits and writing the integro-differential equations	
UNIT-II (10 Hrs)		**UNIT-II (08 Hrs)**	
Network Theorems-I: Superposition, Reciprocity, and Millman's theorems.	**05**	• Application of Superposition theorem to assess the response in electrical circuits in multisource networks • Applications of Reciprocity theorem • Assessment of equivalent voltage sources using Millman's theorem multisource networks	**04**
Network Theorems-II: Thevenin's, Norton's and Maximum power transfer theorems	**05**	• Obtaining Thevenin's and Norton's equivalent circuit of electrical networks • Analysis of networks with and without dependent ac and dc sources by Thevenin's and Norton's theorems • Analysis of ac and dc circuits for maximum power transfer to resistive and complex loads	**04**
UNIT-III (09 Hrs)		**UNIT-III (06 Hrs)**	
Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Bandwidth, Q-factor	**04**	• Identifying the resonant frequency for different circuits • Assessment of bandwidth of resonant circuit • Evaluation of Quality factor and significance • Identifying the circuit	**02**

		elements for resonance to occur at given frequency • Identification of cut off frequencies under different conditions of the circuit	
Transient behaviour and initial conditions: Behaviour of circuit element under switching condition and their representation, evaluation of initial and final conditions in RL, RC, and RLC circuits for AC and DC excitation	**05**	• Identification of initial and final conditions in the electrical circuits • Determination of transient behaviour of current and voltage in resistor, capacitor and inductor	**04**
UNIT-IV (10 Hrs)		**UNIT-IV (06 Hrs)**	
Laplace Transformations and Applications: Step, Ramp and Impulse functions and their Laplace transformation, Waveform synthesis and Laplace transformation initial value theorem and final value theorem, transformed network and their solution.	**05**	• Assessment of Laplace transform of Impulse, Step, Ramp, Sinusoidal signals and shifted functions • Application of initial value and final value theorem for the assessment of initial and final conditions of the circuit elements • Laplace Transform of network and time domain solution for RL, RC and RLC networks for ac and dc excitations	**04**
Two port network parameters: Short Circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets.	**05**	• Identification of various circuit parameters of the two port networks	**02**

Reference Books:

1. Hayt, Kemmerly and Durbin, “Engineering Circuit Analysis", 7th edition, TMH, 2007.
2. M.E.VanValkenburg, "Network analysis", 3rd Edition, PHI, 2002.
3. Roy Chowdhary, "Network and Systems", New age International Publications, 2nd Edition 2013.
4. Joseph Edminister & M. Nahvi, “Electric Circuits", 6th Edition, TMH, 2014.

Basaveshwar Engineering College (Autonomous)
[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]
Bagalkot-587103, Karnataka, India.
Department of Electrical and Electronics Engineering

ELECTRICAL AND ELECTRONICS MEASUREMENTS	
Subject Code: UEE353C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to **list & define** various parameters and features of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
2. Students shall be able to **explain** the operation of different types of electrical & electronic measuring instruments/devices, sensors, transducer and their related components.
3. Students shall be able to **experiment with or make use** of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
4. Students shall be able **compare and contrast** the features of different types of electrical & electronic measuring instruments/devices, sensors & transducers.
5. Students shall be able **evaluate/calculate** various parameters related to different types of electrical & electronic measuring instruments/devices, sensors & transducers.
6. Students shall be able **discuss/choose/test** different types of electrical & electronic measuring instruments/devices, sensors & transducers.

UNIT - I	
Measurement of Resistance, Inductance and Capacitance	**13**
Measurement of medium resistance: Wheatstone bridge - Sensitivity of WS bridge, Galvanometer current, Limitations; Measurement of low resistance: Different Methods of measuring low resistance, Kelvin's Double bridge; Earth Resistance Measurement – Fall of potential method; AC Bridges: General equilibrium equations of AC bridges; Measurement of Self Inductance – Types of bridges for measurement of self inductance, Maxwell's Inductance bridge, Maxwell's Inductance Capacitance Bridge, Anderson's bridge; Measurement of Capacitance: Types of bridges for measurement of capacitance, De Sauty's bridge, Schering Bridge; Errors in bridge circuits, Sources and Detectors.	
UNIT – II	
Measuring Instruments	**08**
Introduction; Types of Instruments, Errors in ammeters and Voltmeters; Permanent Magnet Moving Coil Instrument(PMMC) – Torque equation, Errors in PMMC instruments, Advantages and Disadvantages; Moving Iron Instruments(MI) – Torque equation, Classification of MI instruments, Errors in MI instruments, Advantages and Disadvantages; Electrodynamometer Type Instruments – Torque equation, Advantages and Disadvantages; Thermocouple Instruments – Principle of operation, Construction, Advantages and Disadvantages.	
Measurement of Power and Related Parameters	**05**
Dynamometer Type Wattmeter, Low Power Factor Wattmeter; Induction Type Single Phase Energy meter – Construction, Theory, Error adjustments, Calibration; Dynamometer Type Single Phase Power Factor meter – Construction and Operation; Weston Frequency meter.	
UNIT – III	
Electronic Instruments	**05**
Introduction; Principle of Electronic Energy meter; True RMS reading Voltmeter; Electronic Multimeter; Digital Voltmeter(DVM) ; Classification of DVM- Ramp type DVM,	
Extension of Instrument ranges Introduction; Shunts and Multipliers for AC Ammeter and Voltmeter respectively; Instrument Transformers: Advantages of Instrument Transformers, Ratios of Instrument Transformers, ratio Correction Factor, Burden on Instrument Transformer; Current Transformer(CT) – Theory of CT,	**08**

Errors in CT's, Design features if CT's; Potential Transformer(PT) – Differences between CT and PT, Theory of PT.	
UNIT - IV	
Sensors and transducers	
Definition and meaning of sensors and transducers, Difference between sensors and transducers, Classification (Types) of transducers: Mechanical/Electrical, Active/Passive, Analog/Digital, Modulating/Self balancing, Examples and advantages of electrical transducers. Resistive transducers: Potentiometers, RTD, Thermistor, Magneto-resistor (Principle, construction, working and application for each type). Capacitive transducers: Absolute and differential type, applications. Inductive transducers: Synchronous, Linear variable differential transformer (LVDT) ((Principle, construction, working and application). Self generating (Active) transducers: Piezoelectric, Pyroelectric, Thermocouple (Principle, construction, working and application for each type). Sensor/transducer based instrumentation system: Generalized block diagram representation, Typical examples related to electrical field.	**13**

Reference Books:

1. A. K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", 19th edition, Dhanpat Rai & Son's, New Delhi, 2011.
2. Cooper D and A. D. Helfrick, "Modern Electronic Instrumentation and Measurement Techniques", PHI.
3. Ian R. Sinclair, "Sensors and Transducers", 3rd Edition, Newnes Publication.
4. Golding & Widdies, Pitman, "Electrical Measurements and Measuring Instruments", 5th edition, D.R & Son's, New Delhi.
5. John P Beately, "Principles of Measurement Systems", 3rd edition, Pearson Education, 2006.
6. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.

Transformer and Induction Machines	
Subject Code: UEE354C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

UNIT-I	
Single Phase Transformer	**13**
Transformer construction and types, Principle of operation, emf equation, concept of ideal transformer, no-load and on-load analysis of ideal and practical transformer. Phasor diagrams, Development of equivalent circuit diagram, Calculation of equivalent circuit parameters by OC and SC tests, Transformer ratings and per unit(p.u.) scaling, Types of losses, efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test	
UNIT-II	
Three Phase Transformer	**07**
Types, three phase transformer connections: star-star, star-delta, delta-star, delta-delta, open delta. Choice of connections: bank of single phase transformers for three phase operations. Scott connection for three phase operations, scott connection for three phase to two phase conversation. Labeling of three phase transformer terminals, phase shift between primary and secondary and vector groups, Harmonics in transformer, Suppression of harmonics by tertiary winding	
Parallel operation of Transformer	**03**
Need for parallel operation, conditions to be satisfied for parallel operation and load sharing, Parallel operation of three phase transformer	
Auto Transformer	**03**
Construction, working principle, saving of copper, equivalent circuit and applications	
UNIT-III	
Three Phase Induction Machine	**13**
Construction, types-squirrel cage and slip ring motors. Principle of operation, production of rotating magnetic field, slip, rotor induced emf and it's frequency, power losses in an induction motor, equivalent circuit, torque equation, torque-slip characteristics-motoring generating and breaking modes, starting torque, maximum torque, effect of rotor resistances on torque slip -characteristics, power output, no load and blocked rotor test-evaluation of equivalent circuit parameters, circle diagram and obtain it's performance, double cage and deep bar motors, Cogging and crawling	
UNIT –IV	
Starting and Speed Control of Three Phase Induction Motors	**08**
Need for starter, DOL, star delta, autotransformer and rotor resistance starters, Calculation of starting torque Voltage control, frequency and rotor resistance control	
Single Phase Induction Motors	**05**
Construction, double field revolving theory and principle of operation, equivalent circuit starting of single phase motors: Resistance split phase, capacitor start and capacitor run motors, shaded pole motors	

Course Outcomes:

- Students will be able to explain the principle and construction of transformer and their phasor diagram.
- Students will be able to draw the equivalent circuit of transformer and calculate the parameters using OC and SC test.
- Students will be able to explain the necessary of autotransformer and parallel operation of transformer and their application.
- Students will be able to connect three phase transformer and compute different values.

- Students will be able to state how torque is produced and torque varies with speed for induction motor and compute various electrical and mechanical qualities by no-load and blocked rotor test and circle diagram.
- Students Shall be able to explain starting methods and speed control of single phase and three phase IM and select proper motors for different applications.

References Books:

1. I. J. Nagarath and D.P Kothari, "Electrical Machines" TMI Publications, 4th - Edition 2012.
2. Ashaq Hussian, "Electrical Machines", Dhanapatrai and Co. 2nd - Edition 2007.
3. P.S.Bhimra, "Electrical Machinery", Khanna Publishers, New Delhi, 7th - Edition 2008-2011.
4. Smarjit Ghosh "Electrical Machines" Pearson, 3rd - Edition 2011.
5. P.S.Bhimra, "Generalized Theory of Electrical Machine", Khanna Publishers, New Delhi, 5th - Edition 2008
6. Alexander Longsdorf, "Theory of alternating current", TMH-Publications 1999

Transformer and Induction Machines Laboratory	
Subject Code: UEE355L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Predetermination of the efficiency and other parameters.
2. Controlling methodologies of the machines.
3. Selection of machines for specific application.
4. To study specific characteristic of transformer and its operation.
5. To study specific characteristic of induction motor and its operation.
6. Starting and speed control of induction motor.

List of Experiments:

1. Open circuit and short circuit test on single phase transformer and pre-determination of efficiency, regulation for different loads at power factors. Calculations of equivalent circuit parameters of a given transformer.
2. Sumpner's test.
3. Parallel operation of two single phase transformers (dissimilar ratings)
4. Connections of three single phase transformers: star-star, star-delta, delta-delta and delta-star.
5. Scott Connection. To convert 3-phase to 2-phase supply
6. Load test on three phase induction motor and performance evaluation, (torque-speed, BHP-efficiency, slip BHP, etc).
7. No-load and blocked rotor test on three phase induction motor to calculate parameters of equivalent circuit diagram and performance evaluation.
8. No-load and blocked rotor test on three phase induction motor to draw the circle diagram and hence the performance evaluation of given motor.
9. Speed control of three phase slip ring induction motor by rotor resistance.
10. Load test on single phase induction motor and performance evaluation (torque-speed, BHP- efficiency, slip -BHP, etc)

Electrical and Electronics Measurement Laboratory	
Subject Code: UEE356L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:
1. Student shall be able to use measuring devices and sensors.
2. Student shall be able to analyze electrical circuits from the reading and results obtained from various circuits.
3. Student shall be able to interpret the analysis results obtained and drive inference for the given circuits/systems.

List of Experiments:
1. Measurement of low resistance using Kelvin's double bridge.
2. Measurements of inductance using Maxwell's L-C bridge and determination of Q factor.
3. Measurements of capacitance using De-sauty's bridge and determination of dissipation factor.
4. Adjustment and calibration of l-Φ Energy meter.
5. Measurement of power in a balanced 3-phase circuit using two wattmeter's for star and delta connected loads.
6. Evaluation of transfer characteristics of Resistance Temperature Detector (RTD) using RTD module.
7. Evaluation of transfer characteristics of Light Dependent Resistor (LDR) using LDR module.
8. Evaluation of transfer characteristics of Semiconductor Temperature Sensor using LM35 sensor module/unit.
9. Evaluation of transfer characteristics of Linear Variable Differential Transformer using LVDT module.

Network Analysis Laboratory	
Subject Code: UEE357L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Student shall be able to identify and use the voltage & current sources and other passive elements of electrical networks
2. Student shall be able to verify the electric network theorems and analyze the behavior of circuit elements
3. Student shall be able to interpret the analytical calculations with experiments results of the circuit analysis

List of Experiments:

4. Determination of equivalent resistance in complex electric circuits with star and delta conversions
5. Determination of Average value, rms value, Form factor, Peak factor of sinusoidal wave and square wave
6. Verification of source transformation and source shifting
7. Verification of Kirchhoff's voltage and Current law (AC and DC)
8. Verification of mesh analysis (With all possible combinations of Voltage and Current sources including a supermesh, AC and DC)
9. Verification of node analysis (With all possible combinations of Voltage and Current sources including a supernode, AC and DC)
10. Verification of super position theorem
11. Verification of reciprocity theorem
12. Verification of maximum power transfer theorem with both resistive and impedance loads
13. Verification of Thevenin's, Norton's and Milliman's theorem
14. Determination of frequency response for series resonance circuits
15. Determination of frequency response for parallel resonance circuits
16. Determination of transient response of current in RL and RC circuits with step voltage input
17. Determination of two port network parameters Short Circuit admittance, parameters, open circuit impedance parameters, transmission parameters and hybrid parameters

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BVVS

Department of Electrical and Electronics Engineering

Semester-4 CAY 2021-22 (175 Credits 2020-21 admitted batch)

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UMA435C	Statistical Methods for Electrical Science	3	3	0	0	50	50	100
02	UEE451C	Signals and Systems	4	3	2	0	50	50	100
03	UEE452C	Power Electronics	4	4	0	0	50	50	100
04	UEE453C	Operational Amplifiers and Linear IC's	4	4	0	0	50	50	100
05	UEE454C	DC Machines and Synchronous Machines	4	4	0	0	50	50	100
06	UEE456L	Power Electronics Laboratory	1	0	0	2	50	50	100
07	UEE457L	DC Machines and Synchronous Machines Laboratory	1	0	0	2	50	50	100
08	UEE458L	Linear IC's Laboratory	1	0	0	2	50	50	100
09	UMA430M	Bridge Course Mathematics-II*	0	3	0	0	50	50	100
10	UHS001N	Fundamentals of Quantitative Aptitude & Soft Skills	1	2	0	0	50	50	100
11	UHS226M	Constitution of India**	0	2	0	0	50	50	100
12	UHS488C	Saamskrutika Kannada***	1	2	0	0	50	50	50
		OR							
13	UHS489C	Balake Kannada***	1	2	0	0	50	50	50
Total			24	27	02	06	600	600	1150

*Bridge Course Mathematics –II	:	is a mandatory subject only for students admitted to 4th Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade /class. A PP/NP grade will be awarded for passing/not passing the subject.
**Constitution of India	:	is a mandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class /Rank.
***Saamskrutika Kannada ***Balake Kannada	:	Is for students who speak read and write kannada Is for non-kannada speaking reading and writing

Legend for Scheme	L	Lecturer	T	Tutorial	P	Practical	M	Mandatory
Legend in Subject code	C	Core	E	Elective	C	Credits		

Question paper pattern for Theory SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than 4 sub divisions.
3. Any five full questions are to be answered choosing at least one from each unit

Laboratory Assessments for SEE:

4. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
5. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
6. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

Signal and Systems	
Subject Code: UEE451C	Credits: 04
Contact Hours: 05 (3L-2T-0P)	Assessment: CIE 50 and SEE 50

Course Outcomes:

1. Students shall be able to classify different types of signals and systems.
2. Students shall be able to list and define different types of elementary signals and systems.
3. Students shall be able to derive the properties of signals and systems, convolution, Fourier series, Fourier transform and Z transform.
4. Students shall be able to solve convolution sum and integral, CTFS and DTFS.
5. Students shall be able to decide the stability of system in the Z domain for different types of systems.
6. Students shall be able to construct the continuous time and discrete time system using direct form-I and canonical form.

Lecture –Theory/Derivations 3 Credits (13x3=39 Hrs)	Lecture Hours	Tutorials –Numerical 1 Credit (13x2=26 Hrs)	Tutorial Hours
Unit -I (10 Hrs)		**Unit -I (07 Hrs)**	
Introduction: Definitions of signals and systems, classification of signals, basic operations on signals, Elementary signals, and systems viewed as interconnections of operations, properties of systems.	10	• Numerical on • Numerical on systems and properties of systems • Numerical on system viewed interconnection	07
Unit -II (10 Hrs)		**Unit -II (07Hrs)**	
Time-domain representation for LTI systems: Convolution, impulse response representation, properties impulse response representation, block diagram representations.	10	• Numerical on convolution of continuous and discrete time systems • Numerical on properties of systems • Numerical on block diagram representation on both continuous and discrete system	07
Unit -III (09 Hrs)		**Unit -III (07Hrs)**	

Fourier Analysis of periodic and aperiodic signals: Introduction, Properties of continuous-time Fourier series (excluding derivation of defining equations for CTFS), Fourier representation of discrete-time periodic signals, properties of discrete-time Fourier series (DTFS).	**09**	• Numerical on DTFT • Numerical on DTFS • Numerical on CTFS	**07**
Unit -IV (10 Hrs)		**Unit -IV (05 Hrs)**	
Z-Transforms: Introduction, Z transform, properties of ROC, properties of the Z - transform, inversion of Z -transform, Long division method, Partial fraction expansion method, Transfer function, causality and stability,	**10**	• Numerical on Z transform and properties of Z transform • Numerical on LTI system in Z transform	**05**

Reference Books:

1. Simon Haykin and Bary Vam Veen, "Signals and Systems," John Wiely and Sons, 2nd Edition 2014.
2. H P HSU, "Signals and Systems," Schaums Outline, TMH, 2nd Edition 2011.
3. Michel J Roberts, "Signals and Systems-Analysis of signals through linear systems" TMH, 2003.
4. Alan V Oppenheim, Alan S.Will sky and S.hamid Nawab, "Signals and Systems," Pearson Education, Indian Reprint, 2nd Edition 2013.

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B V V S
Department of Electrical and Electronics Engineering

Power Electronics	
Subject Code: UEE452C	Credits: 04
Contact Hours: 04 (4L-0T-0P)	Assessment: CIE 50 and SEE 50

Course Outcomes:
Students able to

1. Recall, list and define the various semiconductor switches employed in power electronics circuits
2. Students able to describe the operation and switching characteristics of switches and operation of various power converters.
3. Derive the expressions of performance parameters for various power converters connected to R and R L loads
4. Analyze power converter circuits and its behavior and resolve the output parameters connected to R and R-L loads.
5. Design various components for choppers, commutation circuits and snubber elements of switching elements
6. Assess the impact of source and load inductance on operation of power converter and summarize the impact in industrial application.

UNIT-I	
Introduction:	
Introduction to power electronics, block diagram of power electronic converter system, applications of power electronics. Types of power electronic circuits and their peripheral effects.	**02**
Power Transistors:	
Introduction to Power BJT's, MOSFETs and IGBT's – static characteristics, switching characteristics, switching limits, di/dt and dv/dt protection, cooling, heat sinks and snubber circuits.	**06**
Thyristors	
Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.	**05**
UNIT-II	
Controlled Rectifiers:	
Introduction. Classification of rectifiers, principle of phase controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half wave, semi converters and full converters with R, R-L, R-C and RLE load. Performance evaluation of Rectifier, Effects of Load and Source Inductances.	**13**
UNIT-III	
Commutation Techniques:	
Introduction. Natural commutation, forced commutation: self commutation, impulse commutation, resonant pulse commutation and complementary commutation.	**05**
DC –DC Converter	

Introduction. Principle Operation of dc-dc converter, Buck and Boost converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Derivation of duty cycle of buck and boost converter for continuous mode of operation, Introduction for discontinues mode of operations	**08**
UNIT-IV	
Inverters:	
Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configuration to operate with 120 and 180 degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation and Current source inverters.	**08**
AC Voltage Controllers: Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full wave AC voltage controllers with resistive and inductive loads.	**05**

Reference Books:

1. M.H.Rashid “Power Electronics”, 3rd - Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undeland, Robbins” Power Electronics” Wiley Edition 2003
3. P.S.Bimbra, “Power Electronics”**,** IV- edition, Khanna Publishers, 2009.
4. G.K. Dubey, S.R. Dorodla, A. Joshi and R.M.K. Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.
5. M.D. Singh and Khanchandani K.B., “Power Electronics**”,** 2nd - Edition Khanna Publisher, 2007.

Operational Amplifiers and Linear IC's	
Subject Code: UEE453C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes

At the end of this course,

1. Student should be able to explain the characteristics of Op-Amp.
2. Student should be distinguish the operational function of the amplifier.
3. Student should be able to explain about the AC amplifier.
4. Student should be able to define the frequency response of op-amps.
5. Student should be able to design the application of op-amp.
6. Student should be able to evaluate the various types of the filters.

Unit-I

Op-Amps: L-05 Hours

Block diagram and characteristics of 741 Op-amp, Op-amp as an inverting and non- inverting amplifier, voltage follower, adder, subtractor, integrator and differentiator.

Op-Amps as AC Amplifier: L -08 Hours

Capacitor coupled voltage follower, high Z_{in} capacitor coupled voltage follower, capacitor coupled non- inverting amplifier, high Zin capacitor coupled non - inverting amplifier, capacitor coupled inverting amplifier, setting the upper cut - off frequency, capacitor coupled difference amplifier and use of single polarity supply.

Unit-II

Op-Amps Frequency Response and Compensation: L-08 Hours

Op-amp circuit stability, frequency and phase response, frequency compensating methods, manufacture's recommended compensation, op-amp circuit band width, slew rate effects, stray capacitance effects, load capacitance effects, Z_{in} mod compensation and circuit stability precautions.

Signal Processing circuits: L-05 Hours

Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits.

Unit-III

Op-amp Nonlinear circuits: L-06 Hours

Op-amps in switching circuits, zero crossing detectors, inverting Schmitt trigger circuit, non inverting Schmitt circuit. Astable multivibrator and mono-stable multivibrator using 555 timer.

Signal Generator: L-07 Hours

Triangular/Rectangular wave generator, waveform generator design, phase shift oscillator, oscillator amplitude stabilization, Wein bridge oscillator, signal generators output controls.

Unit-IV

Active filters: L- 09 Hours
First and second order high pass and low pass filters, band stop and band pass filters.
D.C Voltage Regulators: L-04 Hours
Voltage regulators basics, voltage follower regulator, adjustable output regulator, LM217 and LM237 integrated circuit voltage regulators

References:

1. David A. Bell, "Operational Amplifier and Linear ICS", 3rd edition, Oxford, 2012.
2. Ramakanth A. Gayakwad, "Operational Amplifier and Linear ICS", 4th edition, PHI, 2016.
3. R.F. Coughlin & F.F. Driscoll, "Operational Amplifier and Linear ICS", 6th edition, PHI, 2015.
4. Bruce Carter and Ron Mancini, "OP AMPS for everyone", 4th edition, Elsevier, 2013.

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Dc Machines and Synchronous Machines	
Subject Code: UEE454C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Student shall be able to explain the principle operation construction and classification of both AC and DC machines
2. Students shall be able to explain the performance operation of both AC and DC machines
3. Students shall be able to identify the machines for different operations/applications by using operating characteristics of machines
4. Students shall be able to calculate different parameters like losses and efficiency by conducting different tests on different machines and gives the conclusion
5. Students shall be able to solve the numerical and compare the results
6. Students shall be able to select the machines for different field applications and identify the significance of parallel operation

UNIT - I	
DC Generator:	**08**
Constructional features, emf equation, types of excitation, types of dc generator, no load and load characteristics, armature reaction, calculation of demagnetizing and cross magnetizing AT/pole, compensating winding, commutation, inter poles, application of dc generators.	
DC Motors:	**05**
Principle of Operation, types, torque equation, characteristics and application of D.C. motors, starters.	
UNIT - II	
Speed control of DC Motor:	**05**
Flux and armature control, Ward Leonard method. Electrical braking of DC motors.	
Testing of D.C Motors:	**08**
Losses in DC. Machine, Efficiency, direct load test on DC machine, Swinburne’s test, Hopkinson’s test, retardation test, Field’s test on DC. Series motors.	
UNIT – III	
Synchronous Machines:	**13**
Construction of salient and non-salient pole synchronous Machines, Advantages of stationary armature, emf equation for generator, effect of distribution and chorded coils, effects of harmonics on emf generated of poly-phase armature windings, phasor diagram of a Synchronous generator with cylindrical rotor, calculation of voltage regulation by EMF, MMF, ZPF, and ASA methods. Phasor diagram and regulation of a salient pole synchronous generator, slip test.	
UNIT – IV	
Parallel Operations Of Generators:	**05**

Parallel operation and stability, operation on infinite bus, operating characteristics, power flow equations of Alternators.	
Synchronous Motors:	**08**
Principle of operation, methods of starting, phasor diagram, effect of changing excitation, two reaction model, V and inverted V curves of synchronous machines, hunting in synchronous machines, effect of damper windings, synchronous condensers.	

Reference Books:

1. I J Nagarath and DP Kothari, “Electrical machines”, 4th - Edition, TMH, New Delhi.
2. B . L .Thereeja Electrical technology val -II
3. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai Publications, 2nd Edition, 2014.
4. M. G. Say, Performance and design of AC machines, CBS publishers.
5. P.S. Bhimra, “Electrical machinery”, Khanna publishers. 7th Edition 2008.
6. Alexander Lngsdorf, “Theory of alternating current machines”, TMH, 2nd Edition 2008

Power Electronics Laboratory	
Subject Code: UEE456L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to explain the basic operation of various power semiconductor devices and passive components.
2. Students shall be able to apply power electronic circuits for different loads.
3. Students shall be able to demonstrate the ability to apply what they have learned theoretically in the field of Power electronics

List of Experiments:

1. Static characteristic of SCR
2. Static and Switching characteristic of IGBT and MOSFET.
3. Static characteristic of TRIAC.
4. Study of SCR firing circuit(R,RC, UJT).
5. Single Phase half wave controlled rectifier with R and RL load.
6. Single phase half controlled bridge rectifier with R and RL load.
7. Single phase fully controlled bridge rectifier with R and RL load.
8. Speed control of a separately excited D.C. motor using an IGBT an MOSFET chopper.
9. Study of SCR commutation circuit
10. Half wave and Full wave bridge Inverter for R and RL load

DC Machine and Synchronous Machines Laboratory	
Subject Code: UEE457L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to identify the related experiment and do the necessary connections for the defined experiment
2. Students shall be able to conduct necessary task on the machines (AC/DC) to note down the related data.
3. Students shall be able to calculate the necessary parameters for the data obtained from the experiments and analyze the related characteristics

List of Experiments:

1. OCC characteristics of D.C. Shunt generator.
2. Load characteristics of a D.C. generator.
3. Load test on a DC motor- determination of speed-torque and BHP-efficiency characteristics
4. Speed control of DC motor by armature voltage control and flux control.
5. Swinburne’s test.
6. Ward Leonard method of speed control of D.C. motor.
7. Hopkinson’s Test.
8. Fields test on series motors.
9. Voltage regulation of alternator by EMF, MMF, method.
10. Voltage regulation of alternator by ZPF method.
11. Synchronization of Alternator with infinite bus.
12. V and Inverted V curves of a synchronous motor

Linear Integrated Circuits Laboratory	
Subject Code: UEE458L	**Credits: 01**
Contact Hours: 02 (0L-0T-2P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

1. Students shall be able to design Op-Amp circuits and analyze simple applications of above circuits.
2. Students shall be able to design Filter circuits and understand the principles of timers and oscillators.
3. Students shall be able to design and analyze rectifier circuits.

List of Experiments:

1. Study of Op-Amp as

a. Inverting and non inverting amplifier

b. Integrator and differentiator.

2. Study of Op-Amp as

a. Voltage follower

b. Adder and substractor

3. Study of Op-Amp as zero crossing detector

4. Study of Op-Amp as Schmitt trigger

5. Study of Op-Amp as triangular and rectangular wave generator.

6. Design and testing of Op-Amp based RC phase shift oscillator.

7. Design and testing of Op-Amp based RC Wein bridge oscillator.

8. Study of rectifiers using Op-Amp.

9. Design and testing of filters of the first and second order using Op-Amp.

10. Study of Astable multivibrator using Op-Amp.

11. Study of Astable multivibrator using 555 timer

Basaveshwar Engineering College (Autonomous) Bagalkot

Department of Electrical and Electronics Engineering

Scheme of Teaching & Evaluation and detailed Syllabus

for B.E Electrical and Electronics Engineering for batch admitted in 2019-20

(based on Joint Board Meeting held on 04.06.2018 and 09-05-2020)

Semester-5 **CAY 2021-22 [175 credits. 2019-20 admitted batch]**

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UEE551C	Field Theory	3	2	2	0	50	50	100
02	UEE552C	Digital Signal Processing	3	2	2	0	50	50	100
03	UEE553C	Control Systems	3	2	2	0	50	50	100
04	UEE554C	Generation Transmission and Distribution	3	3	0	0	50	50	100
05	UEE556E	(Dept. Elective – 1) Testing and Commissioning of Electrical Equipment	3	3	0	0	50	50	100
06	UEE557E	(Dept. Elective – 2) Electrical Machine Design	3	3	0	0	50	50	100
07	UEE561L	Digital Signal Processing Laboratory	1	0	0	2	50	50	100
08	UEE562L	Control System Laboratory	1	0	0	2	50	50	100
09	UEE563L	Analog and Digital Laboratory	1	0	0	2	50	50	100
10	UHS002N	Advanced Quantitative Aptitude and Soft Skills	1	2	0	0	50	50	100
Total			22	16	8	6	500	500	1000

List of Elective Subjects

Electrical Machine Design	Electrical Engineering Materials
Testing and Commissioning of Electrical Equipment	Micro Electro Mechanical Systems
Advanced Power Electronics	Reactive Power management
Fundamentals of Solar Thermal ECS	

Question paper pattern for Theory SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than 4 subdivisions.
3. Any five full questions are to be answered choosing at least one from eachunit

Laboratory Assessments for SEE:

1. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
2. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
3. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

Basaveshwar Engineering College (Autonomous)

[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]

Bagalkot-587103, Karnataka, India.

BVVS

Department of Electrical and Electronics Engineering

FIELD THEORY

Subject Code : UEE551C	**SEE Marks : 100**
Credits : 03 (2-2-0)	**Exam Duration: 03 Hours**

Unit-I

01 Review of Vector Analysis: L-07 Hours, T-06 Hours

Introduction to Scalars and vectors

02 Coulomb's Law and Electric Field Intensity:

Experimental law of Coulomb, electric field intensity, field due to continuous volume charge distribution, field of a line charge, field of a sheet charge.

03 Electric Flux Density, Gauss' Law and Divergence:

Electric Flux Density, Gauss' Law, Divergence. Maxwell's first equation (Electrostatics), vector operator V and the divergence theorem.

Unit – II

04 Energy and Potential: L-06 Hours, T-07 Hours

Energy expended in moving a point charge in an electric filed, the line integral, definition of potential difference and potential. The potential field of a point charge and system of charges, potential gradient, the dipole.

05 Conductors, Dielectrics and Capacitance:

Current and current density, Continuity of current, metallic conductors, Conductor properties and Boundary conditions, capacitance.

Unit – III

06 The Steady Magnetic Field: L-07 Hours, T-06 Hours

Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density.

07 Magnetic Forces:

Force on a moving charge and differential current element, Force between differential current elements, Force and torque on a closed circuit.

Unit – IV

08 Materials and Inductance: L-06 Hours, T-07 Hours

The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit.

09 Time Varying Fields and Maxwell's Equations:

Faraday's law, displacement current, Maxwell's equation in point and Integral form.

Course outcomes: At the end of the course,

- Students should be able to state concept of gradient, divergence and curl of a vector in various systems
- Students should be able to illustrate the Gauss' law, potential energy, and divergence in different applications
- Students should be able to apply different coordinate systems for electromagnetic field computations
- Students should be able to analyze different coordinate systems in electromagnetic field applications

- Students should be able to compare and contrast electric field & magnetic field in different applications
- Students should be able to combine and revise various properties of electromagnetic field applications by multiple methods.

TEXT BOOKS:

01 William H Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - edition, Tata McGraw Hill, 2012.

REFERENCE BOOKS:

01 John Karuss and Daniel A Fleisch, "Electromagnetics with Applications" V-edition McGraw-Hill,1999.

02 Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems," II- edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.

03 David K Cheng, "Field and Wave Electromagnetics", II- edition, Pearson Education Asia, - 1989, Indian Reprint – 2015.

04 Matthew N.O. Sadiku, Elements of Electromagnetics, 6th -Edition, Oxford University Press, 2000.

05 Dr. D. Ganesh Rao, " Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

QUESTION PAPER PATERN FOR SEE:

01 Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.

02 Each Question should not have more than four sub divisions.

03 Any Five Full questions are to be answered choosing at least one from each unit.

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BVVS

Department of Electrical and Electronics Engineering

DIGITAL SIGNAL PROCESSING

Subject Code:	**UEE552C**	**SEE Marks:**	**100**
Credits:	**3 (2-1-0) (Theory 26 hrs, Tutorial 26 hrs)**	**Exam Duration:**	**03 Hrs**

	Lecture-Theory 2 Credits (13 x 2=26 Hrs)	No. of Lecture Hours	Tutorial-Numerical 1 Credit (13 x 2=26 Hrs)	No. of Tutorial Hours
	UNIT - I (8 Hrs)		**UNIT - I (5 Hrs)**	
01	**Discrete Fourier Transform** Introduction, Definition, and derivation of DFT and IDFT , Properties-linearity, shift, Symmetry etc., circular convolution, periodic convolution, use of tabular arrays, circular arrays, Stock Ham's methods, Linear convolution-two finite duration sequences, One finite and one infinite duration –overlap add method	**08**	• Verification of DFT-IDFT properties through numerical, • Assessment of output of a system in frequency domain using different properties of DFT-IDFT • To assess the output of a system for long duration input sequences	**05**
	UNIT II (8 Hrs)		**UNIT II (5 Hrs)**	
02	**Fast Fourier Transform Algorithms** Introduction, decimation in time algorithm (DIT-FFT, DIT-IFFT), First decomposition, Continuation of decomposition, number of computations, number of multiplications, Computational efficiency,	**04**	• Developing N-point DIT-FFT, DIT-IFFT algorithms, • Drawing the 8-point FFT signal flow graphs • Comparing number of calculations for direct DFT and FFT algorithms	**03**
03	**Design of FIR Digital filters** Introduction, Windowing, rectangular, Hamming window,	**04**	• Designing FIR filters for given specifications • Verification of filter design • Sketching of Filter output	**02**
	UNIT III (8 Hrs)		**UNIT III (5 Hrs)**	
04	**Design of IIR Digital filters** Introduction, all pole analog filters-Butterworth and Chebyshev, Design of analog filters, Bilinear Transformation, Design of digital Butterworth and Chebyshev filters, Frequency transformations	**06**	• Designing IIR filters for given specifications • Verification of filter design • Sketching of Filter output • Design of analog filter and Conversion of Analog filter to digital filters	**07**
	UNIT IV (8 Hrs)		**UNIT IV (5 Hrs)**	

05	**Realization of Digital Systems** Introduction, block diagrams and SFG's, Realization of IIR systems- direct form, cascade form, Parallel form, Realization of FIR systems- direct form, cascade form, Linear phase realizations	05	• Obtaining difference equation of IIR and FIR filter. • Realizing the systems in direct form, cascade form, parallel form • Realization of linear phase FIR filters	05
06	**DSP Processors TMS320** Architecture and electrical applications (block diagram approach)	03		

Course Outcomes:

At the end of the course the student should be able to:

1 Recall DFT, IDFT, and basic properties of DSP

2 Classify the FFT algorithms, filters, and design methods

3 Derive DFT properties, FFT algorithms, filter equations, and convolution output

4 Assess the output of system by linear & circular convolution, Stockhams method, and FFT algorithms

5 Implement/realize the discrete LTI system in direct form I & II, cascade and parallel forms

6 Design a filter for the given specifications.

Reference Books :

01 Digital Signal Processing Principle,algorithms and applications 4th edition by Proakis, Pearson Education 2012

02 Digital Signal Processing by Sanjith K. Mithra Edition, 2013

03 Digital Signal Processing by Oppenheim, Pearson Education / PHI, 2015

04 Digital Signal Processing by Salivatanam, A Vallavaraj, Gnanapriya , TMH 2011

05 Digital Signal Processing by Ifeachor Emmauel, Pearson Education, 2nd edition 2010

Question Paper Pattern for SEE:

1. Total of Eight Questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each Question should not have more than four sub divisions
3. Any Five Full questions are to be answered choosing at least one from each unit.

Control System

Subject Code: UEE553C **Credits: 03**
Contact Hours: 03 (2L - 2T - 0P) **Assessment: CIE 50 and SEE 50**

Unit-I

01 Introduction and Transfer function of Systems: **L- 06 Hrs**

Classification of control systems, open loop and closed loop systems, effects of feedback, Mathematical models of physical systems; definition of transfer function, Mechanical systems, Translational systems, Rotational systems, Electrical systems, Analogous systems.

02 Block Diagrams and Signal Flow Graphs: **L- 05Hrs**
Block diagrams (BD), Reduction of BD, Signal Flow graphs (SFG), Drawing block diagram and SFG of simple networks Mason's gain formula, Converting BD into SFG.

Unit-II

03 Time Response of Feed Back Control Systems: **L-06 Hrs**
Standard test signals, Unit step response of First and second order systems, time response specifications, and Time response specifications of second order systems, steady state errors and error constants.

04 Stability Analysis: **L- 03 Hrs**
Concepts of stability, Necessary conditions for Stability, Routh's stability criterion.

Unit-III

05 Root–Locus Techniques **L-03 Hrs**
Root locus concepts, Construction of root loci.

06 Introduction to State Variable Analysis: **L- 06 Hrs**
Concepts of state, state variables and state model, state models for linear continuous time systems, conversion of state model to transfer function and transfer function to state model, solution of state equations,

Unit-IV

07 Frequency Domain Analysis: **L- 07 Hrs**

Introduction, frequency domain specifications, correlation between time and frequency response. Method to draw bode plot, phase margin, gain margin, stability considerations,

08 Nyquist stability criterion. **L- 03 Hrs**

References:

1. 'Norman S Nise' "Control System Engineering " McGraw Hill,
2. Benjamin C Kuo, "Automatic Control System", VII- Edition, PHI, 2010.

3. Richard C. Dorf Robert H Bishop "Modern Control Systems ",VII- Edition, Addison Wesley.

Course outcomes:

After completion of the course, the students shall be able to:

1. Illustrate the control System concept and its types.
2. Analyze the transfer function modeling of systems and its parameters
3. Explain the concept of time response and order of the system.
4. State the various concept of stability.
5. Compare and contrast the various frequency response plots.
6. Apply the State space modeling and solution of state equations

Generation Transmission and Distribution

Subject Code:	**UEE554E**	**Credits:**	**03**
Contact Hours:	**03 (3L - 0T - 0P)**	**Assessment:**	**CIE 50 and SEE 50**

Unit-I

Electrical Power Generation: **03 Hrs**

Hydro Power Generation: Site selection, Line diagram representation, Classification, Merits and Demerits. Thermal Power Generation: Site selection, Line diagram representation, Classification, Merits and Demerits. Nuclear Power Generation: Site selection, Line diagram representation, Classification, Merits and Demerits.

Basic Aspects of Power Generation: **07 Hrs**

Introduction, Load curve and load duration curve. Terms commonly used in system operation: Load factor, Diversity factor, Demand factor, plant capacity factor, plant utilization factor, Installed capacity, reserve capacity, Cold reserve, hot reserve, Spinning reserve, firm power. Effect of diversity factor on cost of generation. Interconnection of power stations, transfer of power. Economic Loading of interconnected stations.

Unit-II

AC Transmission Systems: **08 Hrs**

Typical AC transmission system, Advantages of high voltage transmission. Comparison of conductor material in overhead lines: 3 phase 3 wire system, 3 phase 4 wire system. Components of overhead transmission line: Conductors, Line supports, Insulators – Types, Potential distribution over suspension insulator string, String efficiency, Methods of improving string efficiency. Corona – Factors affecting corona, Imp terms, Methods of reducing corona. Sag in overhead lines- Calculation of sag for equal and unequal supports, Effect of wind and ice loading on sag.

Electrical Parameters of Overhead Transmission Lines: **02 Hrs**

Constants of Transmission line. Inductance of single phase two wire line, Capacitance of single phase two wire line.

Unit-III

Performance of Transmission Lines: **05 Hrs**

Classification of overhead Transmission line. Short Transmission line, Medium Transmission line – End condenser method, Nominal T method, Nominal π method, Long Transmission line. Generalised circuit constants (ABCD) of a transmission line.

Underground Cables: **05 Hrs**

Construction of underground cables, Insulating materials for underground cables, Laying of underground cables. Insulation resistance of single core cable, Capacitance of single core cable, Dielectric stress in a single core cable. Grading of cables: Capacitance grading, Intersheath grading.

Unit-IV

Distribution Systems: **04 Hrs**

Classification of distribution systems. Overhead Vs Underground distribution system. Connection schemes of distribution system. Requirements of a distribution system.

DC Distribution: **04 Hrs**

Types of DC distributors, DC distributor fed at one end- Concentrated loading, Uniform loading. DC distributor fed at both ends - Concentrated loading.

AC Distribution: **02 Hrs**

AC distribution calculation, Methods of solving AC distribution issues.

Textbooks:

1. Soni, Gupta and Bhatnagar, "Power System Engineering", 5th edition, Dhanapat Rai and Co.(P) Ltd.

Publishers, New Delhi, 2016.
2. Mehta V K and Rohit Mehta, " Principals of Power Systems", 4th edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.

References:

1. Gupta J B, "Transmission and Distribution of Electrical power", 9th edition, Sanjeev jumar Kataria Publishers, New Delhi, 2012.
2. Wadhwa C L, "Generation, Distribution and Utilization of Electrical Power", 3rd edition, New age International(p) Ltd., New Delhi, 2012.

Course outcomes:

After completion of the course,

- Students shall be able to **list and define** various parameters and features of Electrical power generation, transmission and distribution.
- Students shall be able to **explain** different mechanical and electrical parameters related to Electrical power generation, transmission and distribution.
- Students shall be able to **relate/articulate** the concepts and theories related to electrical parameters of Electrical power generation, transmission and distribution.
- Students shall be able to **compare and contrast** the features of Electrical power generation, transmission and distribution.
- Students shall be able to **evaluate/calculate** various parameters related to Electrical power generation, transmission and distribution.
- Students shall be able to **discuss/choose/test** issues relating to Electrical power generation, transmission and distribution.

ELECTRICAL MACHINE DESIGN

Subject Code: UEE557E **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Principles of Electrical Machine Design: L-04 Hours

Introduction to design of electrical machines, limitations. Different types of materials and insulators used in electrical machines.

Design of DC Machines: L-06 Hours

Output equation, choice of specific loadings and number of poles, design of main dimensions, armature slot dimensions, commutators, brushes, and magnetic circuit – estimation of ampere turns, yoke, pole and field windings (shunt, series and inter poles).

Unit-II

Design of Transformers (Single phase and three phase): L-10 Hours

Output equation for single phase and three phase transformer, choice of specific loadings, expression for volts/turn , determination of main dimensions of the core, types of windings and estimation of number of turns and cross sectional area of Primary and secondary coils, estimation of no load current , expression for leakage reactance. Design of tank and cooling tube.

Unit-III

Design of Induction Motors : L-10 Hours

Output equation, choice of specific loadings, main dimensions of three phase induction motor, stator winding design, choice of length of the air gap, estimation of number of slots for the squirrel cage rotor, design of rotor bars and end ring, relation between bar and end ring currents. Estimation of no load current, leakage reactance.

Unit-IV

Design of Synchronous Machines : L-10 Hours

Output equation, choice of specific loadings, short circuit ratio, design of main dimensions, armature slots and windings, slot details for the stator of salient and non salient pole synchronous machine. Design of rotor of salient pole synchronous machines, magnetic circuits, dimensions of the pole body, field winding, and rotor of non salient pole machine.

References:

1. Sawhney A. K, “A Course in Electrical Machine Design”, Dhanpat Rai, XVII Edition, 2006.Reactive Power Management, D. Tagare, TMH, 1st Edition, 2004.
2. Mittle, V.N., “Design of Electrical Machine Design”, Standard, 1983.
3. Aggarwal, R.K, “Principles of Electrical Machine Design”, IV Edition, Kataria Publishers, 1992.

Course outcomes:

At the end of the course the student will be able to:

1. Students should be able to identify, list and define different types of materials, parts, insulators, and the terms associated to Electrical machines and design terms
2. Students should be able to classify and explain the Choice of specific loadings of DC, Induction & synchronous machines and transformer
3. Students should be able to derive the expressions and prove the given criterion considering the limitations of the materials

4. Students should be able to calculate the dimension of the machine, number of ampere turns, for a given specific loading
5. Students should be able to estimate the number of slots, number of conductors, turns considering the feature of material & its limitations and the power factor
6. Students should be able to design the machine for a given application considering all the parameters, maximum specific loading, current, voltage, magnetizing current, voltage drop and other parameters of the machine and transformer design

Testing and Commissioning of Electrical Equipment
(Elective)

Subject Code: UEE556E **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Transformers : **L-10 Hrs**

Specifications: Power and distribution transformers as per BS standards. Installation: Location, site, selection, foundation details (like bolts size, their number, etc), code of practice for terminal plates, polarity & phase sequence, oil tanks, drying of windings and general inspection

Commissioning tests: Following tests as per national & International Standards, volt ratio test, earth resistance, oil strength, Bucholz& other relays, tap changing gear, fans & pumps, insulation test, impulse test, polarizing index, load & temperature rise test, Installation and commissioning of transformer, causes and troubles and failures in power Transformer and maintenance of transformer.

Unit-II

Synchronous Machines: **L-10Hrs**

Specifications: As per BIS standards.
Installation: Physical inspection, foundation details, alignments, excitation systems, cooling and control gear, drying out.
Commissioning Tests: Insulation, Resistance measurement of armature & field windings, waveform & telephone interference tests, line charging capacitance.
Performance tests: Various tests to estimate the performance of generator operations, slip test, short circuit test, sudden 3 phase short circuit tests, i vibration test and Abnormal conditions and protection

Unit-III

Induction Motors: **L-10 Hrs**

Specifications: for different types of motors, Duty, I.P. protection. i Installation: Location of the motors (including the foundation details) & its control apparatus, shaft & alignment for various coupling. Fitting of pulleys & coupling, drying of windings.
Commissioning Test: Mechanical tests for alignment, air gap symmetry, tests for bearings, vibrations & balancing.
Electrical tests: Insulation test, earth resistance, high voltage test, starting up, failure to speed up to take the load, type of test, routine test
Trouble causes and remedies and protection of induction motor and maintenance of motors.

Unit-IV

Switch Gear and Protective Devices: **L-09 Hrs**

Standards, types, specification, Installation, commissioning tests, type &i routine tests, possible troubles, causes and corrective actions for circuit breakers and maintenance of circuit breakers.
Specifications of VTs, Specifications of CTs, Testing of Current i Transformer and Voltage transformer.

References

1. Testing & Commissioning Of Electrical Equipment -S. Rao, KhannaPublishers.2004
2. Testing & Commissioning Of Electrical Equipment -B .V. S. Rao, Media Promoters and Publication Pvt., Ltd.
3. Testing & Commissioning Of Electrical Equipment- Ramesh L. Chakrasali

Course Outcomes

Students should be able to

1. Identify the different electrical equipment and define all the terms associated with their tests, specifications and standards
2. Explain the procedures and precautions for conduction of different tests
3. Test commission and install any electrical equipment considering all the guidelines specified by India and foreign countries
4. Prepare a maintenance schedule of different equipment and machines
5. Familiar about electrical safety regulations and rules during maintenance.
6. Trouble shooting chart for various electrical equipment, machines and domestic appliance

Advanced Power Electronics

Subject Code: UEE55XE | **Credits: 03**
Contact Hours: 04 (4L-0T-0P) | **Assessment: CIE 50 and SEE 50**

Unit-I

01. Introduction to Power Electronics: **05hr**
Introduction, Applications, switching characteristics of Thyristor, MOSFET,IGBT, GTO, IGCT and MCT
02. Controlled Rectifiers: **05hr**
Single phase and Three phase full wave controlled rectifier with RL, RLE load, Effect of source and load inductance of single phase bridge controlled converter

Unit-II

03. Inverters: **05hr**
Detailed study of three phase inverter of 120^0 and 180^0. PWM techniques for single phase and three phase inverter, Space Vector PWM technique for three phase inverter
04. Multilevel Inverter: **05hr**
Introduction, concept of multilevel inverter, flying capacitor, diode clamped and Cascaded H-Bridge multilevel converter and its application

Unit-III

05. Multiphase Matrix Converter Topologies: **05hr**
Three-Phase Input with three phase Out Put Matrix converter, Three phase input with Five-Phase Output Matrix Converter, Sinusodial Carrier based PWM techniques
06. AC-Link Universal Power Converter: **05hr**
Introduction, Hard Switching ac-Link Universal Power Converter, Soft Switching ac-Link Universal Power Converter

Unit-IV

07. Power Electronics for Wind Energy Conversion Systems:**05hr**
Introduction, Wind Power Conversion: - Control Variables for Wind Turbines, Wind Turbine Concepts. Power Converters for Wind Turbines: - Two-Level Power Converter, Multilevel Power Converter, Multi-cell Converter. Controls and Grid Requirements for Modern Wind Turbines
08. Power Electronics for Photo Voltaic System: **05hr**
Introduction, Power Curves and Maximum Power Point of PV Systems: Electrical Model of a PV Cell, Photovoltaic Module I–V and P–V curve, MPP under Partial Shading. Grid-Connected PV System, Control of Grid-Connected PV System: Maximum Power Point Tracking Control Methods (Perturb and Observe, Incremental conductance Method, Fractional Open circuit method and Fractional Short Circuit Method)

Reference Books:

1. Rashid .M. H “Power Electronics Hand book”, Academic press,2001.
2. Haitham Abu-Rub, Mariusz Malinowski “Power Electronics for Renewable Energy systems, Transportation and Industrial Applications, by, Wiley publishers 2014.
3. Chakaraborty,SimonsandM.GKramer“PowerElectronicforRenewableEnergyand Distributed Energy System” WE (Ed), 2013.

Course Outcomes:

After completion of the course, the students shall be able to:

1. Recall, list and define the various semiconductor switches employed in power electronics circuits
2. Students able to describe the operation and switching characteristics of switches and operation of various advance power converter.
3. Derive the expressions of performance parameters for various power converters connected to R and R L loads.
4. Analyze and compare the behavior of power converters controlled by sine triangle and SVPWM.
5. Design various components for Multi level inverter, matrix converter and universal power converter connected to R, R-L load and renewable energy sources
6. Assess the performance of advance converter connected to renewable energy sources (PV and Wind turbine).

REACTIVE POWER MANAGEMENT

Subject Code: UEE5XXE **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Introduction: L-10 Hours

Importance of reactive power control in electrical power system, objectives of load compensation, ideal compensator, load compensation specific of a compensator, power factor correction and voltage regulation in single phase system, reactive power bias.

Unit-II

Basic requirement in AC power transmission: **L-10 Hours**

Factor affecting stability and voltage, uncompensated Transmission line: performance equations and performance requirement of lines, voltage profile, voltage-power characteristics, load ability characteristics.

Transmission line compensation: types passive/active compensators, series/shunt compensation and compensation by sectioning.

Unit-III

Harmonics: L-10 Hours

Characteristics and un characteristics harmonics, sources, troubles caused by harmonics on electrical equipment, means of reducing harmonics, types of harmonic filters, DC filters IEEE 519-1992 guidelines telephone interferences.

Unit-IV

Reactive power co-ordination : L-10 Hours

Reactive power management and planning, utility objectives, practices, transmission benefits, reactive power dispatch & equipment impact, reactive power forecasting, reactive power control by DSM, power pooling.

References

4. Reactive power control in electric power systems, T. J. E. Miller, John Wiley & Sons NY 2009
5. Reactive Power Management, D. Tagare, TMH, 1st Edition, 2004.
6. Power System Stability and Control. Kundur, TMH, 9th reprint, 2007.
7. Power System Voltage Stability, Carson. W. Taylor, McGraw-Hill, Inc.

Course outcomes:

At the end of the course the student will be able to:

- Student should be able to identify the basics of Reactive power management.
- Student should be able to explain about the reactive power compensator.
- Student should be able to apply the RPM concept in field.
- Student should be able to define the basic requirement in AC power transmission, factor affecting stability and voltage.
- Student should be able to explain about the harmonics on the system and types of harmonic filters.
- Student should be able to express about the reactive power co- ordination.

Electrical Engineering Materials

Subject Code: UEE55XE **Credits: 03**
Contact Hours: 04 (4L-0T-0P) **Assessment: CIE 50 and SEE 50**

UNIT – I

Conductivity Of Metals: 05 Hours
Introduction, factors affecting the resistivity of electrical materials, motion of an electron in an electric field, equation of motion of an electron, the current carried by electrons, mobility, energy levels of the molecule, emission of electrons from metals, effect of temperature on the electrical conductivity of metals, electrical conducting materials, electrical contact materials, non-linear conductors, thermal conductivity of metals, thermo electric effect.

Insulating Materials: 05 Hours
materials (mica, glass, porcelain, asbestos), organic materials (paper, rubber, cotton silk fiber, wood, plastics and Bakelite), resins and varnishes, liquid insulators (transformer oil) gaseous insulators (air, SF6 and nitrogen) and ageing of insulators.

UNIT – II

Materials for special applications: 05 Hours
Materials for solar cells, fuel cells and battery. Materials for coatings for enhanced solar thermal energy collection and solar selective coatings, Cold mirror coatings, heat mirror coatings, antireflection coatings, and sintered alloys for breaker and switch contacts

Modern Techniques For Materials Studies: 05 Hours
Optical microscopy, Electron microscopy, Photo electron spectroscopy, Atomic absorption spectroscopy, magnetic resonance, nuclear magnetic resonance, electron spin resonance and ferromagnetic resonance.

UNIT – III

Magnetic Materials: 06 Hours
Introduction Properties and Application of Piezoelectric materials, Eletrostrictive materials, Ferromagnetic materials, Magnetostrictive materials, Shape memory alloys, Electro archeological fluids, Magneto archeological fluids, Smart hydro gels

Ceramics: 03 Hours
Properties, application to conductors, insulators & capacitors Plastics, rubber

UNIT – IV

Amorphous Materials: 05 Hours
Crystalline versus Amorphous solids, glass formation, Techniques of preparation, Structural models of Amorphous materials, properties of met glasses

Wind Turbine Blades materials: 05 Hours
Composites materials for wind turbine blades, Fibers, Carbon fibers, Aramid, Basalt, Matrix, Thermosets, Thermoplastics

Reference Books:

1. An Introduction to Electrical Engineering- Indulkar C.S. &Thiruvengadam. S Chand & Company; 4th Edn. 2004 edition (1 December 2006)
2. Materials Science for Electrical and Electronic Engineers, Ian P. Jones, Oxford University Press, Indian Edition, 2007
3. Electrical Properties of Materials, L.Solymar, D.Walsh, 8th Indian Edition- Oxford

University Press Seventh Edition.
4. MEMS and MOEMS Technology and Applications, P.Rai-Choudhury (Editor), PHI, 2009.
5. Introduction to Electronic Properties and Materials, DavidJiles, CRC Press, 2nd Edition.

Course outcomes:

1. An ability to apply basic concept and principles of electrical materials.
2. Formulate to solve engineering problems.
3. Concept of solar cell materials helps in designing.
4. An ability to identify a materials and its structure.
5. To gain the knowledge of properties and engineering application of ceramics and amorphous materials.

Digital Signal Processing Laboratory

Subject Code: UEE561L **Credit: 01**
Contact Hours: 02 (0L-0T-2P) **Assessment: CIE 50 and SEE 50**

List of Experiments:

1. Generation of Unit step, ramp, exponential and sinusoidal signals
2. Convolution of two signals
3. To determine power and energy of the signals
4. To determine impulse response given y(n) and x(n)
5. To determine DTFT of given sequence
6. Circular convolution of two given sequences
7. Computation of N – point DFT of a given sequence and to plot magnitude and phase
8. Linear convolution of two sequence using DFT and IDFT
9. Circular convolution of two sequences using DFT and IDFT
10. Design and implementation of FIR and IIR fitter to meet given specifications.
11. Study of DSP starter kits (DSK)
12. Linear convolution Using DSK
13. Circular Convolution using DSK
14. Computation of N point DFT using DSK

Course outcomes:

After the completion of the course, the student will be able to :-

1. Students should be able to generate universal discrete signals of signal systems & digital signal processing using MATLAB/CCStudio
2. Students should be able to write/model the programme for signal processing experiments in MATLAB/CCStudio
3. Students should be able to compare & contrast results of conducted signal processing experiments with theoretical calculations

Laboratory Assessments:

1) Each Laboratory is evaluated for 100 marks (50 CIE and 50 SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment = 30 Marks.
   - One practical test for 20 Marks (5 marks write up, 10 marks conduction, calculation, Results etc.., 5 marks viva – voce).
3) Allocation of 50 marks for SEE. 25% write-up, 50% conduction, calculation, results etc., 25% Viva – Voce..

Control Systems Laboratory

Subject Code: UEE562L **Credit: 01**
Contact Hours: 02 Hrs **Assessment: CIE 50 and SEE 50**

1. Determine time domain response of second order systems for step input and obtain performance parameters.
2. **a)** Experiment to draw the speed – torque characteristic of a A.C. servomotor.
   b) Experiment to draw the speed torque characteristic of a D.C. servomotor.
3. Design a passive RC lead compensating network for the given specifications, viz., the maximum phase lead and the frequency at which it occurs and to obtain its frequency response.
4. Study the synchro-transmitter and receiver and obtain output vs input characteristics.
5. Determine experimentally the frequency response of a second -order system and evaluation of frequency domain specifications.
6. Design RC lag compensating network for the given specifications. viz., the maximum phase lag and the frequency at which it occurs, and obtains its frequency response.
7. Experiment to draw the frequency response characteristic of a given lag- lead compensating network.
8. Design a PID controller and study its effect on steady state error.
9. Plot the root locus diagram of an open loop transfer function and determine range of gain 'k' for stability. Using MATLAB software
10. Plot a Bode diagram of an open loop transfer function. Using MATLAB software
11. Draw a Nyquist plot of an open loop transfers functions and examine the stability of the closed loop system. Using MATLAB software.

Course outcomes:

After the completion of the course, the student will be able to :-

1. Execute the frequency response and time response analysis of a second order control system through conduction.
2. Analyze and interpret stability of the system through Root Locus, Bode plot and Nyquist plot. Using MATLAB
3. Design Lag, Lead, Lead-Lag compensators and verify experimental results through conduction.
4. Analyze and verify experimental results of a toque- speed characteristic of DC and AC servomotors.
5. Analyze the effect of P, PI, PD and PID controllers on a control system.

Laboratory Assessments:

1) Each Laboratory is evaluated for 100 marks (50 CIE and 50 SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment = 30 Marks.
   - One practical test for 20 Marks (5 marks write up, 10 marks conduction, calculation, Results etc.., 5 marks viva – voce).
3) Allocation of 50 marks for SEE. 25% write-up, 50% conduction, calculation, results etc., 25% Viva – Voce..

Analog and Digital Electronics Laboratory

Subject Code: UEE563L **Credit: 01**
Contact Hours: 02 (0L-0T-2P) **Assessment: CIE 50 and SEE 50**

List of Experiments:

1. Design and testing of diode clipping and clamping circuits.
2. Design of fixed bias and voltage divider bias circuits for BJT.
3. Design of RC coupled single stage BJT amplifier and determination of the gain, frequency response, input and output impedances.
4. Calculation of hybrid parameters of a CE transistor amplifier
5. Simplification, realization of Boolean expressions using logic gates /Universal gates.
   (i) Realization of Full adders and Full Subtractors using logic gates
   (ii) Realization of parallel adder/subtractors using 7483 chip
6. Realization of Binary to Gray Code conversion and vice versa.
7. MUX / DEMUX-use of 74153, 74139 for arithmetic circuits and code converters
8. Realization of One/Two bit comparator and study of 7485 magnitude comparator.
9. Truth table verification of Flip- Flops (i) JK Master slave (ii) T type and (iii) D type
10. Realization of 3 bit counters and MOD- N counter design (7490, 74193).
11. Shift left; Shift Right; SIPO, SISO, PIPO, PISO, operations using 74S95.
12. Ring counter and Johnson counter.

Course outcomes:
After the completion of the course, the student will be able to :-

1. Student should be able to select appropriate components and write the requirement table based on experiment
2. Student should be able to write the procedure, simplify the expressions using K-map and realize the circuit
3. Student should be able to rig-up the circuit and verify output

Laboratory Assessments:

4) Each Laboratory is evaluated for 100 marks (50 CIE and 50 SEE)
5) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment = 30 Marks.
   - One practical test for 20 Marks (5 marks write up, 10 marks conduction, calculation, Results etc.., 5 marks viva – voce).
6) Allocation of 50 marks for SEE. 25% write-up, 50% conduction, calculation, results etc., 25% Viva – Voce..

Basaveshwar Engineering College (Autonomous)

[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]

Bagalkot-587103, Karnataka, India.

BVVS

Department of Electrical and Electronics Engineering

Semester-6 **CAY 2021-22 [175 credits. 2019-20 admitted batch]**

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UEE651C	Power System Analysis and Stability	3	2	2	0	50	50	100
02	UEE652C	Microcontrollers	3	3	0	0	50	50	100
03	UEE653H	Management and Entrepreneurship	3	3	0	0	50	50	100
04	UEE6XXE	Dept. Elective – 3	3	3	0	0	50	50	100
05	UEE655N	Open Elective – 1	3	3	0	0	50	50	100
06	UEE661L	Microcontrollers and IoT Laboratory	1	0	0	2	50	50	100
07	UEE662L	Electrical Auto CAD and MiPower Laboratory	1	0	0	2	50	50	100
08	UEE665P	Mini Project	2	0	0	4	50	50	100
09	UCS659L	Advanced C Programming Laboratory (mandatory)	2	0	2	2	50	50	100
10	UHS003N	Career Planning and Professional Skills	1	2	0	0	50	50	100
Total			22	16	4	10	500	500	1000

List of Elective Subjects

Modern Control Theory	VLSI Design and Applications
Electrical safety in Industrial plants	Battery Management
Electrical Power Utilization and Drives	Energy Efficient Motors
Fundamentals of Wind Energy Conversion Systems	Computer aided electrical drawing
List of Open Electives Subjects @ 6th Sem	
MATLABORATORY for Engineers	Renewable Energy Resources

Question paper pattern for Theory SEE:

4. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
5. Each question should not have more than 4 subdivisions.
6. Any five full questions are to be answered choosing at least one from eachunit

Laboratory Assessments for SEE:

4. Each Laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE)
5. Allocation of 50 marks for CIE Performance and journal write-up: Marks for each experiment = 30 marks / No. of proposed experiments. One Practical test for 20 marks, (5 write up, 10 conduction, calculation, results etc., 5 viva-voce).
6. Allocation of 50 marks for SEE: 25% write up, 50% conduction, calculation, results etc., 25% viva-voce

Power System Analysis and Stability

SubjectCode:UEE651C **Credits:03**
Contact Hours:03(2L - 2T - 0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Power System Representation: (4L-4T Hours)
Standard symbols of power system components, Single line diagram, Per unit system, Per unit impedance of 3 phase components, Change of base, Per unit impedance diagram, Advantages of per unit system calculations, Formation of Y- bus by inspection method-Numerical Problems

Symmetrical Three Phase Faults: (4L-4T Hours)
3 - phase short circuit at the terminals of unloaded generator, Sub transient, Transient and Steady state reactance, Transients on a transmission line, Short circuit currents and Reactance of synchronous machines on load and no load, Short circuit MVA-Numerical Problems

Unit-II

Symmetrical Components: (3L-3T Hours)
Definition of sequence components for 3-Phase unbalanced power systems, Operator "a" and its properties, Expressions for sequence components, Phase shift of symmetrical components in star delta transformer bank-Numerical Problems

Sequence Networks:(3L-3T Hours)
3- Ph power in terms of sequence components, voltage drop due to sequence currents, sequence impedance and sequence networks of power system elements (Alternator, Transformer and Transmission line), positive, negative and zero sequence networks of power system elements-Numerical Problems

Unit-III

Unsymmetrical Fault at the Terminals Unloaded Generator:(3L-3T Hours)
L-G, L-L, L-L-G fault with and without fault impedance at the terminals of unloaded generator- derivation for connection of sequence network and fault currents-Numerical Problems

Unsymmetrical Faults on Power Systems:(3L-3T Hours)
L-G, L-L, L-L-G faults on unloaded power systems, Open conductor faults in power system-Numerical Problems

Unit-IV

Stability Analysis: (3L-3T Hours)
Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Power angle equation for salient and non salient pole synchronous machines-Numerical Problems

Equal Area Criterion:(3L-3T Hours)
Equal area criterion – Stability analysis for sudden change in mechanical input power, 3-ph fault on Generator terminals and on transmission line, Expression for critical clearing angle, Methods to improve stability of power system-Numerical Problems

References:

1. K. Uma Rao, "Computer Techniques and Models in Power Systems", 1st Edition, I. K. International publishing house, 2014.

2. Nagarath and Kothari, “Modern Power System Analysis”, 3rd Edition, TMH, 2009.
3. W.D. Stevenson, “Elements of Power Systems Analysis”, 4th Edition, Mc.Graw Hill Publishers, 2013.
4. HadiSaadat, “Power System Analysis”, TMH, Publishers, 4th Edition 2015.
5. V Neelakantan, "Power System Analysis & Stability”, Shiva Publishers, 2017

Course outcomes:

After completion of the course, the students shall be able to:

1. Students shall be able to recall the procedure for drawing the reactance diagrams of power system network and advantages of per unit system representation
2. Students shall be able to illustrate the significance of fault analysis, sequence components and power system stability studies
3. Students shall be able to derive mathematical expressions for fault currents and rotor angle under different disturbance conditions
4. Students shall be able to make use of per unit system and sequence components to carry out symmetrical and unsymmetrical fault analysis
5. Students shall be able to decide the stability of the power system and fault analysis methodology for different fault conditions
6. Students shall be able to construct positive, negative and zero sequence reactance diagrams and power angle curves for various fault conditions

Microcontrollers

SubjectCode:UEE652C **Credits:03**
Contact Hours:03(3L - 0T - 0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Ch1. Microprocessors and Microcontrollers (4h):

Basics hex numbers, Hexadecimal addition, Block diagram of Computer, bus and Types of buses, memory address, Introduction of Microprocessors and Microcontrollers 8051, Features, Block diagram, pin diagram, program model, Architecture, PSW, PC, SP, Memory

Ch2. 8051 Assembly Language Programming (2h):

Introduction to assembly language programming,

assembling and running a program, The program counter and ROM space,

data types and directives.

Ch3. Addressing Modes(4h):

Introduction, Addressing modes,

External Data Moves, Code Memory Read Only Data Moves, Indexed Addressing Mode, Programs, PUSH and POP Opcodes, programs, Data exchanges. Programs

Unit-II

Ch4. Logical and Arithmetic Operations (5h):

Introduction, Arithmetic instructions, incrementing and decrementing,

Addition, subtraction, multiplication and division, decimal arithmetic,

Byte level Logical instructions, Bit level logical instructions, Rotate and swap instructions, Programs

Ch5. Jump and Call Instructions (5h):

The jump and call program range, jump and call instructions,

machine cycle and time delays generation

Programs

Unit-III

Ch6. 8051 I/O and Timer Programming (6h)

Introduction, I/O programming, I/O Bit Manipulation Programming.

Timers, programming timers 0 and 1 in 8051 assembly.

Counter programming,

Ch7. 8051 Serial Port and Interrupt Programming (4h):

Basics of serial communication, 8051 connections to RS-232,

Serial port programming in 8051 assembly, Introduction to interrupts,

Unit-IV

Ch8. 8051 Interfacing and Applications (5h):

Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor

Ch9. Programming in C for 8051(4h)

Introduction, Programming in C for 8051: data types, Programs on time delays, I/O programming,

References:

1. Kenneth J. Ayala, “The 8051 Microcontroller Architecture, Programming and Applications” 3rd edition, Cengage, 2007.

2. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; "The 8051 Microcontroller and Embedded Systems using assembly and C", 2nd edition, Pearson, 2012.
3. Myke Predko, "Programming and Customizing the 8051 Microcontroller", TMH, 1999, 15th Reprint, 2008
4. Dr.Ramani Kalpathi and Ganesh Raja; "Microcontroller and its applications", 1st revised edition Sanguine Technical publishers, Bangalore-2007.
5. Raj Kamal, "Microcontrollers: Architecture, Programming, Interfacing and system Design", Pearson Education, 2011.
6. Dr.K. Uma Rao and Dr. Andhe Pallavi, "8051 Microcontroller Architecture, Programming and Applications", Sanguine Technical Publishers Bangalore, 2010.

Course outcomes:

After completion of the course, the students shall be able to:

1. List the features of microcontroller, peripherals and define addressing modes
2. Illustrate architecture of microcontroller, functions of registers & pins, addressing modes, directives, programming instructions, interrupts and peripheral devices
3. Identify the instructions/addressing modes, codes for selecting the register banks/timer registers and to make use of appropriate instructions for programs & delay calculation
4. Create, inspect &debug the assembly language instructions/program and re-correct code & assess number of bytes
5. Formulate the flowchart & assembly level /8051C programme for given application
6. Design and construct the interfacing circuit and develop programme with microcontroller 8051 for given application

Modern Control Theory (Elective)

Subject Code: UEE654E **Credits: 03**
Contact Hours: 03 (3L - 0T - 0P) **Assessment: CIE 50 and SEE 50**

Unit-I

01 State Variable Analysis and Design: **L- 05 Hrs**
Introduction, state space representation using physical variable, phase variable and canonical variables.

02 Derivation of transfer function from state model: **L-04 Hrs**
Diagonalization, Eigen values, Eigen vectors, Solution of state equations.

Unit-II

03 Solution State Transition Matrix: **L-05Hrs**

Solution of state equation, state transition matrix and its properties, computation using Laplace transformation, power series method, Cayley- Hamilton method, concept of controllability and observability methods.

04 Pole Placement Techniques: **L-05Hrs**
Stability improvements by state feedback, necessary and sufficient condition for arbitrary pole place placement

Unit-III

05 Design of Controllers: **L-05Hrs**
Introduction and Design of Proportional (P), Integral (I), Differential (D), PI, PD and PID..

06 Design of Compensators: **L-05Hrs**
Lead compensator, Lag compensator and Lag-lead compensator using frequency domain.

Unit-IV

07 Non-Linear Systems: **L-05 Hrs**
Introduction behavior of non linear system common physical non-linearly - saturation, friction, backlash, dead zone, relay multivariable non linearity. Phase plane method singular points stability of nonlinear system.

08 Liapunov Stability Criteria: **L-05 Hrs**
Liapunov function, direct method of Liapunov and the linear system, Hurwitz criterion and Liapunov's direct method, construction of Liapunov functions for non linear system by Krasvskii's method.

References:

1. Benjamin C. Kuo and Farid Golnaraghi, "Automatic Control Systems", VIII- edition, John Wiley and Sons, 2003.
2. Nagoor Kani, "Advanced Control Theory" 2Edition RBA Publications 2014.
3. Parvatikar K, "Modern control Theory" 1Edition, PRISM Publications, 2016.

Course outcomes:

After completion of the course, the students shall be able to:

1. Students should be able to identify state variables, controllers, and compensators for linear and non linear systems.
2. Students should be able to describe/illustrate state space, pole placement technique and different types of nonlinear systems
3. Students should be able to compute eigen values & vectors in state equation and controllability & observability.
4. Students should be able to analyze stability improvements by state feedback, state observer and Liapunov criteria.
5. Students should be able to compare and contrast multiple methods to implement a function in different domains.
6. Students should be able to design the PID controller, compensators and state regulator observer using system parameters.

Electrical Power Utilization and Drives

Subject Code: UEE65XE **Credits: 03**
Contact Hours: 03 (3L - 0T - 0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Electric heating: 10 Hrs

Introduction, Concept of electric heating, Advantages, Modes of heat transfer, Classification of electric heating, Requirements/ properties/Characteristic of a good heating element. Design of heating element, Resistance furnace/Oven, Temperature controlofresistancefurnace.Electricarcfurnace(i)Directarcfurnace(ii)Indirectarc furnace. Induction heating/Furnace: (i) Core type induction furnace – direct & indirect (ii) Coreless induction furnace (iii) High frequency eddy current heating, Dielectric heating.

Unit-II

Tariff : 02 Hrs

Introduction, Definition and significance, Objectives of tariff, Factors governing tariff, Features of good tariff or desirable characteristic of tariff, Types of tariff

Introduction to Electric Drives: 08 Hrs

Concept of electric drive, advantages and classification. Dynamics of motor load combination. Speed torque convention/Multi quadrant operation. Equivalent drive parameters-(i) rotational load (ii) Translational load. Components of load torque: Static torque, Viscous torque, Coulomb torque, Windage torque. Steady state stability: Criterion for steady state stability. Load equalization, Calculation of time and energy loss in transient operation.

Unit-III

DC motor and Induction Motor drives: 06 Hrs

DC motor drives: Speed Torque Characteristics of DC motor: DC shunt motor- Speed control, DC series motor- Speed control. Motoring and electric braking of DC shunt motor, Motoring and electric braking of DC series motor.

Induction Motor drives: Principle of operation, Equivalent circuit, Speed Torque Characteristics of Induction motor. Braking of Induction motor – Regenerative, Plugging, Dynamic braking.

Heating and rating of motors: 04 Hrs

Heating effects, heating and cooling curves. Loading conditions and classes of duty.
Determination of power rating of electric motors for different applications.

Unit-IV

Electric Traction: **10Hrs**

Introduction, Ideal traction system, advantages and Disadvantages of electric traction. Systems of track electrification, Types of railway services. Speed time curves of train movement- Creast speed, Average speed, Schedule speed. Simplified speed time curves. Mechanism of train movement- adhesive weight and co-efficient of adhesion. Tractive effort for propulsion of train. Power output from driving axles, Energy output from driving axles, Specific energy output, Energy Consumption.

References:

1. Garg G C, "Utilization of electrical power and electric drives", Khanna Publishers, 9th edition,2012
2. S K Pillai, "A first course on electric drives", Wiley Eastern Ltd., 2nd Edition,2006.

3. De N K, Sen P K, "Electric Drives", 15th edition, PHI,2012.
4. Wadhwa C L, "Generation, Distribution and Utilization of Electrical Power", 3rd edition, New age International(p) Ltd., New Delhi,2012.
5. Gupta J B, "Utilization of electrical power and electric traction", 10th edition, S K Kataria and sons,2012.
6. Dubey G K, " Fundamentals of electric drives", 2nd edition, Narosa publishingHouse,2010.

Course outcomes:

After completion of the course,

1. Students shall be able to **list and define** various parameters and features of electric heating, tariff, electric drives andtraction.
2. Students shall be able to **explain** various concepts and theory related to electric heating, tariff, electric drives andtraction.
3. Students shall be able to **relate/articulate** the concepts and theories related to electric heating, tariff, electric drives andtraction.
4. Students shall be able to **compare and contrast** the features of electric heating, tariff, electric drives andtraction.
5. Students shall be able to **evaluate/calculate** various parameters related to electric heating, tariff, electric drives andtraction.
6. Students shall be able to **discuss/choose/test** issues relating to electric heating, tariff, electric drives and traction.

VLSI DESIGN

Subject Code: UEE6XXE **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Introduction to MOS Technology: L-05 Hours

Introduction to integrated circuit technology, Metal oxide semiconductor and related VLSI technology, Basic MOS transistors, enhancement mode transistor action, depletion mode transistor, nMOS fabrication, CMOS fabrication, BiCMOS technology. Basic

Electrical Properties of MOS and BiCMOS Circuits: L-05 Hours

Drain to source current verses Voltage characteristics, threshold voltage, trans-conductance, nMOS inverter, determination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, MOS transistor circuit model, BiCMOS inverters.

Unit-II

MOS and BiCMOS Circuit Design Process: L-10 Hours

MOS layers stick diagrams, nMOS design style, CMOS design style, designs rules and layout, and lambda based design rules. Basic Circuit Concept: sheet resistance, area capacitance calculation, delay unit, inverter delay, driving large capacitive loads, super buffers, wiring capacitance.

Unit-III

Subsystem Design and Layout: L-10 Hours

architectural issues, gate (restoring) logic, examples of structure ddesign (combinational logic)- a parity generator, Bus arbitration logic for n-line bus, multiplexers. Subsystem Design Process: General consideration, design process- 4 bit arithmetic processor.

Unit-IV

Semiconductor memories: L-10 Hours

Introduction, Dynamic random access memory, static randomaccess memory, nonvolatile memory, flash memory, Ferro electric random access memory.

References

1. Douglas A. Pucknell, Kamran Eshraghian, "Basic VLSI Design", 3rdEdition, PHI.
2. Sung Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits, Analysis and Design", 3rd Edition, Tata McGraw Hill.
3. S. M. Sze, "VLSI Technology", 2ndEdition, Tata McGraw Hill.

Course Outcomes

At the end of this course,

- Students shall be able to learn details of basics of MOS transistors and digital chip design process
- Students shall be able to understand MOS and BiCMOS Circuit Design Process
- Students shall be able to understand semiconductor memories.
- Students shall be able to Knowledge of stick diagram
- Students shall be able to excel in design of digital integrated circuits
- Students shall be able to understand Electrical Properties of MOS and BiCMOS

Circuits

Battery Management System

Subject Code: UEE6XXE **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Battery-Management-System Requirements: L-09 Hours

Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.

Unit-II

Battery State Estimation: L-10 Hours

Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF),

Unit-III

Battery Health Estimation: L-10 Hours

Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi.

Unit-IV

Cell Balancing: L-10 Hours

Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations.

Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.

References

1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013.
3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling , Artech House September 2015

Prerequisites

Students should have basic knowledge of

- Battery technologies and principle of operation

Course Outcomes

At the end of this course

1. Students should be able to identify, list and define all the terms associated with battery terminologies, Electric vehicles and different filters and methods of optimal control
2. Students should be able to explain the types of battery tests and methods employed to determine SoC and SoH
3. Students should be able to solve numerical problems on fundamental aspects of a rechargeable battery, performance parameters & specifications, battery cell voltage equalization
4. Students should be able to compare and contrast the types of battery state of charge & health estimation methods and control methods for optimal performance of battery
5. Students should be able to conduct tests, observe and draw the inference based on the test results on existing batteries.
6. Students should be able to develop innovative technologies and battery management system for energy conservation

Basaveshwar Engineering College (Autonomous)
[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]
Bagalkot-587103, Karnataka, India.
Department of Electrical and Electronics Engineering

Microcontrollers and IoT Laboratory

Subject Code: UEE661L **Credits:01**
Contact Hours:02(0L - 0T - 2P) **Assessment: CIE 50 and SEE 50**

Part A - Assembly Language Programming

1	Addition of two 8 bit numbers, 16 bit numbers, array of 8 bit numbers, average of an array
2	Subtarction of two 8 bit numbers, 16 bit numbers
3	BCD Addition- two digit numbers, 4 digit numbers
4	Multiplication, Division
5	Arranging an array of number in ascending/descending order
6	To find maximum/minimum number of an array
7	Block of data transfer- Internal RAM, Internal RAM to external RAM
8	To find number of positive and negative numbers in an array
9	Code Coversion-BCD to Hex, Hex to BCD
10	Counters-Binary, BCD

Part B-IOT Programming

1	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.
2	To interface LED/Buzzer with Arduino Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds
3	To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.
4	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
5	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
6	To interface DISPLAY with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.
7	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth
8	To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when I'/'O' is received from smartphone using Bluetooth.
9	Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud
10	Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud
11	To install MySQL database on Raspberry Pi and perform basic SQL queries.
12	Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker
13	Write a program on Arduino/Raspberry Pi to subscribe to MQTT broker for temperature data and print it.
14	Write a program to create TCP server on Arduino Raspberry Pi and respond with humidity data to TCP client when requested.
15	Write a program to create UDP server on Arduino Raspberry Pi and respond with humidity data to UDP client when requested.

AutoCAD lab

Subject Code: UEE662L **Credits:01**

Contact Hours:02(0L - 0T - 2P) **Assessment: CIE 50 and SEE 50**

Part A - Assembly Language Programming

1	Draw Commands- Mirror, Move, copy, offset, rotate, fillet, trim
2	Wiring layout of residential and workshop plan
3	Single Layer 24 Conductor 4 pole progressive Winding with sequence diagram
4	Double Layer 24 Conductor 4 pole DC lap Winding with sequence diagram
5	Double Layer 26 Conductor 4 pole DC lap Winding with sequence diagram
6	12 slots 24 conductors 3 phase full pitch star connected AC winding
7	Assembly of pole, core and field coil for a isometric pole, core and field coil of a DC machine
8	Assembly of single phase 500 kVA core type transformer
9	Assembly of 50 kW DC generator for a given dimension
10	Rotor of 25 kVA alternator assembly
11	Stator of 25 kVA alternator assembly
12	Rotor of 3 phase induction motor assembly

References

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2016), ISBN-10: 8177001019, ISBN-13: 978-8177001013
2. V. N. Mittle & Arvind Mitttle, Design of Electrical Machines, standard publishers distributors
3. S. F. Devalapur, Electrical Drafting, Eastern Book Promoters

Prerequisites:

Students should have basic knowledge of engineering physics and Electrical Machines constructional and operational details

Course Outcomes:

At the end of this course

1. Draw layout of residential and workshop plan using commands
2. Write identify the commands and icons on the Auto CAD software
3. Draw the Windings, assembly of machine parts

Open Elective

Renewable Energy Sources

Subject Code: UEE5XXN **Credits: 03**
Contact Hours: 03 (3L-0T-0P) **Assessment: CIE 50 and SEE 50**

Unit-I

Introduction to Energy Sources: **02Hrs**
Classification of Energy Resources; Conventional Energy Resources – Availability and their limitations; Non-Conventional Energy Resources– Classification, Advantages, Limitations; Comparison of Conventional and Non-Conventional Energy Resources.

Solar Energy Basics: **04Hrs**
Introduction, Solar Constant, Basic Sun-Earth Angles – definitions and their representation, Solar Radiation Geometry (only theory); Measurement of Solar Radiation Data – Pyranometer and Pyrheliometer.

Solar Thermal Systems: **04Hrs**
Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, Concentrating dish type; Solar driers, Solar Still.

Unit-II

Solar Electric Systems: **05Hrs**
Solar Thermal Electric Power Generation – Solar Pond and Concentrating Solar Collector (parabolic trough, parabolic dish, Central Tower Collector). Advantages and Disadvantages; Solar Photovoltaic – Solar Cell fundamentals, module, panel and array. Solar PV Systems – Street lighting, Domestic lighting and Solar Water pumping systems.

Wind Energy: **05Hrs**
Wind and its Properties, History of Wind Energy. Basic principles of Wind Energy Conversion Systems (WECS), Classification of WECS, Parts of a WECS, Derivation for Power in the wind, Advantages and Disadvantages of WECS

Unit-III

Biomass Energy: **05Hrs**
Introduction, Photosynthesis process, Biomass conversion technologies; Biomass Gasification – Principle and Working of Gasifiers, Biogas - production of biogas, factors affectingbiogasgeneration,typesofbiogasplants–KVICandJanatamodel.

Geothermal Energy: **05Hrs**
Introduction, Geothermal resources (brief description); Advantages and disadvantages; Applications of Geothermal Energy

Unit-IV

Energy from Ocean: **06Hrs**
Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants, Advantages and Limitation of TPP.
Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Advantages and Limitation of OTEC.

Emerging Technologies: **04Hrs**
Fuel Cell, Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations).

References:

1. Khan, B. H., Non-Conventional Energy Resources, TMH, New Delhi, 2006.
2. Rai, G. D., Non-Conventional Sources of Energy, IV- Edition, Khanna Publishers, New Delhi, 2007
3. Mukherjee, D., and Chakrabarti, S., Fundamentals of Renewable Energy Systems, New Age International Publishers,2005.
4. Tiwari,G.N.,and Ghosal,M.K.,Renewable Energy Sources: Basic Principles and Applications, Alpha Science International, Ltd., New Delhi, 2006.

Course outcomes:

After completion of the course,

1. **Lst and define** various parameters and features of solar, wind, biomass, geothermal and ocean energy conversion systems.
2. **Explain** various concepts and theory related to solar, wind, biomass, geothermal and ocean energy conversion systems
3. **Relate/articulate** the concepts and theories related to solar, wind, biomass, geothermal and ocean energy conversion systems
4. **Compare and contrast** the features of solar, wind, biomass, geothermal and ocean energy conversion systems
5. **Evaluate/calculate** various parameters related to solar, wind, biomass, geothermal and ocean energy conversion systems
6. Discuss/choose/test issues relating to solar, wind, biomass, geothermal and ocean energy conversion systems

Basaveshwar Engineering College (Autonomous), Bagalkot
Department of Electrical and Electronics Engineering

Scheme of Teaching and Evaluation for B.E Electrical and Electronics

Semester-7 **CAY 2021-22 [175 credits. 2018-19 admitted batch]**

Sl.	Sub Code	Subject	C	Hrs/ Week			Exam Marks		
				L	T	P	CIE	SEE	Total
01	UEE751C	Computer Applications to Power System	3	3	0	0	50	50	100
02	UEE752C	High Voltage, Switchgear and Protection	3	3	0	0	50	50	100
03	UHS753C	Intellectual Property Rights	3	3	0	0	50	50	100
04	UEE754E	Dept. Elective – 4	3	3	0	0	50	50	100
05	UEE755N	Open Elective – 2	3	3	0	0	50	50	100
06	UEE761L	Power System Simulation Lab	1	0	0	2	50	50	100
07	UEE762L	High Voltage and Relay Lab	1	0	0	2	50	50	100
08	UEE764I	Internship*	2	0	0	*	50	50	100
09	UEE765P	Project Work Phase – I	5	0	0	8	50	50	100
Total			24	15	0	12	450	450	900

* Working hours will be as per scheduled working hours prescribed by the industry.

List of Elective Subjects

Electrical Machine Drives	Operation Research
Solar Photovoltaic System Design	Standards and Indian Electricity Act
Professional Communication and Technical Writing	Autotronics (Automotive Electronics)
AI Applications to Power Systems	Embedded System and PLC

List of Open Electives Subjects @ 7th Sem	
Energy conservation in Industrial Systems	Electrical Safety for Engineers

Computer Applications to Power System	
Subject Code: UEE751C	**Credits: 03**
Contact Hours: 03 (3L - 0T - 0P)	**Assessment: CIE 50 and SEE 50**

Unit-I

01 Network Topology: **04 Hours**

Introduction, Elementary Graph Theory, Connected graph, Sub graph Loop, Cut-set, Tree, Co-tree, Basic loops, Basic cut-set. Incidence Matrices:
Element-node incidence matrix A (Bus-incidence matrix), Branch path
incidence matrix K, Basic (Fundamental) cut-set incidence matrix B, Augmented cut-set matrix, Basic loop incidence matrix C, Augmented loop incidence matrix.

02 Primitive Network: **02 Hours**

General primitive element, Impedance and Admittance form of the primitive element, Primitive network matrices.

03 Network Matrices: **04 Hours**

Introduction, Derivation of Ybus = [A][y][A]T, Formation of Ybus by inspection method. Modeling: Transmission lines, Transformers, Loads and generator internal impedance. Examples.

Unit-II

04 Load Flow Studies: **01 Hours**

Introduction, Power Flow Equation, Classification of Buses, Operating Constraints, Data for Load Flow: System data, Generator bus data, Load Data.

06 Gauss-Seidal Method: **04 Hours**

Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples.

07 Newton – Raphson Method: **05 Hours**

Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

Unit-III

08 Economic Operations of Power System: **09 Hours**

Introduction, Performance curves, Economic generation scheduling neglecting losses and generator limits, Economic generation including generator limits and neglecting losses, Iterative technique, Economic Dispatch Including Transmission Losses: Approximation penalty factor, Derivation of transmission loss formula. Introduction to optimal scheduling for hydrothermal plants. Problem formulation, solution procedure and algorithm.

Unit-IV

09 Transient Stability Studies: **05 Hours**

Introduction, swing equation, machine equations. Power system equations.

10 Modeling : **05 Hours**

Modeling of excitation systems: Introduction, DC Excitation system, AC Excitation system. Type 1, Type 2 and Type 3 excitation. Load Model: Static, Dynamic load models.

References:

1. Stag.G. W., and EI-Abaid, A. H., “Computer Methods in Power System Analysis”, (2019 Edition), MEDTECH, A Division of Scientific International 2019.
2. K. Uma Rao, “Computer Techniques and Model in Power Systems”, 2nd edition, I. K. International , 2014.

3. Singh, L. P., "Advanced Power System Analysis and Dynamics", 6th edition, New Age International (P) Ltd, New Delhi, 2014.
4. Nagrath, I. J., and Kothari, D. P., "Modern Power System Analysis", 4th edition, TMH, 2011
5. Pai., M. A., "Computer Techniques in Power System Analysis", 2nd edition, TMH, 2006.

Course outcomes:

After completion of the course, the students shall be able to:

1. State the concepts of power system analysis
2. Illustrate the development of mathematical skills and writing algorithm for various problems involved in power system
3. Apply optimization techniques in scheduling of thermal generators
4. Analyse the different types of algorithm in load flow analysis
5. Compare and contrast types of excitation and load Models
6. Construct the problem formulation in economic dispatch and in transmission losses.

HIGH VOLTAGE, SWITCHGEAR AND PROTECTION	
Subject Code: UEE752C	**Credits: 03**
Contact Hours: 03 (3L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Unit-I

Generation of HVAC and DC Voltage: L-06 Hours

Classification of high voltages, HVAC-transformer, Need for cascade connection, working of transformer units connected in cascade, Series resonant circuit – principle of operation and advantages, Tesla coil, HV – DC voltage doublers circuit, Cock croft – Walton type high voltage DC set. Calculation of high voltage regulation, ripple and optimum number of stages for minimum voltage drop, Important applications of high voltages.

Generation of Impulse Voltage and Current: L-04 Hours

Introduction to standard lightning and switching impulse voltages. Analysis of single -stage impulse generator, expression for output impulse voltage. Multistage impulse generator, working of Mark impulse generator, Rating of impulse generator, Components of multistage impulse generator.

Unit-II

Measurement of High Voltages:L-05Hours

Electrostatic voltmeter – principle, construction and limitation. Chubb and Fortessue method for HVDC measurements. Series resistance micro ammeter, Standard Sphere gap measurements for HVAC, HVDC and factors affecting the measurements.

Insulation Testing Techniques: L-05Hours

Dielectric loss and loss angle measurement using Schering Bridge, Transformer ratios arm bridge, Breakdown in solid dielectrics: Intrinsic breakdown, Breakdown of liquid dielectrics: Suspended particle theory, electronic Breakdown, cavity breakdown(bubble's theory)

Unit-III

Protective Relaying: L-05 Hours

Relay definition, Required qualities of Protective Relaying, Primary and Back up protection, Classification of protective Relaying, Induction type Non-directional over current relay, Directional relay. Differential relay- Principle of operation, Percentage Differential relay, Distance relays: Impedance Relay, Reactance Relay, Mho Relay, R-X diagram and Buchholz Relay.

Protection Schemes: L-05 Hours

Merz-Price protection for generator, Merz -Price protection of Transformer. Inter turn fault, Induction motor protection-Protection against phase fault, ground fault and single phasing.

Unit-IV

Static Relays : L-05 Hours

Introduction, Basic construction and classification. Definite time lag static over current relay, Inverse time static over current relay, Static over voltage and under voltage relay, Microprocessor based over current relay-block diagram approach.

Principles of Circuit Breakers : L-05 Hours

Principles of AC circuit breaking, Principles of DC circuit breaking, Initiation of arc, maintenance of arc, Arc interruption- High resistance and Low resistance interruption. Re striking voltage, Recovery voltage and resistance switching. Types of circuit breakers- Air break and air blast circuit breakers, SF6 circuit breakers- Puffer type and Non Puffer type.

References

1. Sunil Rao, “Switchgear and Protection and Power Systmes”, (13th edition),Khanna Publishers,2008
2. J.B.Gupta, “Switchgear and Protection”, (2nd edition), Katson Publisher,2013
3. Ravindarnath B, “Power System Protection and Switchgear”, 2nd edition, New age International, 2008.

Course outcomes:

At the end of the course:

- Students should be able to define HV voltage generation, measurement and their protection schemes with different circuit configuration.
- Students should be able to illustrate high voltage HV generation, breakdown phenomena in insulating materials and various protective methods.
- Students should be able to solve numerical problems on HV and protection circuit by considering given system parameters.
- Students should be able to analyze the properties/characteristics of HV equipments and protection devices.
- Students should be able to compare & contrast multiple methods to implement protective schemes against different faults in electrical systems.
- Students should be able to develop the expression of fault current in HVAC & DC protective devices.

UHS753C : Intellectual Property Rights
(Credit Structure: 3-0-0)

Faculty In-Charge: Dr. B. G. Hokarani

About the course:

This is a substantive course on Intellectual Property. The course shall give a brief overview of the IP landscape in India. It shall also dwell into the role of IP in the modern intangible economy. The course curriculum covers a wide but definitive areas of study that involve fundamentals of IP and international obligations, economics of IP, justifications, nature of subject-matter, criteria for protection, term, rights, assignment and licensing, defences, limitations, exceptions, public interest considerations, remedies and enforcements. The course will also contain topics that involve the interface of IP with areas such as human rights and competition law and policy.

Course Learning Objectives:

1. **To recognize the importance of IP and to educate the students on basic concepts of Intellectual Property Rights.**
2. **To identify the significance of practice and procedure of Patents.**
3. **To make the students to understand the statutory provisions of different forms of IPRs in simple forms.**
4. **To learn the procedure of obtaining Patents, Copyrights, Trade Marks &Industrial Design.**
5. **To enable the students to keep their IP rights alive.**

The Syllabus

UNIT-I

Introduction to IPRS: **L- 10 Hours**

Importance of human creativity and its recognition and protection. Concepts of Property and Rights. History of IPRs. Different forms of IPRs. Role of IPRs in R and D.

P**atents** :

Meaning of Patent, Object and Value of Patent law. Advantages of Patent to the invertors. Criteria for Patentability. Software and Business Methods Patents. Govt.use of inventions, infringement of Patent and remedies for infringement. Compulsory license.

UNIT- II

Patent Drafting: L-**10 Hours**

Scope of invention, definitions, types of specification, descriptions, drawing, claim drafting and improvement.

Filing Requirement of patent:

Work flow chart in obtaining Patents, Forms to be submitted, assignment requirements, filing mechanism through Individual patent office and PCT route. Importance of PTC, claiming priority from either route. Request for re -examination and revocation. Term of Patent and Patent renewal.

Searching of Prior art:

Prior art- Tangible versus Intangible prior art. Search strategy: key words, structures, sequences, use operators, database for searching- free and paid, disclosed versus claimed matters.

UNIT- III

Trade-Marks: L - **10 Hours**

Meaning and functions of Trade Marks. Concept of Distinctiveness and Trade Marks registration. Trade Marks- Challenges in Non- Conventional Marks. Infringement of Trade Marks and remedies for infringement. Domain Names disputes and Well-Known Marks, Distinction between Trade names &Trade marks.

Industrial Design:

Definition of a design. Concept of Novelty and Originality; Inclusive and Exclusive Designs; Functions of Designs. Industrial Design registration in India. Duplicity of registration, Infringement of Design and remedies for infringement.

UNIT- IV

Copyright: **L- 10 Hours**

Introduction. Nature of Copyright, Subject-matter, protection requirement in Copyright Law, Neighboring/Related Rights. Economic and Moral Rights of Authors. Copyright in the Digital Context. An overview of Copyright protection in India. Transfer of Copyright. Infringement of Copyright, Copyright- fair dealing and remedies. Comparison with Patent and Copyright.

Emerging Copyright works in which copy subsists: Snippet tax and Online Streaming Platforms, Sound related technology, Blockchain technology

Confidential Information and Trade Secrets:

Introduction, Conditions of protection. Essentials for an action for breach of confidence, distinction between Confidential Information and General Information. Data protection laws in India: Cyber-Crimes under the IT Act.2000 **Total: L- 40 Hours**

TextBooks:

1. P.Naryan, "Intellectual Property Law", 3rd Ed,Easern Law House, 2007.
2. Dr. S.R.Myneni, "Law of Intellectual Property", 9th Ed, Asia law House, 2019.

Reference Books:

1.Dr.G.BReddy,"Intellectual Property Rights and Law", Gogia Law Agency.Hydrabad,Reprint edition2020.
2.N.R. Subbaram.S.Viswanathan,"Hand book Indian Patent Law and, Practice"Printers and publishers Pvt,Ltd,2008.
3. Cornish,"Intellectual Property Rights", Universal publications.
4. Dr.B.L.Wadehra,"Law Relating to Intellectual Property" 5th edition,Universal Law publishing Co, Dehli
5. Lionel Bently & Brad Sherman, Intellectual Property Law OUP UK; 4th edition (3 November 2014)

Course Outcomes(COs):

Students will:

CO1:	Distinguish and explain various forms of IPRs.
CO2:	Identify criteria to fit one's own intellectual work in particular form of IPRs.
CO3:	Apply statutory provisions to protect particular form of IPRs.
CO4:	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design etc.
CO5:	Identify procedure to protect different forms of IPRs national and international level.
CO6:	Develop skill of making search using modern tools and technics.

Solar Photovoltaic System Design

Syllabus

Subject Code	**UEE754E**	Session	**Sep 2020 – Jan 2021**	SEE Marks	**100**
Credits	**03**	Staff	**Dr. Suresh H. Jangamshetti**	Exam Duration	**03 Hrs**

Unit-I

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement. **[03 Hrs]**

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems. **[07 Hrs]**

Unit-II

Chapter-03: SPV module – Ratings, standard parameters; factors affecting electricity generated; I-V & P-V Characteristics; connection of modules in series, parallel and series & parallel; Mismatch in series and parallel connections, Introduction to arrays. **[05 Hrs]**

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems. **[05 Hrs]**

Unit-III

Chapter-07: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box; **[03 Hrs]**

Chapter-08: Installation, troubleshooting of stand-alone and grid connected solar PV power systems; Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter; islanding protection; commissioning and system functioning. Field visits within campus to study installations.**[07 Hrs]**

Unit-IV

Chapter-05: SPV system design and integration – Types of SPV systems; Design Methodology for Stand-alone SPV systems. **[04 Hrs]**

Chapter-06: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants. **[06 Hrs]**

References

1. Chetan Singh Solanki, *Solar Photovoltaics – Fundamentals, Technologies and Applications*, PHI Learning Private Limited, New Delhi, 2009
2. Chetan Singh Solanki, Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers, PHI Learning Private Limited, New Delhi, 2014
3. M S Imamuaa and P. Helm *Photovoltaic System Technology A European Hand book*.

4. Tiwari, G. N and Ghosal, M. K., Fundamentals of Renewable Energy Sources, Narosa Publishing House, New Delhi, 2007.

Solar Photovoltaic System Design

Subject Code	**UEE754E**	Session	**Sep 2020 – Jan 2021**	SEE Marks	**100**
Credits	**04**	Staff	**Dr. Suresh H. Jangamshetti**	Exam Duration	**03 Hrs**

Pre-requisites

1. Knowledge about conductor and semiconductor electronics.
2. Knowledge about basic electrical and electronics engineering.
3. Computational techniques and design concepts.
4. Knowledge about basics of power generation, transmission and distribution.
5. Knowledge about renewable energy sources.

Course Outcomes

1. **CO1-R:** Students should be able to define various parameters & features of solar cell, module, panel, array and SPV systems
2. **CO2-U:** Students should be able to describe working of SPV systems and their components
3. **CO3-A:** Students should be able to compute performance of SPV systems for different loads and applications based on numerical problems
4. **CO4-AN:** Students should be able to compare and analyze different SPV systems for specific applications based on performance
5. **CO5-E:** Students **should be** able to operate and test working of SPV systems and their components
6. **CO6-C:** Students should be able to design & discuss a solar PV system – stand alone or grid connected – based on typical loads.

Blooms Taxonomy: Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century

Level-1 (R): Knowledge or Remembering: * observation and recall of information; * knowledge of dates, events, places; * knowledge of major ideas; * mastery of subject matter; * Key words: list, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc. **Eg.** Write a list of vegetables

Level-2 (U): Comprehension or Understanding: * understanding information; * grasp meaning; * translate knowledge into new context; * interpret facts, compare, contrast; * order, group, infer causes; * predict consequences; * Key words: summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend, etc. **Eg.** Retell the story of the "Three Little Pigs" in your own words.

Level-3 (A): Application or Applying: * use information; * use methods, concepts, theories in new situations; * solve problems using required skills or knowledge; * Key words: apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover, etc. **Eg.** Make a model of a swing set with paper and explain how it works

Level-4 (AN): Analysis or Analyzing: * seeing patterns; * organization of parts; * recognition of hidden meanings; * identification of components; * Key words: analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, infer, etc. **Eg.** Make a family tree showing relationships

Level-5: Synthesis or Creating: * use old ideas to create new ones; * generalize from given facts; * relate knowledge from several areas; * predict, draw conclusions; * Key words: combine, integrate, modify, rearrange, substitute, plan, create, design, invent, what if?, compose, formulate, prepare, generalize, rewrite, etc. **Eg.** Design a magazine cover that would appeal to kids in your class

Level-6: Evaluation or Evaluating: * compare and discriminate between ideas; * assess value of theories, presentations; * make choices based on reasoned argument; * verify value of evidence; * recognize subjectivity; * Key words: assess, decide, rank, grade, test, measure, recommend, convince, select, judge, discriminate, support, conclude, summarize, etc. **Eg.** Make a booklet about 5 rules you see as important. Convince others

UEE755N: Energy Conservation in Industrial Systems

Subject Code: UEE755N	SEE Marks: 100
Credits: 03	Exam Duration: 03 Hours

Prelude: Electricity is used in different sectors, like industry, agriculture, commercial, domestic, transpiration, etc. Several devices that consume electricity are intensely employed in these sectors. Users or operators should know the energy consumed by such devices to save energy and thereby the cost of energy. The subject provides theoretical information of energy conservation opportunities in Industrial as well as other sectors.

Prerequisites: The students should have undergone the following courses.

1. UEE125C/UEE225C Basic Electrical Engineering
2. UPH122C/UPH222C Engineering Physics
3. UME124C/UME224C Elements of Mechanical Engineering
4. UBT133M/UBT233M Environmental Studies

Unit-I

Energy Management and Energy Planning : Definition & significance, Energy strategy, Energy policy and Energy planning, Two sides of energy management, Sectors of supply side energy management, Objectives of energy management, Hierarchical levels of supply side energy management, Energy and economy, Essential Imperatives and steps in supply side energy planning, Energy planning flow for supply side, Essential data for supply side energy planning, Per capita energy consumption, Essential Imperatives and steps in user side energy planning, Seven principles of energy management. [07hrs]

Concept and significance of energy conservation: Introduction, Listing of energy conservation opportunities (ECOs), Electrical ECOs, Thermodynamic ECOs, ECOs in Chemical process industry, ECOs in medium and small scale industry, ECOs in residential buildings, shopping complexes and in university campus, Human and animal bio muscle energy, Waste Management , Recycling of discarded materials and energy recycling, Waste Recycling Management. [03 hrs]

Unit-II

Heating and Power Ratings of Industrial Drive Motors: Load diagram, overload capacity, Insulating materials, Heating and cooling of motors, Service conditions of motor drives: Continuous, Intermittent and short time, Selection of motor power capacity : Continuous duty constant load motor application, Continuous duty variable load motor application, intermittent duty motor application and short time duty motor application. **[10 hrs]**

Unit-III

Industrial Heating: Methods of electrical heating: Resistance, Induction; Resistance heating: Heating methods, Resistance furnaces, Heating alloys, Causes for failure of heating elements, temperature control of Resistance furnaces, Arc furnaces, Basic mechanical requirements, Indirect arc furnace; Induction heating: Low frequency induction heating, Skin effect, Dielectric heating, Dipole formation, Generation of dielectric heat, Some applications of dielectric heating, Dielectric heating principle, Design of heating element, Efficiency and losses, Radiant heating, Depth of heat penetration. **[10 hrs]**

Unit-IV
Industrial Lighting: Basic principles of light control, Types of lighting schemes, Design of lighting schemes, Methods of lighting calculation, Factors controlling factory lighting, street lighting and flood lighting schemes, Factors affecting energy efficient lighting schemes. **[10 hrs]**

Course Outcomes	
	After completion of the course, 1. Students shall be able to list and define various parameters and features of Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 2. Students shall be able to explain various concepts and theory related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 3. Students shall be able to relate/articulate the concepts and theories related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 4. Students shall be able to compare and contrast the features of Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 5. Students shall be able to evaluate/calculate various parameters related to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting. 6. Students shall be able to discuss/choose/test issues relating to Energy Management and Energy Planning, energy conservation, Heating and Power Ratings of Industrial Drive Motors, Industrial heating and lighting.
Text Books	
1.	S.Rao and B.B. Parulekar, *Energy technology*, 3rd edition, khanna publishers, 6th reprint, 2009.
2.	M.V. Deshpande, *Elements of electrical power station design*, 3rd edition, wheeler publishing, 2010.
3.	J.B. Gupta, *Generation, transmission and utilization of electric power*, Kataria publication, New Delhi 2015.
Reference Books	
1.	Dr. Lal Jayamaha, “Energy-Efficient Industrial Systems: Evaluation and Implementation”, McGraw-Hill Education, 2016.
2.	Petrecca, Giovanni, “Industrial Energy Management: Principles And Applications”, Springer US, 2018.
3.	Durmuş KAYA, Fatma Canka Kilic’ Hasan Hüseyin ÖZTÜRK, “Energy Management and Energy Efficiency in Industry”, Springer International Publishing, 2021

POWER SYSTEM SIMULATION LAB

Subject Code : UEE761L **SEE Marks : 100**

Credits : 1 **Exam Duration: 03 Hours**

1. ABCD parameters for short and medium network of transmission lines.
   - Verification of Symmetry and Reciprocity of the network.
   - Determination of regulation and efficiency.
2. To determine fault currents and voltages in a single line systems with star-delta transformers at a specified location for SLGF, DLGF, LL and check boundary conditions.
3. Y Bus formation of power systems with and without mutual coupling by singular transformation and inspection method.
4. Determination of power angle diagrams for salient and non-salient pole synchronous m/c s, reluctance power, excitation emf and regulation.
5. Determine stability of power system using Swing equation.
   To determine critical clearing time for SMIB system by varying inertia constant, line parameters / fault location.
6. Write a program to perform load flow study using Gauss- Seidel method
   (only p q Bus not exceeding 4- buses).
7. Formation of Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
8. Write a program to perform load flow study using Fast-Decouple Load Flow Method
9. Optimal Generator Scheduling for Thermal power plants connected to load dispatch center.

Course outcomes:

Students should be able to

1. Formulate and determine the electrical network parameters using electrical topology
2. Model and simulate the steady state analysis of power system network
3. Evaluate generator scheduling and economic load dispatch in power plant.

Note:

All experiments must be simulated using MATLAB and MiPower Software.

LABORATORY ASSESSMENTS FOR SEE:

1) Each Laboratory is evaluated for 100 marks (50CIE and 50SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment =30 marks/No. of proposed experiments.
   - One Practical test, for 20 marks, (5 write up, 10 conduction, calculation, Results etc., 5 viva-voce).
3) Allocation of 50 marks for SEE.25% write up, 50% conduction, calculation, results etc., 25% viva-voce.

HIGH VOLTAGE AND RELAY LAB

Subject Code: UEE762L **Credits: 01**

Contact Hours: 02 (0L-0T-2P) **Assessment: CIE 50 and SEE 50**

Course Outcomes:

Students should be able

- To know the concept of relays and HV systems.
- To understand the operation and IDMT and DMT characteristic of relay.
- To understand concept of various types of relay and their characteristics.
- To study the application of different types of relays in the power system.
- To study the flash over characteristics of HVAC.
- To study breakdown strength of transformer (insulating) oil.

List of Experiments:

1. Operating characteristics of static Under/Over Voltage relay.
2. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
3. Operating characteristics of Electro-Mechanical over current relay.
4. Operating characteristics of Electro-Mechanical Earth fault relay.
5. Operating characteristics of Microcontroller over current relay (DMT and IDMT).
6. Operating characteristics of Numerical Under / Over voltage relay (DMT and IDMT).
7. Operating characteristics of static Over Current relay (DMT).
8. Break down strength of transformer oil.
9. Experiment on field plotting using electrodes.
10. Measurement of high AC and DC voltage using Sphere-gap.
11. Flash-over characteristics of uniform and non-uniform Gaps for HVAC
    a. Plane-Plane Electrodes (Uniform field)
    b. Point-Plane Electrodes (Non-uniform field)
12. Flash-over characteristics of Uniform and non-uniform fields for Direct high voltage
    a. Plane-Plane Electrodes
    b. Point positive, Plane negative
    c. Point negative, Plane positive

LABORATORY ASSESSMENTS FOR SEE:

1) Each Laboratory is evaluated for 100 marks (50CIE and 50SEE)
2) Allocation of 50 marks for CIE
   - Performance and journal write-up: Marks for each experiment =30 marks/No. of proposed experiments.
   - One Practical test, for 20 marks, (5 write up, 10 conduction, calculation, Results etc., 5 viva-voce).
3) Allocation of 50 marks for SEE.25% write up, 50% conduction, calculation, results etc., 25% viva-voce.

Internship

Subject Code	**:UEE764I**	**CIE +SEE Marks**	**:50 + 50**
Credits	**:02**	**Exam Duration**	**:03 Hrs**

All the students have to undergo mandatory internship/training in any one of the reputed industry/ research institute. The training program has to be taken up during the vacation between 6th and 7th semester. The duration of the training program should be for period of 2 weeks. A report on the training is to be submitted. The supervisor/ guide from industry shall allot 50 marks of the CIE and the other 50% by the internal supervisor/guide. SEE evaluation will be made by a committee comprising of HoD as Chairman, UG coordinator and internal supervisor/guide. The SEE will be a Technical Seminar on the industrial training. Marks awarded shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

PROJECT PHASE -I

Subject Code :UEE765P **CIE + SEE Marks :50 + 50**

Credits :05 **Exam Duration :03 Hrs**

Phase –I of the project is part of the final year UG Project. Students have to take up Literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. A certified report and a seminar is to be presented by the students. The seminar should highlight – Broad project area, literature survey, problems definition, Project objectives, implementation schedule of the project and work carried out. Guide will allot CIE marks for 50. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- guide, project coordinator, Hod/Nominee). PEC will allot SEE marks for 50.

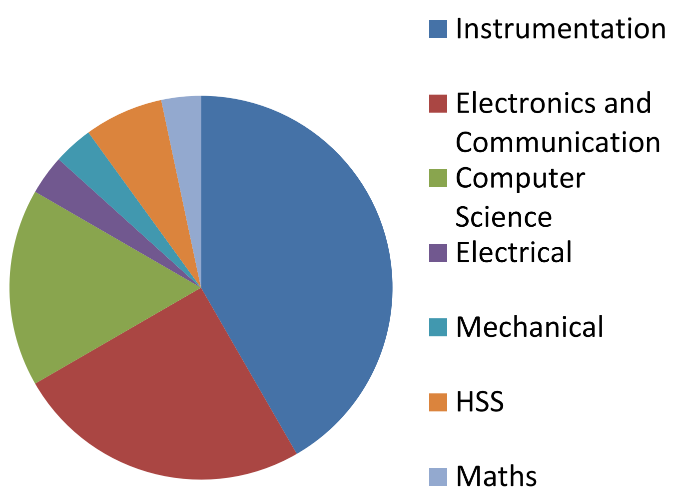
Rubrics for Project Phase-I (VII Semester)

Rubrics	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before one month from the start of 7th semester of BE Program	R1	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)
	Evaluation-II	Before 15 days from the last working day of 7th semester of BE Program	R2	15	
	Evaluation by guide	In the last week of working days	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of 7th semester of BE Program	R4	50	Committee consisting of HOD/Nominee + Project Coordinator + External Examiner

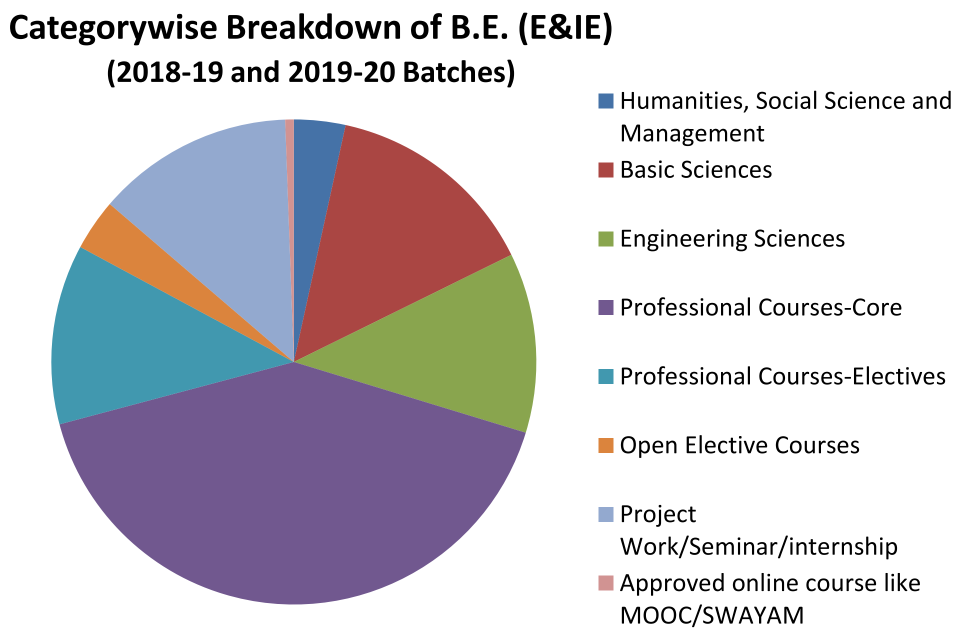
DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING
BASAVESHWAR ENGINEERING (AUTONOMOUS) COLLEGE, BAGALKOT

Stream-wise Breakdown of B.E (E&IE) Curriculum
(2018-19 Admitted to First Year and 2019-20 Lateral Admitted Batches)

Stream	Number of subjects
Instrumentation	25
Electronics and Communication	15
Computer Science	10
Electrical	2
Mechanical	2
HSS	4
Mathematics	2



Course Category	Category wise breakdown of B.E (E&IE) Program No. of credits
Humanities, Social Science and Management	06
Basic Sciences	25
Engineering Sciences	21
Professional Courses-Core	72
Professional Courses-Electives	21
Open Elective Courses	06
Project Work/Seminar/Internship	23
Approved online course like MOOC/SWAYAM	01
TOTAL	**175**



2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION

B.E. (III SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UMA335C	Computational Methods for Electrical Science	03	3	-	-	50	50	100
2	UEI341C	Electronic Circuit Analysis and Design	04	4	-	-	50	50	100
3	UEI342C	Digital Design and VHDL	04	3	2	-	50	50	100
4	UEI343C	Electrical Sensors and Transducers	04	4	-	-	50	50	100
5	UEI344C	Electrical Circuit Analysis	04	3	2	-	50	50	100
6	UEI345L	Analog Circuits Laboratory	1.5	-	-	3	50	50	100
7	UEI346L	Digital Circuits Laboratory	1.5	-	-	3	50	50	100
8	*UBT133M*	*Environmental Studies**	-	2	-	-	50	50	100
9	*UMA330M*	*Bridge Course Mathematics-I**	-	3	-	-	50	50	100
		Total	**22**	**17/ 22***	**04**	**06**	**350/ 450***	**350/ 450***	**700/ 900***

* For lateral admitted diploma students along with other courses

Note: Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.

2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION
B.E. (IV SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UMA435C	Statistical Methods for Electrical Science	03	3	-	-	50	50	100
2	UEI441H	Entrepreneurship Development	03	3	-	-	50	50	100
3	UEI442C	Signals and Systems	04	3	2	-	50	50	100
4	UEI443C	Linear ICs and Data Converters	04	4	-	-	50	50	100
5	UEI444C	Measurement Techniques and Instruments	03	3	-	-	50	50	100
6	UHS001N	Fundamentals of Quantitative Aptitude and Soft Skills	01	1	-	-	50	50	100
7	UEI445L	Linear ICs and Data Converters Laboratory	1.5	-	-	3	50	50	100
8	UEI446L	Process Instrumentation and Measurement Laboratory	1.5	-	-	3	50	50	100
9	*UHS226M*	*Constitution of India**	-	2	-	-	50	50	100
10	UMA430M	*Bridge Course Mathematics-II#*	-	*3*	-	-	*50*	*50*	*100*
		Total	**21**	**17/ 22***	**02**	**06**	**400/ 900***	**400/ 900***	**800/ 1000***

* For lateral admitted diploma students along with other courses

Note: Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.

2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION
B.E. (V SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UEI541C	Microcontroller and Peripherals	03	3	-	-	50	50	100
2	UEI542C	Process Control	04	4	-	-	50	50	100
3	UEI543C	Digital Signal Processing	04	4	-	-	50	50	100
4	UEI51XE	Dept. Elective-I	03	3	-	-	50	50	100
5	UEI52XE	Dept. Elective – II	03	3	-	-	50	50	100
6	UHS002N	Advanced Quantitative Aptitude and Soft Skills	01	1	-	-	50	50	100
7	UEI544L	DSP Laboratory	1.5	-	-	3	50	50	100
8	UEI545L	Microcontroller Laboratory	1.5	-	-	3	50	50	100
9	UEI546L	Process Control Laboratory	01	-	-	2	50	50	100
		Total	**22**	**18**	**00**	**08**	**450**	**450**	**900**

Note: Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.

Group I

Subject Code	Title	Subject Code	Title
UEI511E	Analytical Instrumentation	UEI512E	Communication Systems
UEI513E	Python Programming	UEI514E	Robotics

Group II

Subject Code	Title	Subject Code	Title
UEI521E	Pneumatics and Hydraulic Instrumentation	UEI522E	Automotive Electronics
UEI523E	Object Oriented Programming with C++	UEI524E	Renewable Energy

2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION

B.E. (VI SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UEI641C	Medical Instrumentation	03	3	-	-	50	50	100
2	UEI642C	Control Systems	04	4	-	-	50	50	100
3	UEI643C	ARM Processor	03	3	-	-	50	50	100
4	UEI61XE	Dept. Elective-III	03	3	-	-	50	50	100
5	UHS003N	Career Planning and Professional Skills	01	1	-	-	50	50	100
6	UXXXXXN	Open Elective-I	03	3	-	-	50	50	100
7	UEI644L	ARM Processor Laboratory	01	-	-	2	50	50	100
8	UCS659L	Advanced C Programming	02	-	2	2	50	50	100
9	UEI645P	Mini Project	03	-	-	6	50	50	100
		Total	**23**	**16**	**04**	**10**	**450**	**450**	**900**

Note: **1.** Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.
2. Evaluation of Mini Project is as per the rubrics of BEC Exam Reforms Policy - 2020.

Open Elective-I: UEI646N: Virtual Instrumentation (For students of other departments)

Group III

Subject Code	Title	Subject Code	Title
UEI611E	Intelligent Instrumentation	UEI612E	Micro Electro Mechanical Systems
UEI613E	Computer Networks and Security	UEI614E	Digital Image Processing

2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION
B.E. (VII SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UEI741C	Process Automation	04	4	-	-	50	50	100
2	UEI742C	Lasers and Optical Instrumentation	04	4	-	-	50	50	100
3	UEI71XE	Dept. Elective-IV	03	3	-	-	50	50	100
4	UXXXXXN	Open Elective-II	03	3	-	-	50	50	100
5	UEI743L	Virtual Instrumentation Laboratory	02	0	0	4	50	50	100
6	UEI744L	Process Automation Laboratory	01	-	-	2	50	50	100
7	UEI745I	Internship#	02	-	-	-	50	50	100
8	UEI746P	Project Work-Phase I	05	-	-	5	50	50	100
		Total	**24**	**14**	**00**	**11**	**400**	**400**	**800**

Minimum 4 weeks duration internship program in relevant industry/center of excellence to be completed by the student before admitting to 7th semester and its credentials will be considered in 7th semester.

Note: **1.** Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.
2. Evaluation of Project Work – Phase I is as per the rubrics of BEC Exam Reforms Policy - 2020

Open Elective-II: **UEI747N: Industrial Automation** (For students of other departments)

Group IV

Subject Code	Title	Subject Code	Title
UEI711E	Data Base Management System	UEI712E	VLSI Design
UEI713E	Internet of Things	UEI714E	Advanced Control Systems

2018-19 Batch

SCHEME OF TEACHING AND EXAMINATION
B.E. (VIII SEMESTER) ELECTRONICS AND INSTRUMENTATION ENGINEERING

Sl. No	Subject Code	Subject	Credits	Hours/ Week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UEI81XE	Dept. Elective-V	03	3	0	0	50	50	100
2	UEI82XE	Dept. Elective-VI	03	3	0	0	50	50	100
3	UEI83XE	Dept. Elective- VII	03	3	0	0	50	50	100
4	UEI841S	Technical Seminar	01	0	0	2	50	50	100
5	UEI842P	Project Work-Phase II	12	0	0	12	50	50	100
		Total	**22**	**09**	**00**	**14**	**250**	**250**	**500**

Note: **1.** Students need to register and earn one credit from BoS approved online course (NPTEL/MOOC or equivalent) before the completion of B.E. program.
2. Evaluation of Technical Seminar and Project Work – Phase II is as per the rubrics of BEC Exam Reforms Policy - 2020

Group-V

Subject Code	Title	Subject Code	Title
UEI811E	Industrial Drives and Machines	UEI812E	JAVA
UEI813E	Cloud Computing	UEI814E	Industrial Electronic Equipment Design

Group-VI

Subject Code	Title	Subject Code	Title
UEI821E	Industrial Safety	UEI822E	Wireless Communication
UEI823E	Aeronautical Instrumentation	UEI824E	Artificial Intelligence and Machine Learning

Group VII

Subject Code	Title	Subject Code	Title
UEI831E	Industrial Buses and Data Networks	UEI832E	Operating Systems
UEI833E	Process Modeling	UEI834E	Biomedical Signal Processing

UMA391C: NUMERICAL TECHNIQUES & INTEGRAL TRANSFORMS
3 Credits (3-0-0)

Course Objectives:

To apply the knowledge of Mathematics in various engineering fields, students are able

- *To be understand the numerical methods of solving algebraic, transcendental equations.*
- *To be acquired the knowledge about various methods of interpolation*
- *It is very much essential to understand the basic concepts of numerical differention, numerical integration and numerical solutions of ode.*
- *To be understand concepts of Fourier series, Fourier transforms, and z-transforms, because Fourier series is very powerful tool to solve ode and pde.*

Course outcomes:

On the successful completion of this course, students are able

CO1: The ability to solve engineering problems using non-linear equations and interpolation techniques.

CO2: The ability to solve problems using numerical differention and numerical integration.

CO3: Be capable to perform numerical solutions of ordinary differential equations.

CO4: Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.

CO5: It is essential to understand the basic concepts of Fourier transforms and z –transforms, to solve ode, pde and difference equations.

Unit-I

Numerical Analysis-I: **10 Hours**

Introduction to root finding problems, Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).

Unit-II

Numerical Analysis-II: **10 Hours**

Numerical differentiation using Newton's forward and backward formulae-problems.Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation of any formulae)-problems. Euler's and Modified Euler's method, Runge-Kutta 4^{th} *order method.*

Unit-III

Fourier series: **10 Hours**

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

Unit-IV

Fourier transforms and z-transforms: **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms, Inverse Fourier sine and cosine transforms. Z-transforms-definition, standard forms, linearity property, damping rule, shifting rule-problems.

Resources:

1. Numerical Methods for Engineers by Steven C Chapra & Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from **entire** syllabus.

UEI341C: ELECTRONIC CIRCUIT ANALYSIS AND DESIGN
4 Credits (4-0-0)

Course Objectives:

1. To impart the knowledge of electronic devices.
2. To practice the techniques of FET biasing and small signal analysis.
3. To apply the knowledge of biasing, stability, and feedback concept in designing amplifiers.

UNIT-I

Diode application: Diode equivalent circuits, series biased clippers, parallel biased clippers, positive clampers, negative clampers. **Differential amplifiers:** Introduction, common mode rejection, bipolar differential amplifier pair, DC bias operation, AC operation, common mode operation of circuit, current mirror circuits.

13 Hrs.

UNIT-II

Field Effect Transistor: Introduction, depletion type MOSFET: Basic construction, basic operation and characteristics, P-channel depletion type MOSFETs and symbols, Enhancement type MOSFET: Basic construction, basic operation and characteristics, P-channel enhancement type MOSFETs and symbols, Basics of CMOS. **FET biasing**: Self bias and voltage divider bias arrangements of depletion type MOSFET, feedback biasing and voltage divider biasing arrangements of enhancement type MOSFET.

13 Hrs.

UNIT-III

FET small signal analysis: Introduction, FET small signal model, mathematical and graphical determination of transconductance ratio, self bias configuration, voltage divider bias configuration, E-MOSFET drain-feedback configuration, E-MOSFET voltage divider configuration, designing FET amplifier networks. **Power amplifiers:** Definition and amplifier types, series fed class-A amplifier, transformer coupled class-A amplifier, class-B operation.

13 Hrs.

UNIT-IV

Feedback Amplifiers: Feedback concepts, feedback connection types, feedback amplifiers. **Oscillator amplitude stabilization**: Meaning, diode stabilization circuit for phase shift oscillator and for Wein bridge oscillator, FET stabilization circuit for Wein bridge oscillator, designing of stabilizing circuits. **BJT and FET frequency response**: General frequency considerations, Miller effect capacitance.

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

CO1: Describe the working principles of electronic devices.
CO2: Interpret and illustrate the working of electronic circuits.
CO3: Analyze various electronic circuit configurations and derive expressions for their specifications.
CO4: Solve electronic circuit problems and design electronic circuits.

TEXT BOOKS:

1. Boylestad and Nashelsky, “Electronic Devices and Circuit Theory,” 10^{th} Edition, Pearson, 2009.

2. David A. Bell, “Electronic Devices and Circuits,” 4th Edition, PHI, 2007.

REFERENCE BOOKS:

1. Behzad Razavi, “Fundamentals of Microeletronics,” 2nd edition, Wiley Publication, 2012.
2. Jacob Milman, Christos C. Halkias, “Integrated Electronics,” TMH, 2010.
3. A.P. Malvino, “Electronic Principles,” TMH, 2003.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO3	3	3	-	-	-	-	-	-	-	-	-	-	1	3
CO4	3	1	1	-	-	-	-	-	-	-	-	-	-	2

UEI342C: DIGITAL DESIGN AND VHDL
4 Credits (3-2-0)

Course Objectives:

1. To impart techniques for simplification of Boolean equations.
2. To illustrate design of combinational and sequential logic circuits.
3. To develop ability to analyze combinational and sequential circuits.
4. To impart HDL programming skills.

UNIT-I

Principles of Combinational Logic: Definition of combinational logic, canonical forms, generation of switching equations from truth tables, Karnaugh maps-3 and 4 variables, incompletely specified functions (don't care terms), simplifying max term equations. Quine-McCluskey minimization technique. **Introduction to VHDL:** Structure of VHDL module, operators, data types, styles of description, dataflow description.

10 Hrs.(L)
06 Hrs.(T)

UNIT-II

Analysis and Design of Combinational Logic: General approach, decoders-BCD decoders, encoders., digital multiplexers: Boolean function implementation, adders and subtractors - cascading full adders, look ahead carry adder, binary comparators. **VHDL behavioral description:** Variable assignment statement, sequential statements, VHDL behavioral description for encoders, decoders, multiplexers, adders and comparators

10 Hrs.(L)
06 Hrs.(T)

UNIT-III

Introduction to Sequential Circuits: Basic bistable element, latches, SR latch, application of SR latch, a switch debouncer, the SR Latch, the gated SR latch, the gated D latch, the master-slave flip-flops (pulse-triggered flip-flops): SR, JK, edge triggered flip-flop: the positive edge-triggered D flip-flop, negative-edge triggered D flip-flop. characteristic equations, registers, counters - binary ripple counters, counters based on shift registers. . **VHDL behavioral description** of latches, flip-flops, registers, asynchronous counters

10 Hrs.(L)
06 Hrs.(T)

UNIT-IV

Synchronous binary counters: Introduction, design of a synchronous Mod-n counter using clocked JK , D, T and SR flip-flops. **Sequential Circuits:** Introduction to state machines, Mealy and Moore models, state machine notation, synchronous sequential circuit analysis. Sequential design: construction of state diagrams, design examples. **VHDL behavioral description** of synchronous counters

10 Hrs.(L)
06 Hrs.(T)

Tutorial:

Exploring the VHDL concepts in each unit using appropriate software/modern tool.

Total Hrs.: 40 (L)
24 (T)

Course Outcomes:

Students will be able to:

CO1: (a) Construct the truth table for the given logical problems , obtain Boolean expressions in canonical forms and Simplify Boolean equations using K-map, QM techniques.

(b) Illustrate VHDL data types, operators and write VHDL dataflow description.

CO2: **(a)** Analyze and design combinational circuits.

(b) Describe the VHDL sequential statements and develop VHDL behavioral description for combinational circuits.

CO3: **(a)** Analyze and design registers and counters using flip flops

(b) Develop VHDL behavioral description for flip-flops, registers and asynchronous counters.

CO4: **(a)** Identify, analyze and design sequential circuits.

(b) Develop VHDL behavioral description for synchronous counters and state machines

TEXT BOOKS:

1. John M Yarbrough, “Digital Logic Applications and Design,” Thomson Learning, 2001. ISBN 981-240-062-1.
2. Donald D. Givone, “Digital Principles and Design‖, “McGraw Hill, 2002. ISBN 978-0- 07-052906-9.
3. Nazeih M. Botros, “HDL Programming – VHDL and Verilog,” Dreamtech Press, 2009 Reprint

REFERENCE BOOKS:

1. Charles H. Roth Jr, "Fundamentals of Logic Design", Thomson Learning, 2004.
2. Mono and Kim, "Logic and Computer Design Fundamentals", Pearson, 2nd Edition, 2001.
3. John F. Wakerly, “Digital Design- Principles and Practices,” Prentice Hall, Third Edition.
4. Rajshekhar Allurkar, "Logic Design", CBS Publishers, 2008.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	1	1	1	2	2	2	3	2
CO2	3	3	2	3	3	3	2	1	2	3	3	3	3	2
CO3	3	3	3	3	3	3	2	1	2	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	2	3	3	3	3

UEI343C: ELECTRICAL SENSORS AND TRANSDUCERS
4 Credits (4-0-0)

Course Objectives:

1. To impart the fundamental concepts, working principles, and applications of sensors/ transducers.
2. To provide the knowledge on sensor selection.
3. To use sensor/transducer for a particular application.

UNIT-I

Introduction to sensor: Meaning of sensors and transducers, classification of transducers (Mechanical/electrical, Active/passive, Absolute/Modulated output type), Sensor based measurement system, Static characteristics (Accuracy, precision, sensitivity, error, linearity, resolution, hysteresis), Dynamic characteristics (order, I, II order system response to step input), Introduction to microsensors. **Resistive Sensors:** Potentiometers, Strain gages, Resistive temperature detectors (RTD), Thermistors, Magnetoresistors, Light-dependent resistors (LDR), Resistive hygrometers, Resistive gas sensors, Liquid conductivity sensors.

13 Hrs.

UNIT-II

Self-Generating Sensors: Thermoelectric sensors: Thermocouples, Piezoelectric sensors, Hall effect sensors, Pyroelectric sensors, Photo voltaic sensors, Electrochemical sensors. **Capacitive Sensors:** Variable capacitors: Differential arrangement, Different applications. Differential capacitor: Principle based on variable are, distance and dielectric property, applications.

13 Hrs.

UNIT-III

Inductive sensors: Variable reluctance type, Eddy current type, LVDT, LVDT applications, Variable transformers: Synchros, Resolvers, Inductosyns. Magnetoelastic and magnetostrictive type, Super quantum Interference devices (SQUIDS). **Electromagnetic Sensors:** Sensors based on Faraday's law, Linear velocity sensor, Serach coil magnetometer, Electromagnetic flow meter.

13 Hrs.

UNIT-IV

Digital and Intelligent Sensors: Position encoders, Resonant sensors, Intelligent sensors. **Miscellaneous Sensors:** Sensors based on semiconductor junctions, sensors based on MOSFET transistors, Fiber optic sensors, Ultrasonic based sensors, Biosensors**.**

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

CO1: **(a)** Describe and interpret dynamic and static characteristics of sensors and transducers.
(b) Describe and solve problems on resistive sensors.
CO2: **(a)** Describe self generating and capacitive sensors.
(b) Interpret and analyze self generating and capacitive sensors.
CO3: **(a)** Describe inductive and electromagnetic sensors.
(b) Interpret and analyze inductive and electromagnetic sensors.
CO4: **(a)** Describe digital, intelligent, semiconductor, fiber optic, ultrasonic sensors.
(b) Identify and use sensor for a particular application.

TEXT BOOK:

1. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning," 2nd Edition, Wiley India Private Ltd.

REFERENCE BOOKS:

1. Ian R. Sinclair, "Sensors and Transducers," 3rd Edition, Newnes Publication.
2. D. Patranabis, "Sensors and Transducers," 2nd Edition, PHI.
3. Allan S. Morris, "Measurement and Instrumentation Principles," 3rd Edition, Butterworth & Heinmann Publication.
4. John P. Bentley, "Principles of Measurement Systems," 3rd Edition, 2004, Pearson Publication

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	1	1	1	2	2	2	1	2	3	2
CO2	3	2	2	2	1	1	1	2	2	2	1	3	3	2
CO3	3	2	2	2	1	1	1	2	2	2	1	3	3	2
CO4	3	2	2	2	1	1	1	2	2	2	1	2	3	2

UEI344C: ELECTRICAL CIRCUIT ANALYSIS
4 Credits (3-2-0)

Course Objectives:

1. To impart knowledge on basics of electrical circuits.
2. To practice different methods of circuit analysis.
3. To apply Laplace Transform for electrical circuit analysis.

UNIT-I

The concepts and analysis techniques of AC and DC circuits: Voltage and current sources, Kirchhoff's voltage and current laws, series and parallel combinations of sources, series and parallel combinations of elements, voltage and current division, source transformations, delta-Y conversions, sinusoidal steady state analysis, nodal and mesh analysis**.**

10 Hrs.(L)
06 Hrs.(T)

UNIT-II

Network theorems (applied to DC and AC circuits): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem. **Transient behavior and initial conditions in networks:** Initial and final conditions in elements, geometrical interpretation of derivatives, procedure for evaluating initial conditions.

10 Hrs.(L)
06 Hrs.(T)

UNIT-III

Resonance: The resonance effect, series resonance, parallel resonance, bandwidth and selectivity of resonant circuit, Q factor of resonant circuit. **Circuit Analysis with Laplace transformations:** Introduction of LT and ILT, S-domain impedance and admittance, the s-domain models for initially charged capacitor and initially fluxed inductor, determination of the complete s-domain model for a given circuit, application of various circuit analysis methods to s-domain circuit models, application of LT methods to obtain the complete solutions for first-order and second order circuits.

10 Hrs.(L)
06 Hrs.(T)

UNIT-IV

Network topology: Network and network graph, incidence matrix, properties of incidence matrix, tree of network variables, tie set and tie set schedule, cut set and cut set schedule, formulation and solution of network equations using tie set schedule and cut set schedule. **Two port network parameters:** Relationship of two-port variables, short circuit admittance parameters, open-circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameter sets.

10 Hrs.(L)
06 Hrs.(T)
Total Hrs.: 40 (L)
24 (T)

Course Outcomes:

Students will be able to:

CO1: **(a)** Explain basic concepts of electrical sources and circuits.
(b) Analyze AC and DC circuits using different techniques.
CO2: **(a)** Analyze AC and DC circuits using theorems.
(b) Evaluate transient behavior and initial conditions in electrical circuits.
CO3: **(a)** Analyze the resonance behavior of electrical circuits.
(b) Analyze electrical circuits using Laplace transforms.
CO4: **(a)** Analyze electrical circuits using network topology.
(b) Evaluate two port network parameters

TEXT BOOKS:

1. M.E. Van Valkenburg, "Network Analysis," PHI, 3rd Edition, 2002.
2. William D. Stanley, "Network Analysis with Applications," Pearson Education, 4th Edition, 2004.

REFERENCE BOOKS:

1. Hayt, J. E. Kemmerly, S. M. Durbin, "Engineering Circuit Analysis," TMH, 6th Edition, 2006.
2. Fawwaz T. Ulaby, Michel M. Maharbiz , Cynthia M. Furse, “Circuits,” NTS Press, 3rd Edition.
3. Charles K. Alexander, Matthew N. O. Sadiku, “Fundamentals of Electric Circuits,” McGraw Hill Publications, 5th Edition.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO2	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO3	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO4	3	3	2	2	3	2	1	1	1	2	2	2	3	2

UEI345L: ANALOG CIRCUITS LABORATORY
1.5 Credits (0-0-3)

Course Objectives:

1. To design, test, and analyze various electronic circuits based on diode, BJT, and JFET.
2. To understand the usage of transistors in amplifier circuits.
3. To verify network theorems using resistive networks.

List of experiments:

1. Study of basic instruments.
2. Characteristic of Diode.
3. Characteristic of Transistor.
4. Characteristic of FET.
5. Rectifiers: Half, full, bridge, with and without filters.
6. Clipping circuits.
7. Clamping circuits.
8. Darlington Emitter follower.
9. Frequency response of RC coupled amplifier.
10. Verification of Thevenin’s & Norton’s theorem.
11. Verification of Maximum power transfer & Superposition theorem.
12. Frequency response of series and parallel resonance circuit.

Minimum 10 experiments to be completed from the above list

Course Outcomes:

Students will be able to:

CO1: Design and develop a circuit/system for the given objective
CO2: Conduct the experiment and demonstrate the theoretical concepts
CO3: Analyze and interpret the experimental results

REFERENCE BOOKS:

1. Boylestad and Nashelsky, “Electronic Devices and Circuit Theory,” 10th Edition, Pearson, 2009.
2. David A. Bell, “Electronic Devices and Circuits,” 4th Edition, PHI, 2007.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	3	3	3	3	3	3

UEI346L: DIGITAL CIRCUITS LABORATORY
1.5 Credit (0-0-3)

Course Objectives:

1. To experience the operation of various logic gates and digital circuits.
2. To design combinational and sequential logic circuits.
3. To give hands on experience of digital components and circuits.

List of experiments:

1. Simplification, realization of Boolean expressions using logic gates/universal gates
2. Realization of Half/Full adder and Half/Full Subtractors using logic gat
3. Realization of Binary to Gray code conversion, BCD to Excess-3 and vice versa
4. Realization of parallel adder/Subtractors, Code converter (BCD to Excess-3) using 7483chip
5. MUX/DEMUX – use of 74153, 74139 for arithmetic circuits and code converter
6. Realization of One/Two bit comparator and study of 7485 magnitude comparator
7. Use of: a) Decoder chip to drive LED display b) Priority encoder
8. Truth table verification of Flip-Flops: (i) JK Master slave (ii) T type and (iii) D type
9. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192,74193)
10. Shift register (74LS95)

Course Outcomes:

Students will be able to:

CO1: Design and develop a circuit/system for the given objective
CO2: Conduct the experiment and demonstrate the theoretical concepts
CO3: Analyze and interpret the experimental results

REFERENCE BOOKS:

1. Donald D. Givone, "Digital Principles and Design", Tata McGraw Hill, Edition 2002.
2. John M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2001.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	3	2	3	3	3	3	3	3	3
CO2	3	3	3	3	3	2	3	3	3	3	3	3	3	3
CO3	3	2	3	3	3	2	3	2	3	3	3	3	3	3

UBT133M: ENVIRONMENTAL STUDIES

UNIT-I

Environment & Ecology **L:07 Hrs**

Environmental segments, Ecosystem and classification of ecosystem. Environmental Impacts of human activities : Agriculture, Transportation, Industry, Mining, Urbanization.

Natural **Resources**

Forest, water, mineral, food, land resources and biodiversity,

Renewable Energy: Solar energy, wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biofuels, Hydrogen as fuel.

Non renewable Energy: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT-II

Environmental Pollution **L:07 Hrs**

Water pollution, water quality standards, water borne diseases, Fluoride problem, Air pollution, Noise pollution. Effect ofelectro magnetic waves.

Sustainable future

Concept of sustainable development, threats to sustainability, over exploitation of resources, strategies for sustainable development. Environmental education, conservation of resources. Environment economics — concept of green building, Clean Development Mechanism(CDM).

UNIT-III

Current Environmental Issues of concern **L: 06 Hrs**

Population growth, Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication **Environmental policy legislation rules & regulations**

National environmental policy, environment protection act, legal aspects of air & water act. Functions of Government agencies.

UNIT-IV

Fundamentals of Waste management **L: 06 Hrs**

Solid waste management: Sources, classification, characteristics, collection & transportation, disposal, and processing methods. Hazardous waste management and handling.

Concept of waste water treatment, Bioremediation.

Industrial waste management (Case studies: Cement, plastic, chemical, E—waste, food & construction industry waste management).

Course Outcomes: Students will be able

1. To identify basic aspects of environment and ecology.
2. To recognize natural resources and its uses.
3. To illustrate types of pollution and its effects on environment.
4. To demonstrate the concept of sustainable development.
5. To apply knowledge of environmental protection acts in various societal concerns.
6. To apply the waste management techniques in various fields.

Text Books

1. Benny Joseph “Environmental Studies” Tata McGraw Hill, 2005.
2. Dr. D. L. Manjunath, “Environmental Studies” Pearson Education, 2006
3. Koushik and Koushik “Environmental Science & Engineering” New Age International Publishers, New Delhi, 2006

Reference Books

1. P. Venugopal Rao "Principles of Environmental Science & Engineering" Prentice Hall ofIndia, 2006.
2. Meenakshi "Environmental Science & Engineering" Prentice Hall of India, 2006.
3. S. K. Garg "Environmental Science & Ecological Studies" Khanna Publishers New Delhi, 2007.
4. P.D.Sharma"Ecology and Environment" Rastogi Publications, 2012.

UMA330M: BRIDGE COURSE MATHEMATICS-I

Course Learning Objectives: This course (**UMA330M**) will enable students to master the basic tools of calculus and vectors to become skilled for solving problems in science and engineering.

Differential Calculus: **15 Hours**

Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems

Partial differentiation : Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems,

Integral Calculus: **15 Hours**

Reduction formula $\int \sin^n xdx$, $\int \cos^n xdx$, $\int \tan^n xdx$ and $\int \sin^n x \cos^n xdx$. Evaluation of double and triple integrals. Area bounded by the curve.

Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.

Vector Calculus: **10 Hours**

Vector Differentiation: Scalar and vector fields**.** Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems

Course Outcomes:

On completion of this course, students are able to:

CO1: Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2: Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.

CO3: Apply the concept of multiple integrals and their usage in computing the area and volumes.

CO4 : Apply the knowledge of vector calculus to solve the engineering problems

Text Books:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:** Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

UMA491C: Statistics and Probability Distributions
3 Credits (3-0-0)

Course Objectives:

To apply the knowledge of Mathematics in various Engineering fields, students are able

- To be acquired knowledge about predictions preferably on the basis of mathematical equations.
- To be understand the principal concepts about probability.

Course outcomes:

On completion of this course, students are able

CO1: To apply the least square sense method to construct the specific relation for the given group of data.

CO2: To understand the concept of probability

CO3: To apply the concept of probability to find the physical significance of various distribution phenomena.

CO4: To understand the concepts of probability distributions

CO5: To apply the concept of Markov Chain for commercial and industry purpose.

Unit –I

Statistics: **10 Hours**

Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$ *Correlation, expression for the rank correlation coefficient and regression.*

Unit –II

Probability: **10 hours**

Probability: addition rule, conditional probability, multiplication rule, Baye's rule. *Discrete and continuous random variables-Probability density function, Cumulative distribution function, Problems on expectation and variance*

Unit –III

Probability distributions: **10 Hours**

Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.

Unit –IV

Markov chains: **10 Hours**

Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.

Resources:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Advanced Engineering Mathematics by Peter V. O'Neil.

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire syllabus.

UEI441H: ENTREPRENEURSHIP DEVELOPMENT
3 Credits (3-0-0)

Course Objectives:

1. To impart and inculcate entrepreneurial awareness and qualities.
2. To give awareness about various supports of state/central Govt. agencies.
3. To develop and practice entrepreneurial skills to set up new enterprise.

UNIT-I

Entrepreneur: Meaning of entrepreneur, Evolution of the concept, Functions of an entrepreneur, Characteristics of an entrepreneur, Competencies of an entrepreneur, Types of entrepreneur, Intrapreneur – an emerging class. **Entrepreneurship:** Evolution of entrepreneurship, Development of entrepreneurship, Stages in entrepreneurial process, Role of entrepreneurs in economic development, Entrepreneurship in India, Barriers of entrepreneurship. **Women Entrepreneurship**: Definition, Environment, Challenges in the path of women entrepreneurship, Strategies for the development of women entrepreneurs, Self-help groups.

10 Hrs.

UNIT-II

Small Scale Enterprises (SSEs): Definition, Characteristics, Need and rationale, Objectives, Scope, Role of SSE in economic development, Advantages of SSE, Steps to start an SSE, Various government policy towards SSE, Different policies of SSE, Government support for SSE during 5 year plans, Impact of liberalization, privatization, globalization on Indian SSE, Effect of WTO/GATT, Supporting agencies of government for SSE in India: Meaning, Nature of support, Types of help, Ancillary industry(Definition Only).

10 Hrs.

UNIT-III

Institutional Support for SSEs: TECSOK, KIADB, KSSIDC, KSIMC, DIC Single window agency, SISI (MSME-DI), NSIC, SIDBI, KSFC, Institutions supporting women entrepreneurship in India.

10 Hrs.

UNIT-IV

Preparation of Project: Meaning of project, Project identification, Project selection, Project report, Need and significance of report, Contents, Formulation, Guidelines by planning commission of India for project report, Errors of project report, Project appraisal. **Identification of Business Opportunities:** Business opportunity in various sectors, Formalities for setting up of a small business enterprise (In brief with flow chart), Market feasibility study, Technical feasibility study, Financial feasibility study, Social feasibility study. **The E–commerce**: Benefits of selling on the web, Factors to be considered in launching, Myths of E-commerce, Approaches to E-commerce, Strategies for E-success.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1: **(a)** Describe an entrepreneur/ship and interpret qualities of entrepreneurs.
(b) Identify the importance of woman entrepreneurship.

CO2: **(a)** Describe the importance and rationale of SSE.
(b) State the status of SSE in India and narrate the government policies and support.

CO3: Identify and elaborate state and central government SSE supporting agencies in India.

CO4: **(a)** Describe the meaning and selection of project and identify business opportunity.
(b) Describe the meaning and importance of selling on web.

TEXT BOOK:

1. Poornima M. Charantimath, “Entrepreneurship Development - Small Business Enterprises”, Pearson Education, 2006.
2. Ramesh Burbere, “Management & Entrepreneurship”, Rohan Publishers, Hubli, Karnataka, 2013.
3. Thomas W. Zimmerer, Norman M. Scarborough, “Essentials of Entrepreneurship & Small Business Management”, 4th Edition, Pearson Education.Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.

REFERENCE BOOKS:

1. Vasant Desai, “Dynamics of Entrepreneurial Development & Management”, Himalaya Publishing House.
2. Edward de Bono, “Six Thinking Hats”, Back Bay Books - Little, Brown and Company.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	1	1	2	2	2	3	3	2	2	3	1
CO2	1	2	1	1	1	2	2	2	3	3	2	2	3	1
CO3	1	2	1	1	1	2	2	2	3	3	3	2	3	2
CO4	1	2	2	1	1	2	2	2	3	3	3	2	3	2

UEI442C: SIGNALS AND SYSTEMS

4 Credits (3-2-0)

Course Objectives:

1. To comprehend basic system properties and signals.
2. To compute the output of LTI systems through convolution.
3. To apply Fourier analysis to signals.
4. To apply z-transform technique to signals and systems.

UNIT-I

Introduction: Definition of signal and system**,** signals and systems in various disciplines of engineering and science, classification of signals, elementary signals, basic operations on signals, sampling and aliasing, sampling theorem, systems viewed as interconnections of operations, basic system properties: stability, memory, causality, time invariance and linearity.

10 Hrs.(L)
06 Hrs.(T)

UNIT-II

Time-domain Analysis of Discrete-Time LTI Systems: The convolution sum, convolution sum evaluation procedure, convolution properties, system interconnections. **Time-domain Analysis of Continuous-Time LTI Systems:** The convolution integral, convolution integral evaluation procedure, convolution properties, system interconnections.

10 Hrs.(L)
06 Hrs.(T)

UNIT-III

Fourier Series Representations: Complex sinusoids and frequency response of LTI systems, discrete-time periodic signals: Continuous-time periodic signals: Fourier Series (FS), properties of FS, Discrete-Time Fourier Series (DTFS). **Fourier Transforms Representations:** Continuous-time aperiodic signals: Fourier Transform (FT), properties of FT. Discrete-time aperiodic signals: The Discrete-Time Fourier Transform (DTFT).

10 Hrs.(L)
06 Hrs.(T)

UNIT-IV

The z-transform: The z-transform, the ROC for the z-transform, properties of ROC, properties of z-transform, the inverse z-transform, the transfer function, transform analysis and characterization of LTI systems, the unilateral z-transform and its application to solve difference equations, relationship between z-transform and DTFT, relationship between s-plane and z-plane.

10 Hrs.(L)
06 Hrs.(T)

Tutorial:

Exploring the concepts covered in each unit using appropriate software/modern tool.

Total Hrs.: 40 (L)
24 (T)

Course Outcomes:

Students will be able to:

CO1: **(a)** Classify signals and perform the basic operations on signals.
(b) Determine system properties.
CO2: **(a)** Perform convolution operation and prove its properties.
(b) Use the convolution to determine the output of an LTI system.
CO3: **(a)** Represent the signals in the Fourier domain.
(b) Analyze the signals in the Fourier domain.

CO4: **(a)** Define z-transform, its ROC and compute z-transform of any sequence and vice versa.
(b) State and prove properties of z-transform and use z-transform techniques to solve difference equations.

TEXT BOOK:

1. Simon Haykin, Barry van Veen, "Signals and Systems," John Wiley &Sons (Asia) Pvt. Ltd, 2nd Edition, 2004.
2. B. P. Lathi, "Principles of Linear Systems and Signals," Oxford University Press, 2nd Edition, 2005

REFERENCE BOOKS:

1. A.V. Oppenheim, A.S. Willsky, S.H. Nawab, "Signals and Systems," 2nd Edition, 2006.
2. R.E. Ziemer, W.H. Tranter, D.R. Fannin, "Signals and Systems," Pearson Education, 2nd Edition, 2002.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO2	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO3	3	3	2	2	3	2	1	1	1	2	2	2	3	2
CO4	3	3	2	2	3	2	1	1	1	2	2	2	3	2

UEI443C: LINEAR ICs AND DATA CONVERTERS

4 Credits (4-0-0)

Course Objectives:

1. To provide knowledge of linear ICs and data converters.
2. To design circuits using OPAMPs, timer ICs and voltage regulators.
3. To describe data converters.
4. To facilitate the use of linear and data converter ICs in an application.

UNIT-I

Basics of OPAMP: OPAMP Symbol, Block diagram representation, Important electrical specifications of OPAMP: Input bias current, Input offset current, Input offset voltage, CMRR, PSRR, SR, SVRR, Output current, power dissipation. Ideal OPAMP characteristics. **Direct coupled (DC) amplifiers using OPAMP:** Inverting, Non-inverting type-Circuit design (No derivation). Instrumentation amplifiers using single and three OPAMs. **Capacitor coupled (AC) amplifiers:** Basic voltage follower, High input impedance voltage follower, Non-inverting amplifiers, High input impedance non-inverting Amplifiers, Inverting amplifiers.

13 Hrs.

UNIT-II

OPAMP applications: Active Butterworth HPF and LPF- first, second order design, design examples. Precision rectifiers (Non-inverting positive half wave and full wave types only). Sample and hold amplifiers, Log amplifiers, Integrator and differentiator, Astable multivibrator (square wave generator using single OPAMP), Phase shift oscillators, Wein bridge oscillators, Zero crossing detectors (ZCD), Schmitt trigger.

13 Hrs.

UNIT-III

OPAMP applications: Clamping and clipping, Signal converters: I/V, V/I, V/F, F/V converters. **Phase locked loop:** PSD, VCO, PLL, PLL applications. **Voltage regulators:** Fixed and variable regulators (78/79 Series and IC 317 regulator), Meaning of LDO regulators. **IC 555 timer:** Basic circuit, Design of astable, monostable multivibrator.

13 Hrs.

UNIT-IV

Data Converters: Meaning of Data Acquisition System (DAS), Typical example. Generalized block diagram of ADCs and DACs. Specifications of ADCs/DACs: Accuracy, Linearity, Error, Code skipping, Conversion speed, Resolution (meaning only). **ADC:** Classification (Dual slope, Successive approximation, Flash, Delta-Sigma converter, Dynamic ADC – All these working principle only). **DAC:** Classification- (R-2R, Inverted R-2R, binary weighted- working principle only). Typical ADC/DAC ICs: ADC0816, TL0820, DAC0800/0808, DAC7821. Typical application of ADC and DAC.

13 Hrs.

Total Hrs: 52

Course Outcomes:

Students will be able to:

CO1: **(a)** Describe OPAMP and distinguish important electrical specifications of it.
(b) Design DC and AC amplifiers in inverting, non-inverting and differential modes.

CO2: **(a)** Describe various applications of OPAMP
(b) Design a particular OPAMP circuit for the requirements of an application.

CO3: **(a)** Describe and design OPAMP circuit as clipper/clamper, signal converter.
(b) Describe voltage regulator and timer IC and use them in an application.

CO4: **(a)** Describe DAS, specifications of ADC/DAC.
(b) Use some ADC/DAC ICs for an application.

TEXT BOOK:

1. Ramakant Gayakwad, “Operational Amplifiers,” PHI, 2005.
2. David A. Bell, “Linear ICs and Applications,” PHI, 2007 [only for AC amplifiers].
3. Behzad Razavi, “Principles of Data Conversion System Design,” IEEE Press, 1995.

REFERENCE BOOKS:

1. Sergio Franco, “Design with OPAMPs and Analog ICs,” TMH, 3rd Edition, 2005.
2. Hnatek, “Handbook of A/D and D/A Converters,” John Wiley Publishers.
3. Franco Maloberti, “Data Converters,” Springer Publication, 2007.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	1	1	1	1	2	2	1	2	3	2
CO2	3	3	3	2	1	1	1	1	2	2	1	2	3	2
CO3	3	3	3	2	1	1	1	1	2	2	1	2	3	2
CO4	3	3	3	2	1	1	1	1	2	2	1	2	3	3

UEI444C: MEASUREMENT TECHNIQUES AND INSTRUMENTS

3 Credits (3-0-0)

Course Objectives:

1. To impart the knowledge of units, dimensions and generalized measurement systems.
2. Describe the bridge configurations and their application.
3. To provide working details of digital measuring instruments, CRO, signal generators, and display devices.

UNIT-I

Introduction: Measurements, significance of measurements, application of measurement systems. **Units and Dimensions:** Introduction, unit, absolute unit, fundamental and derived units, dimensions, dimensions of mechanical quantities, dimension equations: dimensions in electrostatic systems, dimensions of electromagnetic systems, problems. **Measurement of Resistance:** DC bridges: measurement of medium resistance: Wheatstone bridge, sensitivity of Wheatstone bridge, limitation of Wheatstone bridge, measurement of low resistances: Kelvin‘s double bridge, Problems on bridges.

10 Hrs.

UNIT-II

AC Bridges: Sources and detectors, general equation for bridge balance. Maxwell’s inductance bridge, Maxwell’s inductance-Capacitance bridge, Hays bridge, Anderson bridge, Owens bridge, De Sauty‘s bridge, Schering bridge, Wein bridge, problems on bridges..

10Hrs.

UNIT-III

Digital Instruments: Digital Voltmeters– Introduction, DVMs based on V – T, V – F , Resolution and sensitivity, General specifications, Digital Multi-meters, Digital frequency meters, Digital measurement of time. **Oscilloscopes:** Introduction, Basic principles, CRT features, Block diagram and working, Typical CRT connections, Dual beam and dual trace CROs, Measurement of phase angle and frequency.

10 Hrs.

UNIT-IV

Signal Generators: Introduction, Fixed and variable AF oscillator, Standard signal generator, Laboratory type signal generator, AF sine and Square wave generator, Square and Pulse generator, Sweep frequency generator, Random noise generator. **Display Devices:** Digital display system, classification of display, Display devices, LEDs, LCD displays.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1: **(a)** Describe the significance of measurement, units, and dimensions and derive units and dimensions for systems.

(b) Interpret the measurement of resistance using bridges.

CO2: **(a)** Analyze AC bridges and use them to determine the capacitance/inductance value.

CO3: **(a)** Illustrate the working principle of digital instruments.

(b) Describe and use CROs.

CO4: Describe the working of signal generator and display devices.

TEXT BOOKS:

1. A. K. Sawhney, “Electronics and Electrical Measurements,” 9th Edition, Dhanpat Rai & Sons, 2011.
2. H. S. Kalsi, “Electronic Instrumentation,” 3rd Edition, Tata McGraw Hill, 2010.

REFERENCE BOOKS:

1. John P. Bentley, "Principles of Measurement Systems," 3rd Edition, Pearson Education, 2003.
2. Cooper D., A. D. Helfrick, "Modern Electronic Instrumentation and Measuring Techniques," PHI/Pearson Education India, 2015.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	2	1	1	2	2	2	2	3	2
CO2	3	3	3	3	2	2	1	1	2	2	2	2	3	2
CO3	3	3	3	3	3	3	2	1	2	1	3	3	3	3
CO4	3	3	3	3	3	3	3	3	2	2	3	3	3	3

UEI445L: LINEAR ICs AND DATA CONVERTERS LABORATORY
1.5 Credit (0-0-3)

Course Objectives:

1. To implement basic circuits for the evaluation of OPAMP characteristics.
2. To realize the operation of OPAMP circuits for different applications.
3. To realize ADC and DAC.

List of experiments:

1. Measurement of Op-Amp parameters: CMRR, Slew rate
2. Design of voltage follower, Inverting, non inverting and Differential amplifier for desired gain
3. Design of adder and substractor circuit
4. Design of Precision full wave rectifier using 741 IC
5. Design of Butter worth I and II order low-pass filters
6. Design of Butter worth I and II order high-pass filters
7. Design of square wave and triangular wave generator using 741 IC
8. Design and implementation of astable and monostable multivibrator using 555 timer
9. 4 Bit Binary weighted and R-2R DAC (using discrete components)
10. DAC using IC DAC 0800/0808/ DAC7821
11. ADC using IC ADC 0809/ ADC0816/TL0820
12. Design and test a function generator that can generate square wave and triangular wave output for a given frequency
13. Design and test voltage controlled oscillator for a given specification (voltage range and frequency range)

Minimum 10 experiments to be completed from the above list

Course Outcomes:

Students will be able to:

CO1: Design and develop a circuit/system for the given objective

CO2: Conduct the experiment and demonstrate the theoretical concepts

CO3: Analyze and interpret the experimental results

REFERENCE BOOKS:

1. Ramakant Gayakwad, "Operational Amplifiers", PHI, 2005.
2. David A. Bell, "Linear ICs and Applications", PHI, 2007.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	2	2	3	3	2	2	3	3
CO2	2	2	2	3	3	3	2	2	3	3	2	2	3	3
CO3	2	2	2	3	3	3	2	2	2	2	2	2	3	3

UEI446L: PROCESS INSTRUMENTATION AND MEASUREMENT LABORATORY
1.5 Credits (0-0-3)

Course Objectives:

1. To get hands on experience of sensors/transducers and to analyze the sensor/transducer characteristics.
2. To promote the usage of various sensors and transducers in varieties of applications.
3. To understand the fundamental concepts, working principles of various DC and AC bridges.
4. To familiarize the use of measuring instruments.

List of Experiments:

1. Transfer characteristics of Thermocouple, Thermistor and RTD.
2. Transfer characteristics of LVDT.
3. Transfer characteristics of LDR.
4. Transfer characteristics of resistive displacement transducer (linear & angular potentiometer).
5. Transfer characteristic of level transmitter.
6. Transfer characteristic of load cell (Full bridge strain gauge arrangement).
7. Resistance measurement using Wheatstone bridge.
8. Low resistance measurement using Kelvin double bridge.
9. Capacitance measurement using Schering capacitance bridge.
10. Inductance measurement using Maxwell bridge.
11. Inductance measurement using Hays bridge.
12. Inductance measurement using Andersons bridge

Minimum 10 experiments to be completed from the above list

Course Outcomes:

Students will be able to:

CO1: Design and develop a circuit/system for the given objective.
CO2: Conduct the experiment and demonstrate the theoretical concepts.
CO3: Analyze and interpret the experimental results.

REFERENCE BOOKS:

1. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning," 2nd Edition, Wiley India Private Ltd.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	2	2	3	3	2	2	3	3
CO2	2	2	2	3	3	3	2	2	3	3	2	2	3	3
CO3	2	2	2	3	3	3	2	2	3	3	2	2	3	3

UHS388C/UHS488C: Samskrutika Kannada
1 Credit (2-0-0)
(ME,CV,AU,IP AND BT BRANCHES)

ಕೋರ್ಸ್ ಉದ್ದೇಶಗಳು:

1 'ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ' ಪಠ್ಯದ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಭಾಷೆ, ಮತ್ತುಕನ್ನಡಿಗರ ಸಾಂಸ್ಕೃತಿಕ ಬದುಕಿನ ಬಗೆಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.

2 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆ ಹಾಗೂ ಅದಕ್ಕೆ ಪೂರಕವಾಗಿರುವ ಕನ್ನಡ ವ್ಯಾಕರಣಾಂಶಗಳ ಬಗೆಗೆ ಅರುವು ಮೂಡಿಸುವುದು. ಪ್ರಾದೇಶಿಕ ಭಾಷೆಯಲ್ಲಿಅರ್ಜಿ ಮತ್ತು ಪತ್ರವ್ಯವಹಾರಗಳನ್ನು ಸಮರ್ಥವಾಗಿ ನಿರ್ವಹಿಸಲು ಪ್ರೇರೇಪಿಸುವುದು. .

3 ತಂತ್ರಿಕಅಧ್ಯಯನದ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ಬರವಣಿಗೆ ಮತ್ತು ಬರವಣಿಗೆಯಲ್ಲಾಗುವ ದೋಷಗಳನ್ನು ಗುರುತಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ನೀಡುವುದು.

4 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಅಡಗಿರುವ ಸೂಪ್ತ ಪ್ರತಿಭೆಯನ್ನು ಅನಾವರಣಗೊಳಿಸುವ ನಿಟ್ಟಿನಲ್ಲಿಅವರಲ್ಲಿ ಕಲೆ, ಬರವಣಿಗೆ ಮತ್ತು ಭಾಷಾಂತರಕಲೆಯಲ್ಲಿಆಸಕ್ತಿಯನ್ನು ಕೆರಳಿಸುವುದು.ಎಲ್ಲಕ್ಕೂ ಮೇಲಾಗಿ ಮಾನವೀಯ ಮೌಲ್ಯಗಳೊಂದಿಗೆ ಸರ್ವಾಂಗೀಣವಾಗಿ ಸಂವರ್ಧನೆಗೊಳಿಸಿ ಅವರನ್ನುರಾಷ್ಟ್ರದಅಮೂಲ್ಯ ಸಂತ್ತನ್ನಾಗಿ ರೂಪಿಸಿಸುವುದು.

ಭಾಗ: I ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ವ್ಯಕ್ತಿಚಿತ್ರಣ **ಅವಧಿ: 6 ಗಂಟೆ**

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕಏಕೀಕರಣ :ಒಂದುಅಪೂರ್ವಚರಿತ್ರೆ– ಜಿ.ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಕನ್ನಡ ಭಾಷೆ ಮತ್ತುಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ– ವಿತಾವಿ
4. ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತುಐತಿಹ್ಯ– ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್

ಭಾಗ: II ಕಥೆ, ಪ್ರವಾಸಕಥೆ ಮತ್ತುಕರಕುಶಲ ಕಲೆ **ಅವಧಿ: 6 ಗಂಟೆ**

1. ಯುಗಾದಿ – ವಸುಧೇಂದ್ರ
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ – ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ
3. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ–ಕರಿಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಭಾಗ: III ಕಾವ್ಯ **ಅವಧಿ: 7ಗಂಟೆ**

1. ವಚನಗಳು – ಬಸವಣ್ಣ, ಅಲ್ಲಮಪ್ರಭು, ಅಕ್ಕಮಹಾದೇವಿ
2. ಕೀರ್ತನೆಗಳು – ಪುರಂದರದಾಸರು, ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು – ಶಿಶುನಾಳ ಶರೀಫರು, ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿಗಳು
4. ಜನಪದಗೀತೆ, 5. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ –ಡಿವಿಜಿ
6. ಬೆಳಗು – ಅಂಬಿಕಾತನಯದತ್ತ, 7.ಅನಿಕೇತನ – ಕುವೆಂಪು

ಭಾಗ: IV ಕಾವ್ಯ, ವಿಜ್ಞಾನ ಮತ್ತುತಂತ್ರಜ್ಞಾನ **ಅವಧಿ: 7ಗಂಟೆ**

ಕಾವ್ಯ

1. ಹೆಂಡತಿಯಕಾಗದ – ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
2. ಮುಂಬೈ ಜಾತಕ–ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
3. ಆ ಮರ ಈ ಮರ–ಚಂದ್ರಶೇಖರಕಂಬಾರ
4. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು – ಸಿದ್ಧಲಿಂಗಯ್ಯ

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

1. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು, ಕಂಪ್ಯೂಟರ್ ಮುಖಾಂತರಕನ್ನಡದಟೈಪಿಂಗ್
2. ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ಧಕೋಶ,
3. ತಾಂತ್ರಿಕ ಪದಕೋಶ

Total: L-26 Hours

ಪಠ್ಯಪುಸ್ತಕ:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (ಸಂ), ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ, ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ.ಕೇಶವಮೂರ್ತಿ, Prasaranga VTU, Belagavi, Karnataka, 2020.

ಕೋರ್ಸ್ ಫಲಿತಾಂಶಗಳು:

At the end of the course the student should be able to:

1 ವಿದ್ಯಾರ್ಥಿಗಳು ಬೌದ್ಧಿಕವಾಗಿ ಬೆಳೆಯುವುದರೊಂದಿಗೆ ನಮ್ಮ ನಾಡಿನ ಮತ್ತುದೇಶದ ಸಾಂಸ್ಕೃತಿಕ ವಾರಸುದಾರರಾಗಿ ಬೆಳೆದು ಸ್ವಾವಲಂಬಿಯಾಗಿ ಬದುಕು ಕಟ್ಟಿಕೊಳ್ಳುತ್ತಾರೆ

2 ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಸಮರ್ಥವಾಗಿ ಮಾತನಾಡುವುದರೊಂದಿಗೆ, ಅನ್ಯರನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುವ ಮನೋಬಲ ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾನೆ. ಇವತ್ತಿನ ಸಂಕೀರ್ಣವಾದ ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಸೌಹಾರ್ದಯುತವಾದ ನಡುವಳಿಕೆಯೊಂದಿಗೆ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಯಾಗಿ ರೂಪುಗೊಳ್ಳುತ್ತಾನೆ.

3 ಜಾಗತಿಕರಣದಇವತ್ತಿನ ಸಂದರ್ಭದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ವತಂತ್ರ ವಾಗಿಆಲೋಚಿಸುವ, ಸ್ವತಂತ್ರವಾಗಿ ಬರೆಯುವ, ಸ್ವತಂತ್ರವಾಗಿ ಚಿಂತನಶೀಲರಾಗುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಪಡೆದು, ಸಮಯೋಚಿತವಾಗಿ ಸೂಕ್ತ ನಿರ್ಧಾರಗಳನ್ನು ಕೈಗೊಳ್ಳುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ದೀಪಸ್ಥಂಬವಾಗಿದೆ.

4 ವಿದ್ಯಾರ್ಥಿಗಳು ಇಂದಿನ ಜಾಗತಿಕ ವಿದ್ಯಮಾನಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಂಡು, ಸಮಾಜದಲ್ಲಿ ಸಂಘಜೀವಿಯಾಗಿ ಬೆಳೆಯುವ ಮನೋಬಲವನ್ನು ಮತ್ತುಆತ್ಮಸ್ಥೈರ್ಯವನ್ನುತುಂಬುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ಸೂಕ್ತವಾದ ಮಾರ್ಗದರ್ಶಿಕೆಯಾಗಿದೆ.

5 ತನ್ನ ಅಸ್ಮಿತೆಯ ಹುಡುಕಾಟದಲ್ಲಿರುವ ವ್ಯಕ್ತಿಗೆ, ಅದು ಈ ನೆಲದ ಸ್ವಾಭಿಮಾನ, ಭಾತೃತ್ವ, ಪ್ರೀತಿ, ಸೌಹಾರ್ದಯುತವಾದ ಮನಸ್ಸುಗಳಲ್ಲಿ ಇದೆಎಂಬುದನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳ ಅರಿತಕ್ಕೆತರುತ್ತದೆ.

6 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಪರಿಸರ ಪ್ರಜ್ಞೆಯನ್ನು ಜಾಗೃತಗೊಳಿಸಿ, ದೈವಸೃಷ್ಟಿಯಾದ ಈ ಅಮೂಲ್ಯ ಸಂಪತ್ತನ್ನು ಹಿತ–ಮಿತವಾಗಿ ಬಳಸಿಕೊಂಡು ಮುಂದಿನ ತಲೆಮಾರಿಗೆಅದನ್ನು ಬಳುವಳಿಯಾಗಿ ಬಿಟ್ಟುಹೋಗುವಲ್ಲಿಜಾಗೃತನಾಗುತ್ತಾನೆ.

ಬಳಕೆ ಕನ್ನಡ

UHS389C/UHS489C Balake Kannada

1 Credit (2-0-0)

(ME,CV,AU,IP AND BT BRANCHES)

ಕೋರ್ಸ್ ಉದ್ದೇಶಗಳು:

1 'ಬಳಕೆ ಕನ್ನಡ 'ಪಠ್ಯದಅಧ್ಯಯನದಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳು ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಅರ್ಥೈಸಿಕೊಂಡು, ಕನ್ನಡದಲ್ಲಿ ಸಂವಹನ ಮಾಡಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ.

2 ಕನ್ನಡ ವರ್ಣಮಾಲೆಯ ಬಗೆಗೆ ಅರಿವು ಮೂಡಿಸುವುದು ಮತ್ತು ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಆಂತರಿಕ ಸಂವಹನ ಕ್ರಿಯೆಯನ್ನು ವೃದ್ಧಿಗೊಳಿಸುವುದು

3 ಕನ್ನಡ ಸಂಖ್ಯೆಗಳ ಬಗೆಗೆ ಅರಿವು ಮೂಡಿಸಿ, ಅವುಗಳನ್ನು ಸಮಯೋಚಿತವಾಗಿ ಬಳಸುವ ವಿದಾನವನ್ನು ಕಲಿಸಿಕೊಡುವುದು..

4 ನಮ್ಮ ನಾಡಿನ ಸಾಂಸ್ಕೃತಿಕ ವೈವಿಧ್ಯತೆಯನ್ನುಅರಿತು, ಅರ್ಥೈಸಿಕೊಂಡು ನಾಡವರೊಂದಿಗೆ ಸೌಹಾರ್ದಯುತವಾಗಿ ಬದುಕಲು ಕಲಿಸುವುದು.

Unit – I

Listening and Hearing **06 Hrs**

Introduction: Activity -I

- Easy learning of a Kannada Language: A few tips
- Necessity of learning a local language:
- Tips to learn the language with easy methods.
- Hints for correct and polite conservation
- About Kannada Language (Kannada Bhashe)
- Eight Kannada authors who have won 'Jnanpith Award'
- Information about Karnataka State

Kelisikolluvudu mattu Alisuvudu: Activity -II

Listening to Kannada words and Sentences through different types of communications of day to day affairs. [Conversations in Kannada – Kannada Bhasheyalli Sambhashanegalu]

Conversation with

- With Friends – Snehitharodane-(ಸ್ನೇಹಿತರೊಡನೆ)
- With Teachers- (ಗುರುಗಳೊಡನೆ)
- In Shop, Market, Bus and Train(ಅಂಗಡಿ, ಮಾರುಕಟ್ಟೆ, ಬಸ್, ರೈಲು)
- In Hotel / Canteen(ಹೊಟೆಲ್/ಕ್ಯಾಂಟೀನ್‌ನಲ್ಲಿ)
- With Dependents(ಅವಲಂಬಿತರೊಡನೆ)
- In Hostel with Friends, Warden, Cooks and Security(ಹಾಸ್ಟೆಲ್‌ನಲ್ಲಿ)
- Vocabulary - Shabdakosha–ಶಬ್ದಕೋಶ
- Conversation - Sambhashane– ಸಂಭಾಷಣೆ- 1 (about City)
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-2(between Friends)
- Excersises to test their knowledge of understanding the Language.

Conversation with Teacher, House Owner and Roommate

- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ- 1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2(With House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ- 3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - III - Conversation with

- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2 (with House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - IV - Conversation with

- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2 (with House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentences in Conversation

Unit – II

Speaking and Asking 06Hrs

Maatanaadhuvudu mattu Keluvudu –ಮಾತನಾಡುವುದು ಮತ್ತು ಕೇಳುವುದು

[Kannada Words and Sentences in Conversation - Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu - ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡದ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು]

In Speaking / Asking -Sambhashaneyalli–ಸಂಭಾಷಣೆಯಲ್ಲಿ

- Nouns - Naamapadagalu– ನಾಮಪದಗಳು
- Pronouns – Sarvanamapadagalu– ಸರ್ವನಾಮಪದಗಳು
- Adjectives – namavisheshanagalu - ನಾಮ ವಿಶೇಷಣಗಳು
- Verbs- Kriyapadagalu– ಕ್ರಿಯಾಪದಗಳು
- Adverbs - kriya visheshanagalu–ಕ್ರಿಯಾ ವಿಶೇಷಣಗಳು
- Conjunctions - Samyogagalu–ಸಂಯೋಗಗಳು
- Prepositions - Upasarga– ಉಪಸರ್ಗಗಳು

- Interrogative words and Sentences in Conversation – Sambhashaneyalli Prashnarthaka padagalu mattu vakyagalu–ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು
- Vicharaneya/ Vicharisuva / Bedikeyavakyagalu (Enquiry / Request sentences in Conversation) - ವಿಚಾರಣೆಯ / ವಿಚಾರಿಸುವ / ಬೇಡಿಕೆಯ ವಾಕ್ಯಗಳು
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation.

UNIT III

Reading – Ooduvudu – ಓದುವುದು 07Hrs

Kannada Wards and Sentenses in General Reading and Conversation- Samanya Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu - ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡದ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು)

- Singular and Plural nouns in Conversation- SambhashaneyalliEkaavachana mattu Bhahuvachana - ಏಕವಚನ ಮತ್ತು ಬಹುವಚನ
- Gender in Conversation - Sambhashaneyalli Linga– ಲಿಂಗ
- Viruddha padagalu /Virodarthaka padagalu (Antonyms)– ವಿರುದ್ಧ / ವಿರೋದಾರ್ಥಕ ಪದಗಳು.
- AsamanjasaUchcharane (Inappropriate Pronounciation) – ಅಸಮಂಜಸಉಚ್ಚಾರಣೆ
- SankhyaVyavasthe (Numbers system)- ಸಂಖ್ಯಾ ವ್ಯವಸ್ಥೆ
- Bhinnamshagalu (Fractions) –ಭಿನ್ನಾಂಶಗಳು
- Tindiya Hesarugalu/ Belagina upaharagala Hesarugalu - Menu (Names) of the breakfast Items –ತಿಂಡಿಯ ಹೆಸರುಗಳು
- Aaharakke sambandhisida padagalu / Aahara padarthagala Hesarugalu– (Names connected with food) –ಆಹಾರಕ್ಕೆ ಸಂಬಂದಿಸಿದ ಪದಗಳು.
- Samaya / Kalakke Sambhandhisida padhagalu (Words Relating to Time)– ಸಮಯ / ಕಾಲಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Dikkugalige sambhadisida padhagalu (Words Relating to Directions) – ದಿಕ್ಕಿಗೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Manavana Bhavanegalige sambandisida Padagalu (Words Relating to Human's feelings and Emotions) –ಮಾನವನ ಭಾವನೆಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು
- Manavana shareerada bhagagalu / Angagalu (Parts of the Human body)- ಮಾನವನ ಶರೀರದ ಭಾಗಗಳು / ಅಂಗಗಳು
- Manava Sambhandhada / Sambhandhaakke sambhadisida padhagalu (Terms Relating to Human Relationship)– ಮಾನವ್ ಸಂಬಂದಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Vaasada sstalakke sambhandisidanthaha padhagalu (Words Relating to Place of Living) - ವಾಸದ ಸ್ಥಳಕ್ಕೆ ಸಂಬಂದಿಸಿದಂತಹ ಪದಗಳು
- Saamanya Sambhashaneyalli Bhalasuvanthaha Padagala Patti (List of Words, used in the general conversation) – ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಯಲ್ಲಿ ಬಳಸುವಂತಹ ಪದಗಳ ಪಟ್ಟಿ

- Additional Excersises to test their knowledge of understanding the Kannada words and sentences in their communication.

UNIT IV

Writing – Bareyuvudu – ಬರೆಯುವುದು 07Hrs

Kannada Alphabets and their Pronunciation – Kannada AksharaMale mattu uchcharane – ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ ಹಾಗೂ ಉಚ್ಚಾರಣೆ ಕನ್ನಡ ಅಕ್ಷರಾಭ್ಯಾಸ

- Kannada Aksharamale (ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ)
- Kannada stress letters - vattakshara (also often written as Ottakashara)
- Kannada khaghunitha (Pronounced as ka-gunitha)
- Excersises to test their knowledge of understanding the Kannada words.
- Pronunciation (Uchcharane), Memorisation and usage of the Kannada Letters
- VargeeyaVyanjanagalaUchcharane (Pronounciation of Structured Consonants) AvargeeyaVyanjanagalaUchcharane (Pronounciation of Unstructured Consonants) Excersises to test their knowledge of understanding the Kannada words.
- Excersises to test their knowledge of understanding the Kannada alphabets.
- Additional Excersises to test their knowledge of understanding the Kannada alphabets.

ಒಟ್ಟು: 26 ಗಂಟೆಗಳು

ಪಠ್ಯಪುಸ್ತಕ:

ಬಳಕೆ ಕನ್ನಡ (ಸಂ), ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ, Prasarang, VTU, Belagavi, Karnataka 2020.

ಕೋರ್ಸ್ ಫಲಿತಾಂಶಗಳು:

At the end of the course the student should be able to:

1 ವಿದ್ಯಾರ್ಥಿಗಳು ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಸುಲಭವಾಗಿ ಅರ್ಥೈಸಿಕೊಂಡು, ಸಾಮಾಜಿಕವಾಗಿ, ಆರ್ಥಿಕವಾಗಿಆಯಾ ಪ್ರದೇಶದಜನರೊಂದಿಗೆಅನ್ಯೋನ್ಯವಾಗಿ ವ್ಯವಹರಿಸುತ್ತಾನೆ.

2 ಈ ಪಠ್ಯಾಧ್ಯಯನದಿಂದ ವಿದ್ಯಾರ್ಥಿಯುಆಯಾ ಪ್ರದೇಶಗಳ ನಂಬಿಕೆ, ಸಂಪ್ರದಾಯ ಮತ್ತು ಆಚರಣೆಗಳನ್ನು ಸುಲಭವಾಗಿ ಅರ್ಥಮಾಡಿಕೊಳ್ಳಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ.

3 ಕನ್ನಡ ಸಂಖ್ಯೆಗಳ ಪರಿಕಲ್ಪನೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಯು ವಾಣಿಜ್ಯ ವ್ಯವಹಾರಗಳನ್ನು ಸುಲಭವಾಗಿ ನೆವೇರಿಸಲು ಸಾಧ್ಯವಾಗುತ್ತದೆ.

4 ಹಂತ ಹಂತವಾಗಿ ವಿದ್ಯಾರ್ಥಿಯು ಕನ್ನಡ ಭಾಷೆಯಲ್ಲಿ ಬರವಣಿಗೆಯಕಲೆಯನ್ನು ಮತ್ತು ಓದುವಕಲೆಯನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾನೆ.

5 ಕನ್ನಡ ಭಾಷೆಯ ನಿರಂತರ ಸಂಪರ್ಕದಿಂದ ವಿದ್ಯಾರ್ಥಿಯು ಸ್ವತಂತ್ರವಾಗಿಆಲೋಚಿಸುವ ಮತ್ತುಅಭಿವ್ಯಕ್ತಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾನೆ.

6 ಈ ಭಾಷೆಯ ಸಂಪರ್ಕದಿಂದಾಗಿ ವಿದ್ಯಾರ್ಥಿಯು ಕನ್ನಡ ಸಾಹಿತ್ಯ ಪ್ರಕಾರಗಳಾದ ಕತೆ, ಕವನ, ಕಾದಂಬರಿ, ನಾಟಕ ಮುಂತಾದ ಕ್ಷೇತ್ರಗಳಲ್ಲಿ ತನ್ನಅಭಿರುಚಿಯನ್ನು ಹೆಚ್ಚಿಸಿಕೊಳ್ಳುತ್ತಾನೆ.

BRIDGE COURSE MATHEMATICS-II

Course Learning Objectives:
The purpose of the course **UMA430M** is to facilitate the students with concrete foundation of differential equations and Laplace transform to acquire the knowledge of these mathematical tools.

Ordinary differential equations of first order: **15 Hours**
Variable seperable,Homogeneous.Exact form and reducible to exact differential equations. Linear and Bernoulli's equation.

Differential Equations of higher order:
Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters(second order); Cauchy's and Legendre homogeneous equations.

Laplace Transform: **15 Hours**
Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function

Inverse Laplace transforms –
Properties. Convolution theorem. Solutions of linear differential equations

Partial Differential Equations(PDE's): **10 Hours**
Introduction to PDE : Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Solution of Lagrange's linear PDE, method of separation of variables,

Course Outcomes:
On completion of this course, students are able to:

CO1: Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.

CO2: Apply the Laplace transform techniques to solve differential equations.

CO3: Understand a variety of partial differential equations and solution by exact methods.

CO4: solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables

Text Books:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:** Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : “Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.,” Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

UHS001N: FUNDAMENTALS OF QUANTITATIVE APTITUDE AND SOFT SKILLS
1 Credits (2-0-0)

Course Objectives:
1. To develop and augment the professional communication skills
2. To augment the ability to understand and analyse a problem and find its solution through analysis of data given
3. To fine-tune the quantitative analysis and problem-solving skills

UNIT-I
Communication Skills & Vocabulary Development: Communication Tools, Active Listening, Non Verbal Communication, Vocabulary Building Techniques, Root Words

08 Hrs.

UNIT-II
Spoken English, English Language Structure & Number Theory: Introduction to IPA, Sounds in English, Grammar and Bouncing, Number System

08 Hrs.

UNIT-III
Presentation Skills & Linear Equations: Presentation Basics, Drills, Captivating the Audience, The God of Math

07 Hrs.

UNIT-IV
Factors and Multiples & Verbal and Visual Reasoning: HCF, LCM, Human Relations, Direction Tests, Coding Decoding, Clocks and Calendars, Visual Reasoning

07 Hrs.
Total Hrs.: 30

Course Outcomes:
After active participation in tis course, the student will have
CO1: learned the importance of non-verbal communication
CO2: understood the various sounds in the English Language
CO3: enhanced his/her vocabulary and learnt techniques to augment it further
CO4: understood analysis of the given problem and learnt to develop a method for solving it
CO5: enhanced and augmented his/her ability to work with quantitative problems

REFERENCE BOOKS:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018

5. Booher Diana, “Communicate With Confidence”, Booher Research Institute, 2011

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		1		
CO2										2		1		
CO3		3										2		
CO4		3										2		

Evaluation Methodology:

Continuous Internal Evaluation: 3 CIEs with 30 Objective Questions in 60 minutes and one assignment of 5 marks (average of weekly assignments)

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

UEI541C: MICROCONTROLLER AND PERIPHERALS
3 Credits (3-0-0)

UNIT-I

8051 Architecture: Features of 8051 microcontroller, Internal block diagram, Oscillator and clock, Accumulator, Data pointer, Program counter, Program status word, Stack pointer, Special function registers, Timer/ counter, I/O ports, Memory organization, **Addressing modes:** Immediate, register, direct and indirect addressing modes,.

10Hrs.

UNIT-II

Instruction Set and Programming: Data transfer, Arithmetic, Logic and compare instructions, Control transfer instructions, Miscellaneous instructions of 8051 microcontroller and assembly programs. **8051 Programming in C:** Data types and time delay in 8051 C, I/O programming in C, Logical operations in C.

10 Hrs.

UNIT-III

8051 Timer Programming in Assembly: Programming 8051 timers, Counter programming, **Interrupts Programming in Assembly:** 8051 interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming serial communication interrupt, Interrupt priority in 8051, **8051 Serial Port Programming in Assembly:** Basics of serial communication, 8051 connection to RS232, 8051 serial port programming in assembly.

10 Hrs.

UNIT-IV

Interfacing Peripherals with 8051 Microcontroller: Keyboard interfacing, LED interfacing, Seven segment LED interfacing, LCD interfacing, Stepper motor interfacing, DC motor interfacing (programs for interfacing peripherals in assembly). Introduction to Arduino.

10Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the internal architecture and instruction set of 8051 microcontroller
- **CO2:** Develop assembly and C programs using 8051 instructions and embedded C
- **CO3:** Analyze the given 8051 assembly programs
- **CO4:** Develop software and hardware for interfacing peripherals with 8051 microcontroller

TEXT BOOKS:

1. Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", 3rd Edition, Thomson publication

2. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly & C", 2nd Edition, Pearson, 2006

REFERENCE BOOKS:

1. Dr. D.S. Suresh Kumar, "8051 Microcontroller", 1stEdition, SK Publishers

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	2	2

UEI542C: PROCESS CONTROL
4 Credits (4-0-0)

UNIT-I

I**ntroduction to Process Control:** Introduction, control systems, process control block diagram, control system evaluation. Introduction to final control: Final Control operation, signal conversions, actuators, control elements.

13 Hrs.

UNIT-II

Controller Principles: Introduction, process characteristics, control system parameters, discontinuous controller modes, continuous controller modes, composite control modes. **Analog Controllers:** Introduction, general features, electronic controllers, pneumatic controllers

13 Hrs.

UNIT-III

Computer Based Control: Introduction, digital applications, computer based controller, other computer applications, control system networks. Distributed Digital Control System: Advantages of digital computer control, process control requirements of computers.

13 Hrs.

UNIT-IV

Control Loop Characteristics: Introduction, control system configuration, multi variable control systems, control system quality, stability, and process loop tuning. **P & ID Symbols and Diagrams:** Flow sheet symbols, inter logic symbols, graphic symbol

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

CO1:(a) Identify the various process control elements and describe their basic principles
CO2:(a) Define and describe various controller modes (proportional, Integral, Derivative)
(b) Analyze and design the analog controllers
CO3:(a) Describe the computer based control system
CO4: (a) Describe the behavior and characteristics of a process control loop and tune it

TEXT BOOKS:

1. C. D. Johnson, "Processes Control Instrumentation", 8 th Edition, PHI.
2. Myke King, "Processes Control: A Practical Approach ", Wiley Publication
3. M. Chidambaram, "Computer Control of Process", Narosa, Publication
4. B G Liptak, "Instrument Engineers Handbook", (Vol. 1 & 2), Chilton publication

REFERENCE BOOKS:

1. S. K. Singh, "Computer Aided Process Control", Prentice Hall of India.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	2	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	2	-	-	-	-	-	-	-	-	-	2	2

UEI543C: DIGITAL SIGNAL PROCESSING
4 Credits (4-0-0)

UNIT-I

Introduction: Digital signal processing and its benefits, sampling, aliasing, sampling theorem, frequency-domain representation of sampling, reconstruction of a band limited signal from its samples, correlation. **The Discrete Fourier Transform (DFT):** DFT, IDFT, DFT as a linear transformation, relationship of the DFT to other transforms, properties of DFT, circular convolution, use of DFT in linear filtering, overlap-add and overlap-save method. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-II

Efficient Computation of the DFT: Introduction, radix-2 FFT algorithm, Radix-2 inverse FFT, decimation-in-time FFT algorithm, decimation-in-frequency FFT algorithm, general computational considerations in FFT algorithms. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-III

Design of Infinite Impulse-response (IIR) Digital Filters: Characteristics of commonly used analog filters-Butterworth and Chebyshev-I filters, design of digital IIR filters from analog Butterworth and Chebyshev-I filters, impulse-invariant transformation method, and bilinear transformation method. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-IV

Design of Finite Impulse-Response (FIR) Digital Filters: Some common window functions (Rectangular, Hamming and Hanning), the Gibbs phenomenon, design of FIR filters using windows and frequency sampling method. **Realization of IIR and FIR systems:** Structure for IIR systems: direct-form, cascade-form, and parallel-form. Structure for FIR and linear phase FIR systems: direct-form, cascade-form. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.
Total Hrs.: 52

Course Outcomes:

Students will be able to:

- **CO1:** **(a)** Describe sampling, aliasing, reconstruction of signals, and relationship of DFT with other transforms
  - **(b)** Compute DFT, IDFT, sectional convolution and state and prove properties of DFT
- **CO2:** **(a)** Develop radix 2-FFT algorithms
  - **(b)** Compute DFT using FFT
- **CO3:** Design IIR filters
- **CO4:** **(a)** Design FIR filters
  - **(b)** Realize IIR and FIR systems
- **CO5:** Use MATLAB command-line functions in the design and analysis of DSP

TEXT BOOK:

1. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing", 4th Edition, Pearson Education, 2007.
2. Johnny R. Johnson, "Introduction to Digital Signal Processing", PHI Pvt. Ltd., 2000.

REFERENCE BOOKS:

1. Alan V. Oppenheim, Ronald W. Schafer, and John R. Buck, "Discrete-Time Signal Processing", 2nd Edition, Pearson Education, 2008.
2. Ashok Ambardar, "Digital Signal Processing: A Modern Introduction", Indian Edition, Thomson Learning, 2007

CO- PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

UEI544L: DSP LABORATORY
1.5 Credit (0-0-3)

List of experiments:

1. Illustrate aliasing effect in the time-domain and frequency domain.
2. Determine the linear convolution and correlation of the given two sequences.
3. Determine the linear convolution of the given two sequences using FFT.
4. Determine the spectrum of the given sequence using FFT.
5. Realize IIR transfer functions in cascade and parallel form.
6. Realize FIR transfer functions in cascade form.
7. Design IIR filter using bilinear transformation method with
   a. Butterworth characteristic
   b. Chebshev type I characteristic
   c. Chebshev type II characteristic
8. Design IIR filter using impulse invariance method with
   a. Butterworth characteristic
   b. Chebshev type I characteristic
   c. Chebshev type II characteristic
9. Design FIR filter using windowing method.
10. Design FIR filter using frequency-sampling method.

Course Outcomes:

Students will be able to:

CO1: Work in a team

CO2: Program and analyze DSP algorithms in MATLAB.

CO3: Design IIR filters to suit specific requirements using MATLAB.

CO4: Design FIR filters to suit specific requirements using MATLAB.

REFERENCE BOOK:

1. Sanjit K. Mitra, “Digital Signal Processing Laboratory”, International Edition , WCB/McGraw-Hill, 2000.

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CO- PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	3	3	3	3	3	-	-
CO2	3	3	3	-	3	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	3	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	3	-	-	-	-	-	-	-	3	3

UEI545L: MICROCONTROLLER LABORATORY
1.5 Credit (0-0-3)

List of experiments:
I. Software Programming:
1. Data Transfer instructions: Block move, Exchange, Sorting, Finding largest element in an array.
2. Arithmetic instructions: Addition, subtraction, multiplication and division.
3. Counters: Binary / BCD /Hexadecimal (up / down).
4. Boolean & Logical instructions: To check whether 0th bit and 5th bit of data is 0 or 1. If the bit is 0 then set the bit (Bit manipulations).
5. Conditional CALL and RETURN: Multiplication of every element of an array with constant.
6. Code conversion: BCD to ASCII; ASCII to Decimal; Decimal to ASCII.
7. Generate a square wave using timer to generate delay.

II. Interfacing Programs:
8. Generate different waveforms: Sine, square, triangular, ramp using DAC interface to 8051.
9. Stepper motor control interface to 8051.
10. DC motor control interface to 8051.

Course Outcomes:

Students will be able to:

CO1: Design and develop a system/program for the given objective
CO2: Conduct the experiment and demonstrate the theoretical concepts
CO3: Analyze and interpret the experimental results

REFERENCE BOOKS:

1. Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", 3rd Edition, Thomson publication
2. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D McKinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly & C", 2nd Edition, Pearson, 2006

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a system/program for the given objective	3	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	Conduct the experiment and demonstrate the theoretical concepts	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	3	2	2	-	-	-	-	-	-	-	-	-	3	3

UEI546L: PROCESS CONTROL LABORATORY

1 Credit (0-0-2)

List of Experiments:

1. Design and implementation of signal conditioning circuit for given RTD to display the physical parameter in the given range using DPM/DVM as display.
2. Design and implementation of signal conditioning circuit for given thermocouple to display the physical parameter in the given range using DPM/DVM as display.
3. Design and implementation of signal conditioning circuit for given thermistor to display the physical parameter in the given range using DPM/DVM as display.
4. Design and implementation of signal conditioning circuit for given AD590 to display the physical parameter in the given range using DPM/DVM as display.
5. Design and implementation of signal conditioning circuit for given load cell arrangement to display the physical parameter in the given range using DPM/DVM as display.
6. Design and implementation of analog controllers using OPAMPS and other passive components.
7. Experiment on synchros and resolvers.
8. Experiment on relay driving circuit to control dc motor.
9. Experiment on current to pressure converter.
10. Experiment on pressure to current converter.

Course Outcomes:

Students will:

CO1: Design and develop a circuit/system for the given objective.

CO2: Conduct the experiment and demonstrate the theoretical concepts.

CO3: Analyze and interpret the experimental results.

REFERENCE BOOK:

1. C. D. Johnson, "Processes Control Instrumentation", 8 th Edition, PHI.

CO-PO Mapping

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a system/program for the given objective	3	2	2	-	-	-	-	-	-	-	-	-	3	3
CO2	Conduct the experiment and demonstrate the theoretical concepts	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	3	2	2	-	-	-	-	-	-	-	-	-	3	3

UEI511E: ANALYTICAL INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction: Analytical methods, **Electromagnetic Spectrum**: Properties of electromagnetic radiation and interaction with matter. **Molecular Spectroscopy**: Measurement of transmittance and absorbance, Beer Lambert's law and its limitations, Components of analytical instruments: Sources of radiation, Wavelength selectors, Sample containers, Detectors. **UV-Visible Absorption Spectrometry**: Single and double beam absorption instruments, Application for qualitative and quantitative analysis.

10 Hrs.

UNIT-II

IR Absorption Spectrometry: Basic components of IR instruments, Non-dispersive spectrometers: Filter photometers, Photometers without filters, Filter correlation analyzers. **Mass Spectrometry**: Features of mass spectroscopy, Components of spectrometers: Sample inlet systems, Electron impact ion source, Mass analyzers- Single focus and double focus magnetic sector analyzer, Quadrupole analyzer and time of flight (TOF) analyzer, Applications.

10 Hrs.

UNIT-III

Atomic Spectroscopy: Principles of AAS, AES and AFS, Sample atomization techniques, Atomic absorption instrumentation, Applications. **X-ray Techniques:** Introduction, Principles, Sources, Detectors, Instrumentation, X-ray absorption method - Absorptiometer, X-ray fluorescence method-Energy dispersive type, X-ray diffraction-powder diffraction method and applications.

10 Hrs.

UNIT-IV

Chromatography: Introduction, Classification, Gas chromatography: Principle, GLC instrumentation, Liquid chromatography: Scope and HPLC instrumentation, Applications. **NMR Spectroscopy:** Principles of NMR spectroscopy, Different types of NMR instruments: FT – NMR, Carbon-13 NMR, Applications.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the importance and basic concepts of qualitative and quantitative analysis.
- **CO2:** Identify components and analytical methods for qualitative and quantitative analysis.
- **CO3:** Describe various principles and techniques employed for instrumental analysis using UV, visible and other EM sources.
- **CO4:** List the applications and usage of analytical instruments.

TEXT BOOKS:

1. Douglas A. Skoog, James Holler, Stanley R.Crounch, "Instrumental Analysis", Cengage Learning Publication, 2007.
2. H.H. Willard, L.L.Merritt, J.A.Dean, F.A. Settle", Instrumental Methods of Analysis", 7th Edition, CBS Publishing and Distribution, 1986.

REFERENCE BOOK:

1. R.S. Khandpur, "Hand Book of Analytical Instrumentation", TMH, 1989.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO4	2	-	-	-	-	-	-	-	-	-	-	-	3	-

UEI512E : COMMUNICATION SYSTEMS

3 Credits (3-0-0)

UNIT-I

Amplitude modulation: Time-domain description, Frequency domain description, Generation of AM waves, Detection of AM waves, AM/DSB, Time-domain description, Frequency domain description, Generation of DSBSC waves, Coherent detection of DSBSC modulated waves. Costas loop, Quadrature carrier multiplexing, AM-SSB/SC generation, Frequency-domain description, Frequency discrimination method for generation an SSB Modulated wave, Time domain description, Phase discrimination method for generating an SSB modulated wave, Demodulation of SSB waves, Comparison of amplitude modulation techniques.

10 Hrs.

UNIT-II

Angle modulation: Basic concepts, Frequency modulation, Spectrum analysis of sinusoidal FM wave, NBFM, WBFM, Constant average power, Transmission bandwidth of FM waves, Generation of FM waves, Direct FM, demodulation of FM waves, Frequency discriminator, ZCD. **Noise in analog modulation systems:** Signal-to-noise ratios, AM receiver model, Signal-to -noise ratios for coherent reception, DSBSC receiver, SSB receiver, noise in AM receivers using envelope detection.

10 Hrs.

UNIT-III

Pulse modulation: Sampling theorem for low-pass and band-pass signal, Statement and proof, PAM, Channel bandwidth for a PAM signal, Natural sampling, Flat-top sampling, Signal recovery though holding, Quantization of signals, Quantization error, PCM, Electrical representations of binary digits, PCM systems.

10 Hrs.

UNIT-IV

Digital modulation: Introduction, Binary Shift Keying, DPSK, QPSK, QPSK transmitter, non-offset QPSK, QPSK receiver, Signal - space representation, BFSK, Spectrum, Receiver for BFSK, Geometrical representation of orthogonal BFSK.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the concepts of Analog modulation and demodulation techniques
- **CO2:** Explain the concepts of digital modulation and demodulation techniques
- **CO3:** Calculate the various parameters of modulated signals
- **CO4:** Analyze the performance of noise in analog communication

TEXT BOOK:

1 Simon Haykin, “Analog and Digital Communication”, John Willey

2 Taub, Schilling, “Principles of Communication Systems”, Tata McGraw Hill.

REFERENCE BOOKS:

1. Roy Blake, “Electronic Communication Systems”, 2nd Edition, Thomson publishers, 2002.
2. George Kennedy, “Electronic Communication Systems”, TMG, 4th Edition.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	-	-	-	-	-	-	-	-	2	3	2
CO2	3	3	1	-	-	-	-	-	-	-	-	2	3	2
CO3	3	3	3	-	-	-	-	-	-	-	-	2	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	2	3	2

UEI513E: PYTHON PROGRAMMING

3 Credits (2-2-0)

UNIT-I

Variables: Values and types, variables, variable names and keywords, **Statements:** Operators and operands, Expressions: Order of operations, Modular operator, String operations, Asking the user for input, Comments, Choosing mnemonic variable name, Debugging, **Conditional execution:** Boolean expression, Logical operators **07 Hrs.**

Tutorials: 06 Hrs

UNIT-II

Functions: Function calls, Built-in functions, Type conversion functions, Math functions, Random numbers, Adding new functions, Definitions and uses, Flow of execution, Parameters and arguments, Fruitful functions and void functions **07 Hrs.**

Tutorials: 06 Hrs.

UNIT-III

Iterations: Updating variables, The while statement, Infinite loops, Finishing iterations with continue, Definite loops using for, Loop patterns, **Strings:** Definition, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods, Parsing strings, Format operator

07 Hrs.

Tutorials: 06 Hrs.

UNIT-IV

Files: Persistence, Opening files, Text files and lines, Reading files, searching through a file, Letting the user choose a file name, Using a try, except and open, Writing files. **Lists:** Definition, Lists are mutable, Traversing a list, List operations, List slices, List methods, Deleting elements, Lists and functions, Lists and strings, Parsing lines, Objects and values, Aliasing, List arguments.

07 Hrs.

Tutorials: 06 Hrs.

Course Outcomes:

Students will be able to:

- **CO1:** Explain syntax and semantics of different statements and functions in Python.
- **CO2:** Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications.
- **CO3:** Write simple applications using regular expressions, different data types.
- **CO4:** Analyze the given Python program

TEXT BOOK:

1 Charles R. Severance, "Python for Everybody: Exploring Data in Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016.

REFERENCE BOOKS:

1. Timothy A. Budd, "Exploring Python", MGH(India), 10th reprint, 2017
2. B. Nagesh Rao, "Learning Python", 2nd Indian Edition, CyBERPLUS, 2018

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	2
CO2	2	3	3	-	3	-	-	-	-	-	-	-	3	2
CO3	2	2	2	-	3	-	-	-	-	-	-	-	3	2
CO4	1	2	1	-	3	-	-	-	-	-	-	-	3	2

UEI514E: ROBOTICS
3 Credits (3-0-0)

UNIT-I
Introduction to Robotics: Robot definitions, robotics systems and robot anatomy, specifications of robots, safety measures in robotics. **Robot Kinematics and Dynamics:** Introduction, forward and reverse kinematics of three degrees of freedom robot arm, forward and reverse kinematics of a four degree of freedom manipulator in 3D.

10 Hrs.

UNIT-II
Robot Drives, Actuators and Control: Functions of drive system, general types of fluids, pump classification, introduction to pneumatics systems, electrical drives, DC motors and transfer functions, AC motors, piezoelectric actuators, stepper motor, drive mechanisms.

10 Hrs.

UNIT-III
Robot End-effectors: Introduction, classification of end effectors, drive systems for grippers, mechanical grippers, magnetic grippers, vacuum grippers, adhesive grippers, hooks, scoops and other miscellaneous devices. **Sensors and Intelligent Robots:** Artificial Intelligence (AI) and automated manufacturing, AI and robotics, need for sensing systems, sensory devices, types of sensors, robot vision systems.

10 Hrs.

UNIT-IV
Applications of Robots: Introduction, capabilities of robot, robotics applications, obstacle avoidance, other uses of robots, robotic application under CIM environment, future of robotics.

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Students will be able to:

- **CO1:** Identify the basic elements of robots, its specifications and interpret the robot kinematics and dynamics
- **CO2:** Infer the functionality of robot drives actuators, end effectors and control mechanism
- **CO3:** Analyze the role of Artificial Intelligence in automated manufacturing
- **CO4:** Identify the potential applications of robots

TEXT BOOK:

1. S. R. Deb and S. Deb, “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2010.

REFERENCE BOOKS:

1. Mikell P. Groover, “Automation, Production Systems, and Computer Integrated Manufacturing”, Prentice Hall, 2001
2. S. Fu, R.C. Gonzalez, C.S.G. Lee, “Robotics Control Sensing Vision and Intelligence”, McGraw Hill, 1987

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	1	-	-	-	-	-	-	-	1	2	1
CO2	2	1	3	2	-	-	-	-	-	-	-	1	2	1
CO3	2	3	1	3	-	-	-	-	-	-	-	1	3	2
CO4	1	1	3	2	2	2	3	2	-	-	2	2	1	3

UEI521E: PNEUMATICS AND HYDRAULICS INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction to Hydraulic Power: Pascal's law and problems on Pascal's Law, continuity equations, introduction to conversion of units. Structure of Hydraulic Control System. **The Source of Hydraulic Power:** Pumps Pumping theory, pump classification, gear pumps, vane pumps, piston pumps, pump performance, pump selection. Variable displacement pumps. **Hydraulic Actuators and Motors:** Linear Hydraulic Actuators [cylinders], Mechanics of Hydraulic Cylinder loading, Hydraulic Rotary Actuators, Gear motors, vane motors, piston motors, Hydraulic motor theoretical torque, power and flow rate, hydraulic motor performance

10 Hrs.

UNIT-II

Control Components in Hydraulic Systems: Directional Control Valves – Symbolic representation, Constructional features, pressure control valves – direct and pilot operated types, flow control valves. **Hydraulic Circuit Design and Analysis:** Control of single and Double – acting Hydraulic cylinder, regenerative circuit, pump unloading circuit, Double pump Hydraulic system, Counter Balance Valve application, Hydraulic cylinder sequencing circuits. Locked cylinder using pilot check valve, cylinder synchronizing circuits, speed control of hydraulic cylinder, speed control of hydraulic motors, accumulators and accumulator circuits**.**

10 Hrs.

UNIT-III

Maintenance of Hydraulic systems: Hydraulic oils – Desirable properties, general type of fluids, sealing devices, reservoir system, filters and strainers, problem caused by gases in hydraulic fluids, wear of moving parts due to solid particle contamination, temperature control, trouble shooting. **Introduction to Pneumatic control:** Choice of working medium, characteristics of compressed air. Structure of Pneumatic control system. **Pneumatic Actuators:** Linear cylinders – Types, conventional type of cylinder working, end position cushioning, seals, mounting arrangements applications. Rod-less cylinders – types, working advantages. Rotary cylinder types construction and application. Design parameters – selection**.**

10 Hrs.

UNIT-IV

Directional Control Valves: Symbolic representation as per ISO 1219 and ISO 5599. Design and constructional aspects, poppet valves, slide valves spool valve, suspended seat type slide valve. **Simple Pneumatic Control:** Direct and indirect actuation pneumatic cylinders, use of memory valve. **Signal processing elements:** Use of Logic gates – OR and AND gates pneumatic applications. Practical examples involving the use of logic gates **Multi-cylinder applications:** Coordinated and sequential motion control. Motion and control diagrams – Signal elimination methods. (using reversing valves). **Electro-Pneumatic control:** Principles-signal input and output pilot assisted solenoid control of directional control valves, use of relay and contactors. **Compressed air:** Production of compressed air – compressors, preparation of compressed air- Driers, Filters, Regulators, Lubricators, Distribution of compressed air- Piping layout. **10 Hrs.**

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1: (a) Analyze the laws associated with hydraulic systems
(b) Interpret the functionality of hydraulic actuators
(a) Infer the working of hydraulic components
CO2: (b) Design and analyze hydraulic circuits
(a) Understand the maintenance of hydraulic systems
CO3: (b) Interpret the functionality of pneumatic actuators
(a) Infer the working of hydraulic components
CO4: (b) Design and analyze pneumatic circuits

TEXT BOOK:

1. Anthony Esposito, "Fluid Power with applications", Fifth edition, Pearson Education, Inc. 2000
2. Andrew Parr, "Pneumatics and Hydraulics", Jaico Publishing Co. 2000

REFERENCE BOOKS:

1. S.R. Majumdar "Oil Hydraulic Systems – Principles and Maintenance", Tata Mc Graw Hill Publishing Company Ltd. 2001
2. S.R.Majumdar, "Pneumatic Systems" , Tata Mc Graw Hill Publishing Company, 1995
3. Pippenger, Hicks, "Industrial Hydraulics", McGraw Hill, New York

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	-	-	-	-	-	-	1	1	2	1
CO2	2	3	3	2	-	-	-	-	-	-	1	1	2	1
CO3	2	2	1	1	-	-	-	-	-	-	2	1	3	2
CO4	1	3	3	2	-	-	-	-	-	-	2	2	1	3

UEI522E: AUTOMOTIVE ELECTRONICS
3 Credits (3-0-0)

UNIT-I

Starting System: Condition at starting, Behavior of starter during starting and its characteristics, Principle and construction of starter motor, Working of different starter drive units, Care and maintenance of starter motor, Starter switches, Three point starter-basic constructions and working principle. **Generator:** Main construction features, Armature winding, Commutator, Basic principle of a D.C. generator, Slip-ring commutation, Operating characteristic and application of D.C. generators, Armature reaction, Total loss in D.C. generator, Working principle of D.C. motor, Types of D.C. motor and it's characteristics, Speed control of D.C motor.

10 Hrs.

UNIT-II

Lighting System &Accessories: Insulated & earth return systems, Positive and negative earth systems, Details of head light and side light, Headlight dazzling and preventive methods, Electrical fuel-pump, Speedometer, Fuel, oil and temperature gauges, Horn, Wiper system, Trafficator. **Automotive Electronics:** Current trends in modern automobiles, Open and close loop systems, Components for electronic engine management, Electronic management of chassis system, Vehicle motion control. **Sensors and Actuators for Automobiles:** Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor- Altitude sensor, Flow sensor, Throttle position sensors.

10 Hrs.

UNIT-III

Electronic Fuel Injection and Ignition Systems: Introduction, Feedback carburettor systems, Throttle body injection and multi port or point fuel injection, Fuel injection systems, Injection system controls, Advantages of electronic ignition systems, Types of solid-state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control. **Electronic Dashboard Instruments:** Onboard diagnosis system, Security and warning system.

10 Hrs.

UNIT-IV

Digital Engine Control System: Open loop and closed loop control systems, Engine cranking and warm up control, Acceleration enrichment, Deceleration leaning and idle speed control, Distributorless ignition, Integrated engine control systems, exhaust emission control engineering. **Chassis and Safety Systems:** Traction control system, Cruise control system, Electronic control of automatic transmission, Antilock braking system, Electronic suspension system, Working of airbag and role of MEMS in airbag systems, Centralized door locking system, Climate control of cars.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Describe the use of various electronics and sensors in automobiles
- **CO2:** Describe the working of different electronic systems used in automobile vehicles
- **CO3:** Demonstrate the knowledge of electronics and sensors involved in automobile systems
- **CO4:** Use sensors and electronic hardware for a specific application in an automobile vehicle

TEXT BOOK:

1. Judge A.W, “Modern Electrical Equipment of Automobiles”, Chapman & Hall, London, 1992.

REFERENCE BOOKS:

1. Tom Denton, “Automobile Electrical and Electronics Systems”, Edward Arnold Publishers, 2000.
2. William B. Ribbens, “Understanding Automotive Electronics”, 5th Edition, Newness Publishing, 2000.
3. Barry Hollembeak, “Automotive Electricity, Electronics &Computer Controls”, Delmar Publishers, 2001.
4. Ronald. K. Jurgon, “Automotive Electronics Handbook”, McGraw-Hill, 1999.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	2

UEI523E: OBJECT ORIENTED PROGRAMMING WITH C++

3 Credits (3-0-0)

UNIT-I

Introduction: Object oriented programming, characteristics of object oriented languages, C++ and C. C++ Programming Basics: Basic programming construction, Cin and Cout statements, per-processor directives, comments, integer variables, character variables, floating point types, type Bool, the setw manipulator, type conversion, arithmetic operators. **Loops and Decisions:** Relational operators, for- loop, while loop, do-while loop, if statement, if-else statement, else-if statement, switch statement, conditional operator, logical operators, precedence.

10 Hrs.

UNIT-II

Structures: A simple structure, defining a structure, defining structure variables, accessing structure members, other structure features, enumerated data type. **Function**s: Simple functions, passing arguments to functions, returning values from functions, overloaded functions.

10 Hrs.

UNIT-III

Objects and Classes: A simple class, C++ objects as physical objects, C++ objects as data types, constructors, destructor's, objects as function arguments, the defaults copy constructor, returning objects from functions.

10 Hrs.

UNIT-IV

Arrays: Array fundamentals, arrays as class member data, arrays of objects. **Operator Overloading**: Creating a member operator function, overloading unary operators, overloading binary operators

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

CO1: **(a)** Demonstrate the basic concept of programming

CO2: **(a)** Analyze and design the programs using the concept of structure

(b) Implement the code that includes the reusability

CO3: **(a)** Apply the concepts of object-oriented programming

CO4: **(a)** Understand the concept of arrays.

(b) Analyze and design the concept of operator overloading

TEXT BOOK:

1. Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publishing..
2. E.Balaguruswamy, "Object Oriented Programming with C++", Tata McGraw Hill

REFERENCE BOOKS:

1 **.** Herbert Schildt, "C++ The Complete Reference", Tata McGraw Hill

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	2

UEI524E: RENEWABLE ENERGY
3 Credits (3-0-0)

UNIT-I

Introduction to Energy Sources: Importance of energy consumption as measure of prosperity, per capita energy consumption, classification of energy resources; conventional energy resources – availability and their limitations; non-conventional energy resources: Classification, advantages, limitations; comparison of conventional and non-conventional energy resources. **Solar Energy Basics:** Introduction, solar constant, basic sun-earth angles – definitions and their representation, solar radiation geometry (only theory); Measurement of solar radiation data: Pyranometer and pyro-heliometer. **Solar Thermal Systems:** Principle of conversion of solar radiation into heat, solar water heaters (Flat plate collectors), Solar cookers: box type, concentrating dish type; solar driers, solar still.

10 Hrs.

UNIT-II

Solar Electric Systems: Solar thermal electric power generation: Solar pond and concentrating solar collector (parabolic trough, parabolic dish, central tower collector). Advantages and disadvantages; Solar photovoltaic: Solar cell fundamentals, module, panel and array. Solar PV systems: Street lighting, domestic lighting and solar water pumping systems. **Wind energy:** Wind and its properties, history of wind energy, wind energy scenario – world and India. Basic principles of wind energy conversion systems (WECS), classification of WECS, parts of a WECS, derivation for power in the wind, advantages and disadvantages of WECS.

10 Hrs.

UNIT-III

Biomass Energy: Introduction, photosynthesis process, biomass conversion technologies; Biomass gasification: Principle and working of gasifies; Biogas: production of biogas, factors affecting biogas generation, types of biogas plants – KVIC and Janata model. **Geothermal Energy:** Introduction, geothermal resources (brief description), advantages and disadvantages, applications of geothermal energy.

10 Hrs.

UNIT-IV

Energy from Ocean: Tidal energy: Principle of tidal power, components of tidal power plant (TPP), classification of tidal power plants, advantages and limitation of TPP. Ocean thermal energy conversion (OTEC): Principle of OTEC system, methods of OTEC power generation: Open cycle (Claude cycle), closed cycle (Anderson cycle) and hybrid cycle (block diagram description of OTEC), advantages & limitation of OTEC. **Emerging Technologies:** Fuel cell, hydrogen energy, and wave energy. (Principle of energy generation using block diagrams, advantages and limitations).

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** List the types and advantages of renewable energy sources and distinguish them
- **CO2:** Describe the technology for generation of different renewable energies
- **CO3:** Identify and assess the strength and weakness of various renewable energy sources and design a method of harnessing these energy sources
- **CO4:** Use renewable energy for a particular system/ application

TEXT BOOK:

1. Rai G. D., “Non-Conventional Sources of Energy,” 4th Edition, Khanna Publishers, 2007.
2. Khan B. H., “Non-Conventional Energy Resources”, TMH, New Delhi, 2006.

REFERENCE BOOKS:

1 Mukherjee D., Chakrabarti, S., “Fundamentals of Renewable Energy Systems”, New Age International Publishers, 2005.

2 Tiwari, G. N., Ghosal M. K., “Renewable Energy Sources: Basic Principles and Applications”, Alpha Science International Ltd., New Delhi, 2006.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	3	3
CO2	3	3	1	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	1	-	-	-	-	-	-	-	-	-	3	2
CO4	3	3	1	-	-	-	-	-	-	-	-	-	2	2

UHS002N: ADVANCED QUANTITATIVE APTITUDE AND SOFT SKILLS

1 Credits (2-0-0)

Course Objectives:

1. To develop and augment the written communication skills
2. To develop a deep sense of analysis towards solving a problem
3. To fine-tune the quantitative, data analysis and interpretation skills

UNIT-I
Professional Communication: Discussions and Debates, Written Communication

08 Hrs.

UNIT-II
Professional Communication: Written Communication
Written English: Synonyms and Antonyms, Error Detection and Correction, Para Jumbles and Miscellaneous Questions

07 Hrs.

UNIT-III
Mathematical Thinking: Ratio, Proportion and Variation, Percentages, Profit and Loss, Simple and Compound Interest, Averages and Allegations, Time and Work

08 Hrs.

UNIT-IV
Analytical Thinking: Analytical Puzzles, Data Analysis

07 Hrs.
Total Hrs.: 30

Course Outcomes:

Students will be able to:

CO1: Demonstrate speaking in public or to an audience
CO2: Demonstrate verbal ability
CO3: Demonstrate written communication
CO4: Analyze the given problem and develop a method for solving it
CO5: Solve quantitative aptitude

REFERENCE BOOKS:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018
5. Edward De Bono, "Lateral Thinking", Penguin Books, New Delhi, 2016

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		2		
CO2										3		2		
CO3										3		1		
CO4		3										2		
CO5		3										2		

Evaluation Methodology:

Continuous Internal Evaluation: 3 CIEs with 30 Objective Questions in 60 minutes

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

UEI641C: MEDICAL INSTRUMENTATION
3 Credits (3-0-0)

UNIT-I
Fundamentals of Bio-signals: Sources, Basic instrumentation system, General constraints in design of biomedical instrumentation systems, Origin of bioelectric signals, Types of bioelectric signals– ECG,EEG, EMG, EOG, ERG. **Electrocardiograph**: Characteristics of Electrocardiogram (ECG), Electrocardiograph block diagram, Transformer coupled isolation ECG preamplifier circuit**,** RL driven circuit, ECG lead system and multi-channel ECG machine.

10 Hrs.

UNIT-II
Electroencephalograph: Electroencephalograph block diagram, 10-20 electrode systems, Unipolar, bipolar and average electrode configurations, Computerized analysis of EEG. **Patient Monitoring System**: Bedside patient monitoring system. **Measurement of Heart Rate:** Average heart rate meter, Instantaneous heart rate meter (cardio tachometer). **Measurement of Pulse Rate:** Reflectance and transmittance photoelectric method, Processing of plythysmographic signals.

10 Hrs.

UNIT-III
Blood Pressure Measurement: Direct and indirect method, Korotkoff's method, Rheographic method, Ultrasonic Doppler shift method. **Blood Flow Meters:** Ultrasonic blood flow meters: Continuous wave flow meter, Doppler imaging flow meter, NMR blood flow meters. **Measurement of Respiration Rate:** Mechanics of respiration**, T**hermistor method, Impedance pnuemography, CO_2 method, Apnoea detectors. **Ventilators**: Artificial ventilation, Positive and negative pressure ventilators.

10 Hrs.

UNIT-IV
Cardiac Pacemakers: Need for cardiac pacemaker, Implantable pacemaker, Programmable pacemaker, Rate responsive pacemakers. **Defibrillators**: AC and DC defibrillators. **Pulmonary Function Analyzer**: Pulmonary function measurement, Measurement of flow-volume by nitrogen washout technique. **Patient Safety:** Electric shock hazards, Precautions to minimize electric shock hazards, Safety codes for electro medical equipment, Introduction to digital health system.

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Students will be able to:

- **CO1:** Characterize the various physiological signals.
- **CO2:** Describe various principles and techniques employed in measurement of vital physiological parameters.
- **CO3:** Categorize and interpret various medical instruments.
- **CO4:** Identify and judge patient safety issues related to medical instrumentation.

TEXT BOOKS:
1 R. S. Khandpur, "Hand book of Biomedical Instrumentation", 2nd Edition, TMH, 2003.
2 J. G. Webster, "Medical Instrumentation, Application & Design", 3rd Edition, John Wiley, 1998.

REFERENCE BOOK:

1. Lesely Cromwell, “Principles of Applied Biomedical Instrumentation”, John Wiley, 2004.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	-	-	-	-	-	-	-	-	-	3	-
CO4	3	-	-	-	-	-	-	-	-	-	-	-	3	-

UEI642C: CONTROL SYSTEMS

4 Credits (4-0-0)

UNIT-I

Introduction: Objective of control system, Importance of control system, Examples of control system, Types of control systems, Open-loop and closed loop control systems, Feed-back and its effects on system performance characteristics. **Modeling of Physical Systems:** Models of mechanical systems, Electrical systems, and Electromechanical systems, Analogous systems: Force-voltage analogy, Force-current analogy. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-II

Block Diagrams and Signal Flow Graphs: Transfer function; Block diagram reduction, Signal flow graphs, Mason's gain formula, and Application of Mason's gain formula to block diagrams. **Time Response of Feedback Control Systems:** Standard test signals, Type and order of system, Steady state error and error constants, Unit-step response of first and second order systems, Time domain specifications. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-III

Stability Analysis: The concept of stability, BIBO stability, Zero-input and asymptotic stability, Routh-Hurwitz (R-H) stability criterion, Application. **Root-Locus Analysis:** The concept of root locus and Complementary root locus, Basic properties of root locus, Construction of root locus. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

UNIT-IV

Frequency Domain Analysis: The concept of frequency response, Polar plots, Procedure for constructing polar plots, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples. Usage of MATLAB command-line functions to verify the solution.

13 Hrs.

Total Hrs.: 52

Course Outcomes:

Students will be able to:

CO1: **(a)** Identify and classify types of control systems
(b) Model a physical system
CO2: **(a)** Reduce and simplify block diagrams and signal flow graphs
(b) Analyse and determine time-domain responses of first and second systems for step and ramp input
CO3: **(a)** Analyse and determine stability of control systems using R-H criterion
(b) Analyse and construct root locus
CO4: **(a)** Analyse and construct polar plot and Bode plot
(b) State and describe Nyquist stability criterion
CO5: Use MATLAB command-line functions for modeling and analysis of LTI systems.

TEXT BOOK:

1. I. J. Nagarath and M Gopal, "Control Systems Engineering", New Age International (P) Ltd., 1999

REFERENCE BOOKS:

1. B. C. Kuo, "Automatic Control Systems", 7^{th} Edition, PHI, 2002.
2. R. S. Allurkar, "Control Systems", EBPB, 2004

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3		-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO5	-	-	-	-	3	-	-	-	-	-	-	-	-	-

UEI643C: ARM PROCESSOR
3 Credits (3-0-0)

UNIT-I

An Introduction to Processor Design: Processor architecture and organization, Abstraction in Hardware design, MU0- A Simple processor, Instruction set design, Processor design trade-offs, The reduced instruction set computer, Design for low power consumption, Architectural inheritance.

10 Hrs.

UNIT-II

Features of Processor Architectures: Von-Neumann and Harvard, ARM7TDMI Features, Programmer's Model and 3-stage pipelined Architecture, Memory Formats and Instruction Length, Features of LPC2148 Microcontroller, Architecture of LPC2148, Memory Mapping and control Operation.

10 Hrs.

UNIT-III

Addressing modes of Data Transfer, Data processing and Controller Transfer instructions in ARM state, Stack operation in ARM, **System Control:** Reset condition, Brown out reset, Clocking and Power control. **Exceptions in ARM7TDMI processor:** Exception handling, Interrupt Latency.

10 Hrs.

UNIT-IV

LPC2148 Peripherals: High level Programming using GPIO, External Interrupt Inputs, Timers, ADC and DAC. Theory on PWM operation, Theory on serial communication: UART, SPI, I2C and CAN protocols, RS232 standards

10 Hrs.
Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Identify the various digital components in ARM Processor architecture
- **CO2:** Select suitable instructions and addressing modes to implement code for specific application
- **CO3:** Interface and write C - Program to access Memory and Peripheral devices
- **CO4:** Develop Program to handle exceptions

TEXT BOOK:

1 Steve Furber, "ARM System On Chip Architecture" , 2nd Edition, Pearson Publication, 2016
2 William Hohl, Christopher Hinds, "ARM Assembly Language: Fundamentals and Techniques", 2nd Edition, CRC Press, 2015

REFERENCE BOOKS:

1 ARM Architecture reference manual DDI 0100E
2 ARM7TDMI Revision: r4p1 Technical Reference Manual
3 LPC2141/42/44/46/48 Single-chip 16-bit/32-bit microcontrollers; up to 512 kB flash with ISP/IAP, USB 2.0 full-speed device, 10-bit ADC and DAC Rev. 5 — 12 August 2011 Product data sheet

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	1
CO2	3	3	2	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	1

UEI644L: ARM PROCESSOR LABORATORY
1 Credit (0-0-2)

List of experiments:

1. Write a C program to interface the LEDs
2. Write a C program to implement counter by interfacing 7 Segment display
3. Write a C program to interface buzzer
4. Write a C program to interface relay
5. Write a C program to interface keys and keyboard
6. Write a C program to interface stepper motor
7. Write a C program to interface DC motor
8. Write a C program to read the digital data from internal ADC
9. Write a C program to generate various waveforms using internal DAC
10. Write a C program to interface external interrupt source
11. Write a C program to interface the LCD and display the given text in given fashion.
12. Write a C program to transmit the data serially using UART.

Minimum 10 experiments to be completed from the above list

Course Outcomes:

Students will be able to:

CO1: Design and develop a system/ program for the given objective
CO2: Conduct the experiment and demonstrate the theoretical concepts
CO3: Analyze and interpret the experimental results

CO-PO Mapping:

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	Design and develop a circuit/program for the given objective	3	3	-	-	-	-	-	-	-	-	-	-	2	2
CO2	Conduct the experiment and demonstrate the theoretical concepts	-	3	2	-	-	-	-	-	-	-	-	-	2	2
CO3	Analyze and interpret the experimental results	-	-	3	-	-	-	-	-	-	-	-	-	2	2

UCS659L: Advanced C Programming Lab
2 Credits (0-2-2)

The objective of the course is to:

1. Imbibe thorough knowledge in advanced C programming concepts.
2. Have proficiency in applying advanced C programming concepts to solve any real world problem.

UNIT -I

Multidimensional arrays. Self-referential structures and Unions. **Pointers:** Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, Lvalue and Rvalue, Examples. **Pointer Applications:** Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples. 06 Hrs

UNIT- II

Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

06 Hrs

UNIT- III

Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.

06 Hrs

UNIT- IV

Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals

06 Hrs

Course outcomes:

The student will be able to:

1. Define advanced C programming concepts like pointers, data structures.
2. Apply the knowledge of advanced C programming concepts to implement given requirement specification or to solve real world problem.
3. Analyze different data structures and use suitable data structure to implement requirement specification.
4. Implement, interpret, debug and test any given advanced C program.
5. Develop software product using advanced C programming concepts to solve real world problem.

Text Books:

1. Gilberg & Forouzan, "Data Structures: A Pseudo-code approach with C," 2nd Edition, 2014
2. Yashwant Kanetkar, "Data Structures through C," BPB Publication, 2017

Reference Book:

1. Reema Thareja, "Data Structures using C," Oxford press, 3rd Edition 2012
2. Jean-Paul Tremblay & Paul G., "An Introduction to Data Structures with Applications," McGraw-Hill, 2nd Edition, 2013

UEI611E: INTELLIGENT INSTRUMENTATION

3 Credits (3-0-0)

UNIT-I

Introduction: Intelligent instrumentation, Definition, Historical Perspective, Current status, software based instruments. **Intelligent Sensors**: Classification, Smart sensors, Monolithic Integrated Smart Sensors, Hybrid Integrated Smart Sensors, Cogent Sensors, Soft or Virtual sensors, Self-adaptive, Self-validating sensors, Soft Sensor Secondary Variable Selection, Rough Set Theory, Model Structures. Self-Adaptive Sensors, Self-Validating Sensors, VLSI Sensors, Temperature Compensating Intelligent Sensors, Pressure Sensor

10 Hrs.

UNIT-II

Sensor Characterization and Linearization: Analog Linearization of Positive and Negative Coefficient Resistive Sensors. Higher-Order Linearization, Quadratic Linearization, Third-Order Linearization Circuit, Nonlinear ADC- and Amplifier-Based Linearization, Interpolation, Piecewise Linearization, Microcontroller-Based Linearization, Lookup Table Method, Artificial Neural Network– Based Linearization, Nonlinear Adaptive Filter–Based Linearization.

10 Hrs.

UNIT-III

Sensor Calibration and Compensation: Sensor Calibration, Conventional Calibration Circuits, Offset Compensation, Error and Drift Compensation, Lead Wire Compensation. **Sensors with Artificial Intelligence:** Artificial Intelligence, Sensors with Artificial Intelligence, Multidimensional Intelligent Sensors, AI for Prognostic Instrumentation, ANN-Based Intelligent Sensors, Fuzzy Logic–Based Intelligent Sensors.

10 Hrs.

UNIT-IV

Intelligent Sensor Standards and Protocols: IEEE 1451 Standard: STIM, TEDS, NCAP. Network Technologies, LonTalk, CEBUS, J1850 Bus: Signal Logic and Format, MI Bus, Plug-n-Play Smart Sensor Protocol.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** To study the concepts of intelligent sensor devices, their performance characteristics and signal and system dynamics.
- **CO2:** To address the issues in dealing signal conditioning operations such as calibration, linearization and compensation.
- **CO3:** To develop the design methodologies for measurement and instrumentation of real world problems.
- **CO4:** To use artificial intelligence in sensor signal processing to solve real world problems.
- **CO5:** To deal with interfacing protocols in wireless networking platform

TEXT BOOK:

1. Manabendra Bhuyan, “Intelligent Instrumentation: Principles and Applications,” CRC Press, Taylor and Francis Group, 2011.

REFERENCE BOOKS:

1. G. C. Barney, “Intelligent Instrumentation,” Prentice Hall, 1995.
2. J.B Dixit, Amit Yadav, “Intelligent Instrumentation for Engineers,” Laxmi Publications Ltd., 2011.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	3	1
CO2	3	2	-	-	-	-	-	-	-	-	-	1	3	2
CO3	3	3	-	-	-	-	-	-	-	-	-	1	3	2
CO4	2	1	-	-	-	-	-	-	-	-	-	1	3	1

UEI612E: MICRO ELECTRO MECHANICAL SYSTEM
3 Credits (3-0-0)

UNIT-I
Overview of Micro Electro Mechanical System and Microsystems: MEMS and Microsystems, typical MEMS and microsystem products, evolution of microfabrication, microsystems and microfabrication, microsystem and microelectronics, microsystem and miniaturization, applications of microsystems in various industries. **Working Principles of MEMS:** Introduction, Microsensors.

10 Hrs.

UNIT-II
Working Principles of MEMS: Microactuation, MEMS and microactuators, Microaccelerometers, microfluidics**. Scaling Laws in Miniaturization:** Introduction to scaling, scaling in geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity, scaling in fluid mechanics, scaling in heat transfer.

10 Hrs.

UNIT-III
Materials for MEMS and Microsystems: Substrates and wafers**,** active substrate materials, silicon as a substrate material, silicon compounds, silicon piezoresistors, Gallium Arsenide, Quartz, Piezoelectric crystals, polymers packaging materials. **Microsystem Fabrication Processes:** Introduction to microfabrication, Photolithography, Ion implantation, diffusion, oxidation, chemical vapor deposition, physical vapor deposition, deposition by epitaxy, etching.

10 Hrs.

UNIT-IV
Micromanufacturing: Bulk micromachining, Surface micromachining, LIGA process. **Microsystem Design:** Introduction**,** Design considerations, Process design, Computer aided design.

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Students will be able to:

- **CO1:** Interpret the benefits of miniaturization and identify the various applications of microsystems
- **CO2:** Elucidate the effect of scaling and illustrate the working principle of microsensors and microactuators
- **CO3:** Analyze the characteristics of various materials and their significance in micro manufacturing
- **CO4:** Infer the microsystem fabrication processes and elucidate the micro manufacturing design and process

TEXT BOOKS:

1. Tai, Ran Hsu, "MEMS and Microsystems: Design and Manufacture", TMH, 2002.
2. G.K. Ananthsuresh, K.J. Vinoy, S. Gopalkrishna, K.N. Bhat, V.K. Aatre "Micro and Smart Systems", Wiley Publisher, 2010, ISBN:9788126527151.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	2	1	-	-	-	-	1	2	1
CO2	2	2	2	1	-	-	1	-	-	-	-	1	2	2
CO3	2	1	1	1	-	-	2	-	-	-	-	2	2	2
CO4	2	2	2	3	-	-	1	-	-	-	1	2	1	3

UEI613E: COMPUTER NETWORKS AND SECURITY
3 Credits (3-0-0)

UNIT-I

Introduction: Uses of computer networks, Network hardware, Network software, Reference models. **The physical layer**: The theoretical basis for data communication, Guided transmission media, Wireless transmission.

10 Hrs.

UNIT-II

The data link layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols. **The medium access control sub-layer**: The channel allocation problem, Multiple access protocols: Aloha, Carrier Sense Multiple Access protocols.

10 Hrs.

UNIT-III

The Network layer: Network layer design issues, Routing algorithms, Congestion control algorithm.
The Transport layer: The transport services, Elements of transport protocol.

10 Hrs.

UNIT-IV

Network security: Cryptography, Symmetric key algorithms, Public key algorithms. **The Application laye**r: Domain name system (DNS), The DNS name space, resource records. Electronic mail, Architecture, World Wide Web (WWW). Architectural overview.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** List the applications of computer networks and Identify different types of networks.
- **CO2:** Explain function and role of physical, data link, network, transport and application layer of OSI reference model.
- **CO3:** Comprehend the design issues of different layers of OSI reference model.
- **CO4:** Discuss the concept of cryptography

TEXT BOOK:

1 Andrews S. Tanenbaum, “Computer Networks”, 4^{th} Edition, Pearson Education

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO3	2	2	3	2	-	-	-	-	-	-	-	1	3	1
CO4	2	2	3	2	-	-	-	-	-	-	-	1	3	1

UEI614E: DIGITAL IMAGE PROCESSING
3 Credits (3-0-0)

UNIT-I

Digital Image Fundamentals: Introduction, Fundamental steps in digital image processing (DIP), Components of DIP system, Simple image formation model, Image sampling and quantization, Basic relationship between pixels, Color image processing fundamentals and models. Two-dimensional mathematical preliminaries, 2D transforms: DFT, DCT, KLT, SVD.

10 Hrs.

UNIT-II

Image Enhancement: Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional smoothing, median, Geometric mean. **Image Restoration:** Image restoration - degradation model. Unconstrained restoration: Lagrange multiplier. Constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering.

10 Hrs.

UNIT-III

Image Segmentation: Edge detection, Edge linking via Hough transform, Thresholding, Region based segmentation, Region growing, Region splitting and merging, Segmentation by morphological watersheds, Basic concepts, Dam construction, Watershed.

10 Hrs.

UNIT-IV

Image Compression: Need for data compression, Huffman, Run length encoding, Shift codes, arithmetic coding, Vector quantization, Transform coding, JPEG standard, MPEG.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Students will be able to:

- **CO1:** Analyze general terminology of digital image processing.
- **CO2:** Examine various types of images, intensity transformations and spatial filtering.
- **CO3:** Apply image enhancement and restoration techniques in practical applications.
- **CO4:** Apply image segmentation and compression techniques in practical applications.

TEXT BOOK:

1 Rafael C. Gonzalez, Richard E. Woods, “Digital Image Processing”, Pearson, 2nd Edition, 2004.
2 Anil K. Jain, “Fundamentals of Digital Image Processing”, 2nd Edition Pearson.

REFERENCE BOOKS:

1 Kenneth R. Castleman, “Digital Image Processing”, Pearson, 2006.
2 Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education Inc., 2004.
3 D. E. Dudgeon, R. M. Mersereau, “Multidimensional Digital Signal Processing”, Prentice Hall.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	2	2	2	2	-	-	-	-	-	-	-	1	2	1
CO3	2	2	3	2	-	-	-	-	-	-	-	1	3	1
CO4	2	2	3	2	-	-	-	-	-	-	-	1	3	1

UHS003N: CAREER PLANNING AND PROFESSIONAL SKILLS

1 Credits (2-0-0)

Course Objectives:

1. To enhance the ability to think and reason critically
2. To augment the student's attention to detail and problem-solving skills in basic computations
3. To successfully handle personal interviews and enhance public speaking skills

UNIT-I
Professional Communication: Mock Group Discussions, Interview Handling Skills

08 Hrs.

UNIT-II
Professional Communication: Résumé Writing, Leadership Skills and Team Workmanship, Spoken English
Written English: Reading Comprehension

07 Hrs.

UNIT-III
Written English: Sentence Completion, Critical Reasoning
Analytical Thinking: Boolean Logic and Cryptarithms

08 Hrs.

UNIT-IV
Mathematical Thinking: Time, Speed and Distance, Permutations and Combinations, Probability

07 Hrs.
Total Hrs.: 30

Course Outcomes:

Students will be able to:

CO1: Interact with confidence in personal interviews successfully
CO2: Demonstrate leadership and team workmanship skills
CO3: Analyze the given problem and develop a method for solving it
CO4: Solve quantitative aptitude

REFERENCE BOOKS:

1. R. S. Aggarwal, "A Modern Approach to Verbal and Non – Verbal Reasoning", Sultan Chand and Sons, New Delhi, 2018
2. R. S. Aggarwal, "Quantitative Aptitude", Sultan Chand and Sons, New Delhi, 2018
3. Chopra, "Verbal and Non – Verbal Reasoning", MacMillan India
4. M Tyra, "Magical Book on Quicker Maths", BSC Publications, 2018

6. Edward De Bono, “Lateral Thinking”, Penguin Books, New Delhi, 2016

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1										3		2		
CO2										3		3		
CO3		3												
CO4		3												

Evaluation Methodology:

Continuous Internal Evaluation: 3 CIEs with 30 Objective Questions in 60 minutes

Semester Ending Examination: 50 Objective Questions in 90 minutes covering entire syllabus

UEI741C: PROCESS AUTOMATION
4 Credits (4-0-0)

Course Objectives:

1. To convey the importance and benefits of industrial automation.
2. To develop PLC programming skills.
3. To discuss SCADA and DCS for process automation.

UNIT-I

Introduction: Expectations from automation, Basic functions, Historical development of control systems, Current trends in computer of process plants. **Intelligent Controllers:** Model based controllers, Predictive control, Artificial intelligence based systems. **Introduction to Programmable Logic Controllers (PLC):** Introduction to PLC operation-The digital concept, Analog signals, The input status file, The output status file, Input and output status files, Sixteen point I/O modules, PLC memory, Input modules - Discrete type, Discrete AC and DC type. Output Modules - Discrete type, Solid-state type, Switching relay type.

13 Hrs.

UNIT-II

Introduction to Logic: The logic, Conventional ladder v/s LPLC ladder, Series and parallel function of OR, AND, NOT, XOR logic, Analysis of rung. **PLC Instructions:** The basic relay instructions normally open and normally closed instructions, Output latching instructions, Understanding relay instructions and the programmable controller input modules, Interfacing start stop push-button and motor to PLC, Developing ladder diagram with analytical problems.

13 Hrs.

UNIT-III

Timer and Counter Instructions: On delay and off delay and retentive timer instructions, PLC counter up and down instructions, Combining counters and timers, Developing ladder diagram with analytical problems. **Comparison and Data Handling Instructions:** Data handling instructions, Sequencer instructions - Programming sequence output instructions, Developing ladder diagram with analytical problems.

13 Hrs.

UNIT-IV

Supervisory Control And Data Acquisition (SCADA): Introduction. Channel scanning, Conversion to engineering units, Data processing, Distributed SCADA system. **Distributed Control System (DCS):** Introduction, Distributed versus Centralized control, Advantages of Distributed Control System, Functional requirements of distributed control system, System architecture, Distributed Control Systems.

13 Hrs.

Total Hrs.: 52

Course Outcomes:
Student will be able to:

CO1: a. Elucidate the role of automation in industry and comprehend the various controllers used in industries
b. Illustrate typical elements of PLC and its memory organization

CO2: a. Compare electrical relay logic and PLC ladder logic illustrate the working of PLC instructions
b. Develop program using basic PLC instructions

CO3: a. Illustrate the working of advanced PLC instructions
b. Develop program for PLC applications

CO4: a. Interpret the role of SCADA in process control
b. Analyze the role of Distributed Control System (DCS)

Text Books:

1. Garry Dunning, "Introduction to Programmable Logic Controllers," 2nd Edition. Thomson Publishing, ISBN: 981-240-625-5.
2. Krishna Kant, "Computer based Industrial Control," 6th Edition, 2004, PHI, ISBN: 1-203-11237

Reference Books:

1. Curtis Johnson, "Process Control Instrumentation Technology", Prentice Hall of India.
2. Bela G. Liptak, "Instrumentation Engineers Hand Book – Process Control", Chilton Book Company, Pennsylvania.
3. W.Bolton, "Industrial Control and Instrumentation", Universities Press.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	1	1	--	--	--	--	--	1	--	1	3	2
CO2	2	3	3	1	2	--	--	--	--	1	--	1	2	3
CO3	3	3	3	3	2	--	--	--	--	1	--	1	2	3
CO4	2	2	2	1	--	--	--	--	--	1	2	1	3	2

UEI742C: LASERS AND OPTICAL INSTRUMENTATION
4 Credits (4-0-0)

Course Objectives:

1. To discuss various laser devices.
2. To know the application of lasers in different fields.
3. To discuss the fundamentals of optical fibers and optical sensors.

UNIT-I

Fundamentals of Lasers: Emission and absorption of radiation, Einstein relations, population inversion with 2 level, 3 level and 4 level energy systems, optical feedback, line shape function, laser losses, threshold conditions, laser modes, properties of laser light, classification of lasers, **Doped and Semiconductor Lasers:** Doped insulator lasers –Nd:YAG laser, Ruby laser, Semiconductor lasers – basics, threshold current density for semiconductor lasers, power output of semiconductor lasers, hetero junction lasers.

13 Hrs.

UNIT-II

Gas, ion and molecular Lasers: Gas lasers: Atomic lasers- He-Ne laser, Ion laser-Argon laser, Molecular laser-CO_2 laser, Liquid dye lasers, Single mode operation, Mode locking technique- Introduction, active & passive mode locking, Q-switching technique: Introduction, methods of Q-switching- Rotating mirror method, Electro-optic method, Passive method. **Laser applications:** Measurement of distance - Interferometric methods, beam modulation telemetry, pulse echo techniques. Holography-Principle, holographic computer memory system.

13 Hrs.

UNIT-III

Optical Fibers: Introduction, fiber benefits, areas of application, structure of fiber, propagation of light in fibers, Principles of fiber optics: Ray theory transmission, total internal reflection, numerical aperture, mode theory of optical propagation, fiber specification, types of fiber: Step index fiber, graded index fiber, multi-mode and single mode fiber, fiber materials, and optical fiber cables. **Optical source**: LED- Principle, characteristics, construction, working.

13 Hrs.

UNIT-IV

Optical Detectors: Characteristics, Photo detectors- photo multiplier tube, photo diode, PIN diode, avalanche diode, photo transistor, CMOS, CCD image sensors(Working principles only), **Optical fiber sensors:** Phase and polarization fiber sensors, ring with multi turn fiber coil, optical fluid level detector, optical fiber flow sensors, current measurement by single mode optical fiber sensors, fluro-optic temperature sensors, photo elastic pressure sensors, laser Doppler velocimeter using optical fiber, fiber Bragg grating sensor .

13 Hrs.

Total Hrs.: 52

Course Outcomes:
Student will be able to:

CO1 Describe the fundamental concepts of laser and optical instruments.
CO2 Define various principles of laser and optical instruments.
CO3 Describe techniques employed in laser and optical instruments.
CO4 Depict the applications of laser and optical instruments.

Text Books:

1. Wilson, Hawkes, "Optoelectronics: An Introduction," 2nd Edition, Prentice-Hall of India, 2001.
2. K.Sarkar, D.C. Sarkar, "Optoelectronics and Fiber Optics Communication," New Age Int. Pub., 2004.
3. P. Sarah, I.K.," Lasers and Optical Fiber Communications," International Publishung House Pvt. Ltd., 2008.

Reference Books:

1. Wilson, Hawkes, "Laser Principles and Applications," 7th Edition, 1987, PHI, ISBN: 978-0135237052.
2. Orazio Svelto, "Principles of Lasers," 5th Edition, Springer, 2010.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	--	--	--	--	--	--	--	--	--	--	3	2

UEI743L: VIRTUAL INSTRUMENTATION LABORATORY

2 Credits (0-0-4)

Course Objectives:

1. To learn the components of virtual instrumentation and develop programs for given application
2. To interface DAQ card to measure and control a parameter
3. To implement small projects in VI

List of Experiments:

1. Creating controls and indicators of different data types
2. Creating basic components of a VI
3. Creating Virtual Instrumentation for simple applications
4. Programming exercises for loops and charts
5. Programming exercises for arrays and matrices
6. Programming exercises for subVIs
7. Programming exercises for clusters and graphs
8. Programming exercises on case and sequence structures, file Input/Output.
9. Data acquisition through Virtual Instrumentation.
10. Developing voltmeter using DAQ cards.
11. Developing signal generator using DAQ cards.
12. Simulating reactor control using Virtual Instrumentation.
13. Real time temperature control using Virtual Instrumentation
14. Real time sequential control of any batch process.

Course Outcomes:

Students will be able to:

CO1	Apply the concepts of VI for the given logic
CO2	Analyze the software and hardware components of VI
CO3	Develop LabVIEW program for the given application

Text Books:

1. Jerome, Jovitha, "Virtual instrumentation using LABVIEW", PHI, 1st Edition,2010

Reference Books:

1. Bitter, R., Mohiuddin, T. and Nawrocki, M., "Labview Advanced Programming Techniques", CRC Press, 2nd Edition, 2007.
2. Jamal, R. and Picklik, H., "Labview – Applications and Solutions", National Instruments Release.
3. Johnson, G., "Labview Graphical programming", McGraw-Hill, Newyork, 1997.

   Wells, L.K. and Travis, J., "Labview for Everyone", Prentice Hall, New Jersey, 1997.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	--	--	3	--	--	--	--	--	--	--	2	1
CO2	1	1	--	--	3	--	--	--	--	--	--	--	1	2
CO3	2	2	--	--	3	--	--	--	--	--	--	--	2	1

UEI744L: PROCESS AUTOMATION LABORATORY
1 Credits (0-0-2)

Course Objectives:
1. To give hands on experience of PLC programming and interfacing.
2. To make use of computers for process control.

List of Experiments:
Part A (PLC):
1. Implementation of Boolean functions using PLC.
2. Sequential control experiments using PLC. Logic should be solved using ladder diagram technique.
3. Experiments on timers and counter instructions of PLC.
4. Interfacing external devices to PLC.
5. Implementation of level control process using PLC
6. Implementation of automatic bottle filling process using PLC.
7. Implementation of control of conveyer belt using PLC.
8. Implementation of elevator control using PLC.

Part B (Computerized Process Control):

1. Interfacing the level process station to the computer using available arrangement and controlling it through PID controller.
2. Interfacing the flow process station to the computer using available arrangement and controlling it through PID controller.

Course Outcomes:
Students will be able to:

CO1 Design and develop a system/write program for the given objective.
CO2 Conduct the experiment/ execute the program and demonstrate the theoretical concepts.
CO3 Analyze and interpret the results.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	2	3	3
CO2	3	3	3	2	3	--	--	--	--	--	--	2	2	3
CO3	3	3	3	2	2	--	--	--	--	--	--	2	3	3

UEI711E: DATA BASE MANAGEMENT SYSTEM
3 Credits (3-0-0)

Course Objectives:

1. Provide a strong foundation in database concepts, technology.
2. Practice SQL programming through a variety of database problems**.**
3. Design and build database applications for real world problems.

UNIT-I

Introduction to Databases: Introduction, Characteristics of database approach, Advantages of using the DBMS approach, History of database applications. Overview of Database Languages and Architectures: Data Models, Schemas, and Instances. Three schema architecture and data independence, database languages, and interfaces, The Database System environment. **Conceptual Data Modelling using Entities and Relationships:** Entity types, Entity sets, attributes, roles, and structural constraints, Weak entity types, ER diagrams, examples, Specialization and Generalization.

10 Hrs.

UNIT-II

Relational Model: Relational Model Concepts, Relational Model Constraints and relational database schemas, Update operations, transactions, and dealing with constraint violations. Relational Algebra: Unary and Binary relational operations, additional relational operations (aggregate, grouping, etc.) Examples of Queries in relational algebra. Mapping Conceptual Design into a Logical Design: Relational Database Design using ER-to-Relational mapping. SQL: SQL data definition and data types, specifying constraints in SQL, retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL, Additional features of SQL.

10 Hrs.

UNIT-III

SQL : Advances Queries: More complex SQL retrieval queries, Specifying constraints as assertions and action triggers, Views in SQL, Schema change statements in SQL. Database Application Development: Accessing databases from applications, An introduction to JDBC, JDBC classes and interfaces, SQLJ, Stored procedures, Case study: The internet Bookshop. Internet Applications: The three-Tier application architecture, The presentation layer, The Middle Tier.

10 Hrs.

UNIT-IV

Normalization: Database Design Theory – Introduction to Normalization using Functional and Multivalued Dependencies: Informal design guidelines for relation schema, Functional Dependencies, Normal Forms based on

Primary Keys, Second and Third Normal Forms, Boyce-Codd Normal Form, Multivalued Dependency and Fourth Normal Form, Join Dependencies and Fifth Normal Form. Normalization Algorithms: Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decompositions, Algorithms for Relational Database Schema Design, Nulls, Dangling tuples, and alternate Relational Designs, Further discussion of Multivalued dependencies and 4NF, Other dependencies and Normal Forms.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Effectively explains the basic concepts of databases and data models
CO2	Develops an Entity-Relationship model based on user requirements. Use Structured Query Language (SQL) for database manipulation.
CO3	Effectively designs basic and advanced SQL queries to retrieve data from the database.
CO4	Applies various Normalization techniques for database design improvement.

Text Books:

1. Ramez Elmasri and Shamkant B. Navathe, "Fundamentals of Database Systems", 7th Edition, 2017, Pearson.

Reference Books:

1. Ramakrishnan, and Gehrke, "Database management systems" 3rd Edition, 2014, McGraw Hill.
2. Silberschatz Korth and Sudharshan, "Database System Concepts", 6th Edition, McGrawHill, 2013.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO3	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO4	3	3	3	2	3	--	--	--	--	--	--	1	3	2

UEI712E: VLSI DESIGN
3 Credits (3-0-0)

Course Objectives:

1. To build upon the theoretical, mathematical and physical analysis of digital VLSI circuits.
2. To understand the fabrication process of MOS technology
3. Understand the concept of parasitic resistance, capacitance and thus propagation delay of gate level circuit.
4. To learn the concepts of designing VLSI Subsystems.

UNIT-I

Introduction to MOS Technology: Introduction to integrated circuit technology, Metal oxide semiconductor and related VLSI technology, Basic MOS transistors, enhancement mode transistor action, depletion mode transistor, nMOS fabrication, CMOS fabrication, BiCMOS technology.Basic Electrical Properties of MOS and BiCMOS Circuits: Drain to source current verses Voltage characteristics, threshold voltage, trans-conductance, nMOS inverter, termination of pull up to pull down ratio, nMOS inverter driven through one or more pass transistors, alternative forms of pull up, CMOS inverter, MOS transistor circuit model, BiCMOS inverters**.**

10 Hrs.

UNIT-II

MOS and BiCMOS Circuit Design Process: MOS layers stick diagrams, nMOS design style,CMOS design style, designs rules and layout, and lambda based design rules. Basic Circuit Concept: sheet resistance, area capacitance calculation, delay unit, inverter delay, driving large capacitive loads, super buffers, wiring capacitance.

10 Hrs.

UNIT-III

Subsystem Design and Layout: architectural issues, gate (restoring) logic, examples of structured design (combinational logic)- a parity generator, Bus arbitration logic for n-line bus, multiplexers. Subsystem Design Process: General consideration, design process- 4 bit arithmetic processor.

10 Hrs.

UNIT-IV

Semiconductor memories: Introduction, Dynamic random-access memory, static random-access memory, nonvolatile memory, flash memory, Ferro electric random-access memory.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Understand the fabrication process of IC technology and analysis of the operation of MOS transistor.
CO2	Draw the stick diagrams of various logic circuits. Estimate the various delay encountered in logic circuits.
CO3	Implement and design of building blocks of data path and sub systems.
CO4	Demonstrate an understanding of working principle of operation of different types of memories.

Text Books:

1. Douglas A. Pucknell, Kamran Eshraghian, “Basic VLSI Design”, 3rd Edition, PHI
2. Sung Mo Kang, Yusuf Leblebici, “CMOS Digital Integrated Circuits, Analysis and Design”, 3rd Edition, Tata McGraw Hill

Reference Books:

1. S. M. Sze, “VLSI Technology”, 2nd Edition, Tata McGraw Hill.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	2	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	2	--	--	--	--	--	--	--	--	--	3	2

UEI713E: INTERNET OF THINGS
3 Credits (3-0-0)

Course Objectives:

1. To explain the characteristics, functional units of IoT
2. To understand the design concepts of IoT
3. To understand the applications and data analytics of IoT

UNIT-I

Introduction & Concepts: Definition and Characteristics of IoT, Things in IoT, IoT Protocols, IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates. **IoT and M2M:** SDN and NFV for IoT.

10 Hrs.

UNIT-II

Developing Internet of Things: IoT Platform Design Methodology, Specifications: Requirements, Process, Domain, Information, Services, Level, Functional, Operational, Integration, **Application Development Python Language:** Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date and Time Operations, Classes, Python Packages of Interest for IoT. **IoT Physical Devices and End Points:** Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, I2C.

10 Hrs.

UNIT-III

Programming Raspberry Pi with Python: Controlling LED, Interfacing Switch, Other IoT Devices: Arduino, Beagle Bone Black. **Cloud and Data Analytics:** Introduction to cloud storage Models and Communication APIs, Python Web Application Framework – Django, Web Services for IoT, SkyNet Messaging Platform, **Data Analytics for IoT**: Apache Hadoop, spark.

10 Hrs.

UNIT-IV

IoT Case Studies: Home Automation: Smart Lighting, Cities: Smart Parking, Environment: Weather Reporting Bot, Forest Fire Detection; Agriculture – Smart Irrigation, IoT Printer.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Describe fundamentals of IoT
CO2 Describe the characteristics of protocols with IoT
CO3 Analyze the design steps associated with IoT
CO4 Design systems using IoT and data analytics

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-on Approach,” Universities Press, 1st Edition, 2014

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	--	--	--	--	--	--	--	--	--	--	--	2	1
CO2	2	--	--	--	3	--	--	--	--	--	--	--	2	1
CO3	1	--	--	--	3	--	--	--	--	--	--	2	1	2
CO4	1	--	--	--	3	--	--	--	--	--	--	2	2	1

UEI714E: ADVANCED CONTROL SYSTEMS
3 Credits (3-0-0)

Course Objectives:

1. To impart the concept of compensation techniques in control system.
2. To obtain a state space model of a system.
3. To design and analyze a system in state space.
4. To design feedback controller and observer.

UNIT-I

Design of Feedback Control Systems: Concepts of design and compensation, cascade compensation networks, phase-lead and phase-lag control design approaches using both root locus plots and Bode diagrams. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-II

Control System Analysis in State-space: State variable representation, state variables of a dynamic system, the state differential equation, block diagram and signal-flow graph state models, conversion of state equations and transfer functions, conversion of transfer functions to canonical state variable models. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-III

State transition matrix: The time response and the state transition matrix, properties of state transition matrix, solving state equations via Laplace transform and directly in time domain. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

UNIT-IV

Control System Design in State-space: Concepts of controllability and observability, methods of testing controllability and observability, pole-placement design using feedback, stability improvement by state feedback, necessary condition for arbitrary pole placement, design of state observers, state feedback with integral control. Usage of MATLAB command-line functions to verify the solution.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Design and compensate a system.
CO2 Model and analyse a system in state space.
CO3 Determine state transition matrix and solve state equations.
CO4 Test linear system for controllability and observability and design state feedback controller and observer.
CO5 Use MATLAB command-line functions to verify solutions.

Text Books:

1. M.Gopal, "Control Systems", 3rd Edition, Tata McGraw Hill, 2011.
2. Katsuhiko Ogata, "Modern Control Engineering", 4th Edition. Pearson Education, 2002.

Reference Books:

1. Richard C. Dorf and Robert H, Bishop, "Modern Control Systems", Addison Wesley Longman Inc., 1999.
2. M.Gopal, "Digital Control and State Variable Methods", 3rd Edition, Tata McGraw Hill, 2000.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	3	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO5	--	--	--	--	3	--	--	--	--	--	--	--	--	--

UEI811E: INDUSTRIAL DRIVES AND MACHINES
3 Credits (3-0-0)

Course Objectives:

1. To explain dynamics and modes of operation of electric drives, selection of motor power ratings and control of dc motor using rectifiers.
2. To analyze the performance of induction motor drives under different conditions.
3. To explain the control of induction motor, synchronous motor and stepper motor drives.
4. To discuss typical applications electrical drives in the industry.

UNIT-I

Electrical Drives: Electrical Drives, Advantages of Electrical Drives. Parts of Electrical Drives, Choice of Electrical Drives, Status of dc and ac Drives. **Dynamics of Electrical Drives:** Fundamental Torque Equations, Speed Torque Conventions and Multiquadrant Operation. Equivalent Values of Drive Parameters, Components of Load Torques, Nature and Classification of Load Torques, Calculation of Time and Energy Loss in Transient Operations, Steady State Stability, Load Equalization. **Control Electrical Drives:** Modes of Operation, Speed Control and Drive Classifications, Closed loop Control of Drives. **Selection of Motor Power Ratings:** Thermal Model of Motor for Heating and Cooling, Classes ofMotor Duty, Determination of Motor Rating.

10 Hrs.

UNIT-II

Direct Current Motor Drives: Controlled Rectifier Fed dc Drives, Single Phase Fully Controlled Rectifier Control of dc Separately Excited Motor,Single Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Three Phase Fully Controlled Rectifier Control of dc Separately Excited Motor,Three Phase Half Controlled Rectifier Control of dc Separately Excited Motor, Multiquadrant Operation of dc Separately Excited Motor Fed Form Fully Controlled Rectifier,Rectifier Control of DC Series Motor. **Induction Motor Drives:** Analysis and Performance of Three Phase Induction Motors, Operation with Unbalanced Source Voltage and Single Phasing,Operation with Unbalanced Rotor Impedance, Analysis of Induction Motor Fed From Non-Sinusoidal Voltage Supply,Starting, Braking, Transient Analysis.Speed Control Techniques **-** Stator Voltage Control, Variable Voltage Frequency Control from Voltage Sources.

10 Hrs.

UNIT-III

Induction Motor Drives (continued): Voltage Source Inverter (VSI) Control, Cycloconverter Control, Closed Loop Speed Control and Converter Rating for VSI and Cycloconverter Induction Motor Drives, Variable Frequency Control from a Current Source, Current Source (CSI) Control,current regulated voltage source inverter control, speed control of single phase induction motors. **Synchronous Motor Drives:** Operation from fixed frequency supply-starting, synchronous motor variable speed drives, variable frequency control of multiple synchronous motors. Self-controlled synchronous motor drive employing load commutated thyrister inverter.

10 Hrs.

UNIT-IV

Synchronous Motor Drives (continued): Self-controlled synchronous motor drive employing load commutated thruster inverter, Starting Large Synchronous Machines, Permanent Magnet ac (PMAC) Motor Drives, Sinusoidal PMAC Motor Drives, Brushless DC Motor Drives. **Stepper Motor Drives**: Variable Reluctance, Permanent Magnet, Important Features of Stepper Motors, Torque Versus Stepping rate Characteristics, Drive Circuits for Stepper Motor. **Industrial Drives:** Textile Mills, Steel Rolling Mills, Cranes and Hoists, Machine Tools.

10 Hrs.

Total Hrs.: 40

Course Outcomes:

Student will be able to:

CO1 Explain dynamics and different modes of operation of electric drives.

CO2 Suggest a motor for a drive and control of dc motor using controlled rectifiers.

CO3 Analyze the performance of induction motor drives under different conditions.

CO4 Suggest a suitable electrical drive for specific application in the industry.

Text Books:

1. Gopal K. Dubey**,** “Fundamentals of Electrical Drives”, Narosa Publishing House, 2nd Edition, 2001.
2. Vedum Subramanyam, “Electrical Drives: Concepts and Applications,” McGrawHill, 2nd Edition, 2011.

Reference Books:

1. N.K De, P.K. Sen, “Electric Drives,”PHI Learning, 1st Edition, 2009.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	--	--	--	--	--	--	--	--	1	3	2
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	2	3	3

UEI812E: JAVA
3 Credits: (3-0-0)

Course Objectives:

1. Gain knowledge about basic Java language syntax and semantics to write Java programs
2. Understand the fundamentals of object-oriented programming in Java
3. Understand the principles of inheritance, packages and interfaces
4. Understand the concept of exception handling and AWT

UNIT-I

Evolution of Java: Java's Lineage, the creation of Java, Java changed the internet, byte code, Java buzzwords, an overview of Java, data types, variables and arrays, operators, control statements.

10 Hrs.

UNIT-II

Introducing classes: Class fundamental, declaring objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection. **Methods and classes:** Overloading methods, using object as parameters, argument passing, returning objects, recursion, access control, static, introducing final, the finalize method (), stack class.

10 Hrs.

UNIT-III

Inheritance: Inheritance, using super, creating a multilevel hierarchy, when constructors are called, method overriding, dynamic method dispatch, using abstract classes, using final with Inheritance, the object class. **Packages and Interfaces**: packages, access protection, importing packages, interfaces.

10 Hrs.

UNIT-IV

Exception handling: Fundamentals, exception types, uncaught exception, using try and catch, Multiple catch clauses, Nested try Statements, throw and finally statements. **AWT**: AWT classes, window fundamentals, working with frame windows, creating window programs, displaying information within a window

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Set up Java JDK environment to create, debug and run Java programs.
CO2	Implement object-oriented concepts using programming examples
CO3	Demonstrate concepts of inheritance and importing of packages
CO4	To implement the exception handling mechanism and AWT concepts

Text Books:

1. Herbert Schildt, "Java The Complete Reference", 7th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. E Balagurusamy, "Programming with Java", 6th Edition, MGH.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	2	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	2	3	2
CO3	3	3	3	2	--	--	--	--	--	--	--	2	3	2
CO4	3	3	3	2	--	--	--	--	--	--	--	2	3	2

UEI813E: CLOUD COMPUTING
3 Credits (3-0-0)

Course Objectives:

1. To impart the knowledge of cloud computing, its advantages, characteristics, challenges and platforms.
2. To provide the knowledge of cloud computing architecture, reference model, types of cloud, service models with respect to all service models.

UNIT-I

Introduction: Cloud Computing at a Glance, Historical Development, Characteristics of Cloud Computing, Building Cloud Computing Environments, Computing Platforms and Technologies. **Cloud Computing Architecture:** Introduction, Cloud Reference Model, Types of Clouds, Economics of Cloud, Open Challenges.

10 Hrs.

UNIT-II

Aneka: Cloud Application Platform: Framework Overview, Anatomy of the Aneka Container, Building Aneka Clouds, Cloud Computing and Management. **Concurrent Computing:** Thread Programming: Introducing Parallelism for Single Machine Computation, Programming Application with Threads, Multi Applications with Threads, Multithreading with Aneka, Programming Applications with Aneka Threads.

10 Hrs.

UNIT-III

Virtualization: Introduction and Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Virtualization and Cloud Computing. Pros and Cons of Virtualization, Technology Examples. **Cloud Platforms in Industry:** Amazon Web Services, Google AppEngine, Microsoft Azure**.** **Cloud Applications:** Scientific Applications, Business and Consumer Applications.

10 Hrs.

UNIT-IV

High Throughput Computing: Task Programming: Task Computing, Task-based Application Models, Aneka Task-Based Programming. **Data Intensive Computing:** Map- Reduce Programming, Data-Intensive Computing, Technologies for Data-Intensive Computing, Aneka Map Reduce Programming.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Understand the definition of cloud computing, its advantages, characteristics, challenges and platforms.
CO2	Describe cloud computing architecture, reference model, types of cloud, service models with respect to all service models etc.
CO3	Deploy cloud instances in Aneka cloud computing platform and threading programming of Aneka
CO4	Analyze virtualization technology, Cloud Platforms in Industry and High Throughput and Data Intensive Computing, etc.

Text Books:

1. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", McGraw Hill Education (India) Private Limited.

Reference Books:

1. Barrie Sosinsky, "Cloud Computing Bible", Wiley Publication, India 2010.
2. Kumar Saurabh, "Cloud Computing" Second Edition, Wiley Publication, India.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO2	2	2	2	-	-	-	-	-	-	-	-	-	3	1
CO3	2	2	2	-	2	-	-	-	-	-	-	-	3	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	3	2

UEI814E: INDUSTRIAL ELECTRONIC EQUIPMENT DESIGN
3 Credits (3-0-0)

Course Objectives:

1. To understand the various processes and systems to address human needs
2. To develop competence to create tangible electronic products
3. To follow comprehensive process of design for the production of equipment/systems

UNIT-I

Introduction to Industrial Design: General introduction in the course, role of industrial design in the domain of industry, product innovation, designer's philosophy and role in product design. Product development tools and methods. **Product Design Methodology:** Electronic product design and development, methodology, creativity techniques, brain storming, documentation.

10 Hrs.

UNIT-II

Product Planning: Defining the task, scheduling the task, estimation of labor cost and amount of documentation. **Ergonomics:** Ergonomics of electronics electronic use of ergonomics at work placesand plat layouts, ergonomics of panel design, case study.

10 Hrs.

UNIT-III

Aesthetics: Elements of aesthetics, aesthetics of control design. **Visual Communication Techniques:** Perspective, band sketching and rendering technique, elements of engineering drawing, assembly drawing part drawing, exploded views. **Product Anatomy:** Layout design, structure design, standard and non standard structures, Industrial standards.

10 Hrs.

UNIT-IV

Product Detailing: Product detailing in sheet metal and plastics for ease of assembly, maintenance and aesthetics. **Product Manufacturing:** Different manufacturing processes in sheet metal and plastics, product finishing, finishing methods like platting, anodization, spray painting, powder coating. **Value Engineering:** Introduction to marketing, graphics and packing.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Understand user centered design process.
CO2	Develop sketches, virtual/physical appearance models for electronic products and refine existing product designs.
CO3	Make mock-up model and working prototype along with design documentation.
CO4	Design some laboratory level/ household electronic equipment.

Text Books:

1. Peter Z., "German Design Standard," Volume2, Reddot, 2006.
2. Clarkson P. J, Coleman R. and Keates, S., "Inclusive Design, Design for the whole population,"Springer Verlag Gmbh, 2003.

Reference Books:

1. Jordan P. W., "Designing Pleasurable Products: An Introduction to the New Human Factors," Taylorand Francis, 2002.
2. Otto K. and Wood K., "Product design: Techniques in Reverse Engineering and New ProductDevelopment," Prentice Hall, 2001.
3. Cross N. "Engineering Design Methods: Strategies for Product Design", Willey, 2000.
4. Cagan J., Vogel C. M., "Creating Breakthrough Products -Innovation from Product Planning toProgram Approval," Pearson Education, 2007.
5. Norman D. A., "The design of everyday things, Basic Books," 2002.
6. Chakrabarty D., "Indian Anthropometric Dimensions for Ergonomic Design Practice," NID, Ahmedabad, 1999.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	1	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	1	2	3

UEI821E: INDUSTRIAL SAFETY
3 Credits (3-0-0)

Course Objectives:

1. To understand the need and importance of safety measures in industries
2. To stress upon the safety measures in chemical, petrochemical, cement and construction industries
3. To understand the need and importance of health and hygiene in industries

UNIT-I

Safety in Oil, Gas, Chemical, Petrochemical Industries; Need of safety in chemical industries, Types of chemical industries, Indian Standards. Overview of hazards and controls: Chemical, Storage, Material (Property) , Process, Pollution. Safe transfer and transportation of chemicals, Instrumentation for safe plant Operation, Inspection, Testing and Maintenance. **Safety in Petroleum Refinery, Mining and Petrochemical Industry:** OISD norms for petroleum industry, Petroleum classification and hazards due to petroleum product. Hazards of bulk storages, and their control measures.

10 Hrs.

UNIT-II

Safety in Petroleum Refinery, Mining and Petrochemical Industry: OISD norms for petroleum industry, Petroleum classification and hazards due to petroleum product. Hazards of bulk storages, and their control measures. **Safety in Construction and Cement Industry :** Basic Parameters governing the safety in construction such as site planning and layout, safe access, safety work permit and checklist, good housekeeping. Safety in the use of construction machinery and equipment. Health and welfare ofconstruction workers: Dust, noise, vibration, heat, humidity, and other hazard. First aid, medical examinations and health records.

10 Hrs.

UNIT-III

Safety Integrity Level (SIL): SIL in industries, SIL1, 2, 3, and 4 in industries, TUV, Functional Safety Level (IEC Standards), Safety Instrumented System (SIS), **Risk Management and Selecting a SIS or SIL Level.**

10 Hrs.

UNIT-IV

Industrial Health and Hygiene: Occupational health hazard, Introduction & classification of health hazards. Dangerous properties of chemicals, dust, gases, fume, mists, vapors, smoke and aerosols and their health effects. Routes of human entry system, recognition, evolution and control basic hazards, and bio chemical action of toxic substance and toxicity, type and degreesof toxic effects, threshold limits of exposure (TLV), Physiology of work and occupational diseases.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Understand the need and rationale of safety in industries
CO2 Describe certain methods of safety measures in core/manufacturing industries
CO3 Understand the concept of health and hygiene in industries
CO4 Inculcate the practices of safety measures while working in industries

Text Books:

1. John Ridley, "Safety at Work", Butterworth & Co., London, 1983.
2. Roland P. Blake , "Industrial Safety" Prentice Hall, Inc., New Jersey, 1973.
3. L M Deshmukh, "Industrial safety management", TATA McGraw Hill, 2010.

Reference Books:

1. Krishnan N.V. "Safety Management in Industry" Jaico Publishing House, Bombay, 1997.
2. Industrial Safety -National Safety Council of India.
3. Grimaldi and Simonds , "Safety Management", AITBS Publishers , New Delhi (2001).
4. Industrial Safety National Safety Council of India.
5. Safety, health and working condition in the transfer of technology, Inter National Labor Office.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	1	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO3	3	3	3	--	--	--	--	--	--	--	--	1	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	1	2	3

UEI822E: WIRELESS COMMUNICATION

3 Credits (3-0-0)

Course Objectives:

1. To impart cellular network systems and their generation.
2. To describe the wireless network architecture and operation.
3. To discuss cellular network modulation techniques.

UNIT-I

Evolution and deployment of cellular telephone systems: Different generations of wireless cellular networks,1G, 2G, 2.5G, 3G and 4G cellular systems. **Common cellular system components:** Common cellular network components, Hardware and software views of cellular networks, 3G cellular system components, Cellular component identification, Call establishment.

10 Hrs.

UNIT-II

Wireless network architecture and operation: Cellular concept, Cell fundamentals, Capacity expansion techniques, Cellular backbone networks, Mobility management, Radio resources and power management Wireless network security, **CDMA technology:** CDMA overview, CDMA network and system architecture.

10 Hrs.

UNIT-III

GSM and TDMA techniques: GSM system overview, GSM network and system architecture, GSM channel concept.**GSM system operation:** GSM identities, GSM system operations (traffic cases), Call handoff, GSM infrastructure communications (Um interfaces), other TDMA systems.

10 Hrs.

UNIT-IV

Wireless modulation techniques and hardware: Transmission characteristics of wire line and fiber system, Characteristics of air interface, Path loss models, Wireless coding techniques, Digital modulation techniques, Spread spectrum modulation techniques, UWB radio techniques, Diversity techniques. Introduction to wireless LAN 802.11X technologies, Evolution of Wireless LAN, IEEE 802.11design issues.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Define the characteristics of different generations of cellular networks and identify the basic functions of common cellular system components.
CO2 Comprehend the Architecture and operation of wireless mobile network and capacity expansion techniques.
CO3 Describe the operation of GSM system, GSM protocol architecture, TDMA and CDMA systems.
CO4 Discuss different wireless modulation techniques and working of different wireless technologies.

Text Books:

1. Gary J. Mullet, "Wireless Telecom Systems and Networks", Thomson Learning, 2006.

Reference Books:

1. Lee W.C.Y., "Mobile Cellular Telecommunication", McGraw Hill, 2002.
2. P. Agrawal, "Wireless Communication", Thomson Learning, 2007.
3. David Tse, Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge, 2005.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	3	1
CO2	2	1	-	-	-	-	-	-	-	-	-	-	3	1
CO3	2	-	-	-	-	-	-	-	-	-	-	-	3	2
CO4	2	-	-	-	-	-	-	-	-	-	-	-	3	2

UEI823E: AERONAUTICAL INSTRUMENTATION
3 Credits (3-0-0)

Course Objectives:

1. To describe the basics of Aircraft and instrumentation involved in aircraft systems.
2. To discuss about the measurement of various aircraft parameters.
3. To explain the techniques for measurement of fuel quantity and engine control instrument.

UNIT-I

Introduction: Aircraft types, Components of airplane, Introduction to the aircraft instruments, Classification of aircraft instruments, Basic "T" grouping of instruments, Instrument displays, Cockpit layout. **Theory of Air Data Instruments:** Pneumatic type and air data computers, International standard atmosphere (ISA), Basic pneumatic air data system, Combined Pitot-static probe.

10 Hrs.

UNIT-II

Air Data Instruments: Air speed indicator, Mach-meters, Altimeters, Instantaneous vertical speed indicator. **Directional Systems**: Earth's total magnetic field, Horizontal and vertical components of total field direct reading compass and its limitations, Total magnetic effect. **Air Data Warning System:** Mach warning system, Altitude alerts system, Airspeed warning system.

10 Hrs.

UNIT-III

Gyroscopic Flight Instruments: Basic mechanical gyro and its properties: Rigidity and Precision, limitations of a free gyroscope, Methods of operating gyroscopic flight instruments, Gyro horizon principle, Erection systems for gyro horizons, Direction indicator, Turn and bank indicator, Turn coordinator.

10 Hrs.

UNIT-IV

Engine Instruments: Pressure measurement,Temperature measurement, Capacitance type volumetric fuel quantity indicator, Densitometer, Fuel quantity indicator by weight, EPR, EGT, Integrated impeller type flow meter.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Identify and list various engineering components of aircraft.
CO2 Describe general instrumentation of aircraft.
CO3 Compare and interpret the working of air data, engine and power plant instruments of an aircraft.
CO4 Distinguish the functionality of air data instruments from other instrumentation.

Text Books:

1. EHJ Pallet, "Aircraft Instruments and Integrated Systems", Longman Scientific & Technical, 1992.

Reference Books:

1. C A Williams, "Aircraft Instruments", Galgotia Publications, New Delhi.
2. Bhaskar Roy, "Aircraft Propulsion", Elsevier Publications, New Delhi.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	2
CO2	3	3	--	--	--	--	--	--	--	--	--	--	3	3
CO3	3	2	2	--	--	--	--	--	--	--	--	--	3	2
CO4	3	2	2	--	--	--	--	--	--	--	--	--	3	2

UEI824E: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

3 Credits (3-0-0)

Course Objectives:

1. To describe the AI concepts and algorithms
2. To analyse simple knowledge-based systems
3. To explain the concepts of machine learning, linear regression, classification
4. To solve the problems of decision tree, linear and logistic regression

UNIT-I

Introduction to Artificial Intelligence: Definition, foundations, history, Introduction to Agents and environment; Rationality; the nature of environment; the structure of agents. **Problem solving:** Problem-solving agents; Example problems; Searching for solution; uninformed search strategies. Informed Search and **Exploration:** Informed search strategies; Heuristic functions.

10 Hrs.

UNIT-II

Constraint Satisfaction: Backtracking search for CSPs, Knowledge and Reasoning: Logical Agents: Knowledge-based agents; Logic; propositional logic: A very Simple Logic: Reasoning patterns in propositional logic; Effective propositional inference; Agents based on propositional logic. First-Order Logic, Inference in First-Order Logic – 1: Representation revisited; Syntax and semantics of first-order logic; Using first-order logic; Knowledge engineering in first-order logic.

10 Hrs.

UNIT-III

Introduction to Machine Learning: Definition of Machine Learning, Examples of Machine Learning applications, Well posed learning problems, Designing learning system, perspectives and issues in Machine Learning, **Decision Tree Learning:** Introduction, Decision tree representation, Problems, Basic algorithm, Hypothesis space search, Inductive bias, Issues. Hands on with Python programming.

10 Hrs.

UNIT-IV

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, **Logistic Regression:** Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Over fitting, Regularization. Hands on with Python programming.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Illustrate the fundamentals of knowledge representation, inference and theorem proving.
CO2	Analyse simple knowledge-based system.
CO3	Explain the concepts of Machine Learning.
CO4	Solve the problems of Machine learning.

Text Books:

1. Stuart Russel and Peter Norvig, "Artificial Intelligence a Modern Approach", 3rd Edition, Pearson Education, 2015.
2. Tom M. Mitchell, "Machine Learning", McGraw-Hill Education, 2017.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	--	--	--	--	--	--	--	--	--	--	2	1
CO2	2	2	--	--	--	--	--	--	--	--	--	--	2	1
CO3	1	3	--	--	--	--	--	--	--	--	--	2	1	2
CO4	1	3	--	--	--	--	--	--	--	--	--	2	2	1

UEI831E: INDUSTRIAL BUSES AND DATA NETWORKS
3 Credits (3-0-0)

Course Objectives:

1. To understand industrial communication standards.
2. To analyze industrial communication problems.
3. To troubleshoot industrial communication problems.

UNIT-I

Introduction: Modern instrumentation and control system, Open System Interconnection (OSI) model, Protocols, Standards. **Overview of** EIA-232, EIA-485 and Fiber Optics.

10 Hrs.

UNIT-II

Modbus Protocol: General overview, Modbus protocol structure, Function codes, Troubleshooting, Modbus plus overview. **HART Protocol:** Introduction to HART and smart instrumentation, HART protocol, Physical layer, Datalink layer, Application layer, Troubleshooting. **AS Interface overview:** Introduction, Layer-1, Layer-2, Operating characteristics, Troubleshooting.

10 Hrs.

UNIT-III

DeviceNet overview: Physical layer, Connectors, Device taps, Cable description, network power, datalink layer, Application layer, Troubleshooting. **Profibus**: Introduction, ProfiBus protocol stack, The ProfiBus communication model, Relationship between application process and communication, Communication objects, Performance, System operation, Troubleshooting.

10 Hrs.

UNIT-IV

Foundation Field Bus Overview: physical layer, Data link layer, Application layer, User layer, Error detection and diagnostic, Troubleshooting. **Industrial Ethernet Overview**: 10Mbps ethernet, 100 Mbps ethernet, Gigabit ethernet, Industrial ethernet, Troubleshooting. **TCP/IP Overview:** Internet layer protocol, Host-to-Host layer, Troubleshooting. **Radio and wireless communication overview:** Components of radio link, The radio spectrum and frequency allocation, Radio modems.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Describe the essential components of Industrial communication system.
CO2 Understand the structure of various buses.
CO3 Identify the problems in industrial communication networks.
CO4 Troubleshoot the problems in industrial communication.

Text Books:

1. Steve Mackay, Edwin Wright, Deon Reynders, John Park, "Practical Industrial Data Networks: Design Installation and troubleshooting," Newnes Publication, 2004.
2. Sunit Kumar Sen, "Fieldbus and Networking in Process Automation," CRC Press, 2021.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	--	--	--	--	--	--	--	2	3	2
CO2	3	1	1	1	--	--	--	--	--	--	--	2	3	2
CO3	3	3	1	1	--	--	--	--	--	--	--	2	3	2
CO4	3	3	1	2	--	--	--	--	--	--	--	2	2	3

UEI832E: OPERATING SYSTEM
3 Credits (3-0-0)

Course Objectives:

1. Recognize the concepts and principles of operating systems.
2. To study the process management and scheduling.
3. To understand the working of an OS as a resource manager, file system manager.

UNIT-I

Introduction to operating systems, System structures: What operating systems do; Computer System organization; Computer System architecture; Operating System structure; Operating System operations; Process management; Memory management; Storage management; Protection and Security; Distributed system; Special-purpose systems; Computing environments. Operating System Services;User - Operating System interface; System calls; Types of system calls; System programs; Operating system design and implementation; Operating System structure; Virtual machines; Operating System generation; System boot. Process Management Process concept; Process scheduling; Operations on processes; Inter process communication,

10 Hrs.

UNIT-II

Multi-threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Process Scheduling: Basic concepts; Scheduling Criteria; Scheduling Algorithms; Multiple-processor scheduling; Thread scheduling. Process Synchronization: Synchronization: The critical section problem; Peterson’s solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

10 Hrs.

UNIT-III

Deadlocks: Deadlocks; System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock. Memory Management: Memory management strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation.

10 Hrs.

UNIT-IV

Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing. **File System, Implementation of File System**: File system: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection: Implementing File system: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

10 Hrs.
Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1 Describe the basic concepts of operating systems and identify the mechanism to handle processes.
CO2 Identify mechanism to handle processes scheduling and synchronization.
CO3 Understands the use of synchronization techniques to avoid deadlock.
CO4 Describe Memory management and file system management in operating System.

Text Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Principles" 7 th edition, Wiley-India.

Reference Books:

1. Milan Milankovic, "Operating System Concepts and Design", 2nd Edition, McGraw Hill.
2. Ann McHoes Ida M Fylnn, Understanding Operating System, Cengage Learning, 6th Edition.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO2	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO3	3	3	3	2	3	--	--	--	--	--	--	1	3	2
CO4	3	3	3	2	3	--	--	--	--	--	--	1	3	2

UEI833E: PROCESS MODELING
3 Credits (3-0-0)

Course Objectives:

1. To define and classify process modelling.
2. To describe the approaches of process modelling.
3. To give insight of various techniques in lumped and distributed process modeling.

UNIT-I

Introduction to Modeling: A systematic approach to model building, classification of models. **Principles of Process Systems and Models:** Conservation principles, thermodynamic principles. Development models of steady state and dynamic lumped and distributed parameter models based on first principles. **Analysis of Ill-conditioned Systems:** Meaning and methods.

10 Hrs.

UNIT-II

Process Modeling: Development of Grey box models. Empirical model building, Statistical model calibration and validation. Population balance models. Examples.

10 Hrs.

UNIT-III

Solutions to Lumped Process Models: Solution strategies for lumped parameter models. Stiff differential equations. Solution methods for initial value and boundary value problems. Euler's method, R-K method, shooting method, finite difference methods.

10 Hrs.

UNIT-IV

Solutions to Distributed Process Models: Solution strategies for distributed parameter models. Solving parabolic, elliptic and hyperbolic partial differential equations. Finite element and finite volume methods.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

- **CO1** Identify and classify models.
- **CO2** Develop process modeling.
- **CO3** Find solution for lumped parameter models.
- **CO4** Find solution for distributed parameter models.

Text Books:

1. M. Hangos, I. T. Cameron, "Process Modeling and Model Analysis", Academic Press, 2001.
2. W.L. Luyben, "Process Modeling, Simulation and Control for Chemical Engineers", 2nd Edition, McGraw Hill Book Co., New York, 1990.
3. W. F. Ramirez, "Computational Methods for Process Simulation", Butterworths, 1995.

Reference Books:

1. Park E. Davis, "Numerical Methods and Modeling for Chemical Engineers", John Wiley & Sons, 1984.
2. Singiresu S. Rao, "Applied Numerical Methods for Engineers and Scientists" Prentice Hall, Upper Saddle River, NJ, 2001.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	--	--	--	--	--	--	--	--	--	3	3	3
CO2	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	3
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	3

UEI834E: BIOMEDICAL SIGNAL PROCESSING
3 Credits (3-0-0)

Course Objectives:
1. To discuss the fundamentals and dynamic characteristics of biomedical signals.
2. To illustrate the methods of data reduction and spectral estimation.
3. To impart the skills of biomedical data handling and analysis.

UNIT-I

Introduction to Biomedical Signals: Nature of biomedical signals, Classification of biomedical signals, Objectives of biomedical signal analysis, Difficulties encountered during acquisition and processing of biomedical signals, Computer aided diagnosis. **DSP of Biomedical Signals**: Sampling, spectral estimation, **Random Processing**: Introduction, Elements of probability theory, Random signal characterization, Correlation analysis, The Gaussian process.

10 Hrs.

UNIT-II

Dynamic Biomedical Signals: Characteristics of ENG, ERG, EOG, EEG, EP, EMG, ECG/EKG, EGG, GSR, and EDR. **ECG QRS Detection**: Power spectrum, Differentiation method, Template matching method, QRS detection algorithm, ST segment analyzer, Portable arrhythmia monitors, Arrhythmia analysis, Signal averaging.

10 Hrs.

UNIT-III

Data Reduction: Turning point algorithm, Fan algorithm, AZTEC algorithm, Huffman and modified Huffman coding, Run length coding, Residual differencing. **Time Series Analysis**: Introduction, AR models, MA models, ARMA models, **Adaptive Segmentation**: Introduction, ACM method, SEM method.

10 Hrs.

UNIT-IV

Spectral Estimation: The BT method, Periodogram, Maximum entropy method, AR method, Moving average method, ARMA method, Maximum likelihood method, **Adaptive Filter** : Introduction, General structure, LMS adaptive filter, Adaptive noise canceling - Cancellation of mains interferences, Commercial DSP systems.

10 Hrs.

Total Hrs.: 40

Course Outcomes:
Student will be able to:

CO1	Identify the need of biomedical signal analysis and describe the fundamental concepts of Biomedical signal processing.
CO2	Classify and Characterize various vital biomedical signals.
CO3	Describe various data reduction algorithms used in Biomedical Signal Processing and analysis.
CO4	Depict the application of Spectral Estimation, DSP techniques for biomedical data handling and analysis.

Text Books:

1. Arnon Cohen, “Biomedical Signal Processing,” Volume I and II, CRC press, 1986.
2. Willis J. Tomkin, “Biomedical Digital Signal Processing,” PHI,1993.

Reference Books:

1. D. C. Reddy, “Biomedical Signal Processing,” TMH,2005.
2. Rangaraj M, Rangayyan, “Biomedical Signal Analysis,” John Wiley & Sons, 2nd edition, 2015.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	--	--	--	--	--	--	--	--	--	--	3	1
CO2	3	2	--	--	--	--	--	--	--	--	--	--	3	1
CO3	3	3	3	--	--	--	--	--	--	--	--	--	3	2
CO4	3	3	3	--	--	--	--	--	--	--	--	--	3	2

Basaveshwar Engineering College (A), Bagalkot
DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING
SCHEME OF TEACHING AND EXAMINATION

B.E. (I&PE) III SEMESTER

(Scheme of Teaching for Students admitted to first year in 2018-19[175 CREDITS])

Sl	Subject Code	Subject	Credits	Hours/week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UMA333C	Computational Methods for Mechanical Science	3	3	0	0	50	50	100
2	UIP302C	Material Science & Metallurgy	3	3	0	0	50	50	100
3	UIP330C	Engineering Thermodynamics and Fluid Mechanics	4	3	2	0	50	50	100
4	UIP320C	Strength of Materials	4	3	2	0	50	50	100
5	UIP321C	Machine Tools Technology	4	4	0	0	50	50	100
6	UIP316L	Metallography and Material Testing Laboratory	1.5	0	0	3	50	50	100
7	UIP322L	Machine Shop Practice	1.5	0	0	3	50	50	100
8	UHS388C	Saamskrutika Kannada*	01	1	0	0	50	50	100
	UHS389C	Vyavaharika Kannada **							
9	UMA330M	Bridge Course mathematics-I***	-	2	2	0	50	50	100
10	UBT133M	Environmental Studies***	-	2	0	0	50	50	100
		Total	22	21	6	6	500	500	1000

*Is for students who speak read and write Kannada
** Is for non Kannada speaking reading and writing students
*** Lateral Entry (Diploma) students

MATERIAL SCIENCE AND METALLURGY [03 Credits] [L-T-P:3-0-0]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	Analyze different class of materials their properties, structures and present in them and to understand crystal structures, impacts of defects at the atomic and microstructure scales, atomic diffusion and mechanisms	2	1	1	2	2					1			3	1	2
2	Explain various testing procedure to evaluate mechanical properties of materials and their use in the design of materials for engineering applications	3	2	1	2	2					1			3	1	2
3	Explain solidification, concepts of solid solution and solubility limits, Identify phase diagrams and be able to predict the phase transformations and interpret Fe-C phase diagram, time temperature transformation curve and	3	2	1	3	2					1			3	1	2
4	Explain the purpose and select suitable heat treatment process to achieve desired properties of metals and alloys, classify ferrous and non ferrous metals and study their applications, acquire knowledge about powder metallurgy and its production, composite materials, types and its applications.	3	2	1	2	2					1			3	1	2

UIP302C: MATERIAL SCIENCE AND METALLURGY [03 Credits] [L-T-P:3-0-0]

UNIT I

Crystallography - Concept of UNIT cell, metallic crystal structures, calculation of atomic radius, coordination number and atomic packing factor for different cubic structures, **Crystal imperfections** - Point, line, surface and volume defects, **Atomic diffusion** -Phenomenon, Flick's Istand IIndlaw of
diffusion, factors influencing diffusion, concept of slip and twinning. **08 Hrs.**

UNIT II

Mechanical properties of metals - Concepts of stress and strain, tension test - true stress and true strain, compression test, notch impact test - izod and charpy, hardness test - brinell, vickers and rockwell, **Fatigue** - Fatigue test - fatigue loadings, S-N diagram and fatigue properties, **Failure** - Failure of metals, fracture - fundamentals of fractures, types - ductile &brittle, mechanisms of ductile fracture, griffith's theory of brittlefracture, **Creep** - Creep curve, mechanism of creep and creep resistant materials.

10 Hrs.

UNIT III

Solidification- Mechanism of solidification, homogeneous and heterogeneous nucleation, crystal growth, cast metal structures, **Solid solution** - Types, Hume Rothary rules governing the formation of solids solutions, **Phase diagrams** - basic terms,gibbs phase rule, construction of phase diagrams, lever rule, different types of invariant reactions, **Iron carbon equilibrium diagram** - Salient features of iron and carbon, allotropic forms of iron, Fe-C equilibrium diagram, phases in the Fe-C system, Invariant and TTT curves.

10 Hrs.

UNIT IV

Heat treatment - Basic concept of heat treatment, different types of heat treatment processes, **Ferrous and non-ferrous materials** - Steel, cast irons, copper and its alloys, aluminum and its alloys,magnesium and its alloys, **Powder metallurgy** - Concept of powder metallurgy, application and advantages, production of powder, **Composite material** - Concept and classification of composites, matrix-polymer matrix composites (PMC), metal matrix composites (MMC), ceramic matrix composites (CMC), reinforcement-particle reinforced composites, fibre reinforced composites, reinforcement-matrix interface, applications of various types of composites - automobile, aircrafts, missiles, space hardware, electrical and electronics, marine, recreational and sports equipment.

14 Hrs.

Text Books:

1. Materials Science and Engineering - An introduction by William D. Callister Jr Wiley India Pvt. Ltd. 7th Edition, 2006, New Delhi
2. Mechanical Metallurgy by George E. Dieter, Adapted by David Bacon, (SI Metric Edition), Mc Graw-Hill Book Company and
3. Composites Materials - Production, Properties, Testing and Applications by K. Srinivasan, Narosa Publishing House, New Delhi.

Reference Books:

1. Introduction to Material Science for Engineering, 6th Edition by James F. Shackel Ford, Pearson, Prentice Hall, New Jersey 2006
2. Materials Science and Engineering by V. Raghavan, 5thEdition, Prentice Hall, India, 2007
3. A Text Book on Material Science and Metallurgy by O. P. Khanna, DhanpatRaiPublications (P) Ltd, New Delhi
4. Elements of Material Science and Engineering by Van Vlack, 6th Edition, Addison Wesley Publishing Company and
5. Foundation of Material Science and Engineering by Smith, 3rd Edition Mc Graw Hill, 1997.

ENGINEERING THERMODYNAMICS AND FLUID MECHANICS [04 Credits] [L-T-P:3-2-0]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	To understand and explain the various laws of thermodynamics, the theory and applications of engineering thermodynamics, thermodynamic properties, equations of state, methods used to describe and predict phase equilibria	3	2	1	2	2					1			3	1	2
2	To learn the equivalence of two statements of second law of thermodynamics, to study the inequality of Clausius and application of the inequality of Clausius and establish the property entropy of a system and to apply the concepts to solve various heat problems	3	2	1	2	2					1			3	1	2
3	Identify and obtain fundamental aspects of fluid flow behavior, analyze and understand the various fluid flow principles and governing equations andunderstand the principles of continuity, momentum, and energy as applied to fluid motions and	3	2	1	2	2					1			3	1	2
4	To develop and apply the fluid flow equations for various flow instruments and flow problems. Estimate pressure drop in fluid flow systems.	3	2	1	2	2					1			3	1	2

ENGINEERING THERMODYNAMICS AND FLUID MECHANICS [04 Credits] [L-T-P:3-2-0]

UNIT I

Definitions of thermodynamics terms - Engineering thermodynamics definition and scope, **Workand heat** - Definition, sign convention, similarities and dissimilarities of heat and work, expressions for displacement work in various processes through P-V diagrams, work done during isentropic, isothermal, isochoric, isobaric and polytropic processes, **Temperature** - Zeroth law of thermodynamics, concepts, measurement scales, **First law of thermodynamics**-Statement of first law, first law to cyclic and non-cyclic processes, **Energy** - Energy as property, modes of energy, steady state steady flow energy equation.

4 hours tutorials to be taken **10 Hrs.**

UNIT II

Second law of thermodynamics - Thermal reservoirs, heat engine, heat pump and refrigerator - schematic representation and efficiency, reversed heat engine, coefficient of performance, kelvin-planck statement and clausius statement of second law of thermodynamics, perpetual motion machine of first kind (PMM-1), perpetual motion machine of second kind (PMM-II), clausius statement of second law, reversible and irreversible process, **Entropy** - Definition, clausius inequality proof, carnot theorem, QR/T as independent path, principal of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy using Tds relations.

8 hours tutorials to be taken **10 Hrs.**

UNIT III

Properties of fluids - Introduction to fluid mechanics and its applications, properties of fluids, viscosity and kinematic viscosity, types of fluids, **Fluid pressure** - Pressure variation in a static fluid, absolute, gauge, atmosphere and vacuum pressure, **Manometers** - Simple and differential manometers, total pressure and centre of pressure, **Buoyancy** - Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies.

4 hours tutorials to be taken **10 Hrs.**

UNIT IV

Fluid kinematics - Types of fluid flow, continuity equation in three dimensions, velocity and acceleration, velocity potential function and stream function, **Fluid dynamics** - Equations of motion, euler's equation of motion, bernoulli's equation from euler's equation, limitation of bernoulli's equation, **Fluid flow measurements**- Veturimeter, orifice meter and pitot tube, **Flow through pipes** - Frictional loss in pipe flow, darcy-weisbach equation and chezy's equation for loss of head due to friction in pipes, hydraulic gradient line and total energy line.

8 hours tutorials to be taken **10 Hrs.**

Text Books:

1. Basic and Applied Thermodynamics by P. K. Nag, Tata McGraw Hill, 6th Edition 2017
2. Basic and Applied Thermodynamics by R. K. Hegde and NiranjanMurty, Sapna Book House, Bengaluru 2005
3. Engineering Thermodynamics by R. K. Rajput, Laxmi Publication (P) Ltd, 5th Edition 2016
4. A Textbook of Fluid Mechanics and Hydraulic Machines by R. K. Bansal, Laxmi Publications Pvt. Ltd., 2009 and
5. Fluid Mechanics and Hydraulics by Dr. JagadishLal (SI unit and MKS unit) - 9th Edition, Metropolitan Book Co Pvt. Ltd., New Delhi. 1995.

Reference Books:

1. Thermodynamics: An Engineering Approach by Yunus A. Cenegal and Michael A. Boles, Tata McGraw Hill Publications, 8th Edition
2. Fundamental of Classical Thermodynamics by Van Wylen and Gordon J. Sonntag, Richard E, Wiley 1985
3. 1000 Solved Problems in Fluid Mechanics (Includes Hydraulic Machines) by K. Subramanya, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005
4. Fluid Mechanics by Dr. A. K. Jain, Khanna Publishers, New Delhi and
5. Hydraulics and Fluid Mechanics including Hydraulic Machines by Dr. P. N. Modi, Dr. S. M. Seth, (SI Unit), Standard Book House, 5th Edition 2005, New Delhi.

UIP320C: STRENGTH OF MATERIALS [04 CREDITS] [L-T-P:3-2-0]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	**Programme Outcomes** **Course Outcomes**	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	Know the physical properties of the materials such as stresses, strains, stress-strain relationship, elastic constants etc. and study the behavior of one dimensional simple component of varied shapes under varied load conditions.	3	3	1	1					1	1			1		
2	Understand the concept of principal stresses through compound stresses in 1D/2D elements.	3	3	1	1					1	1			1		
3	Develop the skill to analyze the bending of beams of different cross sections subjected to varied conditions of loading. Also comprehend the response through deflection and inclination of beams subjected to bending loads.	3	3	1	1					1	1			1		
4	Analyze the cylinders exposed to internal and external pressures from the view point of stresses developed and change in dimensions	3	3	1	1					1	1			1		
5	Know the stresses developed and the rigidity of the mechanical elements transmitting tensional power.	3	3	1	1					1	1			1		
6	Simulate the mechanical elements receiving axial compressive loads under different end conditions and determine their columnar stability.	3	3	1	1					1	1			1		

UIP320C: STRENGTH OF MATERIALS [04 CREDITS] [L-T-P:3-2-0]

UNIT -I

Simple stress and strain: Mechanical properties of materials,Stress, Strain, Stress-Strain relation, Extension / Shortening of a bars, Poisson's ratio, Bars with cross sections varying in steps, Bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position, Thermal stresses, Volumetric strain, Elastic constants. **16 Hrs.**

UNIT -II

Compound stress: Introduction, plane stress system, sign convention, stresses on an inclined plane, Principal stresses.

Bending of beams: Shear forces and bending moments,Types of beams, loads and reactions, Rate of loading, Sign conventions, Relationship between shear force and bending moments, Shear force and bending moment diagrams for different beams subjected to concentrated loads, Uniform distributed load (udl) and couple for different types of beams **16 Hrs.**

UNIT - III

Bending and shear stresses in beams: Theory of simple bending, Assumptions in simple bending, Relationship between bending stresses and radius of curvature, Relationship between bending moment and radius of curvature, Moment carrying capacity of a section, Shearing stresses in beams, Shear stress across rectangular, circular, symmetrical I and T sections

Deflection of beams: Deflection of beams, Equation for deflection, Slope and moments, Double integration method for cantilever and simply supported beams for point load, UDL, UVL and Couple, Macaulay's method. **16 Hrs.**

UNIT - IV

Thick and thin cylinders: Stresses in thin cylinders, Changes in dimensions of cylinder, Thick cylinders subjected to internal and external pressures (Lame's equation).

Torsion of circular shafts: Pure torsion, Assumptions, Derivation of torsional equations, Polar modulus, Torsional rigidity / stiffness of shafts, Power transmitted by solid and hollow circular shafts.

Elastic stability of columns: Introduction to columns, Euler's theory for axially loaded elastic long columns, Derivation of Euler's load for various end conditions, Limitations of Euler's theory, Rankin's formula. **16 Hrs.**

Reference Books:

1. S.S. Bhavikatti, "*Strength of Materials"* Vikas Publications House – Pvt. Ltd., 2nd Ed., 2006.
2. W A Nash *"Strength of materials"*, Tata McGraw Hill, 4th edition
3. K.V. Rao, G.C. Raju, "*Mechanics of materials"*, First Edition,2007
4. Ferdinand Beer, Jr. Johnston, E. Russell, John DeWolf, David Mazurek, McGraw-Hill Education, 2011

UIP321C: MACHINE TOOLS TECHNOLOGY [04 CREDITS] [L-T-P:4 -0-0]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	**Programme Outcomes** / **Course Outcomes**	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	Able to classify various cutting tools based on materials and applications	3											1	3	2	3
2	Understand the constructional features and applications of various machine tools	3				2							1	3	2	3
3	Understand the influence of operating parameters in different machining operations.	3	3			2							1	3	2	3
4	Solve numerical related to various machining operations	3	3										1	3	2	3
5	Understand the operating principle, control parameters and applications in special machining processes	3	3			2							1	3	2	3

UIP321C: MACHINE TOOLS TECHNOLOGY [04 CREDITS] [L-T-P:4 -0-0]

UNIT I

Introduction: Types of cutting tools, Cutting tool materials - HSS carbides, coated carbides, ceramics, Cutting fluids-desired properties, types and selection, Single point and multi point cutting tools, types of chips, built-up edge, factors affecting forces and power, Machinability.

Turning, Shaping and Planning machines: Classification, Constructional features of Turret and Capstan Lathe, tool layout. Shaping and planning machine: Classification, Constructional features, Driving mechanisms, Shaping and planning operations, Tool and work holding devices,

Machining time. **12 Hrs**

UNIT- II

Drilling Machines: Classification, Constructional features, Drilling and related operations, Types of drilling tools, Drill bit nomenclature.

Milling Machines: Classification, Constructional features, Milling cutters, Nomenclatures, Milling operations, Up milling and down milling,

Indexing: Simple and compound indexing. **13 Hrs.**

UNIT-III

Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features. Selection of grinding wheel, Grinding process parameters. Balancing of grinding wheel, mounting of grinding wheels.

Broaching process: Principle of broaching. Details of a broach. Types of broaching machines-constructional details, applications. Advantages and Limitations.

Finishing and other Processes: Lapping and Honing operations – Principles, arrangement of set up and application. Super finishing process,

polishing, buffing operation and application. **12 Hrs.**

UNIT-IV

Non-traditional machining processes: Need for non-traditional machining, Principle, equipment, operation and applications of Electric Discharge Machining, Electro Chemical Machining. Ultrasonic Machining, Laser Beam Machining, Abrasive Jet Machining, Water Jet Machining and Electron

Beam Machining. **13 Hrs**

Text Books:

1. **Workshop Technology,** Hazara Choudhry, Vol-II, Media Promoters& Publishers Pvt. Ltd. 2004
2. **Production Technology,** R.K.Jain, Khanna Publications, 2003.
3. **Production Technology,** HMT, Tata Mc Graw Hill, 2001.

Reference Books:

1. **Manufacturing Science**, Amitabha Ghosh and Mallik, affiliated East West Press, 2003.
2. **Fundamentals of Metal Machining and Machine Tools,** G. Boothroyd, McGraw Hill, 2000.

METALLOGRAPHY AND MATERIAL TESTING LABORATORY[01 CREDITS] [L-T-P:0 -0-2]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	**Programme Outcomes** **Course Outcomes**	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	Analyze the microstructure and characteristics of specimen and have heat treatment studies on various materials	2	2	1	2	2				3	1			2		1
2	Evaluate the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test	2	2	1	2	2				3	1			2		1
3	To utilize UTM for shear, compression and bending tests on mild steel and wooden specimens	2	2	1	2	2				3	1			2		1
4	To conduct impact tests and find the impact value of test specimens	2	2	1	2	2				3	1			2		1
5	Justify the Rockwell hardness test over with Brinelland Vickers hardness and measure the hardness of the given specimen	2	2	1	2	2				3	1			2		1
6	Conduct the torsion test to determine the modulus of rigidity of given specimen and	2	2	1	2	2				3	1			2		1
7	To demonstrate the wear and fatigue test.	2				1				3	1			2		1

METALLOGRAPHY AND MATERIAL TESTING LABORATORY[01 CREDITS] [L-T-P:0 -0-2]

ART-A

1. **Preparation-** Specimen for metallographic examination of engineering materials and study the microstructure of mild steel, plain carbon steel, tool steel, gray cast iron, spheroidal graphite iron, brass, bronze and
2. **Heat treatment-** Annealing, normalizing, hardening and tempering of steel and to study the hardness of heat-treated samples. (Demonstration only).

PART-B

1. Conduct of tensile test on mild steel specimen
2. Shear test on mild steel specimen
3. Compression test on - wooden block and concrete block
4. Bending test on a mild steel specimen
5. Conduct of izod and charpy tests on mild steel specimen
6. Hardness tests
7. Torsion test and
8. Wear and fatigue test (Demonstration only).

Scheme of Examination

One question from part A	:	**20 Marks**
One question from part B	:	**20 Marks**
Viva-voice	:	**10 Marks**

TOTAL : 50 Marks

UIP322L: MACHINE SHOP PRACTICE LABORATORY [1.5 CREDITS] [L-T-P:0 -0-3]

No	Programme Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
		Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1																
2																
3																
4																
5																
6																

UIP322L: MACHINE SHOP PRACTICE LABORATORY [1.5 CREDITS] [L-T-P:0 -0-3]

PART – A

Minimum four jobs consisting of following machining operations, Plain Turning, Taper Turning. Step Turning, Thread Cutting, Facing, Knurling. Eccentric Turning using lathe.

24 Hours

PART- B

Minimum two jobs consisting of following machining operations

Cutting of gear teeth using milling machine. Cutting of V-groove ,Dovetail/Rectangular groove using shaping machine.

12 Hours

Scheme of Examination:

One model) from Part-A	30 marks
One model from Part-B	10 marks
Viva Voce	10 marks
Total	**50 marks**

UHS388C/UHS488C: Samskrutika Kannada

1 Credit (2-0-0)

(AU,BT,CV,IP,ME,CS,EC,EE,EI,IS,AIML BRANCHES)

ಕೋರ್ಸ್ ಉದ್ದೇಶಗಳು:

1 **'**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ**'** ಪಠ್ಯದ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಭಾಷೆ, ಮತ್ತುಕನ್ನಡಿಗರ ಸಾಂಸ್ಕೃತಿಕ ಬದುಕಿನ ಬಗೆಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.

2 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆ ಹಾಗೂ ಅದಕ್ಕೆ ಪೂರಕವಾಗಿರುವ ಕನ್ನಡ ವ್ಯಾಕರಣಾಂಶಗಳ ಬಗೆಗೆ ಅರುವು ಮೂಡಿಸುವುದು. ಪ್ರಾದೇಶಿಕ ಭಾಷೆಯಲ್ಲಿಅರ್ಜಿ ಮತ್ತು ಪತ್ರವ್ಯವಹಾರಗಳನ್ನು ಸಮರ್ಥವಾಗಿ ನಿರ್ವಹಿಸಲು ಪ್ರೇರೇಪಿಸುವುದು. .

3 ತಂತ್ರಿಕಅಧ್ಯಯನದ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ಬರವಣಿಗೆ ಮತ್ತು ಬರವಣಿಗೆಯಲ್ಲಾಗುವ ದೋಷಗಳನ್ನು ಗುರುತಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ನೀಡುವುದು.

4 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಅಡಗಿರುವ ಸೂಪ್ತ ಪ್ರತಿಭೆಯನ್ನು ಅನಾವರಣಗೊಳಿಸುವ ನಿಟ್ಟಿನಲ್ಲಿಅವರಲ್ಲಿ ಕಲೆ, ಬರವಣಿಗೆ ಮತ್ತು ಭಾಷಾಂತರಕಲೆಯಲ್ಲಿಆಸಕ್ತಿಯನ್ನು ಕೆರಳಿಸುವುದು.ಎಲ್ಲಕ್ಕೂ ಮೇಲಾಗಿ ಮಾನವೀಯ ಮೌಲ್ಯಗಳೊಂದಿಗೆ ಸರ್ವಾಂಗೀಣವಾಗಿ ಸಂವರ್ಧನೆಗೊಳಿಸಿ ಅವರನ್ನುರಾಷ್ಟ್ರದಅಮೂಲ್ಯ ಸಂತ್ತನ್ನಾಗಿ ರೂಪಿಸಿಸುವುದು.

ಭಾಗ: I ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ವ್ಯಕ್ತಿಚಿತ್ರಣ **ಅವಧಿ:** 6 ಗಂಟೆ

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕಏಕೀಕರಣ :ಒಂದುಅಪೂರ್ವಚರಿತ್ರೆ– ಜಿ.ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಕನ್ನಡ ಭಾಷೆ ಮತ್ತುಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ– ವಿತಾವಿ
4. ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತುಐತಿಹ್ಯ– ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್

ಭಾಗ: II ಕಥೆ, ಪ್ರವಾಸಕಥೆ ಮತ್ತುಕರಕುಶಲ ಕಲೆ **ಅವಧಿ:** 6 ಗಂಟೆ

1. ಯುಗಾದಿ – ವಸುಧೇಂದ್ರ
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ – ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ
3. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ–ಕರಿಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಭಾಗ: III ಕಾವ್ಯ **ಅವಧಿ:** 7ಗಂಟೆ

1. ವಚನಗಳು – ಬಸವಣ್ಣ, ಅಲ್ಲಮಪ್ರಭು, ಅಕ್ಕಮಹಾದೇವಿ
2. ಕೀರ್ತನೆಗಳು – ಪುರಂದರದಾಸರು, ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು – ಶಿಶುನಾಳ ಶರೀಫರು, ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿಗಳು
4. ಜನಪದಗೀತೆ, 5. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ –ಡಿವಿಜಿ
6. ಬೆಳಗು – ಅಂಬಿಕಾತನಯದತ್ತ, 7.ಅನಿಕೇತನ – ಕುವೆಂಪು

ಭಾಗ: IV ಕಾವ್ಯ, ವಿಜ್ಞಾನ ಮತ್ತುತಂತ್ರಜ್ಞಾನ ಅವಧಿ: 7ಗಂಟೆ

ಕಾವ್ಯ

1. ಹೆಂಡತಿಯಕಾಗದ – ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
2. ಮುಂಬೈ ಜಾತಕ–ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
3. ಆ ಮರ ಈ ಮರ–ಚಂದ್ರಶೇಖರಕಂಬಾರ
4. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು – ಸಿದ್ಧಲಿಂಗಯ್ಯ

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

1. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು, ಕಂಪ್ಯೂಟರ್ ಮುಖಾಂತರಕನ್ನಡದಟೈಪಿಂಗ್
2. ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ಧಕೋಶ,
3. ತಾಂತ್ರಿಕ ಪದಕೋಶ

Total: L-26 Hours

ಪಠ್ಯಪುಸ್ತಕ:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (ಸಂ), ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ, ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ.ಕೇಶವಮೂರ್ತಿ, Prasaranga VTU, Belagavi, Karnataka, 2020.

ಕೋರ್ಸ್ ಫಲಿತಾಂಶಗಳು:

At the end of the course the student should be able to:

1 ವಿದ್ಯಾರ್ಥಿಗಳು ಬೌದ್ಧಿಕವಾಗಿ ಬೆಳೆಯುವುದರೊಂದಿಗೆ ನಮ್ಮ ನಾಡಿನ ಮತ್ತುದೇಶದ ಸಾಂಸ್ಕೃತಿಕ ವಾರಸುದಾರರಾಗಿ ಬೆಳೆದು ಸ್ವಾವಲಂಬಿಯಾಗಿ ಬದುಕು ಕಟ್ಟಿಕೊಳ್ಳುತ್ತಾರೆ

2 ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಸಮರ್ಥವಾಗಿ ಮಾತನಾಡುವುದರೊಂದಿಗೆ, ಅನ್ಯರನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುವ ಮನೋಬಲ ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾನೆ. ಇವತ್ತಿನ ಸಂಕೀರ್ಣವಾದ ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಸೌಹಾರ್ದಯುತವಾದ ನಡುವಳಿಕೆಯೊಂದಿಗೆ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಯಾಗಿ ರೂಪುಗೊಳ್ಳುತ್ತಾನೆ.

3 ಜಾಗತಿಕರಣದಇವತ್ತಿನ ಸಂದರ್ಭದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ವತಂತ್ರ ವಾಗಿಆಲೋಚಿಸುವ, ಸ್ವತಂತ್ರವಾಗಿ ಬರೆಯುವ, ಸ್ವತಂತ್ರವಾಗಿ ಚಿಂತನಶೀಲರಾಗುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಪಡೆದು, ಸಮಯೋಚಿತವಾಗಿ ಸೂಕ್ತ ನಿರ್ಧಾರಗಳನ್ನು ಕೈಗೊಳ್ಳುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ದೀಪಸ್ಥಂಬವಾಗಿದೆ.

4 ವಿದ್ಯಾರ್ಥಿಗಳು ಇಂದಿನ ಜಾಗತಿಕ ವಿದ್ಯಮಾನಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಂಡು, ಸಮಾಜದಲ್ಲಿ ಸಂಘಜೀವಿಯಾಗಿ ಬೆಳೆಯುವ ಮನೋಬಲವನ್ನು ಮತ್ತುಆತ್ಮಸ್ಥೈರ್ಯವನ್ನುತುಂಬುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ಸೂಕ್ತವಾದ ಮಾರ್ಗದರ್ಶಿಕೆಯಾಗಿದೆ.

5 ತನ್ನ ಅಸ್ಮಿತೆಯ ಹುಡುಕಾಟದಲ್ಲಿರುವ ವ್ಯಕ್ತಿಗೆ, ಅದು ಈ ನೆಲದ ಸ್ವಾಭಿಮಾನ, ಭಾತೃತ್ವ, ಪ್ರೀತಿ, ಸೌಹಾರ್ದಯುತವಾದ ಮನಸ್ಸುಗಳಲ್ಲಿ ಇದೆಎಂಬುದನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳ ಅರಿತಕ್ಕೆತರುತ್ತದೆ.

6 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಪರಿಸರ ಪ್ರಜ್ಞೆಯನ್ನು ಜಾಗೃತಗೊಳಿಸಿ, ದೈವಸೃಷ್ಟಿಯಾದ ಈ ಅಮೂಲ್ಯ ಸಂಪತ್ತನ್ನು ಹಿತ–ಮಿತವಾಗಿ ಬಳಸಿಕೊಂಡು ಮುಂದಿನ ತಲೆಮಾರಿಗೆಅದನ್ನು ಬಳುವಳಿಯಾಗಿ ಬಿಟ್ಟುಹೋಗುವಲ್ಲಿಜಾಗೃತನಾಗುತ್ತಾನೆ.

Basaveshwar Engineering College (A), Bagalkot
DEPARTMENT OF INDUSTRIAL & PRODUCTION ENGINEERING

(Scheme of Teaching for Students admitted to first year in 2018-19[175 CREDITS])

V Semester

Sl.	Subject Code	Subject	Credits	Hours/week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UIP501C	Design of Machine Elements	4	3	2	0	50	50	100
2	UIP502C	Industrial Engineering	4	4	0	0	50	50	100
3	UIP513C	Quality Assurance & Reliability	4	3	2	0	50	50	100
4	UIP541H	Management and Entrepreneurship	4	4	0	0	50	50	100
5	UHS002N	Advanced Quantitative Aptitude and Soft Skills/BBC-II	1	1	0	0	50	50	100
6	UIP523C	Theory of Metal Cutting & Tool Design	3	3	0	0	50	50	100
7	UIP542L	Metal Cutting and Product Assembly Laboratory	1	0	0	3	50	50	100
8	UCS559L	Advanced C Programming Lab	2	0	2	2	50	50	100
9	UIP532L	Industrial Engineering Lab	1	0	0	2	50	50	100
		Total	24	19	4	7	450	450	900

UIP501C: DESIGN OF MACHINE ELEMENTS [04 Credits] [L-T-P:3-2-0]

UNIT – I

Stress analysis: Static strength, Static loads and factor of safety, Theories of failure-maximum normal stress theory, maximum shear stress theory, distortion energy theory, stress concentration, Stress concentration factor, Fatigue, Endurance limit, Factors influencing endurance limit, Goodman and Soderberg relationship, Combined loading.

16 Hrs.

UNIT – II

Design of shafts: Design of shaft for pure torsion, pure bending, combined loading, design for strength & rigidity, shafts under fluctuating loads.

Design of Keys: Types of keys, Strength of rectangular and square keys.

Design of Coupling: couplings-design rigid flange coupling and bushed pin type flexible coupling. **16 Hrs.**

UNIT – III

Design of joints: Riveted Joints -Types, rivet materials, Failures of Riveted joints, Efficiency, Welded Joints - Types, Strength of butt and fillet welds. Threaded fasteners, Cotter and Knuckle joints. **16 Hrs.**

UNIT – IV

Design of gears: Introduction to gears, Design of spur gear, stresses in gear tooth, Lewis equation, form factor, dynamic and wear load.

Design of bearings: Mechanisms of Lubrication - Viscosity, bearing modulus, coefficient of friction, minimum oil film thickness-Heat Generated, Heat dissipated, bearing materials, lubricants and properties. Examples of journal bearing and thrust bearing design, Ball and Roller Bearings: Bearing life, equivalent bearing load, selection of bearings of different types. **16 Hrs.**

Reference Books:

1. *Design of Machine Elements* -V. B. Bandhari, -Tata McGraw Hill Publishing Co. Ltd., New – Delhi, 2000.
2. *Machine Design*-Robert .L, Norton -Pearson Education Asia, New Delhi, 2001.
3. *Elements of Machine Design*-N. C. Pandey and C. S. Shah, 2002 -Chorotar Publishing House
4. *Machine Design*-R. K. Jain, Khanna Publications, New Delhi.
5. *Machine Component & Design*-William Orthwan, Jaico Publishing Co.
6. *Design Data Hand Book*-K. Mahadevan and Balaveera Reddy, CBS Publication.

UIP502C: INDUSTRIAL ENGINEERING [04 Credits] [L-T-P:4-0-0]

UNIT-I

Introduction to Industrial Engineering: Definition, history and development of industrial engineering, present state of industrial engineering, contribution to industrial engineering, activities and approach of industrial engineering, objectives and functions of industrial engineering, place of industrial engineering in an organization. **02 Hrs.**

Productivity: Definition of productivity, productivity in individual enterprises, task of management, productivity of materials, land, building, machine and power.

Measurement of productivity, factors affecting the productivity, productivity improvement programmes, wages and incentives (simple numerical problems). **05 Hrs.**

Work study: Definition, objective and scope of work study, Human factors in work study, Work study and. management, work study and supervision, work study and worker

06 Hrs.

UNIT-II

Introduction to method study: Definition, objective and scope of method study, activity recording and examination aids. Charts to record moments in shop operation – process charts, flow process charts, travel chart and multiple activity charts.(With simple problems) **07 Hrs.**

Micro and memo motion study: Charts to record moment at work place – principles of motion economy, classification of moments, two handed process chart, SIMO chart, and micro motion study. Development, definition and installation of the improved method, brief concept about synthetic motion studies. **06 Hrs.**

UNIT-III

Introduction to work measurement: Definition, objective and benefit of work measurement. Work measurement techniques. Work sampling: need, confidence levels,

sample size determinations, random observation, conducting study with simple problems. **06 Hrs.**

Time study: Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, standard performance, scale of rating, factors affecting the rate of working,)**.**

allowances and standard time determination. Predetermined motion time study – Method time measurement (MTM **07 Hrs.**

UNIT-IV

Ergonomics: Introduction, areas of study under ergonomics, system approach to ergonomics model, Man-machine system: Components of man-machine system and their functions – work capabilities of industrial worker, study of development of stress in human body and their consequences, computer based Ergonomics **04Hrs.**

Design of man-machine system: Fatigue in industrial workers. Quantitative/ qualitative representation and alphanumeric displays. Controls and their design criteria, control types, relation between controls and displays, layouts of panels and machines. Design of work places, influence of climate on human efficiency, influence of noise, vibration and light. **05 Hrs.**

Industrial Engineering application: Introduction to Service Sector: Various Services: i) Hotel ii) Health Care iii) Bank iv) Retail Marketing / Department Stores v) Urban bodies, vi) Education vii) Construction viii) Transport and Communication ix) Government. Content of Product Vs. Services. **04 Hrs.**

Text Books:

1. ILO, *Introduction to work study*– ILO, III (Revised)Edition, 2007, ISBN:81-204- 0602-8
2. *Motion and Time study*- Ralph M Barnes, John Wiley, 8th Edition,1985.
3. *Engineered work Measurement*- Wledon, ELBS , 1991 Marvin E. Mundel- Motion and Time study, PHI, 1st edition

References books:

1. *Human Factors in Engineering Design* - S Sanders and E J McCormick, 6th Edition, McGraw Hill, ISBN:0-07-100319-3
2. *Work Study and Ergonomics*- S Dalela and Sourabh, – Chand Publishers, 3rd edition.
3. Industrial Engineering Hand book – Maynard

UIP513C : QUALITY ASSURANCE & RELIABILITY ENGINEERING [04 Credits] [L-T-P:4-0-0]

UNIT-I

Introduction: Historical evolution of quality concepts, definition of quality, quality function, dimensions of quality, quality engineering terminology, statistical methods for quality, quality costs – four categories costs and hidden costs. quality of design and conformance, brief discussion on sporadic and chronic quality problems, quality control and quality improvement, seven quality control tools, quality function deployment, introduction to measurement system analysis (MSA). **06 Hrs.**

Quality Assurance: Definition and concept of quality assurance, departmental assurance activities. quality audit concept, structuring the audit program, planning and . performing the audit activities, audit reporting, ingredients of a quality program engineering, place of industrial engineering in an organization **06 Hrs.**

UNIT-II

Statistical Process Control: Introduction to statistical process control – chance and assignable causes of variation. Basic principles of control charts, choice of. control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC **06 Hrs.**

Control Charts For Variables: Controls charts for X bar and Range, statistical basis of the charts, development and use of X bar and R charts, interpretation of charts. Control charts for X bar and standard deviation (S), development and use of X bar and S chart. Brief discussion on – Pre control X bar and S control charts with variable sample size, control charts for individual measurements, CUSUM chart, moving-range charts. Process capability – definition, standardized formula, methods of estimating process capability, relation to product tolerance. **07 Hrs.**

UNIT-III

Control Charts for Attributes: Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variable sample size. Control chart for non-conformities (defects) – development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for implementing control charts. Acceptance Sampling: Concept of accepting sampling, economics of inspection **08 Hrs.**

UNIT-IV

Acceptance Sampling: Concept of accepting sampling, economics of inspection, Acceptance plans – single, double and multiple sampling. Operating characteristic curves – construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, production risk and consumer risk, published sampling plans. **07 Hrs.**

Reliability and Life Testing: Failure modes of components, definition of reliability, MTBF, failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, parallel and series-parallel device configurations, redundancy and improvement factors evaluations. Numerical examples. **10 Hrs.**

Assignments: Students have to use the software packages like MS Excel, SPSS, Origin to solve the assignment problems. **02 Hrs.**

Text Books:

1. Introduction to statistical Quality Control, D C Montgomery John Wiley and Sons, 4th Edition.SBN:0- 471-31648-2
2. Statistical Quality Control, Grant and Leavenworth, McGraw Hill, 7th Edition.ISBN:00-70-435-553

Reference Books:

1. Quality Planning & Analysis, J M Juran, Frank M Gryna, Tata McGraw Hill, 3rdEdn. ISBN:978-007-462- 1790
2. Reliability and Maintainability Engineering, Charles E. Ebeling, McGraw Hill International Edition, MLM1004, ISBN007115248.
3. Quality Control, Prentice Hall, Dale H. Besterfield, 7thedn, 2003, ISBN-10: 0131131273. Fundamentals of Quality Control and Improvement, AmitavaMitra, Prentice hall, 2nd Edition, 1998, ISBN – 10: 0136450863

UIP501H: MANAGEMENT AND ENTREPRENEURSHIP [04 Credits] (L:T:P-4:0:0)

UNIT-I

Management Introduction: Definition of Management: its nature and purpose, Patterns of Management analysis: A management theory jungle? The systems approach to the management process, functions of a manager. **04 Hrs**

The Nature and Purpose of Planning: Introduction, Types of plans, Steps in planning, Planning process, Nature of Objectives, Concept of Management by Objectives (MBO), Process of MBO, Benefits and weaknesses of MBO, How to set objectives. **04 Hrs**

Decision making*:* Introduction, importance and limitations of decision-making, Evaluation of alternatives, Selecting an alternative, programmed and non-programmed decisions, decision making under certainty, uncertainty and risk. **05 Hrs**

UNIT-II

Nature and Purpose of Organizing: Formal and Informal organization, organization levels and the span of management, Departmentation-by time, by function, by geography, by customer, by product, by process or equipment, Matrix organization, Strategic Business UNITs (SBUs) **04 Hrs**

Staffing: Authority and power, Line and staff concept, Definition, Systems approach to HRM, situational factors affecting staffing, Selection: matching the person with the job, skills and personal characteristics required by managers, matching qualifications with position requirements, System approach to selection, position requirements and job design, skills and characteristics needed by managers, selection process, techniques, and instruments. **05 Hrs**

Human Factors and Motivation: Introduction, motivation & motivators, process of motivation, Maslow's hierarchy of needs, Hertzberg's motivation-hygiene theory, Vroom's expectancy theory, Equity theory, McClelland's needs theory, special motivational techniques **04 Hrs**

UNIT-III

Leadership: Definition, Ingredients of Leadership, Trait approach to leadership, Leadership behaviour and styles, Managerial grid, Situational or contingency approach to leadership **04 Hrs**

Controlling: Basic control process, critical control points, standards and benchmarking, control as a feedback system, real time information and control, preventive control, control of overall performance, requirements for effective controls, budget as a control device **05 Hrs**

Introduction to Entrepreneurship: Entrepreneurship, Importance of Entrepreneurship, Concepts of Entrepreneurship, Characteristics of a Successful Entrepreneur, Classification of Entrepreneurs, Myths of Entrepreneurship **04 Hrs**

UNIT-IV

Institutions Supporting Small Business Enterprises: An Introduction about Central level Institutions, State level institutions, Other Agencies and Industry Associations. **06 Hrs**

Setting Up a Small Business Enterprise: Identifying the Business Opportunity, Business Opportunities in Various Sectors, and Formalities (including Business Plan) for Setting Up of a Small Business Enterprise, Environment Pollution Related Clearances. **07 Hrs**

Reference Books:

1. Harold Koontz , Heinz Weihrich and A Ramachandra Aryasril, "*Principles of Management*", Tata McGraw Hill Int. Book Co,ISBN-10:0-07-058192-4.
2. Poornima M. Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education India, October 22, 2005, ISBN-13: 978-81-7758-260-4, ISBN-10: 81-7758-260-7
3. Harold Koontz and Heinz Weihrich, "*Essentials of Management- An international perspective*", **Eidth Edition**, Tata McGraw Hill Companies, ISBN 13: 978-0-07-014495-8, ISBN 10:0-07-014495-8.
4. Heinz Weihrich and Harold Koontz , "*Management: A Global Perspective*", 10 Edition ,McGraw Hill Int. Edition,ISBN:0-07-069170-3.
5. P.C.Tripathi and P.N.Reddy " *Principles of Management*" 4 Edition, Tata McGraw Hill Int. Book Co, ISBN:0-07-022088-3.
6. Stephen Robbins, " *Management*",
7. Heinz Weihrich , Mark V Cannice and Harold Koontz , "*Management: A Global and Entrepreneural Perspective*", 12 Edition ,McGraw Hill Int. Edition,ISBN:0-0-07-066019-0.

UHS002N: ADVANCED QUANTITATIVE APTITUDE AND SOFT SKILLS /BBC-II (ADVANCED FQAS / BBC-II)

OVERVIEW

Semester 5

Course Objectives

The course objectives for the semester are as follows:

1. Cover advanced topics in the following domains:
    a. quantitative aptitude,
    b. verbal aptitude, and
    c. Reasoning aptitude.
2. Build confidence and self-esteem through the following:
    a. life skills, and
    b. Soft skills.
3. Hone career skills and industry awareness.
4. Develop awareness of career paths and competitive exams.
5.

Course Outcome

After the course, the students will be able to:

1. Answer multiple choice questions from topics in:
    a. quantitative aptitude,verbal aptitude, and reasoning aptitude.
2. Use tools and techniques learnt in soft skills modules to:
    a. build confidence and self-esteem.
3. Speak knowledgeable about career paths and competitive exams.
4.

Domain	Hours	Modules
Quantitative Aptitude (QA)	6	3
Reasoning Aptitude (RA)	6	3
Verbal Aptitude (VA)	6	3
Soft Skills (SS)	6	3
Career Skills (CS)	6	3
Total	30	15

DETAILS

Sl. No.	Domain	Topic	Hours
UNIT I – Quantitative and Reasoning Aptitude Skills Training			
1.	QA	Speed Maths	2
2.	QA	Areas and Volumes	2
3.	QA	Concept Review	2
4.	RA	Number Series and Letter Series	2
5.	RA	Coding and Decoding	2
6.	RA	Concept Review	2
UNIT II –Verbal Aptitude Skills Training			
7.	VA	Reading Comprehension	2
8.	VA	Listening Comprehension	2
9.	VA	Concept Review	2
Unit III – Career Skills			
10.	CS	Orientation to competitive exams, such as GATE, GRE, GMAT, CAT, UPSC, SSC, and Bank PO.	2
11.	CS	Group Discussion – Simulation	2
12.	CS	Orientation to career paths, such as core engineering, IT engineering, public sector, banking, sales and marketing, and entrepreneurship.	2
Unit IV – Soft Skills			
13.	SS	Dressing and Grooming	2
14.	SS	Professional Etiquette	2
15.	SS	E-mail Writing	2

UIP523C : THEORY OF METAL CUTTING AND TOOL DESIGN [03 Credits] [L-T-P:3-0-0]

UNIT-I

Mechanics of metal cutting - Introduction to metal cutting, process parameters in machining, orthogonal and oblique cutting process, mechanism of chip formation, types of chips, determination of shear plane angle, forces calculations (Merchant's circle analysis), velocity relationship, power and energy relationship, shear strain, force measurement using dynamometers.

Geometry of cutting tools - Introduction to single and multi point cutting tools, tool geometry and systems of description of tool geometry. **10 Hrs.**

UNIT-II

Heat generation - Sources of heat generation, regions of heat generation, heat in the primary and secondary zone, heat at the tool / work interface.

Tool wear and tool life - Wear mechanisms, types of tool wear, tool life criteria and Taylor's tool life equation, tool life testing, factors affecting tool life and related problems.

Machinability - Machinability and criteria for machinability, surface finish and surface integrity.

Machining economics - Criteria for minimum cost and maximum production and simple problems

Cutting fluids - Functions of cutting fluids, types, properties and selection of cutting fluids. **12 Hrs.**

UNIT-III

Design of single point cutting tool - Introduction to design of single point cutting tool, nomenclature, design of tool shank and problems related to shank design.

Design of multi point cutting tools - Introduction to design of multipoint point cutting tools.

Drill bit - Nomenclature and geometry of a drill bit, design criteria and related problems.

Milling cutter - Nomenclature and geometry of a milling cutter, design criteria and related problems. **10 Hrs.**

UNIT-IV

Jigs and fixtures - Significance and purpose of jigs and fixtures and their functions in manufacturing processes, classifications of jigs and fixtures, designs features of main elements of jigs and fixtures such as locating, clamping and guiding elements and their integrations,

Design of jigs and fixtures - General guidelines and procedures for design of jigs and fixtures, design and selection of standard elements, concept of modular fixtures and tool presetting fixtures. **10 Hrs.**

Text Books:

1. Fundamentals of Metal Cutting and Machine Tools - B. L. Juneja, G. S. Sekhon and Nitin Seth, New Age International Publishers, second addition, 2008. ISBN: 81-224-1467-2.
2. Production Engineering - P C. Sharma, Khanna Publishers. ISBN: 81-219-0421-8.
3. Machine tools and Tool Design - P. C. Sharma, ISBN: 81-219-2362-X.
4. Manufacturing Technology - Metal Cutting and Machine Tools - PN Rao 3/e, TMH, New Delhi, 2013

Reference books:

1. Metal Cutting Principles - 1st Edition, Milton C. Shaw and I.B.H.
2. Tool Design - Donaldson, LeGain, Goold, New Central Book Agency.
3. Metal Cutting and Tool Design - Dr. B. J. Ranganath, Vikas Publishing House.
4. Introduction to Jigs and fixtures design, M. H. A. Kempster, ISBN: 81-856-1785-6.
5. Fundamentals of Metal Machining and Machine Tools - G. Boothroyd, McGraw Hill, 2000
6. Metal Cutting: Theory and Practice - Bhattacharya A New Central Book Agency, Kolkata, 2007

UIP542L: METAL CUTTING AND PRODUCT ASSEMBLY LABORATORY[01 Credits] [L-T-P:0-0-2]

PART-A

1. Acceptance tests on machines.
2. Determination of cutting forces and analysis of merchant's circle during turning operation using lathe tool dynamometer:
   (a) By keeping speed as a constant parameter and
   (b) By keeping feed a constant parameter.
3. Determination of cutting forces during milling operation using milling tool dynamometer.
4. Measurement of cutting tool temperature using thermo-couples.
5. Determination of chip-reduction co-efficient during metal cutting operation on machines.
6. Measurement of finish of machined surface.

PART-B

Disassembly and Assembly of the following machine parts:

1. Lathe tail stock
2. Swivel vice
3. Screw jack
4. Lathe check
5. Tool head of shaper

SCHEME OF EXAMINATION

One Question from Part A	:	20 Marks
One Question from Part B	:	20 Marks
Viva-Voice	:	10 Marks
Total	**:**	**50 Marks**

UIP532L: INDUSTRIAL ENGINEERING LABORATORY[01 Credit] [L-T-P:0-0-2]

PART – A

Method study

1. Recording Techniques: Preparing the following charts and diagrams - Outline process chart -
2. Multiple Activity Chart - Flow process chart - Flow diagram and - String diagram
3. Experiments on the Application of principle of motion economy Two handed process chart
4. Exercises on conducting method study

PART – B

Work measurement

1. Rating practice using walking simulator, pin board assembly, deck of cards, marble collection activity
2. Determining the standard time for simple operations using stopwatch time study
3. Exercises on estimating standard time using PMTS.
4. Experiments on office work measurement through work sampling

PART – C

Ergonomics

1. Measurement of parameters (heart beat rate, oxygen consumption) using walking simulator
2. Measurement of parameters (heart beat rate, oxygen consumption) using Ergometer
3. Effect of Noise, Light on human efficiency in work environments.

Reference Books:

1. Work Study - Ralph & Barnes 2. Introduction to Work Study - ILO

SCHEME OF EXAMINATION

One Question from Part A	:	10 Marks
One Question from Part B	:	15 Marks
One Question from Part C		15 Marks
Viva-Voice	:	10 Marks
Total	:	**50 Marks**

DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING

SCHEME OF TEACHING AND EXAMINATION
B.E. (I&PE) VII SEMESTER (175 CREDITS)

Sl.	Subject Code	Subject	Credits	Hours/week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UIP750C	Operations Management	4	3	2	0	50	50	100
2	UIP740C	Theory of Metal Forming	4	3	2	0	50	50	100
3		Elective-II	3	3	0	0	50	50	100
4		Elective -III	3	3	0	0	50	50	100
5		Open Elective 2	3	3	0	0	50	50	100
6	UIP738L	Internship	2	0	0	4	50	50	100
7	UIP723L	Software applications Laboratory	1	0	0	2	50	50	100
8	UIP745P	Project- Phase I	5	0	0	10	50	50	100
		Total	25	15	4	16	400	400	800

UIP750C: OPERATIONS MANAGEMENT [Credits: 03] [L-T-P: 2-2-0]

No	Programme Outcomes **Course Outcomes** **Students will be able to:**	Engineering knowledge	Problem analysis	Design/development of solutions:	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real-life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
1	Demonstrate how operations management is important for an organization and analyze the facility location decisions		**2**	**2**	**2**							**1**		**2**	**3**	
2	Evaluate forecasting methods and apply them to real life problems		**2**	**3**	**3**	**2**						**1**		**2**	**3**	
3	Evaluate aggregate planning and analyze different aggregate planning methods		**2**	**3**	**3**	**2**						**1**	**1**	**2**	**2**	
4	Illustrate the method and importance of materials requirements planning and controlling		**2**	**3**	**3**	**2**						**2**	**1**	**3**	**3**	
5	Analyze the flow shop and job shop scheduling with different methods		**2**	**3**	**3**	**3**						**1**	**1**	**2**	**2**	

UIP750C:OPERATIONS MANAGEMENT [Credits: 04] [L-T-P: 3-2-0]

UNIT-I

Operations Management Concepts: Introduction, Historical developments, Operations management, Environment of operations. Operations system decisions. **02 Hrs.**

System Design and Capacity Planning: Introduction, Manufacturing and service systems, Design and system capacity, Capacity planning **02 Hrs.**

Facility Location and Layout: Introduction,Location planning for goods and services. Economic analysis (Location break-even analysis, Cost minimization using transportation linear programming), and Qualitative factor analysis. Facility layout:Analysis and selection of layout (minimizing cost in job shop layout). Determination of layout, types oflayouts**03 Hrs.**

Inventory Management: Definition, Inventory planning for independent demand items,Types of inventories, Inventory costs, Inventory control for deterministic demand items, Inventory control systems, Selective control of inventory, Other issues in inventory planning and control**03 Hrs**.

.

(10 hours Teaching +7 hours Tutorial)

UNIT-II

Forecasting: Forecasting objectives and uses, forecasting variables, Forecasting methodology, Opinion and Judgemental methods,Time series methods, Exponential smoothing, Regression and correlation methods **05 Hrs.**

Aggregate Planning: Introduction: Objectiveof aggregate planning, Aggregate planning methods - policy guidelines, graphic and charting methods, transportation method of solving APP, master scheduling objective, master scheduling methods **05 Hrs.**

(10 hours Teaching +7 hours Tutorial)

UNIT-III

Material Requirements Planning: Introduction, Underlying concepts, System parameters, MRP Logic, MRP implementation **05 Hrs.**

Design of service systems: Characteristic aspects, Customer Contact in Service Systems, Complexity and Divergence in Service Systems, Service Positioning, Service Blueprinting, Other Aspects of Addressing Capacity Issues in Services, Service Quality**05 Hrs.**

(10 hours Teaching +7 hours Tutorial)

UNIT-IV

Scheduling and Controlling: Introduction, objectives of scheduling, scheduling strategies, scheduling and loading guidelines. Brief discussion on scheduling,methodology - Gantt charts, schedule boards and priority decision rules. Priority and Capacity control. **04 Hrs.**

Single Machine Scheduling: Concept, measures of performance, SPT rules. Weighted mean flow time, EDD rules, minimizing total tardiness**03 Hrs.**

Flow Shop Scheduling: Introduction, Johnson’s problem, CDS heuristic, Palmer’s heuristic.

Job shop scheduling: Types of schedules, heuristic procedure, 2 jobs M machine scheduling.

03 Hrs.
(10 hours Teaching +7 hours Tutorial)
Total: 40 hours of Teaching + 28 hours of Tutorial

Text Books:

1. Operations Management- Monks, J.G., McGraw-Hill International Editions, 1987.
2. Operations Management- Theory and Practice, B. Mahadevan, Third Edition, Pearson Publication ISBN 978-93-325-4752-0 eISBN 978-93-325-4171-9
2. Production and Operations Management- Pannerselvam. R, 2nd edition PHI. ISBN 978-81-203-2767-2

Reference Books:

1. Modern Production/Operations Management- Buffa, Wiely Eastern Ltd., 4th edition
2. Production and Operations Management- Chary, S.N, Tata-McGraw Hill., 3rd edition
3. Operations management - James Dilworth. PHI, 3rd edition
4. Operations Management – Lee J Karjewski and Larry P Ritzman, strategy and Analysis, 6th Edn, Pearson Education Asia
5. Productions & operations management - Adam & Ebert.5th editionPHI

Online Resource:https://nptel.ac.in/courses/112/107/112107238/

EBooks: http://bookboon.com/en/operations-management-ebook

UIP740C: THEORY OF METL FORMING [04 Credits] [L-T-P:3-2-0]

Table: Correlation Matrix of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	Programme Outcomes Course Outcomes	Engineering knowledge	Problem analysis	Design / Development of solutions	Conduct investigations of complex problems	Modern tool usage	The engineer and society	Environment and sustainability	Ethics	Individual and team work	Communication	Project management and finance	Life-long learning	The Industrial and Production Engineering Graduates will be able to effectively design, implement, improve and manage systems /activities in manufacturing and service organizations.	Use the knowledge and skills of industrial engineering to model and analyze the real life problems to develop solutions	Engage professionally in industries or as an entrepreneur by applying manufacturing and management practices
The students will be able to:																
1	Attain proficiency in basic metal forming processes/techniques and analyze stress, strain, yielding of material according to different yield theory for a given state of stress	3	2	1	2	2					1			3	1	2
2	Explain principle of forging, determination of pressure distribution, forging load its application and illustrate about the rolling process/operation using different analysis approach to calculate force and pressure distribution	3	2	1	2	2					1			3	1	2
3	Understand and evaluate process of excursion its analysis on the process mechanics and evaluate the variables affecting rod and wire drawing processes and	3	2	1	2	2					1			3	1	2
4	Describe the manufacturing of tube drawing process and its analysis and get well acquaintance with high energy rate forming.	3	2	1	2	2					1			3	1	2

UIP740C: THEORY OF METAL FORMIMG [04 Credits] [L-T-P:3-2-0]

UNIT I

Theory of metal forming processes -Classification of forming processes, flow curve, true stress and true strain, notion of stress, normal and shear stress, stress tensor, components of stress tensor, principal stresses, stress invariants, spherical and deviator stress tensors, yield criteria, von -mises and tresca yield criterion and related problems.

4 hours tutorials to be taken **10 Hrs.**

UNIT II

Forging -Classification of forging processes, forging equipment, forging analysis - calculation of pressure distribution - in case of forging of a rectangular plate and forging of a circular disc in sticking, sliding and mixed conditions, forging defects and related problems, **Rolling** -Classification of rolling processes, rolling mills, forces and geometrical relationships in rolling, calculation of pressure distribution case of rolling of a strip (rolling analysis), defects in rolled products and related problems.

8 hours tutorials to be taken **10 Hrs.**

UNIT III

Extrusion -Classification of extrusion processes, hot extrusion, hydrostatic extrusion, analysis of extrusion process - extrusion of cylindrical rod and strip with friction and related problems, **Drawing of rods, wires** -Rod and wiredrawing process, analysis of drawing process - drawing of cylindrical rod and strip with friction and related problems.

8 hours tutorials to be taken **10 Hrs.**

UNIT IV

Tube drawing process -Introduction and analysis of tube drawing process and related problems, **High energy rate forming** -Introduction to HERF, explosive forming, electro hydraulic forming and electromagnetic forming.

5 hours tutorials to be taken **10 Hrs.**

Text Books:

1. Theory of Plasticity and Metal Forming Processes by Dr. Sadhu Singh, Khanna Publishers, New Delhi
2. Mechanical Metallurgy by George E. Dieter, Adapted by David Bacon, (SI Metric Edition), McGraw-Hill Book Company and
3. Introduction to Industrial Mechanical Working Process by G. W. Rowe.

Reference Books:

1. Theory of Metal Forming and Metal cutting by K. P. Sinha and S. C. Prasad, DhanpatRai& Sons, New Delhi.
2. Metal Forming Processes by G. R. Nagral, Khanna Publishers, New Delhi
3. Metal Forming Technology by Dr. R. Narayanasamy, Ahuja Book Company Pvt. Ltd., New Delhi
4. ASM-Metals handbook and
5. Fundamentals of Working of Metals, Sach G, Pergamon press.

UIP723L: SOFTWARE APPLICATIONS LABORATORY[Credits :01][L-T-P: 0-0-2]

LIST OF Exercises

1. Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update and Delete Commands.
3. Nested Queries and Join Queries
4. Views
5. High level programming language extensions (Control structures, Procedures and Functions).
6. Front end Tools
7. Forms
8. Triggers
9. Menu Design
10. Reports.
11. Database Design and implementation (Mini Project)

2) Assessment Rubrics for Internships and Technical Seminars, Mini-Project, Major Project Phase I&II of BE program

2.1 Internship

2.1.1 Internship Guidelines

- **Step 1:** Request Letter/ Email from the office of Training & Placement cell of the college should go to industry to allot various slots of 4-6 weeks during summer vacation.
- **Step 2:** Industry will confirm the training slots and the number of seats allocated for internships via Confirmation Letter/ Email.
- **Step 3:** Students on joining Training at the concerned Industry / Organization, submit the Joining Report/ Letters / Email.
- **Step 4:** Students undergo industrial training at the concerned Industry / Organization.
- **Step 5:** Students will submit training report after completion of internship.
- **Step 6:** Training Certificate to be obtained from industry.
- **Step 7:** List of students who have completed their internship successfully will be issued by Training and Placement Cell.

2.1.2 Internship Report

2.1.2.1 Student's Diary/ DailyLog

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the Institute immediately after the completion of the training. It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of thediary.
- Adequacy & quality of information recorded.
- Drawings, sketches and datarecorded.
- Thought process and recording techniques used.
- Organization of the information.

2.1.2.2 Internship Report

The Internship report will be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course.

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation through seminar presentation and
3. Viva-voce at the Institute.

2.1.3 Evaluation Through Seminar Presentation/Viva-Voce at The Institute

The student will give a seminar based on his training report, before an expert committee constituted by the concerned department as per norms of the institute. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Evaluation of Internship - Grading Rubric (Industry)

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement	Meets Expectations	Excellent	
	0-1	2-3	4-6	
Internship Evaluation Dimensions – Grading Criteria				
Quality of Work	Work was done in a careless manner and was of erratic quality; Work assignments were usually late and required review; Made numerous errors	With a few minor exceptions, adequately performed most work requirements; Most work assignments submitted in a timely manner; Made occasional errors	Thoroughly and accurately performed all work requirements; Submitted all work assignments on time; Made few if any errors	10
Ability to Learn	Asked few questions and rarely sought out additional information Unable or slow to understand new concepts, ideas, and work assignments; Unable or unwilling to recognize mistakes and was not receptive to making needed changes and improvements	Asked relevant questions and sought out additional information from appropriate sources; Acceptable understanding of new concepts, ideas, and work assignments; Willing to take responsibility for mistakes and to make needed changes and improvements	Consistently asked relevant questions and sought out additional information from appropriate sources; Quickly understood new concepts, ideas, and work assignments; Always willing to take responsibility for mistakes and to make needed changes and improvements	10
Initiative and Creativity	Had little observable drive and required close supervision; Showed little interest in meeting standards; Did not seek out additional work and frequently procrastinated in completing assignments; suggested no new ideas or options	Worked without extensive supervision; Found problems to solve and sometimes asked for additional work assignments; Set his/her own goals and, tried to exceed requirements; offered some creative ideas	A self-starter; Consistently sought new challenges and asked for additional work assignments; Regularly approached and solved problems independently; Frequently proposed innovative and creative ideas, solutions, and/or options	10
Character Traits	Regularly exhibited a negative attitude; Dishonest and/or showed a lack of integrity on several occasions; Unable to recognize and/or was insensitive to ethical and diversity issues; Displayed significant lapses in ethical and professional behavior	Except in a few minor instances, demonstrated a positive attitude; Regularly exhibited honesty and integrity in the workplace; Usually aware of and sensitive to ethical and diversity issues on the job; Normally behaved in an ethical and professional manner	Exceptionally positive attitude; Consistently exhibited honesty and integrity in the workplace; Keenly aware of and deeply sensitive to ethical and diversity issues on the job; Always behaved in an ethical and professional manner	10

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement 0-1	Meets Expectations 2-3	Excellent 4-6	
Internship Evaluation Dimensions – Grading Criteria				
Dependability	Generally unreliable in completing work assignments; Did not follow instructions and procedures promptly or accurately; Careless, and work needed constant follow-up; required close supervision	Generally reliable in completing tasks; Normally followed instructions and procedures; Usually attentive to detail, but work had to be reviewed occasionally; Functioned with only moderate supervision	Consistently reliable in completing work assignments; Always followed instructions and procedures well; Careful and extremely attentive to detail; Required little or minimum supervision	10
Organizational Fit	Unwilling or unable to understand and support the organization's mission, vision, and goals; Exhibited difficulty in adapting to organizational norms, expectations, and culture; Frequently seemed to disregard appropriate authority and decision-making channels	Adequately understood and supported the organization's mission, vision, and goals; Satisfactorily adapted to organizational norms, expectations, and culture; Generally functioned within appropriate authority and decision-making channels	Completely understood and fully supported the organization's mission, vision, and goals; Readily and successfully adapted to organizational norms, expectations, and culture; Consistently functioned within appropriate authority and decision-making channels	10
Response to Supervision	Rarely sought supervision when necessary; Unwilling to accept constructive criticism and advice; Seldom implemented supervisor suggestions; Unwilling to explore personal strengths and areas for improvement	Sought supervision when necessary; Receptive to constructive criticism and advice; Implemented supervisor suggestions in most cases; Willing to explore personal strengths and areas for improvement	Actively sought supervision when necessary; Always receptive to constructive criticism and advice; Successfully implemented supervisor suggestions when offered; Always willing to explore personal strengths and areas for improvement	10

Evaluation of Internship – Grading Rubric (Department Evaluation Committee/Faculty)				
Evaluation Dimensions	**Performance Rating**			Maximum **Score**
	Needs Improvement 0-1	**Meets Expectations 2-3**	**Excellent 4-6**	
Internship Evaluation Dimensions – Grading Criteria				
Demonstration of experience	Offers little in the way of illustrating experiences Fails to adequately address how the experiences relate to the competencies.	Addresses the activities and experiences, but not so clearly and concisely	Well addressed activities and experiences as well as relating them to the program competencies.	10
Report	Unedited and difficult to read It is littered with grammatical and typographical errors, demonstrating little effort to producing a quality report. No reference is made to practical application. Lacks evidence and internship experience	Well-written for the most part but still has somewhat detracting errors that could have been fixed with additional editing prior to submission. Key concepts related to the selected evidence and internship experience are inaccurate or incomplete. Some helpful practical applications are included.	Has been carefully edited and is free or nearly free of any grammatical or typographical errors. Well-organized report is easy to read and understand and stands alone as a quality piece of writing. An accurate and complete reflection of key concepts related to the selected evidence and internship experience Practical applications are included to illuminate issues.	10
Presentation	Information is lacking/unclear and communicated in such a way that the audience cannot understand the purpose of the evidence work and internship experiences.	Information is presented in a clear manner but still lacks practical experience	Information is communicated in a thorough manner and ideas are expressed in such a way that the audience can clearly understand the evidence work and internship experiences.	10

Summary of Internship Evaluation (Industry Representative)	
Evaluation Criteria	**Score from the above tables**
Quality of Work	10
Ability to Learn	10
Initiative and Creativity	10
Character Traits	10
Dependability	10
Organizational Fit	10
Response to Supervision	10
	70
Internship Guide	
Demonstration of experience	10
Report	10
Presentation	10
	30
Total Score	**100**

UIP723L: SOFTWARE APPLICATIONS LABORATORY[Credits :01][L-T-P: 0-0-2]

LIST OF Exercises

1. Data Definition, Table Creation, Constraints,
2. Insert, Select Commands, Update and Delete Commands.
3. Nested Queries and Join Queries
4. Views
5. High level programming language extensions (Control structures, Procedures and Functions).
6. Front end Tools
7. Forms
8. Triggers
9. Menu Design
10. Reports.
11. Database Design and implementation (Mini Project)

2.4 Rubrics for Project Phase-I &II (VII + VIII Semester)

SEMESTER VII

Rubrics for	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before one month from the start of 7th semester of BE Program	R1	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)
	Evaluation-II	Before 15 days from the last working day of 7th semester of BE Program	R2	15	
	Evaluation by guide	In the last week of working days	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of 7th semester of BE Program	R4	50	Committee consisting of HOD/Nominee + Project Coordinator + External Examiner

SEMESTER VIII

Rubrics for	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before one month from the start of 8th semester of BE Program	R5	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)
	Evaluation-II	Before 15 days from the last working day of 8th semester of BE Program	R6	15	
	Evaluation by guide		R7	20	Guide(s)
SEE	Semester End Examination	During SEE of 8th semester of BE Program	R8	50	Committee consisting of HOD/Nominee + Project Coordinator + External Examiner

The evaluation criteria may vary *marginally* (maximum of 5%) from the perspective of different disciplines but the structure/stages of evaluation and allotted marks for each stage of evaluation in both 7th and 8th semesters must be same for all the branches across the institute.

R1. Synopsis presentation (Before one month from the start of 7th semester of BE): Total Marks of 15

<table>
<tr><th rowspan="2">Evaluation Criteria</th><th colspan="3">Score/Marks</th><th rowspan="2">Total Marks</th><th rowspan="2">Evaluation By</th></tr>
<tr><th>Poor
(Needs Improvement)
(1)</th><th>Average
(Acceptable)
(3)</th><th>Very good
(Proficient)
(5)</th></tr>
<tr><td>Motivation And Rationale behind the work</td><td>• Less motivated and has less desire to achieve a goal, accomplish a task, or work
• Need for the process /product which offers viable solutions to accomplish a work towards expectations in a challenging and interesting area is not good</td><td>• Moderately motivated and has some interest to achieve a goal, accomplish a task, or work
• Need for the process /product which offers viable solutions to accomplish a work towards expectations in a challenging and interesting area is okay and acceptable</td><td>• Highly motivated and desirous to achieve a goal, accomplish a task, or work
• Need for the process /product which offers viable solutions to accomplish a work towards expectations in a challenging and interesting area is good</td><td rowspan="3">15</td><td rowspan="3">Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)

Each will evaluate for 15 marks and average of all three is the marks awarded</td></tr>
<tr><td>Literature review</td><td>• Less technical papers are reviewed and less relevant</td><td>• Few technical papers are reviewed and moderately relevant</td><td>• At least 3 technical papers from reputed journals are made and reviews are quite relevant to the project work</td></tr>
<tr><td>Presentation</td><td>• Slides contain some errors, Not legible, flow is okay, body language is minimal, Response to the audience questions and comments are not good</td><td>• Slides are error free, flow is good, body language is acceptable, Responds to the audience questions and comments</td><td>• Slides are error free, quite legible, flow is good, body language is good, Responds accurately to the audience questions and comments</td></tr>
</table>

R2. Internal Evaluation (Before 15 days from the last working day of 7th semester of BE): Total Marks of 15

<table>
<tr><th rowspan="2">Evaluation Criteria</th><th colspan="3">Score/Marks</th><th rowspan="2">Total Marks</th><th rowspan="2">Evaluation By</th></tr>
<tr><th>Poor
(Needs Improvement)
(1)</th><th>Average
(Acceptable)
(3)</th><th>Very good
(Proficient)
(5)</th></tr>
<tr><td>Proposed design methodology</td><td>• Division of problem into modules and but improper selection of design approaches and design methodology and not properly justified</td><td>• Division of problem into modules and but improper selection of design approaches and design methodology and not properly justified</td><td>• Division of problem into modules and good selection of design approaches, appropriate design methodology with proper justification</td><td rowspan="3">15</td><td rowspan="3">Committee consisting of HOD/Nominee + Project Coordinator + Guide(s)

Each will evaluate for 15 marks and average of all three is the marks awarded</td></tr>
<tr><td>Preliminary/Conceptual Design work</td><td>• Very less efforts are made towards preliminary and conceptual design works to accomplish the work</td><td>• Efforts are made towards preliminary and conceptual design works to accomplish the work but some are not clear</td><td>• Preliminary and conceptual design works are carried and are in proper direction to accomplish the project work</td></tr>
<tr><td>Presentation and Report</td><td>• Slides are not organized, and Question-answer is poor, report has errors and not systematic</td><td>• Slides are good but not neatly arranged, delivery is good, Question-answer is average
• Report is not organized systematically</td><td>• Slides are neat, delivery is good, Question-answer is very good, gestures and body languages are perfect
• Report is organized, and is according to the specified format
• References and citations are appropriate</td></tr>
</table>

R3. Evaluation by the guide (Towards the end of 7th semester of BE): Total Marks of 20

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (1)	**Average (3)**	**Excellent (5)**		
Objectives and Feasibility study	• Many possible objectives are left out and very few are stated • Design steps are not feasible to accomplish all the objectives	• Some objectives are stated clearly and some possible objectives are left out • Design steps are less feasible to accomplish all the objectives	• All the objectives are clearly and neatly stated • Design steps to be followed to solve the defined problem are feasible to accomplish all the objectives	20	Guide(s)
Survey and Problem identification	• Topics are surveyed randomly and less relevant to societal and environmental problem	• Topics are surveyed and not fully relevant to society and environment problem	• Extensive survey is made and socially and environmentally relevant problem is identified		
Involvement in the work and ability to work in team	• Less involved in the work	• Would have involved still more	• Sincerely involved in the work and very hard working and has good interest		
Individual Contribution and Peer/Guide interaction	• Lesser involvement and contribution • Rarely met the guide and met on guide's call	• Contributed to the work to some extent • Met the guide for interaction and Sincere and obedient to the guide's call and suggestions	• Good interaction and contributed in a big way • Met the guide for interaction and Sincere and obedient to the guide's call and suggestions • More frequently met the guide for interaction and Sincere and obedient to the guide's call and suggestions		

R4: SEE Evaluation for Project Phase-I (During SEE of 7th semester of BE): Total Marks of 50

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (4)	Acceptable (Average) (6)	Satisfactory (Good) (8)	Proficient (Excellent) (10)		
Identification of Problem Domain and Detailed analysis of Feasibility	• Moderate explanation of the purpose and need of the project • Explanation of the specifications and the limitations of the existing systems not very satisfactory; limited information	• Average explanation of the purpose and need of the project; • Moderate study of the existing systems; collects some basic information	• Good explanation of the purpose and need of the project • Collects a great deal of information and good study of the existing systems	• Detailed and extensive explanation of the purpose and need of the project	50	HOD/nomination + Project coordinator + External examiner Each will evaluate for 50 marks and average of all three is the marks awarded
Objectives and Methodology of Project Proposal	• Only Some objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are not specified properly	• Incomplete justification to the objectives proposed; Steps are mentioned but unclear; without justification to objectives	• Good justification to the objectives; Methodology to be followed is specified but detailing is not done	• All objectives of the proposed work are well defined; Steps to be followed to solve the defined problem are clearly specified • Detailed and extensive explanation of the specifications and the limitations of the existing systems		
Design Methodology	• Partial division of problem into modules and inappropriate selection of computing framework	• Division of problem into modules but inappropriate selection of computing Framework	• Division of problem into modules and good selection of computing framework • Design methodology not properly justified	• Division of problem into modules and good selection of computing framework • Appropriate design methodology and		

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (4)	**Acceptable (Average) (6)**	**Satisfactory (Good) (8)**	**Proficient (Excellent) (10)**		
	• Design methodology not defined properly	• Design methodology not defined properly		properly justified		
Planning of Project Work	• Time frame not properly specified	• Time frame properly specified, but not being Followed	• Time frame properly specified but being followed partly	• Time frame properly specified and being followed		
Presentation	• Contents of presentations are appropriate but not well Arranged • Eye contact with few people and unclear Voice	• Contents of presentations are appropriate but not well Arranged • Eye contact with few people and unclear Voice	• Contents of presentations are appropriate but not well arranged • Satisfactory demonstration, clear voice with good spoken language but eye contact not proper	• Contents of presentations are appropriate and well arranged • Proper eye contact with audience and clear voice with good spoken language		

B.V.V Sangha's

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF INFORMATION SCIENCE & ENGINEERING

Total Credits for BE =175 (as per VTU/AICTE); Min Cr/sem=16; Max Cr/sem=28; Ave=22

III Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl .No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UMA336C	Computational Methods in Computer science	03	3	0	0	50	50	100
2	UIS309C	Discrete Mathematical Structures	03	3	0	0	50	50	100
3	UIS315C	Data Structures and Algorithms	04	3	2	0	50	50	100
4	UIS303C	Logic Design	04	3	2	0	50	50	100
5	UIS314C	Computer Organization	04	4	0	0	50	50	100
6	UIS313L	Advanced C Programming Lab	02	0	2	2	50	50	100
7	UIS312L	Logic Design & Simulation Laboratory	1.5	0	0	3	50	50	100
8	UIS308L	Data Structures Laboratory	1.5	0	0	3	50	50	100
9	UMA330M	Bridge Course Mathematics-I *	--	2	2	--	50	50	100
10	UBT133M	Environmental Studies *	--	2	--	--	50	50	100
		Total	**23**	**18**	**8**	**8**	**450**	**450**	**900**
		Total Contact hours	**34**						

- **Bridge Course Mathematics-I** : **is a mandatory subject only for students admitted to 3rd Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject.**
- **Environmental Studies** : **is amandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class / Rank.**

*A student can register online certification course for a maximum of 3 credits from 3rd to 6th semester. However he has to produce the certificate during 7th semester. A student can register 3 courses of 1 cr each/2 courses of 2 cr and 1 cr/1 course of 3 cr in any semester.

Min Cr/sem=16; Max Cr/sem=28; Ave=22

IV Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl .No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UMA436C	Statistics and Probability Theory	03	3	0	0	50	50	100
2	UIS409C	Microcontroller and Embedded Systems	03	3	0	0	50	50	100
3	UIS424C	OOP with Java	04	4	0	0	50	50	100
4	UISXXXC	Operating Systems	04	3	2	0	50	50	100
5	UIS403C	Analysis and Design of Algorithms	04	3	2	0	50	50	100
6	UHS001N	Fundamentals of Quantitative Aptitude & Soft skills	01	2	0	0	50	50	100
7	UIS421L	Analysis of Algorithms using JAVA Laboratory	1.5	0	1	2	50	50	100
8	UIS410L	Microcontroller and Embedded Systems Laboratory	1.5	0	0	3	50	50	100
9	UMA430M	Bridge Course Mathematics-II *	--	2	2	--	50	50	100
10	UHS226M	Constitution of India *	--	2	--	--	50	50	100
11	UHS488C/ UHS489C	Adalita Kannada/Vyavaharika Kannada *	--	2	--	--	--	--	--
		Total	**22**	**20**	**7**	**5**	**450**	**450**	**900**
		Total Contact hours	**32**						

- **Bridge Course Mathematics –II** : **is a mandatory subject only for students admitted to 4th Semester through lateral entry scheme (Diploma quota). Passing the subject is compulsory, however marks will not be considered for awarding grade /class. A PP/NP grade will be awarded for passing/not passing the subject.**
- **Constitution of India** : **is a mandatory subject for lateral entry students. Question Paper will be of Objective type. Students have to pass the subject compulsorily, however marks will not be considered for awarding Grade / Class /Rank.**

***** Adalita Kannada/Vyvaharika Kannada is a mandatory subject the student has to study the subject but no exam

*A student can register online certification course for a maximum of 3 credits from 3rd to 6th semester. However he has to produce the certificate during 7th semester. A student can register 3 courses of 1 cr each/2 courses of 2 cr and 1 cr/1 course of 3 cr in any semester.

Min Cr/sem=16; Max Cr/sem=28; Ave=22

V Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UISXXXC	Web Programming	03	2	2	0	50	50	100
2	UIS510C	Software Engineering	03	3	0	0	50	50	100
3	UIS503C	Database Management Systems	04	3	2	0	50	50	100
4	UISXXXN	Open Elective-I	03	3	0	0	50	50	100
5	UIS00XX	Professional Elective – I	03	3	0	0	50	50	100
6	UIS00XX	Theoretical Foundations of Computer Science	03	3	0	0	50	50	100
7	UIS511L	Database Application Laboratory	1.5	0	0	3	50	50	100
8	UISXXXL	Web Programming Lab	1.5	0	1	2	50	50	100
9	UHS002N	Advanced Quantitative Aptitude And Soft Skills	01	0	0	0	50	50	100
		Total	**23**	**18**	**5**	**5**	**450**	**450**	**900**
		Total Contact hours	**28**						

Note: For electives refer the table: List of Electives (3 Credits)

*A student can register online certification course for a maximum of 3 credits from 3rd to 6th semester. However he has to produce the certificate during 7th semester. A student can register 3 courses of 1 cr each/2 courses of 2 cr and 1 cr/1 course of 3 cr in any semester.

Min Cr/sem=16; Max Cr/sem=28; Ave=22

VI Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UIS603C	Computer Networks	04	3	2	0	50	50	100
2	UIS00XX	Professional Elective – II	03	3	0	0	50	50	100
3	UIS00XX	Professional Elective- III	03	3	0	0	50	50	100
4	UIS00XX	Professional Elective – IV	03	3	0	0	50	50	100
5	UIS00XX	Open Elective– II	03	3	0	0	50	50	100
6	UIS612L	Computer Networks Laboratory	1.5	0	0	3	50	50	100
7	UISXXXL	Advanced JAVA Programming laboratory	1.5	0	0	3	50	50	100
8	UIS615P	Mini Project	02	0	0	3	50	50	100
9	UHS003N	Career Planning and Professional Skills	01	2	0	0	50	50	100
		Total	**22**	**17**	**2**	**9**	**450**	**450**	**900**
Total Contact hours			**28**						

Note: For electives refer the table: List of Electives (3 Credits)

*A student can register online certification course for a maximum of 3 credits from 3rd to 6th semester. However he has to produce the certificate during 7th semester. A student can register 3 courses of 1 cr each/2 courses of 2 cr and 1 cr/1 course of 3 cr in any semester.

Min Cr/sem=16; Max Cr/sem=28; Ave=22

VII Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UIS710C	Object Oriented Modeling and Design	03	3	0	0	50	50	100
2	UIS711C	Software Testing	03	3	0	0	50	50	100
3	UIS00XX	Professional Elective – V	03	3	0	0	50	50	100
4	UIS00XX	Professional Elective – VI	03	3	0	0	50	50	100
5	UIS00XX	Open Elective– III	03	3	0	0	50	50	100
6	UIS707L	Object Oriented System Design Lab	1.5	0	1	2	50	50	100
7	UIS716L	Software testing Lab	1.5	0	1	2	50	50	100
8	UIS718I	Internship	02	0	0	4	50	50	100
9	UIS807S	Seminar	01	0	0	02	50	50	100
10	UISXXXO	Online Certification Course registration	03						
		Total	**24**	**12**	**2**	**13**	**400**	**400**	**800**
Total Contact hours			**27**						

Note: For electives refer the table: List of Electives (3 Credits)

*A student can register online certification course for a maximum of 3 credits from 3rd to 6th semester. However he has to produce the certificate during 7th semester. A student can register 3 courses of 1 cr each/2 courses of 2 cr and 1 cr/1 course of 3 cr in any semester.

Min Cr/sem=16; Max Cr/sem=28; Ave=22

VIII Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester)

Sl. No.	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecture	Tutorial	Practical	CIE	SEE	Total
1	UIS511H	Management & Entrepreneurship (HSS)	03	4	0	0	50	50	100
2	UISXXXH	Startup and IPR (HSS)	03	3	0	0	50	50	100
3	UIS806P	Project	15	0	0	0	50	50	100
		Total	**21**	**09**	**0**	**2**	**250**	**250**	**500**
Total Contact hours			**23**						

*** Working hours will be as per scheduled working hours prescribed by the industry.**

Note: For electives refer the table: List of Electives (3 Credits)

Syllabus

Subject Title	:	**Computational Methods in Computer science**
Subject code	:	UMA336C
Semester	:	**3**
Credits with LTP Structure	:	**03 credits (2L-0T-0P)**
Lecture Hours per Week		**2**
Tutorial Hours per Week		**0**
Total Contact Hours	:	**26**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Numerical Analysis: Bisection Method, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof).		**10**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Numerical Differentiation and integration: Numerical differentiation using Newton's forward and backward formulae-problems.Trapezoidal rule, Simpson's one third rule, Simpson's three eighth rule and Weddle's rule (no derivation ofany formulae)-problems.		**10**	**00**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Numerical solutions offirst order ODEand PDE: Taylors Series Method, Euler's and Modified Euler's method, Runge-Kutta 4th order method, Milne's predictor and corrector method (problems only).Numerical solutions ofone-dimensional heat and wave equations by explicit method, Laplace equation by using standard five point formula.		**10**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Calculus of Variations Variation ofa function and a functional, extremal ofa functional, variational problems, Euler's equation, standard variational problems including geodesics, minimal surface of revolution, hanging chain and Brachistochrone problems.		**10**	**00**

Text Books:

1. Numerical Methods for Engineers by Steven C Chapra&Raymond P Canale.
2. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
3. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi.

Advanced Engineering Mathematics by E Kreyszig (John Wiley & Sons)

Reference:

Subject Title	:	**DISCRETE MATHEMATICAL STRUCTURES**
Subject code	:	**UIS309C**
Semester	:	**3**
Credits with LTP Structure	:	**3 Credits (3L-0T-0P)**
Lecture Hours per Week		**3 Hours**
Tutorial Hours per Week		**00**
Total Contact Hours	:	**66 (40 Teaching Hours + 26 Tutorial Hours)**

UNIT - I	**16 Hours**	**Teaching Hours**	**Tutorial Hours**
Fundamentals Principles of Counting: The Rules of sum and product, permutations, combinations: the binomial theorem, combinations with repetition, mathematical induction, recursive definitions. **Recurrence relation**: first order linear recurrence relation, the second order linear homogeneous recurrence relation with constant coefficient		**10**	**6**
UNIT - II	**16 Hours**	**Teaching Hours**	**Tutorial Hours**
Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence: the laws of logic, logical implication: rules of inference, the use of quantifiers, quantifiers, definitions and the proofs of theorems. **Set Theory:** Sets and subsets, set operations and the laws of set theory, counting and Venn Diagrams, probability, the axioms of probability.		**10**	**6**
UNIT - III	**17 Hours**	**Teaching Hours**	**Tutorial Hours**
Relations and Functions: Cartesian products and relations, functions: plain and one to one, on to functions: sterling numbers of the second kind, special functions, the pigeonhole principle, function composition and inverse functions, properties of relations, computer recognition: zero one matrices and directed graphs, partial order: Hasse diagram, equivalence relations and partitions, lattices. **Semigrops and Groups**: Definition, example and elementary properties, Homomorphism, Isomorphism and cyclic groups, Cosets and lagrange's theorem		**10**	**7**
UNIT - IV	**17 Hours**	**Teaching Hours**	**Tutorial Hours**
An introduction to graph theory: Definitions and examples, subgraphs, complement and graph isomorphism, vertex degree: Euler trails and circuits**.** **Trees:** definitions, properties and examples, rooted trees, trees and sorting weighted trees and prefix codes		**10**	**7**

Text Books:
"Discrete and Combinatorial Mathematics-An Applied Introduction", Ralph P Grimaldi, Pearson Education, 4th and 5th Edition
Reference Books:
1. C.L.Lin, "Elements of Discrete Mathematics" 2nd Editions 2. Thomas Khoshy "Discrete Mathematics with applications" 3. Richard Johasonbangh "Discrete Mathematics" 6th Edition 4. Kenneth H rossey "Discrete Mathematics & etc applications" 6th edition

Subject Title	:	DATA STRUCTURES & ALGORITHMS
Subject code	:	**UIS315C**
Semester	:	**3**
Credits with LTP Structure	:	**4 Credits (3L-1T-0P)**
Lecture Hours per Week	:	**3 Hours**
Tutorial Hours per Week	:	**2**
Total Contact Hours	:	**66 (40 Teaching Hours + 26 Tutorial Hours)**

UNIT - I	16 Hours	Teaching Hours	Tutorial Hours
Introduction to data structures: Structures in C. **The stack**: Definition and Examples: Primitive operations, An Example, The stack as an Abstract data type. , Representing Stacks in C: Implementing pop operation, Testing for exceptional conditions, Implementing the push operations. , An Example- Infix, Postfix and Prefix: Basic Definitions and Examples, Evaluating a postfix expression, Program to evaluate a postfix expression, Limitations of the program, Converting an expression from Infix to Postfix, Program to convert an expression from Infix to Postfix. **Recursion**: Recursive definition and processes: The factorial function, Properties of recursive definitions or Algorithms. , Recursion in C: Factorial in C., writing recursive programs: The Towers of Hanoi Problem.		**10**	**6**
UNIT - II	**16 Hours**	**Teaching Hours**	**Tutorial Hours**
Queues: ***The queue and its sequential representation***: The queue as an abstract data type, C implementation of queues, The insert operation, The priority queue, Array implementation of a priority queue. **Lists:** ***Linked lists***: Inserting and removing nodes from a list, Linked implementation of stacks, The getnode and freenode operations, Linked implementation of queues, The linked list as a data structure, Examples of list operations, List implementation of priority queues, Header Nodes.		**10**	**6**
UNIT - III	**17 Hours**	**Teaching Hours**	**Tutorial Hours**
Lists in C: Array implementation of lists, Limitations of the array implementation, Allocating and freeing dynamic variables, Linked lists using dynamic variables, Queues as lists in C, Examples of list operations in C, Noninteger and nonhomogeneous lists, Comparing the dynamic and array implementation of lists, Implementing Header Nodes. , An example:simulation using linked lists. **Other list structures**: Circular lists, The stack as a circular list, The queue as a circular list, Primitive operations on circular lists, The Josephus problem, Header nodes, Addition of long positive integers using circular lists.		**10**	**7**
UNIT - IV	**17 Hours**	**Teaching Hours**	**Tutorial Hours**
Trees: Binary trees: Basics, Operation on Binary trees, Applications of Binary trees. Binary tree representations: Node representations of Binary trees, Node Representation of binary trees, Internal & external nodes, Implicit array representation of Binary trees, Choosing a Binary tree representation, Binary tree traversal in c, traversal using a father field, heterogeneous binary trees. ***Trees and their applications***: C representation of trees, Tree traversals, General expressions as trees, Evaluating an expression tree, Constructing tree.		**10**	**7**

Text Books:

1) "Data structure using C", Aaron M. Tennenbaum, Yedidyah Langsam and Moshe J. Augenstein, Pearson Education/PHI 2006.

Reference Books:

1) Behrouz A. Forouzan, Richard F. Gilberg , "A Structured Programming Approach Using C", Second Edition, Thomson Brooks/Cole .
2) Behrouz A. Forouzan and Richard F. Gilberg, Thomson, "Computer Science A structured Programming Approach using C", II edition, 2003.
3) Richard F. Gilberg and Behrouz, "Data structures A pseudo code approach with c ", Thomson, 2005.
4) Robert Kruse and Breuse Leung, "Data structures and program Design in C", PEARSON Education, 2007.

Subject Title	:	LOGIC DESIGN

Subject code	:	**UIS303C**
Semester	:	**3**
Credits with LTP Structure	:	**4 Credits (3L-2T-0P)**
Lecture Hours per Week	:	**3 Hours**
Tutorial Hours per Week	:	**2 Hours**
Total Contact Hours	:	**66 (40 Teaching Hours + 26 Tutorial Hours)**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Boolean Algebra: Definition of Boolean algebra, Boolean algebra theorems, A two-valued Boolean algebra, Boolean formulas and functions, Canonical Formulas, Manipulations of Boolean formulas **Gates and Combinational networks**: Incomplete Boolean functions and Don't care conditions, Additional Boolean operations and Gates		**10**	**6**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Simplification of Boolean Expressions: Formulations of simplification problem, Prime implicants and Irredundant disjunctive expressions, Prime implicates and Irredundant conjunctive expressions, Karnaugh maps, Using Karnaugh maps to obtain minimal expressions for complete Boolean functions, Minimal expressions of incomplete Boolean functions The Quine-McCluskey method of generating Prime implicants and Prime implicates, Decimal method for obtaining prime implicants, Variable-Entered Karnaugh maps.		**10**	**6**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Logic Design with MSI Components and Programmable Logic Devices: Binary adders and subtracters, Decimal adders, Comparators, Decoders, Multilpexers. Programmable logic devices (PLDs), Programmable read only memories (PROMs), Programmable logic arrays (PLAs), Programmable array logics (PALs).		**10**	**7**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Flip-Flops and Simple Flip-Flop Applications: The basic Bistable element, Latches, Master-Slave flip-flops (Pulse-Triggered flip-flops), Edge triggered flip-flops, Characteristic equations, Registers, Counters, Design of Synchronous Counters. **Synchronous sequential networks:** Structure and operation of clocked synchronous sequential networks, Analysis of clocked synchronous sequential networks.		**10**	**7**

Text Books:

1. Donald D. Givone, "Digital Principles and Design", McGraw Hill Edition 2002:
   Chapter 3: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9
   Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.8, 4.11, 4.14
   Chapter 5: 5.1, 5.2, 5.3, 5.4, 5.6, 5.7, 5.8, 5.9, 5.10
   Chapter 6: 6.1, 6.2, 6.4, 6.5, 6.6, 6.7, 6.8, 6.9
   Chapter 7: 7.1, 7.2

Reference Books:

1. Leach and Malvino, "Digital Principles and Applications", TMH, New Delhi, 2002.
2. Yarbrough J. M, "Digital logic- Applications and Design, Thomson Learning, New Delhi, 2001.

Subject Title	:	**COMPUTER ORGANIZATION**
Subject code	:	**UIS314C**

Semester	:	**3**
Credits with LTP Structure	:	**4 Credits (4L-0T-0P)**
Lecture Hours per Week	:	**4 Hours**
Tutorial Hours per Week	:	**00**
Total Contact Hours	:	**52 (52 Teaching Hours + 00 Tutorial Hours)**

UNIT - I	**13 Hours**	**Teaching Hours**	**Tutorial Hours**
Basic Structure of Computer**:** Computer Types. Functional Units, Basic Operational Concepts, Bus Structures, Performance – processor clock, Basic Performance Equation, Clock rate, Performance Measurement. Machine Instructions and Programs**:** Numbers, Arithmetic Operations and Characteristics, Memory Location and Addresses, Memory Operations. Instructions and Instruction Sequencing: Addressing Modes, Assembly language, Basic Input and Output operations, Stacks and Queues, Subroutines.		**13**	**0**
UNIT - II	**13 Hours**	**Teaching Hours**	**Tutorial Hours**
Input/Output organization: Accessing I/O Devices, Interrupts-interrupt hardware, Enabling and disabling interrupts, Handling multiple devices, Controlling device requests, Exceptions, Direct memory access, Buses, Interface circuits, Standard I/O interfaces-USB; Device characteristics, Architecture, Addressing.		**13**	**0**
UNIT - III	**13 Hours**	**Teaching Hours**	**Tutorial Hours**
Basic processing unit: Fundamental concepts, Execution of a complete instruction, Multiple bus organization, Hard-wired control, Micro programmed control. Memory system**:** Basic Concepts, Semiconductor RAM Memories, Read Only Memories, Speed, Size and cost, Cache Memories, Mapping Functions.		**13**	**0**
UNIT - IV	**13 Hours**	**Teaching Hours**	**Tutorial Hours**
Basic Arithmetic concepts for ALU: Addition and subtraction of signed numbers, Design of fast adders; Carry-lookahead addition only, Multiplication of positive numbers, Signed operand multiplication, Fast multiplication, Integer division, Floating point numbers and operations.		**13**	**0**

Text Books:
Computer Organization, Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 5th edition, TMH, 2002.
Reference Books:
Computer Organization and Architecture, William Stallings,7th edition,PHI,2006

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

BRIDGE COURSE MATHEMATICS-I
(Common to all branches)
(Effective from the academic year 2018-19)

Subject Code : UMA330M	**CIE Marks : 50**
Contact Hours/Week : 3L	**SEE Marks: 50**
Total Hours:40	**Exam Hours : 03**
Semester : III	**Credits: Mandatory**

Course Learning Objectives: This course (**UMA330M**) will enable students to master the basictools of calculus and vectorsto become skilled for solving problems in science and engineering.

Differential Calculus: **15 Hours**

Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems

Partial differentiation : Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions.Jacobians-problems,

Integral Calculus: **15 Hours**

Reduction formula $\int \sin^n xdx, \int \cos^n xdx, \int \tan^n xdx$ and $\int \sin^n x \cos^n xdx$. Evaluation of double and triple integrals. Area bounded by the curve.

Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.

Vector Calculus: **10 Hours**

Vector Differentiation: Scalar and vector fields**.** Gradient, directional derivative; curl anddivergence-physical interpretation; solenoidal and irrotational vector fields- problems

Text Books:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43^{rd} Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10^{th} Ed.(Reprint), 2016.

Reference books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:**Early TranscendentalsJames Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6^{th} Edition,McGraw-Hill Book Co., New York, 1995.
4. B.V.Ramana: "Higher Engineering Mathematics" 11^{th} Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7^{th} Ed., 2010.

Course Outcomes: On completion of this course, students are able to:

CO1: Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2: Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.

CO3: Apply the concept of multiple integrals and their usage in computing the area and volumes.

CO4 : Apply the knowledge of vector calculus to solve the engineering problems

Question paper pattern for SEE

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.

Any five full questions are to be answered

Subject Title	:	Statistical methods for Computer sciences
Subject code	:	UMA436
Semester	:	**4**

Credits with LTP Structure	:	**03 credits (2L-0T-0P)**
Lecture Hours per Week		**2**
Tutorial Hours per Week		**0**
Total Contact Hours	:	**26**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Statistics : Curve fitting by the method of least squares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$. Correlation, expression for the rank correlation coefficient and regression.		**10**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Probability: Probability: addition rule, conditional probability, multiplication rule, Baye's rule. Discrete and continuous random variables-Probability density function, Cumulative distribution Function,		**10**	**00**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Probability distributions: Binomial distributions Poisson distributions and Normal distributions. Concept of joint probability, Joint distributions - discrete and continuous random variables, Independent random variables, Problems on expectation and variance.		**10**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Markov chains: Markov chains: Introduction, Probability vectors, Stochastic Matrices, Fixed Points and Regular stochastic Matrices, Markov chains, higher transition probabilities, stationary distribution of regular Markov chains and absorbing states.		**10**	**00**

Text Books:

1. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
2. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).
3. Advanced Engineering Mathematics by H. K. Dass
4. Advanced Engineering Mathematics by E. Kreyszig (John Wiley & Sons)
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, Wiley India Pvt. Ltd 2nd edition 2012.
6. A first course in Complex analysis with applications by Dennis G. Zill Patrick D Shanahan, 2nd edition 2010.
7. Advanced Engineering Mathematics by Peter V. O'Neil.

Reference:

Subject Title	:	**Microcontroller and Embedded Systems**
Subject code	:	**UIS409C**
Semester	:	**3**
Credits with LTP Structure	:	**3 Credits (3L-0P-0T)**
Lecture Hours per Week		**3 Hours**
Tutorial Hours per Week		**00**
Total Contact Hours	:	**40 (40 Teaching Hours + 00 Tutorial Hours)**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutoria Hours**
The 8051 Microcontrollers, Assembly Language Programming: Microcontrollers and Embedded systems, Overview of the 8051 family, Inside the 8051, Introduction to 8051 Assembly programming, Assembling and running an 8051 program, the program counter and ROM space in the 8051, 8051 data types and directives, 8051 flag bits and PSW register, 8051 register banks and stack, pin description of the 8051. **Jump, Loop and Call Instructions, I/O Port Programming**: Loop and Jump instructions, Call instructions, Time delay for various 8051 chips, 8051 I/O programming, I/O bit manipulation programming.		**10**	**0**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutoria Hours**
8051 Addressing Modes, Arithmetic, Logic Instructions and Programs: Immediate and register addressing modes, Accessing memory using various addressing modes, Bit addresses for I/O and RAM, Extra 128-byte-on-chip RAM in 8052. Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction and data serialization, BCD, ASCII, and other application programs.		**10**	**0**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutoria Hours**
8051 Programming in C, Pin description of 8051: Data types and time delay in 8051 C, I/O programming in 8051 C, Logic operations in 8051 C, Data conversion programs in 8051 C, Accessing code ROM space in 8051 C, Data serialization using 8051 C. **8051 Timer Programming in Assembly and C**: Programming 8051 timers, counter programming, Programming timer 0 and 1 in 8051 C.		**10**	**0**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutoria Hours**
8051 Serial Port Programming in Assembly and C: Basics of serial communication, 8051 conversion to RS232, 8051 serial port programming in Assembly, Programming the second serial port, Serial port programming in C. **Interrupts Programming in Assembly and C**: 8051 interrupts, Programming timer interrupts, Programming external hardware interrupts, Programming the serial communication interrupt, Interrupt priority in the 8051/52, Interrupt programming in C.**MOTOR Control:** DC and Stepper Motors.		**10**	**0**

Text Books:

1. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, " The 8051 Microcontroller and Embedded System using Assembly and C. Pearson 2nd Edition, 2011.
   Chapter 1: 1.1-1.2, Chapter 2: 2.1-2.7, Chapter 3: 3.1-3.3, Chapter 4: 4.1-4.2, Chapter 5: 5.1-5.4, Chapter 6: 6.1-6.5, Chapter 7.1-7.6, Chapter 8: 8.1, Chapter 9: 9.1-9.3, Chapter 10: 10.1-10.5, Chapter 11: 11.1-11.6, Chapter 17: 17.2-17.3

Reference Books:

1. Kenneth J. Ayala, "The 8051 Microcontroller Architecture, Programming and Applications", 2nd Edition, Penram Internation 1996.
2. Dr. Uma Rao and Dr. Andhe Pallavi, "The 8051 Microcontroller Architecture, Programming and Applications", Pears Education Sanguine.
3. V Udayshankar, M S Mallikarjunaswamy, " 8051 Microcontroller: Hardware, Software and Applications", McGrawHill, N

Delhi.

Semester	:	**IV**
Subject	:	**OBJECT-ORIENTED PROGRAMMING WITH JAVA**
Subject code	:	**UIS424C**
Credits	:	**04 (3L-0P-1T)**
Teaching Hours		**40 Lecture, 26 Tutorials.**

UNIT - I

Object-oriented Concepts

OOP Concepts: Procedural Programming, Problems with procedural programming, Object-oriented programming, P.O.P v/s O.O.P, OOP features- Encapsulation, Inheritance, Polymorphism, etc., Benefits of OOP, Applications of OOP, Pure OOP languages-five rules, The 'Object' concept, ADT, Encapsulation and Information Hiding, Class v/s Object, Type and Interface, Instantiating classes, Interaction between objects, Association, Aggregation and Decomposition, Example, Generalization and Specialization, Example.

10 Hours

UNIT - II

Introduction to Java

Evolution of Java: Java's lineage, Creation of Java, How Java changed the internet, Byte code, Features of Java.

An Overview of Java: Features of Java, First simple program, Lexical Issues.

Data Types and Variables: The Primitive Types, Literals, Variables, Type Conversion and Casting, Automatic Type Promotion.

Operators: Arithmetic operator, Bitwise operators, Relational operators, Boolean Logical operators, Assignment operators, The '?' Operator, Operator precedence.

Control Statements: Java's selection statements, Iteration statements, Jump statements.

Arrays: One-dimensional arrays, Multi-dimensional arrays.

10 Hours

UNIT – III

Classes, Inheritance and Interfaces

Introducing Classes: Class fundamentals, Declaring Objects, Assigning object reference variables, Introducing methods, Constructors, The 'this' keyword.

Methods and Classes: Overloading methods, Introducing Access control, Understanding static, Introducing final.

Inheritance: Inheritance basics- Member access and inheritance, Using super, Multi-level inheritance, Method overriding; Dynamic method dispatch, abstract classes , using 'final' with inheritance.

Interfaces: Defining an interface, Implementing interfaces, Applying Interfaces.

10 Hours

UNIT - IV

Packages, Exceptions and Threads

Packages: Packages, Access protection, Importing packages.

Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, Java's built-in exceptions.

Multithreaded programming: The Java Thread model, The Main thread, Creating a thread, Creating multiple threads, Thread priorities, Synchronization, Interthread communication, Suspending, Resuming and Stopping threads.

10 Hours

Text Books	:	1. The Complete Reference -Java, Herbert Schildt, 7th edition, McGraw Hill Publication.
Reference Books	:	

UIS403C: ANALYSIS AND DESIGN OF ALGORITHMS

4 CREDITS (4 – 0 – 0)

UNIT – I
13 Hours
Introduction: What is an Algorithm?, Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures. **Fundamentals of the Analysis of Algorithm Efficiency**: Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Nonrecursive Algorithms, Mathematical Analysis of Recursive Algorithms, Example: Fibonacci Numbers.
UNIT – II
13 Hours
Brute Force: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search. **Divide-and-Conquer**: Mergesort, Quicksort, Binary Search, Binary Tree Traversals and Related Properties, Multiplication of Large Integers and Stressen's Matrix Multiplication. **Decrease-and-Conquer**: Insertion Sort, Depth-First Search and Breadth-First Search, Topological Sorting, Decrease-by-a-Constant-Factor Algorithms, Variable-Size-Decrease Algorithms.
UNIT – III
13 Hours
Transform-and-Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction. **Space and Time Tradeoffs**: Sorting by Counting, Input Enhancement in String Matching, Hashing, B-trees. **Dynamic Programming**: Computing a Binomial Coefficient, Warshall's and Floyd's Algorithms, The Knapsack Problem and Memory Functions.
UNIT – IV
13 Hours
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Limitation of Algorithm Power:** Lower-Bound Arguments, Decision Trees. **Coping with the Limitations of Algorithm Power:** Backtracking, Branch-and-Bound.
Text Book(s): 1) Anany Levitin, "Introduction to the Design & Analysis of Algorithms", 2nd Edition, [Chapters or Topics: 1, 2.1–2.5, 3.1, 3.2, 3.4, 4.1–4.5, 5.1–5.3, 5.5, 5.6, 6.1, 6.3, 6.4, 6.6, 7, 8.1, 8.2, 8.4, 9, 11.1–11.3, 12.1–12.2], Pearson Education, 2007.
Reference Book(s): 1) Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, "Introduction to Algorithms", 2nd Edition, PHI, 2006. 2) Horowitz E., Sahni S., Rajasekaran S. "Computer Algorithms", Galgotia Publications, 2001.

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

BRIDGE COURSEMATHEMATICS-II
(Common to all branches)
(Effective from the academic year 2018-19)

Subject Code : UMA430M	**CIE Marks : 50**
Contact Hours/Week : 03	**SEE Marks: 50**
Total Hours:40	**Exam Hours : 03**
Semester : IV	**Credits: Mandatory**

Course Learning Objectives: The purpose of the course **UMA430M** is to facilitate the students withconcrete foundation of differential equations and Laplace transform to acquire the knowledge of these mathematical tools.

Ordinary differential equations of first order: 20 Hours
Variable seperable,Homogeneous.Exact form and reducible to exact differential equations.Linear and Bernoulli's equation.

Differential Equations of higher order:
Second and higher order linear ODE's with constant coefficients-Inverse differential operator, method of variation of parameters(second order); Cauchy's and Legendre homogeneous equations.

Laplace Transform: 20 Hours Introduction, Definition of Laplace Transform, Laplace Transform of Elementary functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function

Inverse Laplace transforms –
Properties. Convolution theorem. Solutions of linear differential equations

Text Books:

- B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 43rd Ed., 2015.
- E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2016.

Reference books:

1. Thomas' Calculus: Early Transcendentals, Single Variable (13th Edition)
2. **Calculus:**Early Transcendentals James Stewart
3. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill Book Co., New York, 1995.
4. B.V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
5. Veerarajan T.," Engineering Mathematics for First year", Tata McGraw-Hill, 2008.
6. N.P.Bali and Manish Goyal: A Text Book of Engineering Mathematics, Laxmi Publishers, 7th Ed., 2010.

Course Outcomes: On completion of this course, students are able to:

CO1: Explain various physical models through first and higher order differential equations and solve such linear ordinary differential equations.

CO2: Apply the Laplace transform techniques to solve differential equations.

CO3: Understand a variety of partial differential equations and solution by exact methods.

CO4: solve PDE by direct integration and Solution of Lagrange's linear PDE, method of separation of variables

Question paper pattern for SEE

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

College Name	:	**Basaveshwar Engineering College (Autonomous), Bagalkot**
Department Name	:	**Information Science and Engineering**
Semester	:	**IV**
Subject	:	**OPERATING SYSTEM**
Subject code	:	**UISXXXC**
Credits	:	**03**
Teaching Hours		**40**

UNIT - I

INTRODUCTION TO OPERATING SYSTEMS, PROCESS MGMT

Role of Operating systems: user view, system view; Operating System structure; Operating System operations; Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Virtual machines.

Process management: Process concept; Operations on processes; Process Scheduling: Basic concepts; scheduling criteria; Scheduling algorithms; Multiple-Processor scheduling, **10 Hrs**

UNIT - II

THREADS AND PROCESS SYNCHRONIZATION

Interprocess communication, Threads: concepts, Multi-Threaded Programming: Overview; Multithreading models; Thread Libraries; Threading issues. Thread scheduling.

Synchronization: The Critical section problem; Peterson's solution; Synchronization hardware; Semaphores; Classical problems of synchronization; Monitors.

10 Hrs

UNIT - III

DEADLOCKS AND MEMORY MANAGEMENT

Deadlocks: Deadlocks: System model; Deadlock characterization; Methods for handling deadlocks; Deadlock prevention; Deadlock avoidance; Deadlock detection and recovery from deadlock.

Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Virtual Memory Management: Background; Demand paging; Page replacement; Allocation of frames;.

10 Hrs

UNIT - IV

FILE SYSTEM: CONCEPTS AND IMPLEMENTATION, SECONDARY STORAGE STRUCTURES

File system: File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Protection. Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

Protection: Goals,principles and domain of protection, Access Matrix

10 Hrs

Text Books	:	Abraham Silberschatz, Peter Baer Galvin , Greg Gagne: Operating System Principles, 9th edition, Wiley-India, 2006. (Chapters: 1.1, 1.4 -1.9, 2.1 – 2.8, 3.1- 3.4, 4.1- 4.4, 5.1 – 5.5, 6.1 – 6.7, 7, 8.1 – 8.6, 9.1, 9.2, 9.4 – 9.6, 10, 11.1 – 11.5, 12.1 – 12.6, 17.1- 17.4)
Reference Books	:	1. D.M Dhamdhere: Operating systems - A concept based Approach, 2nd Edition, Tata McGraw- Hill, 2002. 2. P.C.P. Bhatt: Operating Systems, 2nd Edition, PHI, 2006. 3. Harvey M Deital: Operating systems, 3rd Edition, Addison Wesley, 1990.

Subject Title	:	THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE
Subject code	:	UIS00XXC
Semester	:	V
Credits with LTP Structure	:	4 Credits (3L-0P-2T)
Lecture Hours per Week	:	3 Hours
Tutorial Hours per Week	:	2 Hours
Total Contact Hours	:	66 (40 Teaching Hours + 26 Tutorial Hours)

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Automata: Introduction to Finite Automata, The central concepts of Automata theory. Finite Automata: Deterministic Finite automata, Non-Deterministic Finite Automata. An application of Finite Automata, and Finite Automata with Epsilon-transitions, ***Regular Expressions:*** Regular expressions, Finite Automata and Regular Expressions, and Applications of Regular Expressions.		**10**	**6**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Properties of Regular Languages: Proving languages not to be regular languages, Closure properties of regular languages, Decision properties of regular languages, and Equivalence and Minimization of Automata. **Context Free Grammars and Languages:** Context Free Grammars, Parse trees, Applications of Context Free Grammars, Ambiguity in Grammars and Languages.		**10**	**6**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Pushdown Automata: Definition of the Pushdown Automaton, The languages of a PDA, Deterministic Pushdown Automata. ***Properties of Context-Free Languages***: Normal forms for Context Free Grammars and The pumping lemma for Context Free Languages.		**10**	**7**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Introduction To Turing Machine: The Turning Machine, Programming Techniques for Turning Machines, Extensions to the basic Turning Machines, Turing Machine and Computers.		**10**	**7**

Text Books:

1. John. E., Hopcroft, Rajeev. Motwani, Jeffrey. D., Ullman, “Introduction to Automata Theory, Languages and Computation”, 3rd Edition, Pearson Education, 2007. (Chapters: 1.1, 1.5, 2.2 to 2.5, 3.1 to 3.3, 4, 5, 6.1, 6.2, 6.4, 7, 8.1 to 8.4, 8.6)

Reference Books:

1. Peter. Linz, “An Introduction to Formal Languages and Automata", Third Edition, Fifth printing.
2. John, E., Hopcroft, Jeffrey. D. Ullman, “Introduction to Automata Theory, Languages and Computation”, Narosa Publication.
   A. M., PadmaReddy, “Finite Automata and Formal Languages, Pearson Education, 2012

College Name	:	**Basaveshwar Engineering College (Autonomous), Bagalkot**
Department Name	:	**Information Science and Engineering**
Semester	:	**V**
Subject	:	**SOFTWARE ENGINEERING**
Subject code	:	**UIS510C**
Credits	:	**03**
Teaching Hours	:	**40**

UNIT - I

INTRODUCTION: Evolution- from an art form to an engineering discipline, software development projects, exploratory style of software development, emergence of software engineering, notable changes in software development practices, computer systems engineering.

SOFTWARE LIFE CYCLE MODELS: A few basic concepts, waterfall model and its extensions, rapid application development, agile development models, spiral model, a comparison of different life cycle models

REQUIREMENTS ANALYSIS AND SPECIFICATION: Requirements gathering and analysis, software requirements specification (SRS). **10 Hours**

UNIT - II

SOFTWARE DESIGN: Overview of the design process, how to characterize a good software design, cohesion and coupling, layered arrangement of Modules, approaches to software design

FUNCTION-ORIENTED SOFTWARE DESIGN: Overview of SA/SD methodology, structured analysis, developing the DFD model of the system, structured design, detailed design, design review

OBJECT MODELLING USING UML: Basic Object-orientation concepts, Unified Modelling Language, UML diagrams, Use case model,, Class diagrams, Interaction diagrams, Activity diagram, State chart Diagram

USER INTERFACE DESIGN: Characteristics of a good user interface, basic concepts, types of user interfaces **10 Hours**

UNIT - III

CODING AND TESTING: Introduction to program testing, Coding, code review, software documentation, testing, unit testing, black – box testing,

White – box testing, debugging, program analysis tools, integration testing, testing object-oriented programs, systems testing

SOFTWARE RELIABILITY AND QUALITY MANAGEMENT: Software reliability, statistical testing, software quality, software quality management system, ISO 9000, SEI capability maturity model

COMPUTER AIDED SOFTWARE ENGINEERING: CASE and its scope, Case Environment, CASE support in software life cycle, other characteristics of CASE tools **10 Hours**

UNIT - IV

SOFTWARE PROJECT MANAGEMENT: software project management complexities, responsibilities of a software project manager, project planning, metrics for project size estimation, project estimation techniques, COCOMO – a heuristic estimation technique, Staffing level estimation, scheduling, organization and team structures, staffing, risk management, software configuration management

EMERGING TRENDS: client- server software, client server architectures, CORBA, COM/DCOM, Service - oriented architecture (SOA), software as a service (SaaS), **10 Hours**

Text Books	:	Fundamentals of software engineering, Rajib Mall, 4th edition, pHI
Reference Books	:	1. Software Engineering, Ian Somerville, 7th edition, Pearson Education 2. “Software Engineering- A Practitioners Approach”, Pressman R.S, MGH New Delhi. 3. “An integral approach to software Engineering”, Jalote P, Narosa, New Delhi.

College Name	:	**Basaveshwar Engineering College (Autonomous), Bagalkot**
Department Name	:	**Information Science and Engineering**
Semester	:	**V**
Subject	:	**DATABASE MANAGEMENT SYSTEMS**
Subject code	:	**UIS503C**
Credits	:	**04(3L-0P-2T)**
Teaching Hours		**40**

UNIT - I

INTRODUCTION: Characteristics of database approach; Advantages of using DBMS approach; Usage of DBMS. Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment; Centralized and client-server architectures; Classification of Database Management systems.

ENTITY-RELATIONSHIP MODEL: Using High-Level Conceptual Data Models for Database Design; An example database application; Entity types, Entity sets, Attributes and Keys; Relationship types, Relationship sets, Roles and Structural constraints; Weak entity types; Refining the ER Design; ER Diagrams, Naming conventions and design issues.

10 hours

UNIT - II

RELATIONAL MODEL AND RELATIONAL DATABASE CONSTRAINTS: Relational model concepts; Relational model constraints and Relational database schemas; Update operations, Transaction and dealing with constraint violations.

SQL: data definition and data types; Specifying basic constraints in SQL; Schema change statements in SQL; Basic queries in SQL; More complex SQL queries. Insert, Delete and Update statements in SQL; Specifying constraints as Assertion and Trigger; Views (Virtual Tables) in SQL;

PL/SQL: PL/SQL Concepts, PL/SQL Language Fundamentals, SQL in PL/SQL: DML Statements in PL/SQL.

10 hours

UNIT - III

DATABASE DESIGN: Informal design guidelines for relation schemas; Functional dependencies; Normal forms based on primary keys; General definitions of second and third normal forms; Boyce-Codd Normal Form

PROPERTIES OF RELATIONAL DECOMPOSITIONS: Algorithms for relational database Schema design; Multivalued dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form

10 hours

UNIT - IV

TRANSACTION MANAGEMENT: Introduction to transaction processing; Transaction & system concepts; Desirable properties of transactions; Characterizing schedules based on recoverability; Characterizing schedules based on serializability; Transaction support in SQL; Transaction Control in PL/SQL.

CONCURRENCY CONTROL: Two-phase locking techniques for concurrency control.

10 hours

Text Books	:	1. "Fundamentals of Database Systems", Remez Elmasri & Shamkant B. Navathe, 5th Edition, Pearson Education. 2. "Oracle PL/SQL by Example", BENJAMIN ROSENZWEIG, ELINA RAKHIMOV, 5th Edition, Pearson Education.
Reference Books	:	1. "Database Management Systems", Ramakrishanan Gehrke 3rd edition, McGraw-Hill Higher Education; 2. "An Introduction to Data base systems"C. J. Date , Addision Wesley, 4th edition.

UIS508C : ADAVANCED JAVA PROGRAMMING

3CREDITS (3L – 0P – 0T)

UNIT – I
10 Hours
Applets and Event Handling **The Applet Class:** Two types of Applets, Applet basics, Applet Architecture, An Applet skeleton, Simple Applet display methods, Requesting repainting, The HTML'APPLET' tag, Passing parameters to Applets. **Event Handling:** Two Event Handling Mechanisms, The Delegation Event Model, Event Classes, Sources of Events, Event Listener Interfaces, Using the Delegation Event Model
UNIT – II
10 Hours
Java2 Enterprise Edition and Servlets **Java2 Enterprise Edition(J2EE) Overview:** J2EE and J2SE, The Birth of J2EE, Databases, The maturing of Java, Java beans and java message service, need for J2EE. **Multi-Tier architecture**: Distributive Systems, The tier, J2EE multitier architecture. **Servlets**: Java Servlets and Common Gateway Interface Programming, A Simple Java Servlet. Anatomy of a Java Servlet, Reading data from a client, Reading HTTP request headers, Sending data to a client and Writing the HTTP response header, Working with Cookies, Tracking Sessions.
UNIT – III
10 Hours
JDBC and Embedded SQL **JDBC Objects:** The concepts of JDBC, JDBC Drivers Types, JDBC Packages, A brief overview of the JDBC Process, Database connection, Statement Objects, ResultSet, Transaction Processing, Metadata, Data Types, Exceptions **JDBC and Embedded SQL**: Model programs, Tables, Inserting data into tables, Selecting data from a table, Updating tables, Deleting data from a table.
UNIT – IV
10 Hours
Java Server Pages (JSP) **JSP Syntax and semantics**: JSP Overview**,** The JSP Development model, Components of JSP Page, A complete example, Expressions, Scriptlets and Declarations: Expressions, Scriptlets, and Declarations. **Request dispatching:** Anatomy of request processing, Including other resources, The include directive, The <jsp:include> action, Method to be used, Forwarding requests.
Text Book(s): 1. The Complete Reference -Java, Herbert Schildt, 7th edition, McGraw Hill Publication.(Chapters 21,22) 2. The Complete Reference –J2EE, Jim Keogh, McGraw Hill Publication.(Chapters 1, 2, 6, 7, 10) 3. The Complete Reference –JSP 2.0, Phil Hanna, McGraw Hill Publication.(Chapters 4, 5, 6, 7)
Reference Book(s): 1. Java 6 Programming Black Book, Dreamtech Press. 2007. 2. Core servlets and Java Server Pages, Marty Hall, Larry Brown, Volume 1: Core Technologies, Second Edition.

UIS610C: WEB PROGRAMMING
3 CREDITS (3 – 0 – 0)

UNIT – I

13 Hours

FUNDAMENTALS OF WEB, XHTML - Internet, HTTP request and HTTP response phase, MIME, The Web Programmers Toolbox.

XHTML: Basic syntax; Standard XHTML document structure; Basic text markup. XHTML : Images; Hypertext Links; Lists; Tables; Forms; Frames; Syntactic differences between HTML and XHTML. CSS: Introduction; Levels of style sheets; Style specification formats; Selector forms; Property value forms; CSS: Font properties; List properties; Color; Alignment of text; Background images; The <span> and <div> tags;

HTML5 and Cascading Style Sheet: HTML5 features, HTML4 VS HTML5 new elements.

UNIT – II

13 Hours

Basics of JavaScript: General syntactic characteristics; Primitives, Screen output and keyboard input; Control statements; Object creation and modification, Arrays; Functions; Pattern matching using regular expressions.

JavaScript & XHTML Documents: The Document Object Model, Element Access in JavaScript, Events & Event Handling, Basic Concepts of Event handling, Events, Attributes & Tags, Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Textbox & password Elements, The Focus Event, Validating from Input, The DOM 2 Event Model, Event Propagation, Event handler registration, An Example of the DOM 2 Event Model, The Navigator Object, DOM Tree Traversal and Modification, DOM Tree Traversal, DOM Tree Modification.

UNIT – III

13 Hours

Dynamic Documents with JavaScript: Introduction, Positioning Elements, Absolute Positioning, Relative Positioning, Static Positioning, Moving Elements, Element Visibility, Changing Colors & Fonts, Changing Colors, Changing Fonts, Dynamic Contents, Stacking Elements, Locating the Mouse Cursor, Reacting to the Mouse Click, Slow Movement of Elements, Dragging & Dropping Elements.

Introduction to XML: Introduction, The Syntax of XML, XML Document Structure, Document Type Definitions: Declaring Elements, Declaring Attributes, Declaring Entities, A Sample DTD, Internal & External DTDs, Namespaces, XML Schemas: Schemas Fundamentals, Defining the Schema, Defining the Schema Instances, An Overview of Data types, Simple Types, Complex Types, Displaying Raw XML Documents, Displaying XML Documents with CSS, Displaying XML documents with CSS; XSLT style sheets; XML processors;

UNIT IV

13 Hours

Introduction to PHP: Origins and Uses of PHP, Overview of PHP, General Syntactic Characteristics, Primitives, Operations and Expressions, Output, Control statements, Arrays, Functions, Pattern Matching, Form Handling, Files, Cookies, Session Tracking, Database access with PHP and MySQL.

Ruby : Origins and uses of Ruby, Scalar types and their operations, Simple input and output, Control statements, Arrays, Hashes, Methods, Classes, Code blocks and iterators, Pattern matching.

Text Book(s):

1. Programming the World Wide Web **-** Robert W. Sebesta, 4th Edition, Pearson Education, 2008.

Reference Book(s):

1. Internet & World Wide Web How to program - M. Deitel, P.J.Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
2. Web Programming Building Internet Applications - Chris Bates,3rd Edition, Wiley India, 2006.
3. The Web Warrior Guide to Web Programming **-** Xue Bai et al,Thomson, 2003.
4. M.Srinivasan: Web Technology Theory and Practice, Pearson Education, 2012.
5. Jeffrey.C.Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, Eleventh Impression, 2012

Syllabus

Academic Year	**:**	**2019– 20**
Semester	**:**	**06**
Subject	**:**	**Computer Networks**
Subject Code	**:**	**UIS610C**
Credits	:	**03**
Teaching Hours	:	**40**

Unit –I	**10 Hours**
Introduction: Data Communications: Components, Data representations, Data flow, Networks: Distributed Processing, Network Criteria, And Physical structures, Categories of Networks [LAN, WAN, MAN], Protocols: Key elements. **Network Models:** The OSI Model: layered architecture, peer to peer processes, and encapsulation, Layers in the OSI model : [Brief description of all seven layers], TCP / IP Protocol Suite: physical, data link, network, transport and application layer, Addressing: physical, logical and port addresses. **Physical Layer: Transmission Media**: Guided Media: Twisted pair cable, Coaxial cable, Fiber Optic cable, Unguided Media: Radio waves, Microwaves, Infrared.	
Unit –II	**10 Hours**
Switching: Definition, Circuit switched networks, Data gram Networks, Virtual circuit networks. **Data Link Layer: Error detection and correction**: Cyclic codes: Checksum. **Data link control**: Protocols: Noiseless channels: Noisy channels.	
Unit –III	**10 Hours**
Network Layer: Logical Addressing: IPv4 Addresses: Address Space, Notation, Classful Addressing, Classless Addressing, IPv6 Addresses: Structure, Address Space. **Network Layer :Internet Protocol:** IPv4, IPv6, Transition from IPv4 to IPv6 **Network Layer: Address mapping, Error Reporting, and Multicasting:** ARP, RARP, and ICMP. **Network Layer: Delivery, Forwarding & Routing:** Delivery, Forwarding: Routing Table, Unicast routing protocols: Distance vector routing [RIP Description], Link state routing [OSPF Description], Path vector routing [BGP Description].	

<table>
<tr><td colspan="3"></td></tr>
<tr><td colspan="2" align="center">Unit-IV</td><td>10 Hours</td></tr>
<tr><td colspan="3">Transport Layer: Process to Process Delivery: UDP: TCP: TCP services, TCP features, Segment, A TCP connection. SCTP: SCTP services, SCTP features, Packet format, An SCTP association.
Congestion Control and Quality of Service: Congestion control: Open loop congestion control and closed loop congestion control.
Application Layer: Domain Name System: Name Space, Domain Name Space, DNS In The Internet, Resolution.
Remote Logging, Electronic Mail and File Transfer: Remote logging: Telnet, Electronic mail: Architecture ,File Transfer: FTP</td></tr>
<tr><td>Text Book(s)</td><td>:</td><td>Data Communications and Networking Behrouz A. Forouzan, 4th Edition, Tata McGrawHill, 2006.
[Unit-I: Chapters 1, 2 ,7
Unit-II: Chapters 8, 10, 11
Unit-III: Chapters 19,20, 21,22
Unit-IV: Chapters 23, 24, 25 and 26]</td></tr>
<tr><td>Reference Books</td><td>:</td><td>1) Communication Networks –Fundamental Concepts and Key Architectures Alberto LeonGarcia and Indra Widjaja, 2 nd Edition, Tata McGrawHill, 2004.
2) Computer and Communication Networks Nader F. Mir, Pearson Education, 2007.
3) Data and Computer Communication William Stallings, 8 th Edition, Pearson Education, 2007.
4) Computer Networks – A Systems Approach Larry L. Peterson and Bruce S. David, 4th Edition, Elsevier, 2007.
5) Introduction to Data Communications and Networking – Wayne Tomasi, Pearson Education, 2005.</td></tr>
</table>

College Name	:	**Basaveshwar Engineering College (Autonomous), Bagalkot**
Department Name	:	**Information Science and Engineering**
Semester	:	**VII**
Subject	:	**Object Oriented Modeling and Design**
Subject code	:	**UIS710C**
Credits	:	**03**
Teaching Hours	:	**40**

UNIT - I

INTRODUCTION, MODELING CONCEPTS, CLASS MODELING: Object Orientation, OO development, OO themes; Evidence for usefulness of OO development; OO modeling history.

Modeling as Design Technique: Modeling; abstraction; the three models. Class Modeling: Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips. **Advanced Class Modeling:** Advanced object and class concepts; Association ends; N-Ary associations; Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages; Practical tips. **10 Hours**

UNIT - II

STATE MODELING, ADVANCED STATE MODELING, INTERACTION MODELING, PROCESS OVERVIEW:

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. **Advanced State Modeling:** Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models; Practical tips. **Interaction Modeling:** Use case models; Sequence models; Activity models. Use case relationships; Procedural sequence models; Special constructs for activity models. **10 Hours**

UNIT - III

SYSTEM CONCEPTION, DOMAIN ANALYSIS, APPLICATION ANALYSIS, AND SYSTEM DESIGN-1:

System Conception: Devising a system concept; Elaborating a concept; Preparing a problem statement.

Domain Analysis: Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. **Application Analysis:** Application interaction model; Application class model; Application state model; Adding operations. **System Design -1:** Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy. **10 Hours**

UNIT - IV

SYSTEM DESIGN-2, CLASS DESIGN, IMPLEMENTATION MODELING, AND DESIGN PATTERNS:

System Design -2: Handling boundary conditions; Setting the trade-off priorities; Common architectural styles; Architecture of the ATM system as the example. **Class Design:** Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recursing downwards, Refactoring; Design optimization; Reification of behavior; Adjustment of inheritance; Organizing a class design; ATM example. **Implementation Modeling:** Overview of implementation; Fine-tuning classes; Fine-tuning generalizations; Realizing associations; Testing. **10 Hours**

Text Books	:	1. Michael. Blaha, James. Rumbaugh **"Object-Oriented Modeling and Design with UML"**, 2nd Edition, Pearson Education, 2005.
Reference Books	:	1. **Ali. Bahrami, "Object Oriented Systems Development",** McGraw-Hill, 2008. 2. Grady. Booch **"Object-Oriented Analysis and Design with Applications",** 3rd Edition, Pearson, 2007. 3. Mark. Priestley, **"Practical Object-Oriented Design with UML"**, 2nd Edition, Tata McGraw-Hill, 2003.

UIS711C: SOFTWARE TESTING
3 CREDITS (3-0-0)

UNIT – I
10 Hours
Preliminaries **Software Testing:** Humans, Errors, And Testing, Software Quality, Requirements, Behavior And Correctness, Correctness Versus Reliability, Testing And Debugging, Test Metrics, Software Testing, Testing And Verification, Defect Management, Execution History, Test-Generation Strategies, Static Testing, Types Of Testing.
UNIT – II
10 Hours
Test Generation **Domain Partitioning:** Introduction, The Test-Selection Problem, Equivalence Partitioning, Boundary Value Analysis, Category-Partition Method. **Predicate Analysis**: Cause-Effect Graphing.
UNIT – III
10 Hours
Problems And Methods **Structural Testing:** Overview, Statement Testing, Branch Testing, Condition Testing, Path Testing, Procedure Call Testing, Comparing Structural Testing Criteria, The Infeasibility Problem. **Basic Techniques** **Dependence And Data Flow Models:** Definition-Use Pairs, Data Flow Analysis, Classic Analyses: Live And Avail, From Execution To Conservative Flow Analysis, Data Flow Analysis With Arrays And Pointers, Interprocedural Analysis. **Problems And Methods** **Data Flow Testing:** Overview, Definition-Use Associations, Data Flow Testing Criteria, Data Flow Coverage With Complex Structures, The Infeasibility Problem.
UNIT – IV
10 Hours
Problems And Methods **Test Case Selection And Adequacy:** Overview, Test Specifications And Cases, Adequacy Criteria, Comparing Criteria. **Process** **Integration And Component-Based Software Testing:** Overview, Integration Testing Strategies, Testing Components And Assemblies. **System, Acceptance And Regression Testing:** Overview, System Testing, Acceptance Testing, Usability, Regression Testing, Regression Test Selection Techniques, Test Case Prioritization And Selective Execution.
Text Book(s): 1) Aditya P. Mathur**, “FOUNDATIONS OF SOFTWARE TESTING”,** [Chapters or Topics: 1, 2], Pearson Education, 2008. 2) Mauro Pezze, Michal Young, “**SOFTWARE TESTING AND ANALYSIS Process Principles and Techniques”**, [Chapters or Topics: 6, 9, 12, 13, 20, 21, 22], Wiley India, 2008.
Reference Book(s): 1) Srinivasan Desikan, Gopalaswamy Ramesh, “**SOFTWARE TESTING PRINCIPLES AND PRACTICES”,** 2nd Edition, Pearson, 2007. 2) Ron Patton, “**SOFTWARE TESTING”**, 2nd edition, Pearson, 2004. 3) Brian Marrick, “**THE CRAFT OF SOFTWARE TESTING”**, Pearson, 1995.

College Name	:	**Basaveshwar Engineering College (Autonomous), Bagalkot**
Department Name	:	**Information Science and Engineering**
Semester	:	**VIII**
Subject	:	**MANAGEMENT AND ENTREPRENEURSHIP**
Subject code	:	**UIS514H**
Credits	:	**03 (3L-0P-0T)**
Teaching Hours		**40**

UNIT - I

INTRODUCTION:
Management: Science, Theory and Practice, Managing: Science or Art, The Functions of Managers, The Systems Model of Management, Management and Society, Social Responsibility and Ethics

PLANNING: The Nature and Purpose of Planning, Types of Plans, Steps in Planning, The Planning Process, Objectives: Management by Objectives, Strategies, Policies and Planning Premises, The strategic Planning Process, Effective Implementation of Strategies, Premising and Forecasting, Decision Making, Importance of Rational Decision making, Limitations of Rational Decision making, Types of Decision Making, Case Studies

ORGANIZING: The Nature and Purpose of Organizing, Formal and Informal Organization, Organizational Division, The Department, Organization Levels and span of management, The structure and process of Organizing, Effective Organizing, The Departmentation, Matrix Organization, Strategic Business Units, Line Staff Authority and Decentralization, Authority and Power, Line and Staff Concepts, Functional Authority, Decentralization of Authority, Delegation of Authority, Promoting an appropriate Organization Culture, Case Studies

10 Hrs

UNIT - II

STAFFING: The Systems Approach to HRM, An Overview of the staffing Function, Situational Factors affecting Staffing, Selection Process, Techniques and Instruments, Orienting and Socializing New Employees, Performance Appraisal and Career Strategy, Formulating the Career Strategy, Manager and Organization Development, Manager Development Process and Training, Case Studies

LEADING: Human Factors in Managing, Motivation and Motivators, Motivation Content and Process, Theories, Motivational Techniques, A systems and Contingency Approach to Motivation, Leadership, Ingredients of Leadership, Trait Approaches to Leadership, Leadership Behavior 10 Hrs

UNIT - III

COMMUNICATION: Communication: importance of communication, Purposes of Communication, Principles of effective communication, Communication networks in a working group, Checks on in-plant communication, Communication in Indian industries.

CONTROLLING: The System and Process of Controlling, Control as a feedback system, Feed Forward Control, Requirements for Effective Controls, Control Techniques, The Budget, Traditional Non-budgetary Control, Information Technology, Direct Control Vs Preventive Control, Case Studies10 Hrs

UNIT - IV

ENTREPRENEUR: Meaning of an Entrepreneur, Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneurs, Intrapreneur – an emerging class, Concept of Entrepreneurship, Steps in Entrepreneurial process, Role of Entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship: Barriers

PREPARATION OF PROJECT: Meaning of Project and, Project Identification / Project Selection, Project Report: Contents and Formulation, Identification of Business Opportunities, Project Appraisal, Market Feasibility Studies, Technical Feasibility Studies, Financial Feasibility Studies, Social Feasibility Studies.

INSTITUTIONAL SUPPORT: Different Schemes: TECSOK, KIADB, KSSIDC, KSIMC, DIC, Single window Agency:, MSME, NSIC, SIDBI, KSFC.

MICRO, SMALL & MEDIUM ENTERPRISES (MSME): Definition and Characteristics, Need and Rationale, Objectives and Scope, Role of MSME in Economic Development, Advantage of MSME, Steps to start an MSME Government Policy towards MSME, Impact of Liberalisation, Privatisation & Globalization on MSME, Effect of WTO, GATT 10 hrs

Text Books	:	1. Essentials of Management, Harold Koontz and Heinz Weihrich, TMH, 7th Edition. 2. Principles of Management, P C Tripathi and P N Reddy, The McGraw-Hill, 4^{th} Edition.
Reference Books	:	1. Entrepreneurship Development – Small Business Enterprises Poornima M Charantimath, 2. Management & Entrepreneurship – Ramesh Burbure

3rd Semester

Basaveshwar Engineering College (Autonomous), Department of Mechanical Engineering

Scheme Autonomous Syllabus (175 credits) 2020-21 (Regular) and 2021-22(Lateral) Batch

B.E. III SEMESTER

Sl. No	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME329C	Numerical Techniques & Fourier Series	3	3	-	-	50	50	100
02	UME311C	Material Science & Metallurgy	3	3	-	-	50	50	100
03	UME313C	Basic Thermodynamics	3	2	2	-	50	50	100
04	UME314C	Strength of Materials	3	2	2	-	50	50	100
05	UME312C	Foundry and Welding Tech	3	3	-	-	50	50	100
06	UME 3XXC	Theory of Machines	3	2	2	-	50	50	100
07	UME307L	Material Science & Material Testing Lab	1	-	-	2	50	50	100
08	UME310L	Mechanical Drawing Lab	1	-	-	2	50	50	100
09	UME308L	Foundry & Forging Lab	1	-	-	2	50	50	100
10	UMA 330 M	**Bridge Course Mathematics-I	-	3	-	-	50	50	100
11	UBT 133 M /UBT233 M	Environmental Studies	-	2	-	-	50	50	100
12	UHS388C / UHS389C	Samskruthika Kannada# or Balake Kannada$	1	2	0	0	50	50	**100**
	Total Credits :		**22**	**22**	**06**	**06**	**600**	**600**	**1200**

****Bridge Course Mathematics – I and Environmental Studies** are mandatory subject only for diploma students admitted to BE 3rd Semester through Lateral Entry scheme during 2021-22 onwards. Passing the subject is compulsory: however marks will not be considered for awarding grade/class. A PP/NP grade will be awarded for passing/not passing the subject respectively.

Note: Online course: (NPTEL / SWAYAM / COURSERA)

1. The course should be of minimum 04 weeks duration to earn 01 credit.
2. The Students has to qualify in MOOCs recommended course of total 03 credits during III/IV/V/VI semester and to be evaluated in VII Semester

Samskruthika Kannada : For the students who have studied the kannada in 10th standard

$ Balake Kannada : For the students who have no studied the kannada in 10th standard

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Numerical Techniques & Fourier Series			
Course Code	**UMA329 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	100
Credits	3-1-0	SEE Exam Hours	03

Unit-I

Numerical Analysis-I: **10 Hours**

Introduction to root finding problems, Newton-Raphson method. Finite differences, forward and backward difference operators (no derivations on relations between operators) Newton-Gregory forward and backward interpolation formulae. (Without proof), Lagrange's and Newton's divided difference interpolation formulae (without proof) Numerical differentiation using Newton's forward and backward formulae-problems.

Unit-II

Numerical analysis-II: **10 Hours**

Numerical Integration: Simpson's one third rule, Simpson's three eighth rule (no derivation of any formulae)-problems. Numerical solution of ODE and PDE: Euler's and Modified Euler's method, Runge-Kutta 4th order method, Numerical solutions of one-dimensional heat and wave equations by explicit method, Laplace equation by using five point formula.

Unit-III

Fourier series: **10 Hours**

Periodic functions, Conditions for Fourier series expansions, Fourier series expansion of continuous and functions having finite number of discontinuities, even and odd functions. Half-range series, practical harmonic analysis.

Unit-IV

Fourier transforms: **10 Hours**

Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms. Inverse Fourier sine and cosine transforms.

Total: 40 Hours

Assignment Test for 5 Marks: Ten objective type questions can be prepared from entire Syllabus

Course outcomes:

On the successful completion of this course, students are able

CO1	The ability to solve engineering problems using non-linear equations and interpolation techniques.
CO2	The ability to solve problems using numerical differentiation
CO3	Be capable to perform numerical integration and solutions of ordinary differential equations
CO4	Fourier analysis provides a set of mathematical tools which enable the engineer to break down a wave into its various frequency components. It is then possible predict the effect of a particular waveform.
CO5	It is essential to understand the basic concepts of Fourier transforms to solve ordinary differential equation and pde

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Reference Books				
1	Numerical Methods for Engineers	Steven C Chapra& Raymond P Canale		
2	Higher Engineering Mathematics	Dr. B.S. Grewal	Khanna Publishers, New Delhi	
3	Advanced Engineering Mathematics	H. K. Das	S. Chand & company Ltd, New Delhi	
4	Advanced Engineering Mathematics	E Kreyszig	John Wiley & Sons	

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Material Science & Metallurgy			
Course Code	**UMA311 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	100
Credits	3	SEE Exam Hours	03

Unit –I

Structure of Crystalline Solids: **10 Hours**

Fundaments concepts of unit cell, space lattice, Bravaias space lattices, unit cells for cubic structure and HCP, coordination numbers and atomic packing factor for different cubic structures. Crystal imperfections – point, line, surface and volume defects. Diffusion mechanism, Fick's laws of diffusion.
Concepts of stress and strain, tensile properties, Impact test of materials, Hardness – Rockwell, Vickers and Brinell hardness testing. Plastic deformation.

Unit -II

Fatigue, Creep and Fracture **10 Hours**

Fatigue: fracture tests, S-N curves, factors affecting fatigue life and protection methods. Creep: the creep curves, mechanism of creep, creep resistant materials. Types, stages in cup and cone fracture.

Solid solutions:

Types, rules of governing the formation of solid solutions. Phase diagrams: basic terms, Gibbs phase rules, cooling curves, construction of phase diagrams, interpretation of equilibrium diagrams (use of tie line and Lever rule), types of phase diagrams (Eutectic systems, peritectic, eutectoid, peritectoid reactions).

Unit -III

Equilibrium phase Diagrams: **10 Hours**

Iron – iron carbide equilibrium phase diagram, phases in $Fe\text{-}Fe_3C$ system, invariant reactions, microstructure of slowly cooled steels, effect of alloying elements on $Fe\text{-}Fe_3C$ diagram. The TTT diagrams, drawing of TTT diagrams, TTT diagrams for eutectoid steels, effect of alloying elements.

Heat Treatment:

Annealing, normalizing, hardening, Induction hardening, harden ability, Jominy end-quench test.

Unit –IV

Engineering Alloys: **09 Hours**

Properties, composition and uses of low carbon, mild medium and high carbon steels, cast Irons, gray CI, white CI, malleable CI, SG iron. The light alloys, Al and Mg and Titanium alloys. Copper and its alloys: brasses and bronzes.

Corrosion:

Corrosion and its prevention: Galvanic cell, the electrode potentials, polarization, passivation. General methods of corrosion prevention by alloying, stress corrosion cracking.

Assignment:

Course Outcomes: At the end of the course, the students will be able to:

CO1 : Gain understanding of the relationships between the structures, properties and applications of various engineering material and understand various mechanical properties of materials.

CO2 : Gain the knowledge of various modes of failure of materials, also to understand and interpret solid solution and various phase diagrams

CO3 : Gain the knowledge of $Fe\text{-}Fe_3C$ equilibrium phase diagrams and to understand various heat treatment processes and their applications.

CO4 : Understand the composition and properties of various engineering alloys. Understand the process of corrosion, its causes and preventive methods.

Question paper pattern for SEE:

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Materials Science & Engineering- An Introduction	William D.Callister Jr.	Jr. Wiley India Pvt. Ltd.	6th Edition 2006, New Delhi
2	Essentials of Materials For Science And Engineering	Donald R. Askeland, Pradeep P.Phule	Thomson Engineering	2006
Reference Books				
1	Introduction to Material Science for Engineering	James F. Shackel ford	Pearson, Prentice Hall, New Jersy	**2006**
2	Physical Metallurgy, Principles & Practices	V Raghavan	PHI	2nd Edition 2006, New Delhi
3	Foundation of Material Science and Engineering	Smith	McGraw Hill	3rd Edition 1997

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Foundry & Welding Technology			
Course Code	**UME 312 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	100
Credits	3	SEE Exam Hours	03

UNIT - I

Introduction: **10 Hours**

Concept of Manufacturing process, its importance. Classification of Manufacturing processes. Introduction to Casting process steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance. Classification of patterns.

Binder: Definition, Types of binder used in mouldingsand.**Additives**: Need, Types of additives used.

Sand Moulding : Types of base sand, requirement of base sand. Types of sand moulds.Moulding sand mixture ingredients (base sand, binder & additives. Method used for sand moulding.

Cores: Definition, Need, Types. Method of making cores, Binders used. Concept of Gating &Risering. Casting defects causes, features and remedies.

UNIT - II

SPECIAL MOULDING PROCESSES :10 Hours

Study of important moulding processes:

Green sand, Core sand, Dry sand, Sweep mould, CO2 mould, Shell mould, Investment mould& Full mould.

Metal moulds: Gravity die-casting, Pressure die casting, centrifugal casting, Squeeze Casting, Slush casting and continuous casting processes

UNIT - III

WELDING **11 Hours**

Welding process: Definition, Principles, Classification, Application, Advantages & limitations of welding.

Arc Welding: Principle, Metal Arc welding **(MAW)**, Flux Shielded Metal Arc Welding **(FSMAW)**, Inert Gas Welding **(TIG & MIG)** Submerged Arc Welding **(SAW)** and Atomic Hydrogen Welding processes. **(AHW)**

Gas Welding: Principle, Oxy – Acetylene welding, Reaction in Gas welding, Flame characteristics, Gas torch construction & working. Forward and backward welding.

Special type of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

UNIT - IV

METALLURGICAL ASPECTS IN WELDING **08 Hours**

Structure of welds, Formation of different zones during welding. Heat affected zone (HAZ). Concept of electrodes, Filler rod and fluxes. Welding defects – Detection causes & remedy.

Inspection Methods – Types of inspection .NDT inspection (Advnatges) Methods used for Inspection of casting and welding. Visual, Magneticparticle, Fluorescent particle, Ultrasonic, Radiography inspection

Assignment: A set of questions covering whole syllabus will be given to the students. The students will answer to all the questions in the assignment booklet and submit.

Course Outcomes: At the end of the course, the students will be able to:

CO1 : Select suitable manufacturing processes to manufacture the products optimally

CO2 : Explain the technology, variables and complexity involved in producing a casting.

CO3 : Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application

CO4 : Interpret metallurgical aspects in welding, inspection methods for the quality assurance of components made of casting and welding process

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Manufacturing & Technology	P.N.Rao	Tata McGraw Hill	2nd Edition 2003
2	Manufacturing-I	Dr.K.Radhakrishna	Sapna Book House	5th Edition 2006
Reference Books				
1	Manufacturing Technology	Serope and Kalpakjain	Pearson Education Asia	5th Edition 2006
2	Process and Materials of Manufacturing	Roy A Lindberg	Pearson Education	4th Edition 2006.

B. E. MECHANICAL ENGINEERING SEMESTER -III			
BASIC THERMODYNAMICS			
Course Code	**UME 313 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	100
Credits	3-1-0	SEE Exam Hours	03

UNIT – I

Work & Heat: Definition of work-according to mechanics, according to thermodynamics, examples, sign convention; Displacement work- PdV expressions for displacement work in various processes through p-v diagrams, Other types of work – shaft work, paddle wheel work, working straining a bar, free expansion work, electrical work; Heat- definition, units and sign convention; Comparison and differences between work and heat, Numerical Problems

First Law of Thermodynamics: Joule's experiments; Statement of the First law of thermodynamics-cyclic, non-cyclic processes; Energy- modes of energy, internal energy, internal energy as a property; Specific heat- at constant volume, at constant pressure; Enthalpy; Extension of the First law to control volume- steady state-steady flow energy equation, important applications with line diagram, Numerical Problems.

UNIT- II

Second Law of Thermodynamics: Energy- High grade, low grade; Heat reservoirs-heat source and heat sink; Heat engines-definition, schematic representation, thermal efficiency; Reversed heat engines-refrigerator, heat pump, COP; Second Law of Thermodynamics- Kelvin -Planck statement, PMM II, Clasius's statement; Equivalence of the two statements; Reversible and irreversible process – definition, factor that make a process reversible and irreversible; Carnot cycle- processes involved in Carnot cycle, PV, TS and line diagram; Carnot principles; Thermodynamic temperature scale. Numerical Problem.

Entropy: Carnot theorem; Clausius theorem; Entropy – property of a system; Clausius inequality-statement, proof, application to a reversible cycle; Entropy change of an irreversible process of a closed system; Principle of increase of entropy; Calculation of entropy using TdS relations, simple problems based on processes.

UNIT – III

Pure substances: Pure substances-definition, examples, PT and PV diagrams, triple point, critical points, sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapor, saturated vapor and superheated vapour states of a pure substance with water as example; Enthalpy- sensible, latent, total, super heat; Dryness factor (quality); TS and HS diagrams and representation of various processes on these diagrams, Separating and throttling calorimeter- description, line diagram. Numerical Problems.

UNIT - IV

Real gases: Introduction; Van der Waal's Equation; Van der Waal's constants in terms of critical properties; Reduced properties; Van der Waal's equation in terms of reduced properties; Compressibility factor; Generalized compressibility chart; Principles of corresponding states, Numerical Problems.

Ideal gases: Equation of state; Internal energy and enthalpy as functions of temperature only; Universal and particular gas constants; Evaluation of heat, work, change in internal energy, enthalpy and entropy in various quasi-static processes; Ideal gas mixture-mass fractions, mole fractions, molecular weight of the mixture of ideal gases, Dalton's law of additive pressures, Amagat's law of additive volumes, evaluation of properties, Numerical Problems.

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define the concepts of heat, work, and energy, develop/analyze energy application device Demonstrate a basic understanding of the First Law of Thermodynamics for energy conservation analysis of different thermodynamics processes of systems and control volumes and to estimate required balances of heat, work and energy flow (heaters, coolers, pumps, turbines, pistons, etc.).

CO2 Demonstrate a basic knowledge of the Second Law of Thermodynamics and its corollaries to determine whether a cycle is possible, and to determine the maximum performance/efficiency of cycles and its application to systems and control volumes. Use second Law of Thermodynamics for entropy balance analysis of different Thermodynamics processes of systems and control volume to solve problems in thermodynamics.

CO3 Use steam tables, equations, and charts, in evaluation of thermodynamic properties, calculate energy/enthalpy required for a particular application (boilers, heat exchangers, etc).

CO4 Use real / ideal gas equations/ charts/tables to calculate change in properties of the systems in case of single fluid and mixture of fluids.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Basic Thermodynamics	B.K.Venkanna&Swati.B. Wadawadagi	PHI New Delhi	Any edition
2	Thermodynamics – AEngineering Approach	Yunus, A.Cenegal and Michael A.Boles	Tata McGraw Hill Pub. Co., 2002	
Reference Books				
1	Advanced Engineering Thermodynamics	Adrian Bejan	John wiely	3rd Edition
2	Engineering Thermodynamics	Nihal E.Wijeysundera	World Scientific	2nd Edition
3	Classical Thermodynamics		WielyEstern	2nd Edition
Data Hand Book:				
[1] Thermodynamic data handbook by Nijaguna&Samaga				
[2] Refrigeration and Air conditioning data hand book				

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Strength of Materials			
Course Code	**UMA314 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	100
Credits	3-1-0	SEE Exam Hours	03

UNIT I

Simple stress and strain: **10 Hours**

Introduction, stress, strain, mechanical properties of materials, Linear elasticity, Hooke's Law and Poisson's ratio, Stress-Strain relation – behavior in Tension for Mild steel and non ferrous metals. Extension / Shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular), Elongation due to self weight, Principle of super position.

Stress in composite section: Volumetric strain, expression for volumetric strain, elastic constants, simple shear stress, shear strain, temperature stresses (including compound bars).

UNIT II

Compound stresses: **10 Hours**

Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle (introduction).

Thick and thin cylinders: Stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation), (compound cylinders not included).

UNIT III

Bending moment and Shear force in beams: **09 Hours**

Introduction, Types of beams, loads and reactions, shear forces and bending moments, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (udl) and couple for different types of beams.

Bending and shear stresses in beams: Introduction, theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, shear streses, symmetrical I and T sections.

UNIT IV

Deflection of beams: **10 Hours**

Introduction, differential equation for deflection, equations for deflections-Cantilever subjected to concentrated load at free end,udl,simply supported beam subjected to point load at mid-span.UDL.

Torsion of circular shafts and Elastic stability of columns: Introduction, pure torsion, assumptions, derivation of torsional equations, polar modulus, torsional rigidity / stiffness of shafts, power transmitted by solid and hollow circular shafts.

Introduction to columns, Euler's theory for axially loaded elastic long columns, derivation of Euler's load for various end conditions, limitations of Euler's theory, Rankine's formula.

Assignment:

Course Outcomes: At the end of the course, the student will be able to:

CO1 To be able to understand the different types of physical loads, properties of the materials, such as stresses, strains, elasticity, deformation for varying cross section, compound bars, self-weight and thermal stresses.

CO2 Analyze the compound stresses analytically ,and graphically and cylinders exposed to internal and external pressures from the view point of stresses developed and change in their dimensions

CO3 To be able to understand the shear force and bending moment and estimate bending of beams of subjected to different loads with different end conditions of beams. Analyze the bending and shear stresses for different cross sections.

CO4 To be able to understand the concept torque, stresses developed and the rigidity of the mechanical elements transmitting power or subjected to twisting moment.columns with different end conditions subjected to axial loading and

Question paper pattern:

1. Total of Eigh,t question with two from each unit to be set uniformly covering the entire Syllabus.
2. Each question should not have more than four sub division.
3. Any Five full questions choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Mechanics of Materials	K.V. Rao, G.C. Raju		First Edition,2007
2	Mechanics of materials	James M. Gere	Thomson	Fifth edition 2004
3	Mechanics of materials	Ferdinand Beer & Russell Johnstan	TATA MaGrawHill	2003
4	Mechanics of materials	H. J.Sawant	Technical publications	2010
Reference Books				
1	Strength of Materials	S.S.Bhavikatti	Vikas publications House – Pvt. Ltd.	2nd Ed., 2006
2	Mechanics of materials	R. C. Hibbeler	Printice Hall, Pearson Edu	2005
3	strength of material	Dr.R.K.Bansal	Laxmi publications	Fourth edition 2010

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Theory of Machines			
Course Code	**UMA316 C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:2:0	SEE Marks	100
Credits	3-1-0	SEE Exam Hours	03

UNIT – I

Introduction:6 Hours

DEFINITIONS: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine. kinematic chains and inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain.

MECHANISMS: 7 Hours

Quick return motion mechanisms -Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms – Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

UNIT- II

STATIC FORCE ANALYSIS: 6 Hours

Introduction: Static Equilibrium. Equilibrium of Two and Three Force Members. Members with Two Forces and Torque, Free Body Diagrams, Principle of Virtual Work. Static Force Analysis of Four Bar Mechanism and Slider-Crank Mechanism with and without friction.

BALANCING OF ROTATING MASSES: 8 Hours

Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses by Balancing Masses in Same plane and in Different planes.

UNIT - III

GOVERNORS: 6 Hours

Types of Governors: Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power

GYROSCOPE: 6 Hours

Vectorial Representation of Angular Motion, Gyroscopic Couple. Effect of Gyroscopic Couple on Ship, Plane Disc, Aeroplane, Stability of Two Wheelers and Four Wheelers.

UNIT - IV

GEAR TRAINS: 6 Hours

Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.

CAMS: 7 Hours

Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife -edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.

Assignment: Quiz of 25 questions and MCQ Type

Course Outcomes: At the end of the course, the student will be able to:

CO1 Construct/Compose mechanisms to provide specific motion.
CO2 To understand forces acting on the mechanisms.
CO3 To analyze the effect of a gyroscopic couple on Ship, Aeroplan and an Automobile.
CO4 To understand gears & gear trains and construct cam profile for the specific follower motion.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Theory of Machines	Rattan S. S	McGraw-Hill Education	2nd edition, 2005.
2	Theory of Machines	Sadhu Singh	Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi	2nd edition, 2006.
Reference Books				
1	Theory of Machines & Mechanisms	Shigley. J. V. and Uickers, J.J	OXFORD University press.	3rd edition 2004
2	Theory of Machines	Robert L. Norton	McGraw-Hill Higher Education	3rd edition 2006

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Material Science and Material Testing Lab			
Course Code	**UMA307L**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**0-0-2**	SEE Marks	100
Credits	**01**	SEE Exam Hours	03

PART – A

1. Impact Test (Charpy)
2. Impact Test (Izod)
3. Brinnell Hardness Test
4. Vickers Hardness Test
5. Rockwell Hardness Test

PART - B

1. Tensile test using UTM
2. Compression Test using UTM
3. Bending Test using UTM
4. Shear Test using UTM
5. Preparation of samples for micro structural analysis (Demonstration)

* All test as per ASTM standards

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3. For remaining 20 marks one practical test to be conducted

The SEE practical is conducted for 50 marks two question to be set from each Part A, and Part B. for 20 marks each and 10 marks Viva voce.

CO1 :
CO2 :
CO3 :
CO4 :

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Mechanical Drawing Lab			
Course Code	**UMA310L**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**0-0-2**	SEE Marks	100
Credits	**01**	SEE Exam Hours	03

Part – A

Drafting overview

Scales (Enlarging and Reducing BIS Code of engineering)
Dimensioning and tolerance
Surface finish
Conventions, abbreviations and symbols
Orthographic conversion (Miscellaneous Problems)
Component drawing reading 3 examples

PART – B

Assembly

Valves (Any two), using drafter
Free hand sketching of the following
Valve gear mechanism
Automobile parts- Carburetor, Fuel pump, differential, power transmission, steering system, braking system, Clutches, Gear Box

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3. For remaining 20 marks one practical test to be conducted

The SEE practical is conducted for 50 marks two question to be set from each Part A, and Part B. for 20 marks each and 10 marks Viva voce.

CO1 :
CO2 :
CO3 :
CO4 :

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Foundry and Forging Lab			
Course Code	**UMA308L**	CIE Marks	50
Teaching Hours/Week (L:T:P)	**0-0-2**	SEE Marks	100
Credits	**01**	SEE Exam Hours	03

Part – A

1. Testing of Molding sand and Cores and Preparation of sand specimens and conduction of the following tests:

1. Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. Permeability test
3. Core hardness &Mould hardness tests.
4. Grain fineness number test (Sieve Analysis test)
5. Clay content test.
6. Moisture content test.

Shatter index

PART B

2. Foundry Practice

Use of foundry tools and other equipments. Preparation of moulds using two moulding boxes using patterns or without patterns. (Split pattern, Match plate pattern and Core boxes). Preparation of one casting (Aluminum or cast iron-Demonstration only)

PART C

3. Forging Operations

Preparing minimum three forged models involving upsetting, drawing and bending operations. Estimation of length of the raw material. Out of these three models, at least one model is to be prepared by using Power Hammer.

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE and 50 SEE).
2. The CIE in laboratory in classes is carried out for 50 marks (30 marks for the performance and term work)
3. For remaining 20 marks one practical test to be conducted

The SEE practical is conducted for 50 marks two question to be set from each Part A, and Part B. for 20 marks each and 10 marks Viva voce.

CO1 :
CO2 :
CO3 :
CO4 :

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Bridge Course Mathematics - I			
Course Code	**UMA330M**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3-0-0	SEE Marks	100
Credits	**03**	SEE Exam Hours	03

Differential Calculus: **15 Hours**

Review of elementary calculus, Polar curves - angle between the radius vector and tangent, angle between two curves, pedal equation. Taylor's and Maclaurin's series expansions for one variable (statements only)without proof. problems

Partial differentiation : Introduction to function of several variables, Partial derivatives; Euler's theorem - problems. Total derivatives-differentiation of composite functions. Jacobians-problems,

Integral Calculus: **15 Hours**

Reduction formula $\int \sin^n xdx$, $\int \cos^n xdx$, $\int \tan^n xdx$ and $\int \sin^n x \cos^n xdx$. Evaluation of double and triple integrals. Area bounded by the curve.

Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.

Vector Calculus: **10 Hours**

Vector Differentiation: Scalar and vector fields**.** Gradient, directional derivative; curl anddivergence-physical interpretation; solenoidal and irrotational vector fields- problems

Question paper pattern for SEE

1. Total of eight questions uniformly covering the entire syllabus.
2. Each question should not have more than four subdivisions.
3. Any five full questions are to be answered

Course Outcomes: On completion of this course, students are able to:

CO1 : Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2 : Learn the notion of partial differentiation to calculate rates of change of multivariate functions and solve problems related to composite functions and Jacobians.

CO3 : Apply the concept of multiple integrals and their usage in computing the area and volumes

CO4 : Apply the knowledge of vector calculus to solve the engineering problems

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Environmental Studies			
Course Code	**UBT133M**	CIE Marks	50
Teaching Hours/Week (L:T:P)		SEE Marks	100
Credits		SEE Exam Hours	03

B. E. MECHANICAL ENGINEERING SEMESTER -III			
Adalita Kannada (AK) / Vyavaharika Kannada (VK)			
Course Code	UHS389C/UHS489C	CIE Marks	50
Teaching Hours/Week (L:T:P)	2-0-0	SEE Marks	100
Credits	**1**	SEE Exam Hours	03

Balake Kannada

Unit – I

Listening and Hearing **06 Hrs**
Introduction: Activity -I

- Easy learning of a Kannada Language: A few tips
- Necessity of learning a local language:
- Tips to learn the language with easy methods.
- Hints for correct and polite conservation
- About Kannada Language (Kannada Bhashe)
- Eight Kannada authors who have won 'Jnanpith Award'
- Information about Karnataka State

Kelisikolluvudu mattu Alisuvudu: Activity -II

Listening to Kannada words and Sentences through different types of communications of day to day affairs. [Conversations in Kannada – Kannada Bhasheyalli Sambhashanegalu]

Conversation with
- With Friends – Snehitharodane-(ಸ್ನೇಹಿತರೊಡನೆ)
- With Teachers- (ಗುರುಗಳೊಡನೆ)
- In Shop, Market, Bus and Train(ಅಂಗಡಿ, ಮಾರುಕಟ್ಟೆ, ಬಸ್, ರೈಲು)
- In Hotel / Canteen(ಹೊಟೆಲ್/ಕ್ಯಾಂಟೀನ್‌ನಲ್ಲಿ)
- With Dependents(ಅವಲಂಬಿತರೊಡನೆ)
- In Hostel with Friends, Warden, Cooks and Security(ಹಾಸ್ಟೆಲ್‌ನಲ್ಲಿ)
- Vocabulary - Shabdakosha–ಶಬ್ದಕೋಶ
- Conversation - Sambhashane– ಸಂಭಾಷಣೆ- 1 (about City)
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-2(between Friends)
- Excersises to test their knowledge of understanding the Language.

Conversation with Teacher, House Owner and Roommate
- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ- 1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2(With House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ- 3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - III - Conversation with

- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2 (with House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Activity - IV - Conversation with

- Vocabulary - Shabdakosha –ಶಬ್ದಕೋಶ
- Conversation - Sambhashane–ಸಂಭಾಷಣೆ-1 (with Teacher)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-2 (with House Owner)
- Conversation-Sambhashane–ಸಂಭಾಷಣೆ-3 (with Roommate)
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation

Unit – II

Speaking and Asking **06Hrs**
Maatanaadhuvudu mattu Keluvudu –ಮಾತನಾಡುವುದು ಮತ್ತು ಕೇಳುವುದು

[Kannada Words and Sentences in Conversation - Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu - ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡದ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು]

In Speaking / Asking -Sambhashaneyalli–ಸಂಭಾಷಣೆಯಲ್ಲಿ

- Nouns - Naamapadagalu– ನಾಮಪದಗಳು
- Pronouns – Sarvanamapadagalu– ಸರ್ವನಾಮಪದಗಳು
- Adjectives – namavisheshanagalu - ನಾಮ ವಿಶೇಷಣಗಳು
- Verbs- Kriyapadagalu– ಕ್ರಿಯಾಪದಗಳು
- Adverbs - kriya visheshanagalu–ಕ್ರಿಯಾ ವಿಶೇಷಣಗಳು
- Conjunctions - Samyogagalu–ಸಂಯೋಗಗಳು
- Prepositions - Upasarga– ಉಪಸರ್ಗಗಳು
- Interrogative words and Sentences in Conversation – Sambhashaneyalli Prashnarthaka padagalu mattu vakyagalu–ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು
- Vicharaneya/ Vicharisuva / Bedikeyavakyagalu (Enquiry / Request sentences in Conversation) - ವಿಚಾರಣೆಯ / ವಿಚಾರಿಸುವ / ಬೇಡಿಕೆಯ ವಾಕ್ಯಗಳು
- Excersises to test their knowledge of understanding the Kannada Wards and Sentenses in Conversation.

UNIT III

Reading – Ooduvudu – ಓದುವುದು **07Hrs**

Kannada Wards and Sentenses in General Reading and Conversation-Samanya Sambhashaneyalli Kannadada Padagalu mattu Vakyagalu -ಸಂಭಾಷಣೆಯಲ್ಲಿ ಕನ್ನಡದ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು)

- Singular and Plural nouns in Conversation- SambhashaneyalliEkaavachana mattu Bhahuvachana - ಏಕವಚನ ಮತ್ತು ಬಹುವಚನ
- Gender in Conversation - Sambhashaneyalli Linga– ಲಿಂಗ
- Viruddha padagalu /Virodarthaka padagalu (Antonyms)–

ವಿರುದ್ದ / ವಿರೋದಾರ್ಥಕ ಪದಗಳು.

- AsamanjasaUchcharane (Inappropriate Pronounciation) – ಅಸಮಂಜಸಉಚ್ಚಾರಣೆ
- SankhyaVyavasthe (Numbers system)- ಸಂಖ್ಯಾ ವ್ಯವಸ್ಥೆ
- Bhinnamshagalu (Fractions) –ಭಿನ್ನಾಂಶಗಳು
- Tindiya Hesarugalu/ Belagina upaharagala Hesarugalu - Menu (Names) of the breakfast Items – ತಿಂಡಿಯ ಹೆಸರುಗಳು
- Aaharakke sambandhisida padagalu / Aahara padarthagala Hesarugalu– (Names connected with food) –ಆಹಾರಕ್ಕೆ ಸಂಬಂದಿಸಿದ ಪದಗಳು.
- Samaya / Kalakke Sambhandhisida padhagalu (Words Relating to Time)– ಸಮಯ / ಕಾಲಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Dikkugalige sambhadisida padhagalu (Words Relating to Directions) – ದಿಕ್ಕಿಗೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Manavana Bhavanegalige sambandisida Padagalu (Words Relating to Human's feelings and Emotions) –ಮಾನವನ ಭಾವನೆಗಳಿಗೆ ಸಂಬಂಧಿಸಿದ ಪದಗಳು
- Manavana shareerada bhagagalu / Angagalu (Parts of the Human body)- ಮಾನವನ ಶರೀರದ ಭಾಗಗಳು / ಅಂಗಗಳು
- Manava Sambhandhada / Sambhandhaakke sambhadisida padhagalu (Terms Relating to Human Relationship)- ಮಾನವ್ ಸಂಬಂದಕ್ಕೆ ಸಂಬಂಧಿಸಿದಂತಹ ಪದಗಳು
- Vaasada sstalakke sambhandisidanthaha padhagalu (Words Relating to Place of Living) -ವಾಸದ ಸ್ಥಳಕ್ಕೆ ಸಂಬಂದಿಸಿದಂತಹ ಪದಗಳು
- Saamanya Sambhashaneyalli Bhalasuvanthaha Padagala Patti (List of Words, used in the general conversation) – ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಯಲ್ಲಿ ಬಳಸುವಂತಹ ಪದಗಳ ಪಟ್ಟಿ
- Additional Excersises to test their knowledge of understanding the Kannada words and sentences in their communication.

UNIT IV

Writing – Bareyuvudu – ಬರೆಯುವುದು **07Hrs**

Kannada Alphabets and their Pronunciation –
Kannada AksharaMale mattu uchcharane –
ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ ಹಾಗೂ ಉಚ್ಚಾರಣೆ ಕನ್ನಡ ಅಕ್ಷರಾಭ್ಯಾಸ

- Kannada Aksharamale (ಕನ್ನಡ ಅಕ್ಷರಮಾಲೆ)
- Kannada stress letters - vattakshara (also often written as Ottakashara)
- Kannada khaghunitha (Pronounced as ka-gunitha)
- Excersises to test their knowledge of understanding the Kannada words.
- Pronunciation (Uchcharane), Memorisation and usage of the Kannada Letters
- VargeeyaVyanjanagalaUchcharane (Pronounciation of Structured Consonants) AvargeeyaVyanjanagalaUchcharane (Pronounciation of Unstructured Consonants) Excersises to test their knowledge of understanding the Kannada words.
- Excersises to test their knowledge of understanding the Kannada alphabets.
- Additional Excersises to test their knowledge of understanding the Kannada alphabets.

ಒಟ್ಟು: 26 ಗಂಟೆಗಳು

ಪಠ್ಯಪುಸ್ತಕ:

ಬಳಕೆ ಕನ್ನಡ (ಸಂ), ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೊ. ವಿ. ಕೇಶವಮೂರ್ತಿ, Prasarang, VTU, Belagavi, Karnataka 2020.

Samskrutika Kannada

1 Credit (2-0-0)

(AU,BT,CV,IP,ME,CS,EC,EE,EI,IS,AIML BRANCHES)

ಕೋರ್ಸ್ ಉದ್ದೇಶಗಳು:

1 'ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ' ಪಠ್ಯದ ಮೂಲಕ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಭಾಷೆ, ಮತ್ತುಕನ್ನಡಿಗರ ಸಾಂಸ್ಕೃತಿಕ ಬದುಕಿನ ಬಗೆಗೆ ಅರಿವು ಮೂಡಿಸುವುದು.

2 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆ ಹಾಗೂ ಅದಕ್ಕೆ ಪೂರಕವಾಗಿರುವ ಕನ್ನಡ ವ್ಯಾಕರಣಾಂಶಗಳ ಬಗೆಗೆ ಅರುವು ಮೂಡಿಸುವುದು. ಪ್ರಾದೇಶಿಕ ಭಾಷೆಯಲ್ಲಿಅರ್ಜಿ ಮತ್ತು ಪತ್ರವ್ಯವಹಾರಗಳನ್ನು ಸಮರ್ಥವಾಗಿ ನಿರ್ವಹಿಸಲು ಪ್ರೇರೇಪಿಸುವುದು. .

3 ತಂತ್ರಿಕಅಧ್ಯಯನದ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಕನ್ನಡ ಭಾಷೆಯ ಬರವಣಿಗೆ ಮತ್ತು ಬರವಣಿಗೆಯಲ್ಲಾಗುವ ದೋಷಗಳನ್ನು ಗುರುತಿಸುವ ಸಾಮರ್ಥ್ಯವನ್ನು ನೀಡುವುದು.

4 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಅಡಗಿರುವ ಸೂಪ್ತ ಪ್ರತಿಭೆಯನ್ನು ಅನಾವರಣಗೊಳಿಸುವ ನಿಟ್ಟಿನಲ್ಲಿಅವರಲ್ಲಿ ಕಲೆ, ಬರವಣಿಗೆ ಮತ್ತು ಭಾಷಾಂತರಕಲೆಯಲ್ಲಿಆಸಕ್ತಿಯನ್ನು ಕೆರಳಿಸುವುದು.ಎಲ್ಲಕ್ಕೂ ಮೇಲಾಗಿ ಮಾನವೀಯ ಮೌಲ್ಯಗಳೊಂದಿಗೆ ಸರ್ವಾಂಗೀಣವಾಗಿ ಸಂವರ್ಧನೆಗೊಳಿಸಿ ಅವರನ್ನುರಾಷ್ಟ್ರದಅಮೂಲ್ಯ ಸಂತ್ತನ್ನಾಗಿ ರೂಪಿಸಿಸುವುದು.

ಭಾಗ: I ಕನ್ನಡ ನಾಡು, ನುಡಿ, ಸಂಸ್ಕೃತಿ ಮತ್ತು ವ್ಯಕ್ತಿಚಿತ್ರಣ **ಅವಧಿ: 6 ಗಂಟೆ**

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕಏಕೀಕರಣ :ಒಂದುಅಪೂರ್ವಚರಿತ್ರೆ– ಜಿ.ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಕನ್ನಡ ಭಾಷೆ ಮತ್ತುಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ– ವಿತಾವಿ
4. ಡಾ.ಸರ್.ಎಂ.ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತುಐತಿಹ್ಯ– ಎ.ಎನ್.ಮೂರ್ತಿರಾವ್

ಭಾಗ: II ಕಥೆ, ಪ್ರವಾಸಕಥೆ ಮತ್ತುಕರಕುಶಲ ಕಲೆ **ಅವಧಿ: 6 ಗಂಟೆ**

1. ಯುಗಾದಿ – ವಸುಧೇಂದ್ರ
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ – ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ
3. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ–ಕರಿಗೌಡ ಬೀಚನಹಳ್ಳಿ

ಭಾಗ: III ಕಾವ್ಯ **ಅವಧಿ: 7ಗಂಟೆ**

1. ವಚನಗಳು – ಬಸವಣ್ಣ, ಅಲ್ಲಮಪ್ರಭು, ಅಕ್ಕಮಹಾದೇವಿ
2. ಕೀರ್ತನೆಗಳು – ಪುರಂದರದಾಸರು, ಕನಕದಾಸರು
3. ತತ್ವಪದಗಳು – ಶಿಶುನಾಳ ಶರೀಫರು, ಬಾಲಲೀಲಾ ಮಹಾಂತ ಶಿವಯೋಗಿಗಳು
4. ಜನಪದಗೀತೆ, 5. ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗ –ಡಿವಿಜಿ
6. ಬೆಳಗು – ಅಂಬಿಕಾತನಯದತ್ತ, 7.ಅನಿಕೇತನ – ಕುವೆಂಪು

ಭಾಗ: IV ಕಾವ್ಯ, ವಿಜ್ಞಾನ ಮತ್ತುತಂತ್ರಜ್ಞಾನ **ಅವಧಿ: 7ಗಂಟೆ**

ಕಾವ್ಯ

1. ಹೆಂಡತಿಯಕಾಗದ – ಕೆ.ಎಸ್.ನರಸಿಂಹಸ್ವಾಮಿ
2. ಮುಂಬೈ ಜಾತಕ–ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ
3. ಆ ಮರ ಈ ಮರ–ಚಂದ್ರಶೇಖರಕಂಬಾರ
4. ಚೋಮನ ಮಕ್ಕಳ ಹಾಡು – ಸಿದ್ಧಲಿಂಗಯ್ಯ

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ

1. 'ಕ' ಮತ್ತು 'ಬ' ಬರಹ ತಂತ್ರಾಂಶಗಳು, ಕಂಪ್ಯೂಟರ್ ಮುಖಾಂತರಕನ್ನಡದಟೈಪಿಂಗ್
2. ಕನ್ನಡ ಕಂಪ್ಯೂಟರ್ ಶಬ್ಧಕೋಶ,
3. ತಾಂತ್ರಿಕ ಪದಕೋಶ

Total: L-26 Hours

ಪಠ್ಯಪುಸ್ತಕ:

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ (ಸಂ), ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ, ಡಾ.ಎಲ್.ತಿಮ್ಮೇಶ, ಪ್ರೊ.ವಿ.ಕೇಶವಮೂರ್ತಿ, Prasaranga VTU, Belagavi, Karnataka, 2020.

ಕೋರ್ಸ್ ಫಲಿತಾಂಶಗಳು:

At the end of the course the student should be able to:

1 ವಿದ್ಯಾರ್ಥಿಗಳು ಬೌದ್ಧಿಕವಾಗಿ ಬೆಳೆಯುವುದರೊಂದಿಗೆ ನಮ್ಮ ನಾಡಿನ ಮತ್ತುದೇಶದ ಸಾಂಸ್ಕೃತಿಕ ವಾರಸುದಾರರಾಗಿ ಬೆಳೆದು ಸ್ವಾವಲಂಬಿಯಾಗಿ ಬದುಕು ಕಟ್ಟಿಕೊಳ್ಳುತ್ತಾರೆ

2 ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಸಮರ್ಥವಾಗಿ ಮಾತನಾಡುವುದರೊಂದಿಗೆ, ಅನ್ಯರನ್ನು ಅರ್ಥೈಸಿಕೊಳ್ಳುವ ಮನೋಬಲ ಬೆಳೆಸಿಕೊಳ್ಳುತ್ತಾನೆ. ಇವತ್ತಿನ ಸಂಕೀರ್ಣವಾದ ಸಾಮಾಜಿಕ ವ್ಯವಸ್ಥೆಯಲ್ಲಿ ಸೌಹಾರ್ದಯುತವಾದ ನಡುವಳಿಕೆಯೊಂದಿಗೆ ಸಂಪನ್ಮೂಲ ವ್ಯಕ್ತಿಯಾಗಿ ರೂಪುಗೊಳ್ಳುತ್ತಾನೆ.

3 ಜಾಗತಿಕರಣದಇವತ್ತಿನ ಸಂದರ್ಭದಲ್ಲಿ ವಿದ್ಯಾರ್ಥಿಗಳು ಸ್ವತಂತ್ರ ವಾಗಿಆಲೋಚಿಸುವ, ಸ್ವತಂತ್ರವಾಗಿ ಬರೆಯುವ, ಸ್ವತಂತ್ರವಾಗಿ ಚಿಂತನಶೀಲರಾಗುವ ಸಾಮರ್ಥ್ಯವನ್ನು ಪಡೆದು, ಸಮಯೋಚಿತವಾಗಿ ಸೂಕ್ತ ನಿರ್ಧಾರಗಳನ್ನು ಕೈಗೊಳ್ಳುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ದೀಪಸ್ಥಂಬವಾಗಿದೆ.

4 ವಿದ್ಯಾರ್ಥಿಗಳು ಇಂದಿನ ಜಾಗತಿಕ ವಿದ್ಯಮಾನಗಳನ್ನು ಅರ್ಥೈಸಿಕೊಂಡು, ಸಮಾಜದಲ್ಲಿ ಸಂಘಜೀವಿಯಾಗಿ ಬೆಳೆಯುವ ಮನೋಬಲವನ್ನು ಮತ್ತುಆತ್ಮಸ್ಥೈರ್ಯವನ್ನುತುಂಬುವಲ್ಲಿ ಈ ಅಧ್ಯಯನ ಸೂಕ್ತವಾದ ಮಾರ್ಗದರ್ಶಿಕೆಯಾಗಿದೆ.

5 ತನ್ನ ಅಸ್ಮಿತೆಯ ಹುಡುಕಾಟದಲ್ಲಿರುವ ವ್ಯಕ್ತಿಗೆ, ಅದು ಈ ನೆಲದ ಸ್ವಾಭಿಮಾನ, ಭಾತೃತ್ವ, ಪ್ರೀತಿ, ಸೌಹಾರ್ದಯುತವಾದ ಮನಸ್ಸುಗಳಲ್ಲಿ ಇದೆಎಂಬುದನ್ನು ವಿದ್ಯಾರ್ಥಿಗಳ ಅರಿತಕ್ಕೆತರುತ್ತದೆ.

6 ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಪರಿಸರ ಪ್ರಜ್ಞೆಯನ್ನು ಜಾಗೃತಗೊಳಿಸಿ, ದೈವಸೃಷ್ಟಿಯಾದ ಈ ಅಮೂಲ್ಯ ಸಂಪತ್ತನ್ನು ಹಿತ–ಮಿತವಾಗಿ ಬಳಸಿಕೊಂಡು ಮುಂದಿನ ತಲೆಮಾರಿಗೆಅದನ್ನು ಬಳುವಳಿಯಾಗಿ ಬಿಟ್ಟುಹೋಗುವಲ್ಲಿಜಾಗೃತನಾಗುತ್ತಾನೆ.

5^{th}Semester

Basaveshwar Engineering College (Autonomous), Department of Mechanical Engineering
Scheme Autonomous Syllabus (175 credits)

Students admitted to 1st year (Regular) during the academic year on or after 2019-2020
Students admitted to 2nd year (Lateral Entry) during the academic year on or after 2020-21

V Semester. B. E

Sl. No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME 509C	Design of Machine Elements	3	2	2	0	50	50	100
02	UME 512C	Metal Forming	3	2	2	0	50	50	100
03	UME 513C	Fluid Mechanics	3	2	2	0	50	50	100
04	UME 514 C	Turbo Machines	3	2	2	0	50	50	100
05	UME 516 H	Management & Entrepreneurship	3	3	0	0	50	50	100
06	UME XXXE	Dept Elective - I	3	3	0	0	50	50	100
07	UHS 002N	Advanced Quantitative Aptitude and Soft Skills	1	0	2	0	50	50	100
08	UME 515 L	Fuels & I.C Engine Lab	1	0	0	3	50	50	100
09	UME 517 L	Fluid Mechanics & Machinery Lab	1	0	0	3	50	50	100
10	UCS 559 L	Advance C Programming Lab	2	0	2	2	50	50	100
11		Universal Human Values							
		Total Credits	**23**	**12**	**08**	**12**	**450**	**450**	**900**

Department Electives List
The students have to select any one elective from the following table

Subject Code	Subject
UME 511 E	Quality and Reliability Engineering
UME 535 E	Non-Traditional Machining
UME 536 E	Theory of Automotive Engines

B. E. MECHANICAL ENGINEERING SEMESTER – V			
DESIGN OF MACHINE ELEMENTS			
Course Code	**UME509C**	**CIE MARKS**	**: 50**
Teaching Hours/Week (L:T:P)	**2:2:0**	**SEE MARKS**	**: 100**
Credits	**3**	**SEE Exam Hours**	**: 3 Hrs**

UNIT –I

Introduction **06Hours**

Definitions: Normal, Shear, Biaxial and Triaxial STRESSES, Stress tensor, Principal stresses engineering materials and their mechanical properties, Stress-Strain diagrams, Stress analysis, Design considerations: Codes and standards.

Design for Static strength **06 Hours**

Static loads and Factor of Safety, Theories of failure. Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion Energy Theory Failure of Brittle Materials, Failure of Ductile Materials, Stress Concentration, Determination of Stress Concentration Factor

UNIT – II

Design for Fatigue strength **05 Hours**

Design for fatigue strength: Introduction- S-N diagram, low cycle fatigue, high cycle fatigue, endurance limit, endurance limit factors: size effect, surface effect, stress concentration effects. Fluctuating stresses, goodman and Soderberg relationship, stresses due to combined loading, cumulative fatigue damage.

Design of Threaded Fasteners: **03 Hours**

Stresses in threaded fasteners, effect of initial tension, Design of threaded fasteners under static, Dynamic and impact loads, Design of eccentrically loaded Bolted Joints

UNIT – III

Design of Shafts: **10 Hours**

Torsion of shafts, Design for strength and rigidity with steady loading, asme & bis codes for power transmission shafting, shafts under fluctuating loads and combined loads.

UNIT – IV

Design of Springs **07 Hours**

Definitions, Types of springs, stresses in helical coil springs of circular and non-circular cross sections. tension and compression springs, springs under fluctuating loads, Energy stored in springs, Torsion, Belleville and Rubber springs. Leaf springs: Stresses in leaf springs. equalized stresses,

Design of Spur Gears: **05 Hours**

Spur Gears: Definitions, Stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load.

Assignment: Twenty five Multi Choice Questions covering entire syllabus (Quiz)

Course outcomes: By the end of course with aid of design data handbook students shall be able to,

CO1 ***Explain*** the terminologies and preliminary concepts related to Normal, shear, biaxial, tri axial and Principal stresses, stress-strain diagram, codes and standards.
CO2 ***Apply*** the concepts of stress analysis, theories of failure and material science to analyze, design and/or select commonly used machine components.
CO3 ***Apply*** different theories to the design of shafts subject to combined static and dynamic loads
CO4 ***Analyze*** and design ofsprings and spur gears for various loadings and applications

Question paper pattern

1. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
2. Each question carries 20 Marks and should not have more than 4 subdivisions.
3. Any five full questions are to be answer choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Text Books				
1	Design of Machine Elements	V.B. Bhandari	Tata McGraw Hill Publishing Company Ltd	2nd Edition/ 2007
2	Design of Machine Elements	S. C. Sharma	PHI Learning Pvt. Ltd	01-Jan-2002
Reference Books				
1	Machine Design:	Robert L. Norton	Pearson Education Asia,	2001
2	Design of Machine Elements:	M. F. Spotts, T. E. Shoup, L. E. Hornberger,	Pearson Education	2006
3	Fundamentals of Machine Component Design	Robert C. Juvinall and Kurt M Marshek,	Wiley India Pvt. Ltd., New Delhi,	3rd Edition, 2007
4	Mechanical Engineering Design	Joseph E Shigley and Charles R. Mischke.	McGraw Hill International edition	6thEdition 2003

DESIGN DATA HAND BOOKS:

1. Design Data Hand Book – K. Lingaiah, McGraw Hill, 2nd Ed. 2003.
2. Design Data Handbook – K. Mahadevan and Balaveera Reddy, CBS Publication 4th Edition
3. Machine Design Data Handbook – H.G. Patil, Shri Shashi Prakashan, Belgaum.
4. PSG Design Data Handbook PSG College of Technology, Coimbatore.

B.E. MECHANICAL ENGINEERING SEMESTER – V			
Metal Forming			
Course Code	**UME 512 C**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	**SEE Marks**	**100**
Credits	**03**	**SEE Exam Hours**	**03**

UNIT – I

INTRODUCTION AND CONCEPTS **06 Hours**

Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Concepts of true stress, true strain, **{Apply knowledge of engineering fundamentals and mathematics (PO1)}**. Determination of flow stress. Tresca and Von-Mises yield criteria **{Interpretation of data and valid conclusions (PO4)}**, Numerical problems

EFFECTS OF PARAMETERS **04 Hours**

Temperature, strain rate, friction and lubrication, Deformation zone geometry, workability of materials, Residual stresses in wrought products.

UNIT – II

FORGING **05 Hours**

Classification of forging processes **{Communicate effectively to comprehend and write effective reports and design documentation and give and receive clear instructions (PO10)}**.Forging machines and equipment. Expressions for forging pressures and load in open die forging by slab analysis **{Demonstrating the need for sustainable development (PO7)}**, concepts of friction hill and factors affecting it. Die-design parameters. Forging defects, Residual stresses in forging.

ROLLING **05 Hours**

Classification of Rolling processes. Types of rolling mills. Roll separating force. Effects of front and back tensions, friction, friction hill. Maximum possible reduction **{Applying ethical principles (PO8)}**, defects in rolled products, rolling variables. Numerical problems.

UNIT - III

DRAWING: **05 Hours**

Drawing equipment and dies, expression for drawing load by slab analysis **{Applying the knowledge of first principles of engineering science and mathematics (PO2)}**, power requirement. Redundant work and its estimation, optimal cone angle and dead zone formation, drawing variables, Tube drawing and classification, Numerical Problems on wire drawing.

EXTRUSION: **05 Hours**

Types of extrusion processes, extrusion equipment and dies, lubrication and defects in extrusion. Extrusion dies, Extrusion of seamless tubes. Extrusion variables, Numerical problems.

UNIT - IV

SHEET METAL FORMING: **04 Hours**

Forming methods, dies and punches, progressive die, compound die, combination die. Rubber forming. Open back inclinable press (OBI press), piercing, blanking, bending, deep drawing, LDR in drawing, defects of drawn products, stretch forming. Roll bending and contouring **{Applying norms of the engineering practice (PO8)}** and {**Function effectively as an individual, and in diverse teams with multidisciplinary disciplines (PO9)}**.

HIGH ENERGY RATE FORMING METHODS: **02 Hours**

Principles **{Application of law of physics (PO1)}** and **{Recognizing the need (PO12) of HERF}**, advantages, limitations and applications of explosive forming **{Apply reasoning informed by the**

contextual knowledge to assess particularly health, safety and legal issues (PO6) relating to handling of explosives}, electro hydraulic forming and Electromagnetic forming.

POWDER METALLURGY: 04 Hours

Basic steps in Powder metallurgy brief description of methods of production of metal powders, conditioning and blending powders, compaction, sintering **(PO12)**, secondary finishing and secondary manufacturing operations **{Demonstrating the need for sustainable development (PO7)}**, application of powder metallurgy components **{Select and apply appropriate technique based on the shape/size and property of part being produced (PO5) taking into account conventional forming, HERF and P/M route}**, advantages and limitations.

Assignment: (Mention the contents of the Assignment to be submitted)

Course outcomes: By the end of course with aid of design data handbook students shall be able to,

CO1 Classify, compare, choose various metal forming operations; apply, elaborate and analyze yield criteria for ductile metals and summarize the effect of parameters on these operations considering the effect of force.

CO2 Explain, analyze, identify and relate various forging and rolling operations with metal flow and determination with modification of the power necessary to operate the equipments.

CO3 Distinguish, classify and explain types of drawing and extrusion operations in terms of die angle, parts produced, variables; formulate the load required (for existing and maximize reduction) to cause plastic deformation of the metal to occur without non uniform plastic deformation with justification.

CO4 Demonstrate, explain with illustrations and outline the shape finishing operations using sheet metal working, high energy rate forming and powder metallurgy by predicting the behavioral change of the metals during plastic deformation and propose the method to shape the metal by evaluating conventional forming and/or HERF and/or P/M route.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Mechanical Metallurgy (SI Metric Edition)	George E. Dieter	Mc Graw-Hill Series in Materials Science and Engineering	2001
2	Fundamentals of Metal Forming Processes	B. L. Juneja	Second Edition, New Age International Publishers	2010
Reference Books				
1	Technology of Metal Forming Processes	Surender Kumar	Eastern Economy Edition, Prentice-Hall of India Private Limited	2008
2	Principle of Industrial Metal Working Processes	G.W.Rowe	CBS Publishers and Distributors	2005
3	Theory of Plasticity and Metal forming Processes”,	Dr. Sadhu Singh	Third Edition, Khanna Publishers	2013
4	Powder Metallurgy: Science, Technology and Applications	P.C. Angelo, R. Subramanian	Eastern Economy Edition, Prentice-Hall of India Private Limited	2008

B. E. MECHANICAL ENGINEERING 03 Hours SEMESTER – V			
FLUID MECHANICS			
Course Code	UME513C	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	2:2:0	SEE MARKS	: 100
Credits	3	SEE Exam Hours	: 3 Hrs

UNIT –I

Introduction **03 Hours**

Properties of Fluids: Introduction, properties of fluids, viscosity, thermodynamic properties, Surface tension and Capillarity, Vapour pressure and Cavitation, Numerical problems.

Fluid Statics: **08 Hours**

Fluid pressure at a point, Pascal's law, Pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, Simple manometers, differential manometers, Total pressure and center of pressure, Vertical plane surface submerged in a liquid, Horizontal plane surface submerged in a liquid, Inclined plane surface submerged in a liquid, Curved surface submerged in a liquid, Buoyancy, center of buoyancy, metacenter and metacentric height, Conditions of equilibrium for floating and submerged bodies, Numerical problems.

UNIT –II

Fluid Kinematics: **05 Hours**

Introduction, Types of fluid flow, Continuity equation, continuity equation in three dimensions (Cartesian co-ordinate system only), Velocity and acceleration, Velocity potential function and stream function, Numerical problems.

Dimensional Analysis: **05 Hours**

Introduction, Derived quantities, Dimensions of physical quantities, Dimensional homogeneity, Buckingham's ∏ theorem, Raleigh's method, Dimensionless numbers, Similitude and types of similitude, Numerical problems.

UNIT – III

Fluid Dynamics: **03 Hours**

Introduction, Equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids, Numerical problems.

Fluid flow measurements: **03 Hours**

Introduction, Venturimeter, Orifice meter and Pitot tube, Discharge over rectangular and triangular notches, Numerical problems.

Flow through pipes: **05 Hours**

Frictional loss in pipe flow, Darcy- Equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Hydraulic gradient and total energy line, Minor loses in pipes, Sudden enlargement, Sudden contraction, Obstruction, Bend, Elbow, Numerical problems.

UNIT – IV

Laminar flow and viscous effects: **03 Hours**

Reynold's number, Critical Reynold's number, Laminar flow through circular pipe-Hagen Poiseulle's equation, Laminar flow between parallel stationery plates, Numerical problems.

Flow past immersed bodies: **03 Hours**

Drag, Lift, Expression for lift and drag, Pressure drag, Friction drag, Boundary layer concept, Displacement thickness, Momentum thickness and energy thickness, Numerical problems.

Introduction to compressible flow: **04 Hours**

Velocity of sound in a fluid, Velocity of sound in terms of Bulk modules, Velocity of sound for isothermal process, Velocity of sound for adiabatic process.

Mach number, Subsonic, Sonic and Supersonic flows, Propagation of disturbance for different Mach numbers, Mach cone, Stagnation properties, Stagnation Pressure, Stagnation temperature, Area velocity relationship for compressible flow, Numerical problems

Assignment: As decided by the Course Instructor

Course Outcomes: Upon successful completion of this course, the students will be able to:

CO1 *Apply* the knowledge of fluid mechanics in selecting the types of fluids required for various engineering applications.

CO2 *Apply* the knowledge of fluid mechanics to *analyze* the fluid engineering problems by the method of dimensional analysis.

CO3 *Apply* the knowledge of fluid mechanics to *analyze* the fluid flow problems.

CO4 *Apply* the knowledge of fluid mechanics to *analyze* viscous and compressible fluid flow problems

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Fluid Mechanics (SI Units)	Yunus A. Cingel John M. Oimbala	Tata McGraw-Hill	2006
2	Fluid Mechanics and hydraulics	Dr. Jagadishlal	Metropolitan Book Co-Ltd.	1997
3	Fluid Mechanics	Dr.R.KBansal	Lakshmi Publications	2004
4	Hydraulics and Fluid Mechanics	Modi P N and S M Seth	Standard Publication	2005
Reference Books				
1	Fluid Mechanics	Oijush K. Kundu, Iram Cochen	Elsevier	3rd Edition. 2005.
2	Fluid Mechanics	John F. Douglas, Janul and M. Gasiosek and john A. Swaffield	Pearson Education Asia	5thedition. 2006
3	Fluid Mechanics and Fluid Power Engineering	Kumar.D.S	Kataria and Sons	2004
4	Essential Computational Fluid Dynamics	Oleg Ziaanov	Jhon Wiley	
5	1000 Solved Problems in Fluid Mechanics	Subramanya K	TMH	2006

B.E. MECHANICAL ENGINEERING SEMESTER – V			
Turbomachines			
Course Code	**UME 514 C**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	**SEE Marks**	**100**
Credits	**03**	**SEE Exam Hours**	**03**

UNIT - I

Introduction: 04 Hours

Definition of turbomachine, Parts of a turbo machine, Comparison with positive displacement machine, Classification of turbomachines, Application of dimensional analysis to turbomachines and their physical significance, specific speed for power absorbing and power developing machines, Numerical problems on dimensional analysis and model studies.

Energy Transfer in Turbomachines: 06 Hours

Euler turbine equation, Alternate form of Euler turbine equation, Components of energy transfer, Degree of reaction, General analysis of a turbo machine, Effect of blade discharge angle on energy transfer and degree of reaction, General analysis of turbines (axial flow machines), Utilization factor, Relation between utilization factor and degree of reaction, Condition for maximum efficiency, Condition for maximum utilization factor, Optimum blade speed ratio and maximum energy transfer, Numerical problems on above topics

UNIT - II

General analysis of power absorbing turbomachines: 04 Hours

General analysis of centrifugal pumps and compressors, Effect of blade discharge angle, Analysis on performance, Theoretical head capacity relationship, Centrifugal machines stage parameters, Work done, Power, Stage pressure rise, Degree of reaction, Numerical problems on above topics.

Centrifugal Pumps: 06 Hours

Working principle, Main parts of a centrifugal pump, Classification, Head, Static head, Manometric head, Pump Efficiencies, Manometric, Mechanical, Hydraulic, Volumetric and Overall efficiency; Work done by the pump, Pressure rise in a pump, Minimum starting speed, Multistage pumps; Cavitation, Numerical problems on above topics.

UNIT - III

Steam and Gas Turbines: 04 Hours

Impulse staging and need for compounding, Compounding, Velocity, Pressure, Velocity and pressure compounding, Impulse turbine, Performance parameters, Effects of friction and blade angles on blade efficiency, Condition for maximum efficiency, Maximum efficiency and work done, Numerical problems on above topics.

Multistage impulse turbine (two stage):02 Hours

work done, Blade efficiency, Condition for maximum efficiency, Maximum blade efficiency, Maximum work done, Maximum utilization factor with equiangular blades, Numerical problems on above topics.

Reaction turbines:04 Hours

Degree of reaction, Condition for maximum efficiency (without carry over efficiency), Maximum efficiency, Maximum work done, Utilization for factor, Condition for maximum utilization factor, Maximum utilization factor, Blade design parameters, Numerical problems on above topics.

UNIT - IV

Hydraulic Turbine: 05 Hours

Unit quantities, Terminology, Pelton Wheel, Velocity triangle, Power developed, Hydraulic efficiency, Condition for maximum hydraulic efficiency, Maximum hydraulic efficiency, Turbine efficiency, Hydraulic, Mechanical, Volumetric and Overall efficiency, important design parameters. Numerical problems on above topics.

Francis and Kaplan turbines:05 Hours

Velocity triangle, Runner shapes for different blade speeds (blade angles), Design parameters, Draft tube and types draft tubes, functions of a draft tube, Efficiency of a draft tube, Kaplan and Propeller turbines, Velocity triangles, Design parameters, Numerical problems on above topics.

Assignment: As decided by the Course Instructor

Course Outcomes: At the end of the course student will be able to

CO1 *Apply* the knowledge of turbo machinery terminology to *develop* governing equation for rotating machinery and classify the rotating machines.
CO2 *Apply* the knowledge of turbo machinery to *analyze* the power absorbing turbomachine (Centrifugal machines)
CO3 *Apply* the knowledge of turbo machinery to analyze the impulse and reaction steam turbines.
CO4 *Apply* the knowledge of turbo machinery to analyze the water turbines (Pelton, Francis and Kaplan water turbines)

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be solved choosing at least one from each unit

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Text Books				
1	Principles of Turbo machinery	D.G.Shephered	The Macmillan Company	1964.
2	An Introduction to energy Conversion - Volume III – Turbo machinery	A. Kadambi and Manohar Prasad	New Age International publishers	1977.
Reference Books				
1	Turbines, Compressors and Fans,	S.M.Yahya,	Tata McGraw Hill Company	2nd Edition, 2002
2	Gas Turbine Theory	H.Cohen, GFC Rogers and HIH Saravanamuttoo	Thomson Press (India) Ltd.	4th Edition,1998.
3	Gas Turbines	V.Ganeshan	Tata Mc Graw Hill	2nd edition, 2002.
4	A Treatise on Turbo machines	G.Gopalaksrihsna and D. Prithiviraj	Scitech Publications (India) PVT., Limited	2002.

B. E. MECHANICAL ENGINEERING Semester - V			
MANAGEMENT & ENTREPRENEURSHIP			
Course Code	**UME516H**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**100**
Credits	**3**	**SEE Exam Hours**	**03**

UNIT-I

Management **5 Hours**

Introduction, Meaning, nature and characteristics of Management, Scope and Functional areas of management, Management as a science, art of profession, Roles of Manager, Levels of Management, Development of Management Thought: early management approaches.

Planning **5 Hours**

Nature, importance and purpose of planning process, Objectives, Types of plans (Meaning only), Importance of planning – steps in planning & planning premises

UNIT-II

ORGANIZING AND STAFFING: **5 Hours**

Nature and purpose of organization, Principles of organization, Types of organization, Departmentation, Committees, Nature and importance of staffing, Process of Selection & Recruitment (in brief).

MOTIVATION AND BEHAVIOR: **5 Hours**

Hawthorns studies and its findings, Maslow's theory, X and Y theory, Immaturity theory motivation hygiene theory, McClelland‟s theory of motivation.

UNIT-III

DIRECTING & CONTROLLING: **5 Hours**

Meaning and nature of directing, Leadership styles, Communication: Meaning and importance, Coordination: meaning and importance and Techniques of Co–Ordination. Controlling: Meaning and steps in controlling, Essentials of a sound control system, Methods of establishing control (in brief).

ENTREPRENEUR: **5 Hours**

Meaning of Entrepreneur, Functions of an Entrepreneur, Types of Entrepreneur (only types), Role of entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship: its Barriers.

UNIT-IV

SMALL SCALE INDUSTRIES: **5 Hours**

Definition, Characteristics, Need and rationale, Objectives, Scope, role of SSI in Economic Development. Advantages of SSI Steps to start and SSI, Government policy towards SSI, Different Policies of SSI, Government Support for SSI during 5 year plans. Supporting Agencies of Government for SSI, Meaning, Nature of support, Objectives, Functions (brief).

QUALITY PHILOSOPHY: **5 Hours**

The Meaning of Quality and Quality Improvement, Brief History of Quality Methodology, Statistical Methods for Quality Control and Improvement

Assignment: 2 Quiz to be conducted

COURSE OUTCOME: At the end of the course, student will be able to

CO1	Demonstrate the ability of understanding, the nature, purpose, evolution, patterns of management. Analyze the purpose of planning, distinguish different plans and able to describe the detailed process of planning.
CO2	Identify and apply the nature and purpose of organizing, Departmentation, Staffing, Human factors and motivation.
CO3	Express the need of Leadership, concepts of directing and controllingDemonstrate the importance of Entrepreneurship, role of Entrepreneur, Characteristics, and Classification of Entrepreneurs.
CO4	Develop the knowledge of small-scale industries, characteristics, role, and government support and quality philosophy.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl no	Title of the book	Name of the Author/s	Name of the publishers	Edition and year
Textbooks				
1	Essentials of Management	Harold Koontz	Tata McGraw-Hill	8th Education, 2010
2	Entrepreneurship Development and Small Business Enterprises:	Poornima M. Charantimath	Pearson Education India	3rd Edition 2015
3	Introduction to Statistical Quality Control	Douglas C. Montgomery	Wiley international	8th edition 2019
Reference Books				
1	Principles of Management	P.C.Tripathi, P.N.Reddy	Tata McGraw Hill	5th edition 2012
2	Management and Entrepreneurship	Kanishka Bedi	Oxford University Press	4th edition 2009
3	Principles of Management	Harold Koontz, Cyril O'Donnell	McGraw Hill Create	5th edition 2018

B.E. MECHANICAL ENGINEERING SEMESTER – V			
Advanced Quantitative Aptitude and Soft Skill			
Course Code	**UHS 002 N**	**CIE Marks**	**50**
Teaching Hours/Week (L: T:P)	**2:2:0**	**SEE Marks**	**100**
Credits	**03**	**SEE Exam Hours**	**03**

B. E. MECHANICAL ENGINEERING SEMESTER-V			
QUALITY AND RELIABILITY ENGINEERING			
Course Code	UME521 E	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	100
Credits	3	SEE Exam (Hours)	03

UNIT-I

INTRODUCTION 05 Hours
Definition of quality, Quality dimensions, Quality aspects-quality of design, quality of conformance and quality of performance. Quality Control-offline quality control, statistical process control and acceptance sampling plans (Only introduction). Quality Assurance

PHICAL METHODS OF DATA PRESENTATION & QUALITY IMPROVEMENT 05 Hours Histograms, Run Charts, Pareto Diagrams, Cause and Effect diagrams and Scatter diagrams.

UNIT-II

STATISTICAL PROCESS CONTROL: 05 Hours
Causes of Variation in quality, Central limit theorem, Control charts for variables and attribute (simple problem only), Process capability studies (theory only)

ACCEPTANCE SAMPLING PLANS: 05 Hours
Introduction, Advantages and disadvantages of sampling, producer's risk, consumer's risk, operating characteristics curve (simple problems to draw OC curve), effect of sample size and acceptance number on OC curve.

UNIT-III

RELIABILITY 10 Hours
Definition of reliability, reliability function, MTTF, hazard rate function, bathtub curve, derivation of the reliability function – constant failure rate model, time dependent failure rate models: Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution

UNIT-IV

SYSTEM RELIABILITY 05 Hours
System reliability (Series, Parallel, Mixed and Standby components). Reliability and life testing plans (failure terminated and time terminated tests).

RELIABILITY IMPROVEMENT AND ALLOCATION 05 Hours
Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems

Assignment:
- Quality dimensions, Quality aspects.
- Acceptance sampling plans and quality Assurance
- Control charts for variables and attribute
- Operating Characteristics curve.
- Bathtub curve and derivation of the reliability function
- Reliability and life testing plans

Course Outcomes: At the end of the course, the student will be able to:

CO1 Be able to understand the concept of quality and able to identify aspects of quality.
CO2 Be able to understand the process of causes for variation by conducting the process of quality control.
CO3 Be able to identify and analyze the failure analysis of the components and subcomponents of mechanical and electronic items.
CO4 Be able to know the system concepts of reliability and its improvement tradeoffs.

Question Paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl no	Title of the book	Name of the Author/s	Name of the publishers	Edition and year
Textbooks				
1	Fundamental and Quality Control and Improvement	Amitava Mitra	Prentice Hall of India	Second Edition, 2007
2	Reliability Engineering	L. S. Srinath	East-West Press	2008
Reference Books				
1	Statistical Quality Control	M.Mahajan	Dhanpat Rai & Co. (P) Ltd.	

B. E. MECHANICAL ENGINEERING SEMESTER - V			
NON-TRADITIONAL MACHINING			
Course Code	**UME535E**	**CIE Marks**	**50**
Teaching Hours/Week(L:T:P)	**3:0:0**	**SEE Marks**	**100**
Credits	**3**	**SEE Exam Hours**	**03**

UNIT - I

Introduction: 03 Hours

History, classification, comparison between conventional and non-conventional machining, need for non-traditional machining processes, process selection.

Mechanical Processes:

Ultrasonic Machining: 04 Hours

Introduction, definition, equipment, principle of material removal, process description, elements of process, tool feed mechanism, effect of process parameters, process capability, mechanics of cutting-theory of Miller, theory of Shaw, applications, advantages and limitations.

Abrasive Jet Machining: 03 Hours

Introduction, principle, equipment, variables in AJM: carrier Gas, type of abrasive, size of abrasive grain, velocity of the abrasive jet, mean number of abrasive particles per unit volume of the carrier gas, work material, standoff distance (SOD), nozzle design, shape of cut, process characteristics - material removal rate, nozzle wear, applications, advantages and disadvantages.

UNIT - II

Thermal Metal Removal Processes:

Electric Discharge Machining: 07 Hours

Introduction, spark erosion machining processes, mechanism of metal removal, spark erosion generators, electrode feed control, power delivered by an R-C circuit, critical resistance, electrical parameters in R-C circuit, dielectric fluids, electrodes for spark erosion, electrode wear, tool electrode design, electrode material selection, flushing; pressure flushing, suction flushing, side flushing, pulsed flushing, machining accuracy, surface finish, characteristics of spark eroded surfaces, machine tool selection, applications, advantages and disadvantages.

Electron Beam Machining: 03 Hours

Introduction, equipment for production of electron beam, generation and control of electron beam, -theory of electron beam machining, thermal &non thermal types, process capabilities, applications and limitations.

UNIT - III

Plasma Arc Machining: 04 Hours

Introduction, plasma, non thermal generation of Plasma and equipment, mechanism of metal removal, PAM parameters, process characteristics, types of torches, applications, advantages and disadvantages.

Laser Beam Machining: 04 Hours

Introduction, principle of generation of lasers, equipment and machining procedure, types of lasers, process characteristics, material removal, thermal features of laser machining, thermal analysis, cutting speed and accuracy of speed, advantages and limitations, applications.

Ion Beam Machining: 02 Hours

Introduction, mechanism of metal removal and associated equipment, process characteristics, applications, advantages and disadvantages.

UNIT - IV

Electro chemical and Chemical machining processes:

Electro chemical machining: **06 Hours**

Classification of electro chemical machining processes-principle of electro chemical machining, elements of the electro chemical machining process: cathode tool, anode work piece, source of DC power, electrolyte, ECM machine, chemistry of the process, metal removal rate, tool design, tool shape correction, applications, advantages and disadvantages, electro chemical grinding, electro chemical honing, electrochemical deburring.

Chemical Machining: **04 Hours**

Introduction, elements of process, chemical blanking process : preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking, chemical milling (contour machining): process steps–masking, etching, process characteristics of CHM: material removal rate, accuracy, surface finish, applications, advantages and disadvantages.

Assignment:

- A set of questions covering whole syllabus will be given to the students. The students will answer to all the questions in the assignment booklet and submit.

Course Outcomes: At the end of the course, the students will be able to:

CO1 Classify nontraditional machining and conventional machining processes with respect to type of energy, mechanism of material removal and process capability.

CO2 Compare nontraditional machining and conventional machining processes with respect to their advantages, limitations and applications.

CO3 Analyze various process parameters affecting the material removal rate for a particular machining process.

CO4 Decide a particular non-traditional machining process for a particular material, type of counter, quantity of material to be removed.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the publisher**	**Edition and year**
Textbook/s				
1	Modern Machining Processes	P.C Pandey & H.S. Shan	Tata McGraw Hill	2017
Reference Books				
1	Advanced Machining Processes	Hassan Abdel	Mc Graw Hill, Mechanical Engineering Series	2016
2	Production technology	HMT	Tata Mc Graw Hill	2012
3	Metals hand book	ASME	ASME	Vol-3
4	High velocity forming of metals	F.M Wilson	Prentice Hall	2015
5	Non-Conventional Machining	P.K.Mishra	The Institution of Engineers (India) Text book series, Narosa Publishing House	2005

B. E. MECHANICAL ENGINEERING SEMESTER-V			
Theory of Automotive Engineering			
Course Code	**UME 546 E**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**3:0:0**	**SEE Marks**	**100**
Credits	**3**	**SEE Exam (Hours)**	**03**

UNIT - I

10 Hours

Introduction: Historical development of automobiles. Types of power plant, principle of engineoperation. Classification of engines; V- engines, stratified charge engines, variable compression ratio engine.

Fuel air cycles: Uses of fuel air cycle, variation of specific heats, dissociation, comparison of PVdiagram of air standard cycle and fuel air cycle for SI engine, thermal efficiency and fuel consumption, effect of variables.

Two stroke and four stroke engines: Principles of engine operation(SI and CI), scavenging -systems, theoretical processes, parameters, relative merits and demerits, valve and port timing diagrams.

UNIT - II

10 Hours

Liquid fuels: Properties and tests: specific gravity, viscosity, flash and fire points, calorific value, rating of fuels.

Petrol fuel: Octane number, chemical energy of fuels, reaction equation, volatility properties of A/F mixture, combustion temp, combustion charts.

Combustion in SI engines: Ignition limits, stages of combustion, ignition lag, effect of engine variables on ignition lag, effect of variables on flame propagation, abnormal combustion,detonation,theory of detonation, effect of engine variables on detonation, control of detonation, CFR engine, knock rating of SIengine fuels, surface ignition, SI engine.

UNIT - III

10 Hours

Diesel fuels: Properties and rating of fuels; cetane number, chemical energy of fuels, reaction equation, properties of A/F mixture, combustion temp, combustion charts. Vapor pressure, cloud and pour point, annealing point, diesel index, carbon residue.

Combustion in CI engines: Stages of combustion, air fuel ratio in CI engines, delay period, variables affecting delay period, diesel knock, methods of controlling diesel knock, CI combustion chambers, open and divided. Induction swirl, turbulent combustion chambers, types, M - combustion chamber.

UNIT - IV

10 Hours

Dual fuel and multi-fuel engines: Combustion in dual fuel engines, factors affecting combustion. Main types of gaseous fuels, supercharge knock control and performance of diesel fuel engines. Characteristics of multi fuel engines, modification of fuel system, suitability of various engines as multi fuel unit, performance of multi fuel engines.

Engine performance: Performance parameters BHP, FHP, IHP, specific fuel consumption, volumetric efficiency, thermal efficiency, specific weight, heat balance sheet, testing of engines, numerical problems.

Assignment: Quiz of 25 questions and MCQ Type

Course Outcomes: At the end of the course, the students will be able to:

CO1 Compare and correlate between principles of engine operation, theoretical and actual cycle diagrams
CO2 Correlate between different types of power plants and operational fuel air cycle and valve timing diagrams of CI and SI engines
CO3 Analyse different phases of combustion and their significance in engine performance and study of combustion chambers
CO4 analyse the onset abnormal combustion and its impact on the engine performance and emissions
CO5 know principle and working of dual and multi fuel engines and various types of engines
CO6 understand the basics of IC engine principle, operation and combustion analysis

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	I.C. Engines	Mathur and Sharma	Dhanpat Rai &Sons, New Delhi	1994
2	Fuels & Combustion	S.P. Sharma and Chandramohan	Tata McGrawHill, New Delhi	1987
Reference Books				
1	Internal Combustion Engines and Air Pollution. Harper International Edition	Obert, Edward F.	Harper & Row, New York, NY,	1973
2	Fuels & Combustion	Karl W. Smith, Marion L.; Stinson	McGraw-Hill Book Company, Inc.	1952
3	Internal combustion engines	Lester Clyde Lichty	McGraw-Hill book company, inc.	1939

B. E. MECHANICAL ENGINEERING SEMESTER-V			
FUEL AND I.C. ENGINE LAB			
Course Code	**UME 515L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0-0-2**	**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**

Part A

Individual Experiments

1. Determination of Flash point and Fire point of lubricating oil and liquid fuel using Abel / Clevland / Pensky Martins Apparatus.
2. Determination of Viscosity of a lubricating oil using Redwood viscometer
3. Determination of Viscosity of lubricating oil using Saybolts viscometer.
4. Determination of Cloud and Pourpoint of Lubricating oil/fuel
5. Determination of Carbon residue by Conradson fuel apparatus.
6. Determination of Density of lubricating oil/fuel.
7. Distillation of fuel.

Part B
Group experiments

Performance tests on I. C. Engines, calculations of IP, BP, FP, thermal efficiencies, mechanical efficiency, volumetric efficiency, air fuel ratio, SFC, BSEC, heat balance sheet for
Four stroke diesel and petrol engine
Variable compression ratio diesel / petrol engine
Multi cylinder diesel / petrol engine for Morse test

Scheme for Examination:

One Question from Part A - 15 Marks (05 Writeup+10)
One Question from Part B - 25 Marks (05 Writeup+20)
Viva-Voce - 10 Marks

Total 50 Marks

Course Outcomes: At the end of the course, the students will be able to:

CO1 Students will demonstrate the ability to conduct, to measure and to calculate/analyze properties of oil/fuel.
CO2 Students will demonstrate the ability to calculate the effect of operating parameters on the performance of SI and CI engines
CO3
CO4

B. E. MECHANICAL ENGINEERING SEMESTER-V			
FLUID MECHANICS AND MACHINERY LABORATORY			
Course Code	**UME 517L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0-0-2**	**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**

Part A

Calibration of flow measuring device: (any 3)

a. Orifice plate
b. Flow nozzle
c. Venturimeter
d. Rotameter
e. V- Notch
f. Determination of co efficient of friction of flow through pipe
g. Determination of minor losses (Sudden Expansion, Sudden Contraction, Bend and Elbow) in flow through pipes
h. Determination of force developed by impact of jets on vanes

Part B

Group experiments

a. Performance testing of turbines
b. Pelton wheel,
c. Francis turbine
d. Kaplan turbine
e. Performance testing of pumps
   Single stage and multi stage centrifugal pump
   Reciprocating pump
   Performance test on two/single stage reciprocating air compressor
   Performance test on air blower

Scheme for Examination:

One Question from Part A - 15 Marks (05 Writeup+10)
One Question from Part B - 25 Marks (05 Writeup+20)
Viva-Voce - 10 Marks

Total 50 Marks

Course Outcomes: At the end of the course, the students will be able to:

CO1 Students will demonstrate the ability to conduct, to measure and to calculate coefficient of discharge of Venturimeter and Orifice meter.
CO2 Students will demonstrate the ability to calculate the effect of operating parameters on the performance of centrifugal pump and Reciprocating pump.
CO3 Students will demonstrate the ability to calculate the effect of operating parameters on the performance and power developed by pelton wheel, Francis turbine
CO4 Students will demonstrate the ability to calculate major losses and minor losses in a pipe flow

B. E. MECHANICAL ENGINEERING SEMESTER-V			
ADVANCED C PROGRAMMINGLABORATORY			
Course Code	**UMC559L**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**0-0-4**	**SEE Marks**	**100**
Credits	**1**	**SEE Exam (Hours)**	**03**

Unit –I6 hours
Multidimensional arrays. Self-referential structures and Unions. Pointers: Introduction, Pointers for inter function communication, Pointers to pointers, Compatibility, L value and R value, Examples. Pointer Applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, memory allocation functions, array of pointers, Examples.

Unit -II 6 hours
Data Structures, Classifications (Primitive &Non-Primitive), Data structure Operations, Stacks: Definition, Stack Operations, Array Representation of Stacks, Stacks using Dynamic Arrays, Stack Applications: Queues: Definition, Array Representation, Queue Operations. Programming Examples.

Unit –III6 hours
Linked Lists: Definition, Representation of linked lists in Memory, Linked list operations: Traversing, Searching, Insertion, and Deletion. Applications of Linked lists.

Unit -16 hours
Trees: Terminology, Binary Trees, Properties of Binary trees, Array and linked Representation of Binary Trees, Binary Tree Traversals.

Scheme for Examination:

Course Outcomes: At the end of the course, the students will be able to:

CO1
CO2
CO3
CO4

Sl No	Title of the Book	Name of the Author/s	Name of the publisher	Edition and year
Textbook/s				
1	Data Structures: A Pseudo-code approach with C	Gilberg&Forouzan	CengageLearning	2nd Edition, 2014
2	Data Structures through C	Yashwant Kanetkar	BPB Publications	2017
Reference Books				
1	Data Structures: A Pseudo-code approach with C	Gilberg&Forouzan	CengageLearning	2nd Edition, 2014
2	Data Structures using C	Reema Thareja	Oxford press	3rdEdition 2012
3	An Introduction to Data Structures with Applications	Jean-Paul Tremblay & Paul G	McGraw-Hill	2ndEdition,2013

Web links and Video Lectures:
1. https://nptel.ac.in/courses/106/106/106106130/
2. https://www.classcentral.com/course/edx-c-programming-pointers-and-memory-management-11533

3. https://academicearth.org/computer-science/
4. http://nptel.vtu.ac.in/econtent/courses/BS/15PCD23/index.php

7th Semester

Basaveshwar Engineering College (Autonomous), Department of Mechanical Engineering
Scheme Autonomous Syllabus (175 credits) 2020-21 (Regular) and 2021-22(Lateral) Batch
VII Sem. B. E (Mechanical Engineering)

Sl No	Code	Subject	Credits	Hours/Week			Examination Marks		
				Lecturer	Tutorial	Practical	CIE	SEE	Total
01	UME 704 C	Finite Elements Methods	3	2	2	-	50	50	100
03	UME 709 O	*On line course	1	-	-	-	-	-	-
04	UME 7XX E	Dept Elective – 2	3	3	-	-	50	50	100
05	UME 7XX E	Dept Elective – 3	3	3	-	-	50	50	100
06	UME 7XX E	Dept Elective – 4	3	3	-	-	50	50	100
07	UME 705 L	CAE Lab	1	-	-	2	50	50	100
08	UME 706 L	CNC Lab	1	-	-	2	50	50	100
09	UME 7XX N	**Open Elective- 2	3	-	-	-	-	-	-
10	UME 711 P	Project Phase –I + Internship	5+2	-	-	10	50	50	100
11	UXX XXX N	**Open Elective	2	2	-	-	50	50	100

***Online course should be of minimum 04 weeks duration to earn 01 credit.**

****Open elective - I is offered by other department to Mechanical Engineering Students**

Electives offered by the Department:

The Students have register for any three-elective selecting maximum one from each group

Group – I	Group – II	Group – III	Group - IV
UME 713 E: Non-Destructive Testing UME 721 E: Advance Manufacturing Technology UME 712 E: Composite Materials	UME 727 E: Control Engineering UME 728 E: Tool Design	UME 720 E: Power Plant Engineering UME 729 E: Refrigeration & Air conditioning	UME 730 E: Operation Management UME 731 E: Six Sigma

*** For awarding B.E. (Mechanical Engineering) degree, each student is required to complete minimum of 04 weeks or (02 weeks + 02 weeks) of Internship between 3rd and 6th semester to earn 02 credits which will be awarded during 7th Semester.**

B. E. MECHANICAL ENGINEERING SEMESTER -VII			
Finite Element Methods			
Course Code	**UME 704C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	100
Credits	3	SEE Exam Hours	03

UNIT – I

10 hours

Introduction: Equilibrium equations in elasticity subjected to body force, traction forces, stress strain relations for plane stress and plane strain, Boundary conditions, Initial conditions, Euler's Lagrange's equations of bar, beams, Principle of a minimum potential energy, principle of virtual work, Rayleigh-Ritz method Galerkins method and Matrix techniques .

Basic Procedure: General description of Finite Element Method, , Discretization process; types of elements 1D, 2D and 3D elements, size of the elements, location of nodes, node numbering scheme, half Bandwidth, Stiffness matrix of bar element by direct method, Properties of stiffness matrix, Preprocessing, post processing. Engineering applications of finite element method. Advantages & Disadvantages of FEM.

UNIT – II

10 hours

Interpolation Models: Polynomial form of interpolation functions- linear, quadratic and cubic, Simplex, Complex, Multiplex elements, Selection of the order of the interpolation polynomial, Convergence requirements, , static condensation. penalty approach and elimination method.

one dimensional bar element: Recall of 1D linear bar element. Lagrangian interpolation, Higher order one dimensional elements- quadratic, Cubic element and their shape functions, properties of shape functions, Effect of temperature on 1D elements and stress calculation.

UNIT – III

10hours

TWO dimensional elements: Shape functions and stiffness matrix of 2D elements four-Node quadrilateral, Nine-Node quadrilateral Eight-Node quadrilateral, serendipity and lagrange comparison with 2D pascals triangle. CST and LST shape functions ,jacobian matrix , stiffness matix, force terms, stress calculation and Numerical integration. Introduction to 3-D elements shape function of tetrahedron element

UNIT – IV

10hours

TRUSSES AND BEAM ELEMENTS: Analysis of trusses and beam elements its shape functions, stiffnesmatrix and stress calculation

Heat Transfer Problems: Steady state heat transfer, 1D heat conduction governing equation, boundary conditions, One dimensional element, Functional approach for heat conduction, Galerkin approach for heat conduction, heat flux boundary condition, 1D heat transfer in thin fins.

Assignment: (Mention the contents of the Assignment to be submitted)

Course Outcomes: At the end of the course, the student will be able to:

CO1 Understand the fundamental theory of the FEM method
- Generate the governing FE equations for systems governed by partial differential equations

CO2 Understand the role and significance of shape functions in finite element formulations and use linear, quadratic, and cubic shape functions for interpolation
- Apply the FEM method to solve Bars subject static load and thermal load.

CO3 Understand the formulation of two-dimensional elements (triangle and quadrilateral elements)
- Apply the concept of Lagrange interpolation for 3D elements.

CO4 Understand the formulation of truss, beams and Heat transfer concept.
- Apply the FEM method to solve truss and beams.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	NameoftheAuthor/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Finite Elements in enginring	ChandrupatlaT.R	Pearson Edition.	3rd edition, 2015.
2	Finite Element Analysis	C.S.Krishnamurthy	Tata McGraw Hill Publishing Co. Ltd, New Delhi,	2nd edition, 1995
3	Fundamental Finite Element Analysis and Application	Asghar Bhatt	PageTurner	3rd edition, 2013.
4	Advanced Topics in Finite Element Analysis of Structures with Mathematica and MATLAB Computations	Asghar Bhatt	PageTurner	3rd edition, 2013.
Reference Books				
1	The FEM its basics and fundamentals	O.C.Zienkiewicz	Elsevier	6th edition, 2013
2	Finite Element Method	J.N.Reddy	McGraw –Hill	International Edition
3	Finite Element Methods	Daryl. L. Logon	Thomson Learning	3rd edition, 2001.
4	Finite Element Analysis	H.V. Lakshminarayana	universities press	2004

B. E. MECHANICAL ENGINEERING SEMESTER -VII			
NON-DESTRUCTIVE TESTING			
Course Code	**UME 713C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3-0-0	SEE Marks	100
Credits	03	SEE Exam Hours	03

UNIT-I

Introduction to ND Testing: **09 Hours**

Information gathered from NDT, Defects in manufacturing Advantages and disadvantages of NDT, Comparison of destructive & Non-destructive tests, Methods of NDT, Common application of NDT, Flaw detection & evaluation, leak detection & evaluation, Non-Destructive Evaluation, visual inspection
Replication microscopy technique for

Non-Destructive Evaluation: Specimen preparation, replication techniques, and micro structural analysis

UNIT-II

09 Hours

Liquid Penetrant Inspection: Principles, penetrant methods, procedure, materials used, equipment, parameters and applications

Magnetic Particle Inspection: Principle, general procedure, advantages & limitations, applications, magnetic field generation, types of magnetic particles and suspension liquids,
Direction of the Magnetic Field, Importance of Magnetic Field Direction

UNIT-III

09 Hours

Radiography Inspection: principle, X-ray radiography, equipment, Gamma-ray radiography, real time radiography & film radiography, radiation safety, advantages, disadvantages, and applications of **radiography Computed tomography:** Principles, capabilities, comparison to other NDE methods, CT equipment's, industrial computed tomography applications

UNIT-IV

12 Hours

Ultrasonic inspection: Basic equipment, advantages & limitations, inspection methods pulse echo A, B, C scans transmission transducers & couplants Thermal Inspection: Principles, equipment, inspection methods applications

Eddy Current Inspection: Principles of operation, procedure, advantages & limitations, operating variables, inspection coils, eddy current instruments, application examples

Assignment: (Mention the contents of the Assignment to be submitted)

Course Outcomes: At the end of the course, the student will be able to:

CO1	To have a basic knowledge of surface N D E techniques which enable to carry out various inspection in accordance with the established procedures.
CO2	Differentiate various defect types and select the appropriate N D T methods for better evaluation
CO3	Documentation of the testing and evaluation of the results for further analysis
CO4	Students will be able to understand significance and suitability of various nondestructive testing methods in industrial application.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	**Title of the Book**	**Name of the Author/s**	**Name of the Publishers**	**Edition and Year**
Textbook/s				
1	Non-Destructive –Garden and Reach	Mc Gonnagle Jj	NEWYORK	
REFERENCE BOOKS				
1	Non Destructive Evaluation and Quality Control	Metals Hand Book	American Society of Metals	9TH, EDITION 2001

<table>
<tr><td colspan="4">B. E. MECHANICAL ENGINEERING
SEMESTER -VII</td></tr>
<tr><td colspan="4">ADVANCED MANUFACTURING TECHN0LOGY</td></tr>
<tr><td>Course Code</td><td>UME721E</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L: T:P)</td><td>3-0-0</td><td>SEE Marks</td><td>100</td></tr>
<tr><td>Credits</td><td>03</td><td>SEE Exam Hours</td><td>03</td></tr>
</table>

UNIT-1

05 Hours

Introduction: Introduction to CAD/CAM, product system facilities: Low, medium, and high. Manufacturing support systems, Automation in production systems. Automated manufacturing systems. Computerized manufacturing systems. Reasons for automating, Automation principles and strategies. Discussions.

Fundamentals of Automated Production Lines: **05 Hours**

Introduction, System configurations, Work part transfer mechanisms, Storage buffers, Control of the production line.

UNIT-2

Analysis of Transfer Lines: **05 Hours**

Analysis of Transfer Lines with no internal storage: Basic terminology and Performance measures, Workstation breakdown analysis: Upper bound approach, Lower bound approach, and Analysis of Transfer Lines with storage buffers. Numerical examples.

Automated Assembly System: **05 Hours**

Introduction, System configurations, Parts delivery at workstations, Applications. Quantitative analysis: Parts delivery system, Multi-station and single station assembly machines. Partial automation.

UNIT-3

NC Part Programming: **05 Hours**

Basic components of an NC system, EIA and ISO coding standards, NC part programming exercises.

Computer Assisted Part Programming: **05 Hours**

Defining part geometry**,** Specifying tool path and operation sequence, Computer task in computer-assisted part programming, Part programming with APT exercises.

UNIT-4

Product life cycle management: **05 Hours**

Introduction, Product information, PLM framework, Benefits, Implementation, Enabling technologies, Example of business problem. Product data management: Evolution of PDM systems, Scope, Benefits, Implementation, Software capabilities, software functions

Advances in Automated Factory: **05 Hours**

Industry 4.0**:** functions, applications and benefits, Components of Industry 4.0, Internet of things (IoT), IoT applications in manufacturing, Big-Data and cloud computing for IoT, IoT for smart manufacturing.

Course Outcomes: At the end of the course, the student will be able to:

CO1 will be able to

- read and demonstrate good comprehension of study of two aspects of production systems and how they are sometimes automated and /or computerized in modern industrial practice.

CO2 will demonstrate the ability to

- Apply basic methods of examination of the technology of automated production lines and develop several mathematical models that can be used to analyze their operation.
- Use of mechanized and automated devices to perform the various assembly tasks in an assembly line or cell.

CO3 will demonstrate the ability to

- Evaluate, integrate, and apply programmable automation in which the mechanical actions of the machine tool or other equipment are controlled by a program containing coded alphanumeric data.

CO4 will be able to

- Properly understand PLM; why it is crucial for companies to implement, what a PLM system offers, what PDM is and its relationship to PLM.
- Study the functions and components, applications and benefits of Industry 4.0, Concept of IoT.

Question Paper Pattern for Semester End Examination (SEE):

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Automation, Production Systems and CIM	Groover M. P	Prentice Hall of India	2006
2	Mastering CAD/CAM	Ibrahim Zeid	Tata McGraw Hill	2008
3	CAD/CAM Principles and Applications	P. N. Rao	Tata McGraw Hill	2nd Edition
4	Computer Integrated Manufacturing	Bharat Vijamuri	Sunstar Publisher	4th Edition, 2018.
Reference Books				
1	Industry 4.0	Google Search on the content		

B.E. MECHANICAL ENGINEERING SEMESTER – VII			
COMPOSITE MATERIALS			
Course Code	UME712E	CIE Marks	50
Teaching Hours/ Week (L.T.P)	3.0.0	SEE Marks	100
Credits	3	SEE Exam Hours	03

UNIT - I

Introduction to composite materials **10 Hours**

Definition and classification of composites based on matrix and reinforcement, Characteristics of composite materials, Fibrous composites, Laminate composites and particulate composites. Factors which determine the properties of composites, Benefits of composites, properties and types of reinforcements and matrices, Reinforcement-matrix interface.

UNIT - II

Polymer matrix composites **10 Hours**

Introduction, Polymer matrices, Processing methods like Lay-up and curing, open and closed mold process- hand layup techniques, laminate bag molding, production procedures for bag molding, filament winding, pultrusion, polyforming, thermo-forming, molding methods, properties of PMCs and applications, Some commercial PMCs.

UNIT - III

Metal matrix composites **10 Hours**

Introduction, Metallic matrices, Classification of MMCs, need for production of MMCs, Interface reactions, processing methods like Powder metallurgy, diffusion bonding, Melt stirring, Compo/Rheo casting, Squeeze casting, Liquid melt infiltration, Spray deposition and In situ Processes, Properties of metal matrix composites, Applications, Some commercial MMCs.

UNIT - IV

Mechanics of composite materials **9 Hours**

Continuous fibres, Iso-stress condition, Iso-strain condition, critical volume fraction of fibre and minimum volume fraction of fibre, Numerical on modulus of rigidity, and mechanics of discontinuous fibres, stress Vs strain curves for PMCs, MMCs, and CMCs. Cutting and machining of composites: Reciprocating knife cutting, cutting of cured composite, Joining of composites: Mechanical fastening, Adhesive bonding.

Assignment: Quiz of 25 questions and MCQ Type

Course Outcomes: At the end of the course, the student will be able to:

CO1 Define the composites, matrix and reinforcement, the types, benefits and properties of composites.
CO2 Explain polymer matrix composites, their production methods, applications
CO3 Define and explain metal matrix composites, their production methods, applications
CO4 Understand the mechanics of composite materials, solve the numerical on modulus of rigidity, cutting and joining of composite materials

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Composite Science and Engineering	K. K. Chawla	Springer Verlag	1998
2	Introduction to composite materials	Hull and Clyne	Cambridge University Press	2nd Edition, 1990
3	Composite Materials: Engineering and Science	F. L. Mathew and R. D. Rawlings	Woodhead Publishing Limited	1999
Reference Books				
1	Composite materials handbook	Meing Schwaitz	McGraw Hill Book Company	1984
2	Mechanics of Composite Materials	Robert M. Jones	McGraw Hill Kogakusha Ltd	1998
3	Composite materials	S. C. Sharma	Narosa Publishing House	2000
4	Mechanics of composites	Artar Kaw	CEC Press	2002

B. E. MECHANICAL ENGINEERING SEMESTER -VII			
CONTROL ENGINEERING			
Course Code	**UME 712E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3	SEE Marks	100
Credits	3	SEE Exam Hours	03

UNIT – I

INTRODUCTION5 Hours

Concept of automatic controls, open and closed loop systems, concepts of feedback, requirement of an ideal control system. Types of controllers – Proportional, Integral, Proportional Integral, Proportional Integral Differential controllers.

MATHEMATICAL MODELS: 5 Hours

Transfer function models, Models of Mechanical systems, Hydraulic systems.

UNIT- II

BLOCK DIAGRAMS AND SIGNAL FLOW GRAPHS: 5 Hours

Transfer Functions definition, function, blocks representation of system elements, reduction of block diagrams, signal flow graphs: Mason's gain formula.

TRANSIENT AND STEADY STATE RESPONSE ANALYSIS: 5 Hours

Introduction, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. System stability: Routh's –Hurwitz Criterion.

UNIT - III

FREQUENCY RESPONSE ANALYSIS: 10 Hours

Polar plots: Stability Analysis, Relative stability concepts, phase and gain margin, Bode Plots: stability analysis using Bode plots, Simplified Bode Diagrams.

UNIT - IV

ROOT LOCUS PLOTS: 6 Hours

Definition of root loci, general rules for constructing root loci, Analysis using root locus

CONTROL ACTION AND SYSTEM COMPENSATION: 4 Hours

Series and feedback compensation, Physical devices for system compensation.

Assignment: Quiz of 25 questions and MCQ Type

Course Outcomes: At the end of the course, the student will be able to:

- **CO1** Study the fundamental concepts of Control systems and mathematical modeling of the system.
- **CO2** To study the concepts of block diagrams & signal flow graph and the basic concepts of proportional, integral, and derivative (PID) control.
- **CO3** To study the characteristics of closed-loop control systems, including steady-state and transient response, parametric sensitivity, disturbances, error, and stability.
- **CO4** To learn the basics of stability analysis of the system

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Modern Control Engineering	Katsuhiko Ogata	University of Minnesota. Prentice Hall, New Jersey	5th edition, 2010.
2	Control systems Engineering	I.J. Nagrath and M. Gopal	New Age International Publisher	6th edition, 2018
Reference Books				
1	Control systems Engineering	U.A. Bakshi and V.U.Bakshi	Technical Publications Pune	3rd edition 2011
2	Control Systems	Joseph Distefano and Allen Stubberud	Schaum's Outline Series	3rd edition 2017

B. E. MECHANICAL ENGINEERING SEMESTER – VII			
TOOL DESIGN			
Course Code	UME7XXE/8XXE	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	3:0:0	SEE MARKS	: 100
Credits	3	SEE Exam Hours	: 3 Hrs

UNIT –I

Tool Design Methods: **05hours**

Introduction, the design procedure, drafting, and design techniques in tooling drawing.

Design of Cutting Tools: **06 Hours**

Introduction, the metal cutting process, revision of metal cutting tools-single point cutting tools, milling cutters, drills and drilling, reamers, taps, selection of carbide tools, determining the insert thickness for carbide tools.

UNIT – II

Locating and Clamping Methods: **05 Hours**

Introduction, basic principle of location, locating methods and devices, basic principle of clamping.

Design of Drill Jigs: **06Hours**

Introduction, types of drill jigs, general considerations in the design of drill jigs, drill bushings, methods of construction.

UNIT – III

Design of Fixtures: **05 Hours**

Introduction, types of fixtures, fixtures and economic.

Design of Press-working Tools: **05 Hours**

Power presses, cutting operations, types of die – cutting operations and their design, evolution of blanking and progressive blanking.

UNIT – IV

Design of Sheet Metal Bending, Forming and Drawing Dies: **06 Hours**

Introduction, bending dies, forming dies, drawing dies, evolution of a draw die, progressive dies and selection of progressive dies. Strip development for progressive dies, evolution of progressive dies, examples of progressive dies. Extrusion dies, drop forging dies and auxiliary tools, problems.

Plastics as Tooling Materials: **04 Hours**

Introduction, plastics commonly used as tooling materials, application of epoxy plastic tools, construction methods, metal forming operations with Urethane dies, calculating forces for Urethane pressure pads, problems.

Assignment : Twenty five Multi Choice Questions covering the entire syllabus (Quiz)

Course Outcomes: At the end of the course, the student will be able to:

CO1	***Explain*** the design procedure and design of cutting tools.
CO2	***Analyze*** the locating and clamping methods and design of jigs
CO3	***Design*** of fixtures, press working tools, press tool operations and their economy
CO4	***Design*** of sheet metal bending, forming and drawing dies
CO5	***Analyze*** the commonly used polymer tooling materials and design aspects like pressu forces etc.,

Question paper pattern

- A total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 subdivisions.
- Any five full questions are to answer choosing at least one from each unit.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	Edition/Year of Publication
Reference Books				
1	Tool Design	Cyril Donaldson, George H Lecain and V C Goold	Tata McGraw Hill Publishing Company Ltd	35th reprint Edition/ 2005
2	ASTME, Fundamentals of Tool Design	ASTME	PHI (P), Ltd, New Delhi	1983
3	Machine Tool Design and Numerical Control	N. K. Mehta	Tata McGraw Hill Publisher (P) Ltd, New Delhi	2006
4	Fundamentals of tool design	Wilson F. W.	ASME PHI, New Delhi	1984

B.E. MECHANICAL ENGINEERING SEMESTER – VII			
Power Plant Engineering			
Course Code	UME 720 E	CIE Marks	50
Teaching Hours/Week (L: T: P)	3:0:0	SEE Marks	100
Credits	03	SEE Exam Hours	03

UNIT - I

Introduction: **04 Hours**

Energy and power, Sources of power, Need power generation, Power plant cycles and classification of power plant cycles, Layout of modern steam power plant, Essential requirements of steam power station, Selection of site for steam power station, Capacity of steam power plant, Choice of steam conditions.

Steam Power Plant: **06 Hours**

Different types of fuels used for steam generation, Coal handling, Requirements of good coal handling plant, Coal handling systems, Equipment for burning coal in lump form, Strokers, Different types of stokers, Advantages and disadvantages of using pulverized fuel, Equipment for preparation and burning of pulverized coal, Unit system and bin system, Coal burners, Fluidized bed combustion.

UNIT - II

Ash and dust handling: **04 Hours**

Ash handling equipment and ash handling systems, Dust collection, Removal of smoke and dust, Dust collectors, Efficiency of dust collectors, Uses of ash and dust, General layout of ash and dust collection systems, Fly ash, Fly ash composition, disposal and application.

Chimney draught: **06 Hours**

Classification, Natural draught, Chimney height and diameter, Condition for maximum discharge through chimney, Efficiency of chimney, Draught losses, Artificial draught, Forced, Induced and Balanced draught, Advantages of mechanical draught, Numerical problems on chimney draught.

UNIT - III

Boilers: **04 Hours**

Classification and comparison, Selection of a boiler, Essentials of good boiler, Generation of steam using forced circulation, High and supercritical pressures, L Mont, Benson, Velox, Schmidt, Loeffler and Ramson steam generators.

Accessories: **02 Hours**

Accessories for the Steam Generator such as super-heaters, Desuperheater, Control of super heaters, Economisers, Air Pre-heaters and re-heaters, Feed water heaters and evaporators.

Performance of boilers: **04 Hours**

Evaporative capacity, Equivalent evaporation, Factor of evaporation, Boiler efficiency, Heat losses in a boiler plant, Numerical problems on boiler performance.

UNIT - IV

Steam turbines: **05 Hours**

Steam nozzles, Nozzle efficiency, Compounding of steam turbines, Difference between impulse and reaction steam turbines, Turbine efficiencies. Steam condensers; Classification, Comparison between jet and surface condensers, Numerical problems on steam turbines.

Cooling ponds and Cooling towers: **03 Hours**

Introduction, Natural and artificial ponds, Cooling ponds, Spray ponds. Cooling towers: Introduction, Natural and forced draft cooling towers, Comparison between natural and forced draft cooling towers. Feed water treatment: Impurities in water and troubles caused by the impurities, Methods of feed water treatment, pH value of water.

Cogeneration power plants: **02 Hours**

Classification, Topping and bottoming cycles, Advantages and disadvantages of steam power plants.

Assignment: As decided by the Course Instructor

Course Outcomes: At the end of the course, the student will be able to:

CO1 *Apply* the knowledge of power plant engineering in selecting the types of fuels and burning methods to produce steam.

CO2 *Apply* the knowledge of power plant engineering in selecting ash, dust handling and chimney draught for a steam power plant.

CO3 *Apply* the knowledge of power plant engineering to *analyze* boilers, boiler accessories and performance of boilers.

CO4 *Apply* the knowledge of power plant engineering to *analyze* steam turbines, cooling ponds, towers and co-generation power plants.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 subdivisions.
- Any five full questions are to be solved choosing at least one from each unit

Sl No	Title of the Book	Name of the Author(S)	Name of the Publishers	Edition and Year
Textbook(S)				
1	Power Plant Technology	M.M. EL-Wakil	McGraw Hill, International.	1994.
2	Power Plant Engineering	P.K Nag	Tata McGraw Hill	3rd Ed. 2001
Reference Books				
1	Power Plant Engineering	R.K.Rajput	Laxmi Publications	4th Ed. 2008
2	Power Plant Engineering	Domakundawar	Dhanpath Rai sons.	2003

B. E. MECHANICAL ENGINEERING SEMESTER - VII			
Refrigeration and Air Conditioning			
Course Code	**UME 729 E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	100
Credits	2-1-0	SEE Exam Hours	03

UNIT – I

BRIEF REVIEW OF VARIOUS METHODS OF REFRIGERATION: (6+6) Hours

Vapour compression cycle: Analysis of Vapour Compression cycle using P-H and T-S diagrams- calculations, standard rating of operating conditions, Actual vapour compression cycle, Second law analysis of Vapour Compression Cycle.

REFRIGERANTS:

Types of Refrigerants, Comparative study of Ethane and Methane derivatives, of Refrigerants, Requirements of Refrigerants, Effects of lubricants in Refrigerants, substitutes of CFC Refrigerants, Mixture Refrigerants-azeotropic mixtures.

UNIT- II

MULTI PRESSURE VAPOUR COMPRESSION SYSTEMS: (6+6)Hour

Multi stage compression, Multi evaporator systems, Cascade systems, calculation, production of solid carbon dioxide, System practices for multistage system.

EQUIPMENTS USED IN VAPOUR COMPRESSION REFRIGERATION SYSTEM: Compressors, Principle, types of compressors, capacity control. Condensers: Types and construction, Expansion devices: Types- Automatic expansion valve, Thermostatic expansion valves, capillary tube. Sizing Evaporator: Types & construction.

UNIT - III

VAPOUR ABSORPTION SYSTEM: (7+7) Hours

Common refrigerant absorbent combinations, Binary mixtures, Ammonia Water Absorption system, Actual vapour absorption cycle and its representation on enthalpy. Composition diagram, calculations. Triple fluid vapour absorption refrigeration system. Water-Lithium Bromide absorption chiller.

PSYCHOMETRY OF AIR CONDITIONING PROCESS-REVIEW:

Review of Psychometric processes, Summer Air conditioning, Apparatus Dew point, winter air conditioning. DESIGN CONDITIONS: Outside design conditions, choice of inside conditions, comfort chart. Choice of supply design condition.

UNIT - IV

LOAD CALCULATIONS AND APPLIED PSYCHOMETRICS: (7+7) Hours

Internal heat gains, system heat gains, break up of ventilation load and effective sensible heat factor, Bypass factor, cooling load estimate. Psychometric calculations for cooling. Selection of Air conditioning apparatus for cooling and dehumidification, evaporative cooling.

TRANSMISSION AND DISTRIBUTION OF AIR:
Room Air Distribution, Friction loss in ducts, dynamic losses in ducts, Air flow through simple Duct system, Duct design.

CONTROLS IN REFRIGERATION AND AIR CONDITIONING EQUIPMENTS:
High pressure and low pressure cut out, thermostats, pilot operated solenoid valve, motor controls, bypass control-Damper motor. VAV controls.

Assignment: (Mention the contents of the Assignment to be submitted)

Course Outcomes: At the end of the course, the student will be able to:

CO1 Students will demonstrate the ability to understand vapor compression refrigeration and types of refrigerants

CO2 Students will demonstrate the ability to understand multistage vapor compression refrigeration system and equipment used in vapor compression refrigeration system.

CO3 Student will demonstrate the ability to understand vapor absorption system and psychrometric of air conditioning

CO4 Students will demonstrate the ability to understand load calculations and applied psychromet transmission and distribution of air, controls in refrigeration and air conditioning equipment's

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Refrigeration and air conditioning	C.P.Arora	Tata McGraw Hill Publication,	2nd edition, 2001.
2	Refrigeration and air conditioning	W. F. Stoecker	Tata McGraw Hill Publication,	2nd edition, 1982
Reference Books				
1	Principles of Refrigeration' -	Dossat	Pearson	2006.
2	Air conditioning' PITA, 4th edition, pearson-2005	pita	Pearson	4th edition, 2005
3	Refrigeration and air conditioning	Manohar Prasad		Any edition
Data Hand Book:				
[1] Refrigeration and Air conditioning data hand book				

B. E. MECHANICAL ENGINEERING SEMESTER - VII			
Operations Management			
Course Code	**UME 730 E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	100
Credits	2-1-0	SEE Exam Hours	03

UNIT - 1

Introduction: **5 Hours**

Functional subsystems of organization, System concept of production, Types of production system, Productivity, strategic management, World class manufacturing.

Product Design and Analysis: **5 Hours**

New product development concepts, Process planning and design, Value analysis/Value engineering, Make or buy decision, Ergonomic consideration in product design

UNIT - 2

Forecasting: **6 Hours**

Nature and use of forecasting, Sources of data, Demand patterns, Factors affecting forecast, types of forecasting, Forecasting Models – Linear Regression, Simple moving average, weighted moving average, e, Single exponential smoothing, Double exponential smoothing, Adjusted exponential smoothing and Delphi method.

Facility Location: **4 Hours**

Introduction, factors influencing plant location, break even analysis, single facility location problem, Minimax location problem and gravity location problem.

UNIT - 3

Plant Layout and Materials Handling: **6 Hours**

Introduction, Classification of layout, Layout design procedures – Computerized Relative Allocation of Facilities Technique (CRAFT), Automated Layout Design Program (ALDEP) and, Computerized Relationship Layout Planning (CORELAP).

Line Balancing: **4 Hours**

Concept of mass production system, objective of assembly line balancing, rank positional weight method and the COMSOL Algorithm.

UNIT - 4

Modern Production Management Tools: **10 Hours**

Just-In-Time manufacturing – introduction and overviews of JIT, basic principles, push/pull production, kanban systems (pull systems). Total Quality Management – scope of TQM, benefits of TQM, quality control activities during product cycle, operating quality costs. Kaizen – Key elements of kaizen, classification of kaizen, steps of implementation of kaizen Blitz, guidelines of kaizen team, benefits of kaizen. Lean Manufacturing – steps of lean manufacturing, components of lean manufacturing.

Assignment: (Mention the contents of the Assignment to be submitted)

Course Outcomes: At the end of the course, the student will be able to:

CO1
CO2
CO3
CO4

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Production and Operations Management	R. Panneerselvam	Prentice Hall of India Pvt Ltd	2005
2	Analysis and Control of Production Systems	Elsayed A. Elsayed, Thomas O. Boucher	Pearson	2nd Edition, 1995
3	Production and Operations Management	R. B. Khanna	PHI	2010
Reference Books				
1	Modern Production/Operations Management	Buffa	Wiley Eastern Ltd	2001
2	Operations Management	Joseph G Monks	Mc Graw Hill	1987

B. E. MECHANICAL ENGINEERING SEMESTER - VII			
Six Sigma			
Course Code	**UME 731 E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	2:2:0	SEE Marks	100
Credits	2-1-0	SEE Exam Hours	03

Unit-I

History of Quality and Six Sigma **5 Hours**

Introduction, Common Six Sigma Principles, Challenges of Six Sigma, Six Sigma History and Applications: The development of Statistical Process Control, Normal Curve, PDCA-Cycle, Levels of Six Sigma Certification.

Lean Concepts **5 Hours**

Continuous Process Improvement: Toyota and Lean, Motorola's focus on defects, Lean Process Management, The seven Muda: Transportation, Inventory, Motion, Waiting, Over-production, Over-processing, Defects.

Unit-II

Basic tools of Lean and Six Sigma **5 Hours**

Run chart: Meaning, Use and Construction of Run charts. Control Charts: Meaning, Uses of control charts, Creating control charts. 5S (Seiri, Seiton, Seiso, Seiketsu, Shitsuke): Meaning, Use and Benefits.

Advanced tools of Lean and Six Sigma **5 Hours**

Supplier-Inputs-Process-Output-Customer (SIPOC): Meaning, Construct of SIPOC diagram, Use of SIPOC diagram, General rules for drawing SIPOC diagram, Practical application of SIPOC.
Value Stream Mapping (VSM): Meaning, Use of VSM, Benefits of VSM.

Unit-III

Lean Production System and Lean Six Sigma **5 Hours**

Meaning and Principles of Lean Production System, Benefits of Lean Production System.
Meaning and Myths of Six Sigma, Benefits of Six Sigma, Challenges in implementation of Six Sigma.

Lean Six Sigma (LSS) Project Selection **5 Hours**

Meaning of LSS-project, Selection and prioritization of Lean Six Sigma project, Management of project reviews, Tips for making LSS projects successful.

Unit-VI

Six Sigma Methodology: (DMAIC) **5 Hours**

Define: Define the customers, Project boundaries, the process to be improved.
Measure: Develop a data collection plan for process and determine types of defects and metrics.
Analyze: Find gaps in current process, prioritize opportunity to improve & identify sources of variation.

Improve: Create innovate solutions, Develop, and deploy implementation plan.
Control: Control the improvements to keep the process on the new course.

Industrial Case Studies: **5 Hours**

1. Application of Six Sigma methodology in casting industry.
2. Application of Six Sigma methodology in an automobile industry.

Assignment: (Mention the contents of the Assignment to be submitted)

Course Outcomes: At the end of the course, the student will be able to:

CO1 Explain the Principles, Challenges, Applications and Certification of Six Sigma. Also Lean, Seven Wastes, and Continuous Process Improvement.
CO2 Distinguish between basic and advanced tools of Lean Six Sigma and their application.
CO3 Evaluate the significance of Lean production system and Lean Six Sigma.
CO4 Apply, Lean Six Sigma methodology (DMAIC) to Manufacturing Industries.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 marks and should not have more than 4 sub divisions.
- Any five full questions are to be answered choosing at least one from each unit.

Sl No	Title of the Book	Name of the Author/s	Name of the Publishers	Edition and Year
Textbook/s				
1	Lean Six Sigma for Small and Medium Sized Enterprises: A Practical Guide	Jiju Antony, S. Vinodh, E. V. Gijo	CRC Press, Taylor & Francis Group, Publication	31st March 2021, 1st Edition, ISBN: 9780367782955.
2	Six Sigma: A Complete Step-by-Step Guide	The Council of Six Sigma Certification	The Council of Six Sigma Certification	2018 Edition,
Reference Books				
1	Six Sigma for Small Business	Greg Brue	Entrepreneur Media, Inc.	2006
2	The Six Sigma Handbook	Thomas Pyzdek	McGraw-Hill Publisher	2003

B. V. V. Sangha's

BASAVESHWARA ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Syllabus for M. Tech. (CSE) for the 2018-19, 2019-20 and 2020-21 Admitted Batch

Semester-I:

Sl. No	Subject Code	Name of the Subjects	Credits	Hours / Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PCS141C	Advanced Algorithms	4	3	2	0	50	50	100
2	PCS142C	Big Data and Analytics	4	3	2	0	50	50	100
3	PCS002E	Computer Graphics &Visualization	4	4	0	0	50	50	100
4	PCS009E	Cryptography and Network Security	4	4	0	0	50	50	100
5	PCS038E	Advances in Operating Systems	4	4	0	0	50	50	100
6	PCS143L	Computing Lab-1 (Advanced Algorithms)	1	0	0	2	50	50	100
Total			**21**	**18**	**4**	**2**	**300**	**300**	**600**

Semester-II:

Sl. No	Subject Code	Name of the Subjects	Credits	Hours / Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PCS241C	Advanced Database Technologies	4	3	2	0	50	50	100
2	PCS242C	Advanced Computer Networks	4	3	2	0	50	50	100
3	PCS243C	High Performance Computing	4	3	2	0	50	50	100
4	PCS003E	Digital Image Processing	4	4	0	0	50	50	100
5	PCS006E	Machine Learning	4	4	0	0	50	50	100
6	PCS037E	Wireless Ad-Hoc Networks	4	4	0	0	50	50	100
7	PCS244L	Computing Lab-2 (Advanced Computer Networks)	1	0	0	2	50	50	100
Total			**25**	**21**	**6**	**2**	**350**	**350**	**700**

Semester-III:

Sl. No	Subject Code	Name of the Subjects	Credits	Hours / Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PCS023E	Storage Area Networks	4	4	0	0	50	50	100
2	PCS341I	Internship	8	0	0	16	50	50	100
3	PCS342P	Project Phase-I	10	0	0	20	50	50	100
Total			**22**	**4**	**0**	**36**	**150**	**150**	**300**

Semester-IV:

Sl. No	Subject Code	Name of the Subjects	Credits	Hours / Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PCS441P	Project Phase-II	20	0	0	40	50	50	100
Total			**20**	**0**	**0**	**40**	**50**	**50**	**100**

PCS141C

Advanced Algorithms
4 CREDITS (3-2-0)

Unit-I	**L-12 Hours**
Amortized Analysis: Aggregate, Accounting and Potential Methods. Graph Algorithms: Bellman - Ford Algorithm; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT Representation of polynomials; the DFT and FFT; Efficient implementation of FFT.	12 Hours
Unit-II	**L-12 Hours**
Number -Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Powers of an element; RSA cryptosystem; Primality testing; Integer factorization. String-Matching Algorithms: Naive string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm Boyer – Moore algorithms.	12 Hours
Unit-III	**L-12 Hours**
Probabilistic and Randomized Algorithms: Probabilistic Algorithms, randomizing deterministic algorithms, Monte Carlo and Las Vegas Algorithms, Probabilistic numerical algorithms, Probabilistic parallel algorithms: NP-Complete Problems, The classes P and NP, Reducibility, NP- complete problems: Cook's theorem, Sample NP-complete problems, the class co-NP, The Classes NC and P-Complete Approximation Algorithms Bin Packing, The Steiner tree problem, the facility location problem.	12 Hours
Unit-IV	**L-12 Hours**
Introduction to parallel algorithms and architectures: Approaches to the design of parallel algorithms, Architectural constraints and design of parallel algorithms, Performance measures of parallel algorithms, parallel sorting Internet algorithms Search Engines, Ranking web pages, Hashing, Caching, content delivery and consistent hashing, Message security algorithms.	12 Hours
Total L (Lecture)	**48 Hours**

Text Books :
1. T. H Cormen, C E Leiserson, R L Rivest and C Stein: **"Introduction to Algorithms"**, 2nd Edition, Prentice-Hall of India, 2002.
2. Kenneth A. Berman and Jerome L. Paul: **"Algorithms"**, Cengage Learning, 2002.

Reference Books :
1. Ellis Horowitz, SartajSahni, S.Rajasekharan: "**Fundamentals of Computer Algorithms"**, 2nd Edition, University Press, 2007. Alfred V. Aho,John E. Hopcroft, J.D.Ullman: "**The Design and Analysis of Computer Algorithms"**, Addison-Wesley, 1974.

Course Outcomes :
1. Analyze randomized algorithms. Employ indicator random variables and linearity of expectation to perform the analyses. Recite analyses of algorithms that employ this method of analysis.
2. Understand the different methods of amortized analysis (aggregate analysis, accounting and potential method). Perform amortized analysis.
3. Know major string matching algorithms and compare efficiencies of different algorithms.
4. Know the wide range of advanced algorithmic problems, their

relations and variants, and application to real-world problems.

5. Identify the different ways to analyze randomized algorithms (expected running time, probability of error). Recite algorithms that employ randomization.

PCS142C

BIG DATA AND ANALYTICS
4 CREDITS (3-2-0)

Unit-I **L-12 Hours**

Types of digital data: 12 Hours

Types of Digital Data, Structured: Sources of structured data, Ease with Structured data, Semi-Structured: Sources of semi-structured data, Unstructured: Sources of unstructured data, Issues with terminology, Dealing with unstructured data.

Big Data:

Characteristics of data, What big data? Definitions and Challenges of big data, other characteristics of data which are not definitional traits of big data, Why big data? Are we just an information consumer or do we also produce information? Traditional Business Intelligence(BI) versus Big data, A typical BI environment, A big data environment, Big data stack, What is changing in the realms of big data?

Big data analytics:

Where do we begin? What is big data analytics? What big data analytics isn't? Why this sudden hype around big data analytics? Classification of analytics top challenges facing big data, why is big data analytics important? Greatest challenges that prevent businesses from capitalizing on big data, what kind of technologies are we looking towards to help meet the challenges posed by big data? Data science, Data Scientist – your new best friend!!!, Terminologies used in big data environment, In memory analytics, In database processing, Massively parallel processing, Parallel versus distributed systems, Shared Memory architecture, Consistency, Availability, Partition Tolerance (CAP) theorem explained, Basically Available Soft State Eventual Consistency (BASE), Few top Analytics tools, Introduction to Jasper Report using Jasper Soft Studio.

Unit-II **L-12 Hours**

The big data technology landscape: 12 Hours

NoSQL, Where is it used? What is it? Types of NoSQL databases, Why NoSQL? Advantages of NoSQL, What we miss with NoSQL? NoSQL Vendors, SQL Versus NoSQL, NewSQL, Comparison of SQL, NoSQL and NewSQL, Hadoop: Features of Hadoop, Key advantages of Hadoop,Versions of Hadoop, Hadoop 1.0, Hadoop 2.0, Overview of Hadoop Ecosystems, Hadoop Versus, SQL, Integrated Hadoop systems offered by leading market vendors, Cloud based Hadoop solutions.

Hadoop:

Introducing Hadoop, Why not RDBMS, Distributed Computing Challenges, Brief History of Hadoop, Hadoop Overview, Hadoop Components, High Level Architecture of Hadoop, Hadoop Distributed File System(HDFS), HDFS Architecture, Daemons Related to HDFS, Working with HDFS Command, Special Features of Hadoop, Processing Data With Hadoop,Introduction, How Map Reduce Works? Map Reduce Example, Word Count Example using Java.

Managing Resources and Applications with YARN:

Introduction, Limitation of Hadoop 1.0, Hadoop 2: HDFS, Hadoop 2: YARN, Interacting with HadoopEcoSystem, Hive,Pig, HBASE, Sqoop, Business Intelligence on Hadoop.

Unit-III **L-12 Hours**

NoSQL - MongoDB: 12 Hours

What is MongoDB? Why MongoDB? Using JSON, Creating or generating a unique key, Support for dynamic queries, Storing binary data, Replication, Sharding, Updating information in-place, Terms used in RDBMS and MongoDB, Data types in MongoDB,

MongoDB - CRUD (Insert(), Update(), Save(), Remove(), find()), MongoDB- Arrays, Java Scripts, Cursors, Map Reduce Programming, Aggregations.

NoSQL - Cassandra:

What is Cassandra? Why Cassandra? Peer to peer network, Gossip and Failure detection, Anti-Entropy & Read Repair, Writes in Cassandra, Hinted handoffs, Tunable consistency,Cassandra- CQLSH - CRUD, Counter, List, Set, Map, Tracing.

Unit-IV **L-12 Hours**

Hadoop Hive: 12 Hours

Introduction to Hive - The Problem, Solution - Hive Use Case, Data Growth, Schema Flexibility and Evolution, Extensibility, What is Hive, History of Hive and Recent Releases of Hive, Hive Features, Hive Integration and Work Flow, Hive Data Units, Hive Architecture, Hive Primitive Data Types and Collection Types, Hive File Formats, Hive Query Language - Statements, DDL , DML, Hive Partitions, Bucketing, Views, Sub Query, Joins, Hive User Defined Function, Aggregations in Hive, Group by and Having, Serialization and Deserialization, Hive Analytic Functions.

Hadoop - Pig:

Introducing Pig, History and Anatomy of Pig, Pig on Hadoop, Pig Features, Pig Philosophy, Word count example using Pig, Use Case for Pig, Pig Primitive Data Types, Colletion Types and NULL, Pig Latin Overview, Pig Latin Grammar - Comments, Keywords, Identifiers, Case sensitivity in Pig, Common Operators in Pig, Pig Statements, LOAD, STORE, DUMP, Interactive Shell - GRUNT, FILTER,SORT,GROUP BY,ORDER BY, JOIN, LIMIT, Pig Latin Script, Local Mode,Map Reduce Mode, Running Pig Script,Working with Field, Tuple, Bag,User Defined Function, Parameters in Pig.

Total L (Lecture) **48 Hours**

Text Books :

1. Big Data and Analytics, SeemaAcharya and SubhashiniChellappan – Wiley India, 2015.

Reference Books :

1. Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2012.
2. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, 2007.
3. Paul Zikopoulos, Dirk deRoos, Krishnan Parasuraman, Thomas Deutsch, James Giles, David Corrigan, “Harness the Power of Big data – The big data platform”, McGraw Hill, 2012.
4. Michael Minelli, Michehe Chambers, “Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today’s Business”, 1st Edition, AmbigaDhiraj, Wiely CIO Series, 2013.

Course Outcomes :

1. Explain the significance, characteristics and challenges of big data in storage, analysis and manipulation of data.
2. Differentiate various Big data technologies like HadoopMapReduce, Pig, Hive, MongoDB and Cassandra.
3. Comprehend the significance of NoSQL and NewSQL databases.
4. Apply the knowledge of computing tools and techniques in the field of Big Data for solving real world problems.
5. Identify the challenges in Big Data with respect to IT Industry and pursue quality research.

PCS002E

COMPUTER GRAPHICS AND VISUALIZATION
4 CREDITS (4-0-0)

	Unit-I	**L-12 Hours**
	Application of Computer Graphics, Video-Display Devices: Refresh CRT, Raster display Random Display. Color CRT. Raster scan systems, Introduction to OpenGL, OpenGL Point and Line functions, Line Drawing Algorithm, Circle generating Algorithm, 3D: object representations: Polyhedra, OpenGL Polyhedron Functions, Quadric Surfaces, Super Quadrics, OpenGL Quadric and Super Quadric surface functions.	12 Hours
	Unit-II	**L-12 Hours**
	Basic Two-dimensional transformations, Matrix representation of Homogeneous coordinates, 2D Composite Transformation, Geometric Transformation in 3D, 3D Translation, 3D Rotation, 3D scaling, Other 3D transformations, OpenGL Geometric Transformations, 3D Viewing Coordinate parameters, Orthogonal projections, OpenGL 3D viewing functions.	12 Hours
	Unit-III	**L-12 Hours**
	Visible Surface Detection: Classification of Visible surfaces, Back-Face Detection, Depth-Buffer Method, A-Buffer Method, Scan line Method, Depth sorting Method, BSP- TREE Method, Area- Subdivision method, OpenGL- Visibility Detection Functions, Illumination Models: light sources, Basic illumination models, OpenGL Illumination Functions.	12 Hours
	Unit-IV	**L-12 Hours**
	Graphical User Interface: Interactive Picture construction, OpenGL Interactive Input functions, OpenGL Menu functions, Designing Graphical user Interface, Color Models: Standard Primaries, RGB color model, YIQ Colour models, CMY color model. Computer Animation: Design of Animation Sequences, Motion Specifications, Periodic motions, OpenGL Animation Procedures.	12 Hours
	Total L (Lecture)	**48 Hours**

Text Books : 1. Computer Graphics with OpenGL, Hearn and Baker, 3rd Edition Pearson Education 2009.

Reference Books :
1. Interactive Computer Graphics A Top-Down Approach with OpenGL, Edward Angel, 5th Edition, Addison Wesley 2008.
2. Computer Graphics Using OpenGL- F. S. Hill , Stephen M. Kelley, 2nd Edition Prentice Hall 2006.

Course Outcomes :
1. Know the architecture of graphics systems and Understand Graphics algorithms.
2. Illustrate 3D object representation using Graphics function.
3. Develop application using transformation functions.
4. Analyze visible surface detection algorithms in 3D object representations.
5. Construct application using viewing, color and illumination models.

PCS009E

CRYPTOGRAPHY AND NETWORK SECURITY
4 CREDITS (4-0-0)

Unit-I **L-12 Hours**

Symmetric Ciphers: 12 Hours

Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. Classical Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Cipher and the Data Encryption Standard: Simplified DES, Block Cipher Principles.

Unit-II **L-12 Hours**

The Data Encryption Standard, The Strength of DES, Differential and Linear Cryptanalysis. Symmetric Ciphers: Triple DES, Blowfish. Confidentiality Using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation. Public-Key Encryption, Digital signatures and Authentication Protocols: Number Theory: Prime Numbers, Format's and Euler's Theorems, Testing for Primality. Public-Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange. 12 Hours

Unit-III **L-12 Hours**

Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MDS Message Digest Algorithm. Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standard. **Network Security:** Authentication Applications: Kerberos, XS09 Directory Authentication Service. Electronic Mail Security: Pretty Good Privacy. 12 Hours

Unit-IV **L-12 Hours**

IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload. Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction. 12 Hours

Total L (Lecture) **48 Hours**

Text Books : 1. William Stallings, Cryptography and Network Security: Principles and Practice, 3rd Edition, Pearson Education, 2002.

Reference Books : 1. William Stallings, Network Security Essentials: Applications and Standards, 5th Edition, Pearson Education, 2013.

Course Outcomes :

1. Identity and analyze the existing security vulnerabilities, services and mechanisms in a computer network and develop a security model to prevent, detect and recover from the attacks.
2. Illustrate the basic concept of encryption and decryption for secure data transmission and apply them.
3. Analyze and compare various cryptography techniques, authentication and key management protocols.
4. Explain the services and mechanisms employed at the different layers of the OSI to provide security.
5. Evaluate the existing computing systems and propose new strategies to secure data communication.

PCS038E

ADVANCES IN OPERATING SYSTEMS
4 CREDITS (4-0-0)

Unit-I **L-12 Hours**

Operating System Overview: 12 Hours

Operating System Objectives and Functions, The Evolution of Operating Systems, Major Achievements, Developments Leading to Modern Operating Systems, Microsoft Windows Overview, Traditional UNIX Systems, Modern UNIX Systems, Linux.

Process Description and Control:

What is a Process? Process States, Process Description, Execution of the Operating System, Security Issues, UNIX SVR4 Process Management.

Threads, SMP, and Microkernels:

Processes and Threads, Symmetric Multiprocessing (SMP), Microkernels, Linux Process and Thread Managements.

Unit-II **L-12 Hours**

Concurrency: Mutual Exclusion and Synchronization: 12 Hours

Principles of Concurrency, Mutual Execution: Hardware Support, Semaphores, Monitors, Message Passing, Readers / Writers Problem.

Concurrency: Deadlock and Starvation:

Principles of Deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategy, Dining Philosophers Problems, Dining Philosophers Problems, Linux Kernel Concurrency Mechanisms.

Unit-III **L-12 Hours**

Memory Management and Virtual Memory: 12 Hours

Memory Management requirements, Memory Partitioning, Paging, Segmentation, Security Issues.

Virtual Memory:

Hardware and Control structures, OS Software, Linux Memory Management.

Multiprocessor and Real-Time Scheduling:

Multiprocessor Scheduling, Real-Time Scheduling, Linux Scheduling.

Unit-IV **L-12 Hours**

Embedded Operating Systems: 12 Hours

Embedded Systems, Characteristics of Embedded Operating Systems, eCOS, TinyOS.

Distributed Processing, Client/server and Clusters:

Client/server Computing, Distributed Message Passing, Remote Procedure, Clusters, Windows Vista Clusters Server.

Total L (Lecture) **48 Hours**

Text Books : 1. William Stallings, "Operating Systems: Internals Design and Principles", 6th edition, Longman, 2009.

Reference Books : 1. Gary Nut, "Operating Systems", Third Edition, Pearson Education. 2006.
2. MukeshSinghal, NiranjanShivaratri, "Advanced Concepts in Operating Systems – Distributed, Database and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

3. Rajib Mall, "Real-Time Systems: Theory and Practice", Prentice Hall, 2006.
4. Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", Fourth Edition, Prentice Hall, 2014.
5. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, "Operating System Concepts", Wiley, Eighth edition, 2008.

Course Outcomes :

1. Exposed to different operating systems and advancements.
2. Familiar with the concepts like multithreading and synchronization.
3. Having the knowledge of scheduling in multiprocessor systems.
4. Realizing the importance of memory management in operating systems.
5. Having the knowledge of distributed, client-server and cluster environments.

PCS143L

Computing Lab 1 (Advanced Algorithms)
1 CREDIT (0-0-2)

Lab Assignment List

Note: The following programs can be executed on any tool/language.

1. Design and write a program to implement Extended Euclid's algorithm to compute the, greatest common divisor of integers *a* and *b*, also the coefficients of Bézout's identity, which are integers *x* and *y* such that ax+ by= gcd (a,b).
2. Design and write a program to implement a Miller Rabin / Monte Carlo algorithm to test the primality of a given integer and determine its performance.
3. Design and write a program to calculate pow(x,n) i.e for given two integers x and n, compute x^n. Assume that x and n are small and overflow doesn't happen.
4. Design and write a program to implement the Bellman-Ford algorithm to solve the single-source shortest-paths problem and determine its performance.
5. Design and write a program to implement Johnson's algorithm to solve the all pairs shortest path problem, i.e. given an input graph with general edge weights (can be negative) with no negative cycles, find the shortest (u, w) path for all pairs of vertices (u, w). If the input graph has any negative cycles, the program will report this.
6. Design and write a program to implement Ford Fulkerson algorithm to find maximum flow and determine its performance.
7. Design and write a program to solve string matching problem using naïve approach and Boyer Moore approach. Compare the performance.
8. Design and write a program to solve string matching problem using the KMP algorithm. Determine the performance.
9. Design and write program to solve string matching problem using Robin Karp algorithm and determine its performance.
10. Design and write a program to solve string matching problem using Finite Automata and determine its performance.

PCS241C **ADVANCED DATABASE TECHNOLOGIES**
4 CREDITS (3-2-0)

Unit-I	**L-12 Hours**
Review of Relational Data Model and Relational Database Constraints: Relational model concepts; Relational model constraints and relational database schemas; Update operations, transactions and dealing with constraint violations. **Database-System Architectures:** Centralized and Client-Server Architecture; Server System Architectures; Parallel Databases; Distributed Systems; Network Types.	12 Hours
Unit-II	**L-12 Hours**
Concepts of Object Databases: Overview of Object-Oriented Concepts; Objects, identity, Object Structure and Type Constructors; Encapsulation of operations, methods, and persistence; Type and class hierarchies, and inheritance; complex objects. **Object Database Standards, Languages and Design:** Overview of Object model of ODMG; Object definition Language ODL; Object Query Language OQL; Conceptual design of Object database.	12 Hours
Unit-III	**L-12 Hours**
Distributed Databases: Homogeneous and heterogeneous Databases; Distributed Data storage; Distributed transactions; Commit Protocols; Concurrency Control in Distributed Databases; Availability; Distributed Query Processing; Heterogeneous Distributed Databases. **Parallel Databases:** Introduction; I/O Parallelism, Interquery Parallelism; Intraquery Parallelism; Intraoperation Parallelism; Interoperation Parallelism; Query Optimization.	12 Hours
Unit-IV	**L-12 Hours**
Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. **More RecentApplications:** Mobile databases; Multimedia databases, Geographical information system and Genome database management. The concept of big data.	12 Hours
Total L (Lecture)	**48 Hours**

Text Books :

1. RameezElmashri, Shamakant B Navathe, 'Fundamentals of Database Systems', Fifth Edition, Pearson Education. (5.1-5.3 (except 5.2.5 & 5.3.4); 20.1-20.5; 21.1-21.5(except21.4); 24.1-24.4(except 24.3.2 & 24.4.5-24.4.8); 30.1-30.4(except 30.2.3).
2. Abraham Silberschatz, Henry. F. Korth and S.Sudharsan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2011. (17.1- 17.5; 18.1-18.7; 19.1-19.8 (except 19.4.3, 19.6.3-19.6.6); 20.1- 20.8 (except 20.4.2 – 20.4.4).

Reference Books :

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003.
2. Connolly and Begg: Database Systems, 4th Edition, Pearson Publications, 2009.

Course Outcomes :

1. Describe, define and apply the major components of the relational database model to database design.
2. Acquire the knowledge of some contemporary topics in database research like parallel databases, distributed databases, data warehousing and data mining.
3. Master some advanced topics in database; typical topics are distributed concurrency control, database recovery, query optimization.
4. Evaluate and apply advanced database development techniques.
5. Design advanced database systems.

PCS242C **ADVANCED COMPUTER NETWORKS**
4 CREDITS (3-2-0)

Unit-I **L-12 Hours**
12 Hours

Review of Basic Concepts:
(Self Study)

Direct link networks:
Hardware Building Blocks-nodes, links; Encoding, Framing(Self Study), Error Detection- Two-Dimensional Parity, Internet checksum Algorithm, cyclic Redundancy Check; reliable Transmission- Stop-and-Wait, Sliding Window, Concurrent Logical Channels; Ethernet (802.3), Rings (802.5, FDDI) – Token Ring Media Access Control, Token Ring Maintenance, FDDI (Self Study),Wireless.

Packet Switching:
Switching and forwarding – Datagrams, Virtual Circuit Switching, Source Routing; Bridges and LAN Switches – Learning Bridges, Spanning Tree Algorithm, Broadcast and Multicast, Limitations of Bridges; cell switching (ATM) – Cells, Segmentation and Reassembly, Virtual Paths, Physical Layers for ATM, Implementation and Performance.

Unit-II **L-12 Hours**
12 Hours

Internetworking:
Simple internetworking (IP) – What is an Internetwork?, Service Model, Global Address, Datagram Forwarding in IP, Address Translation(ARP), Host Configuration(DHCP), Error Reporting(ICMP), Virtual Networks and Tunnels; Routing – Network as a Graph, Distance Vector(RIP), Link State(OSPF), Metrics, Routing for Mobile Hosts, Global Internet – Subnetting, Classless Routing(CIDR), Interdomain Routing(BGP), Routing Areas, IP Version 6(IPv6), Multiprotocol Label Switching - Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels.

End-to-End Protocols:
Simple Demultiplexer (UDP); Reliable byte stream (TCP) – End-to-End Issues, Segment Format, Connection Establishment and Termination, Sliding Window Revisited, Triggering Transmission, Adaptive Retransmission, Record Boundaries, TCP Extensions, Alternative Design Choices, Remote Procedure Call – RPC Fundamentals, RPC Implementaions (SunRPC, DCE).

Unit-III **L-12 Hours**
12 Hours

Congestion Control and Resource Allocation:
Issues in resource allocation – Network Model, Taxonomy, Evaluation Criteria; Queuing discipline – FIFO, Fair Queuing; TCP Congestion Control – Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit and Fast Recovery; Congestion – Avoidance mechanisms – DECbit, Random Early Detection (RED), Source-Based Congestion Control, Quality of Service – Application Requirements, Integrated Services (RSVP), Differentiated Services, Equation-Based Congestion Control.

End – to – End Data:
Presentation Formatting – Taxonomy, Examples (XDR, ASN.1, NDR), Markup Languages (XML), Data Compression – Lossless Compression Algorithms, Image Compression (JPEG), Video Compression (MPEG), Transmitting MPEG over a Network, Audio Compression (MP3).

Applications:
Traditional applications – Electronic Mail (SMTP, MIME, IMAP), World Wide Web

(HTTP), Name Service (DNS), Network management (SNMP); Web services – Custom application Protocols (WSDL, SOAP), A Generic application Protocol (REST) (Self Study), Multimedia Applications – Session Control and Call control, Resource Allocation for Multimedia Applications, Overlay Networks – Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks.

Unit-IV **L-12 Hours**

Wireless networks: 12 Hours

Introduction; The wireless channel; Link Level Design; Channel access; Network design; Wireless Networks Today; Future Systems and Standards.

Optical Networks:

Optical Links; WDM systems; Optical Cross-Connects; Optical LANs; Optical Paths and Networks.

Total L (Lecture) **48 Hours**

Text Books :

1. Larry L. Peterson and Bruce S. David: Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.
2. J. Walrand and P. Varaya, "**High Performance Communication Networks**", Harcourt Asia (Morgan Kaufmann), 2000.

Reference Books :

1. Behrouz A. Forouzan: Data Communications and Networking, 4th Edition, Tata McGraw Hill, 2006.
2. William Stallings: Data and Computer Communication, 8th Edition, Pearson Education, 2007.
3. Alberto Leon-Garcia and IndraWidjaja: Communication Networks - Fundamental Concepts and Key Architectures, 2nd Edition Tata McGraw-Hill, 2004.

Course Outcomes :

1. Explain the various functions carried out by various layers of TCP/IP protocol stack.
2. Understand the state-of-the-art in network protocols, architectures and applications.
3. Enumerate the relative advantages and disadvantages of various topologies, encoding schemes, medium access control schemes and protocols employed in computer networks.
4. Identify the various design and performance issues involved in developing different networks, particularly in LAN, WAN, optical and wireless networks.
5. Apply different error detection/correction techniques, routing techniques, congestion control techniques and compression techniques.

PCS243C

HIGH PERFORMANCE COMPUTING
4 CREDITS (3-2-0)

Unit-I **L-12 Hours**

Introduction: 12 Hours

Stored program computer architecture, General purpose cache based microprocessor architecture, Performance metrics and benchmarks, Transistors galore: Moore's low, Pipelining, Superscalarity, SIMD. Memory hierarchies:, Cache, Cache mapping, Prefetch Multicore processors, Multithreaded processors, Vector processors, Design principles, Maximum performance estimates.

Parallel Computers:

Taxonomy of parallel computing paradigms, Shared memory computers, Cache coherence UMA, ccNUMA, Distributed memory computers, Hierarchical (hybrid) systems Interconnection Network,Basic performance characteristics of networks, Buses, Switched and fat tree networks, Mesh networks, Hybrid Networks.

Unit-II **L-12 Hours**

Basic of parallelization: 12 Hours

Parallelism, Data parallelism, Functional parallelism, Parallel scalability Simple scalability laws, Parallel efficiency, Serial performance versus strong scalability Refined performance models, Choosing the right scaling baseline, Case study, Load imbalance.

GPUs as Parallel Computers:

Architecture of a Modern GPU, Why More Speed or Parallelism, Parallel Programming Languages and Models, Overarching Goals Evolution of Graphics Pipelines, the Era of Fixed-Function Graphics Pipelines, Evolution of Programmable Real-Time Graphics, Unified Graphics and Computing Processors, GPGPU: An Intermediate Step in GPU Computing Scalable GPUs.

Unit-III **L-12 Hours**

Cluster Computing: 12 Hours

Introduction to Cluster Computing, Scalable Parallel Computer Architectures, Cluster Computer and its Architecture, Classifications, Components for Clusters, Cluster Middleware and Single System Image, Resource Management and Scheduling, Programming Environments and Tools, Applications.

Grid Computing:

Introduction to Grid Computing, Virtual Organizations, Architecture, Applications, Computational, Data, Desktop and Enterprise Grids, Data-intensive Applications, High-Performance Commodity Computing.

Unit-IV **L-12 Hours**

Power-Aware Computing and Communication, Power-aware Processing Techniques, 12 Hours
Power aware Memory Design, Power-aware Interconnect Design, Software Power Management High Performance architecture examples IBM CELL BE, Nvidia Tesla GPU, Intel Larrabee Microarchitecture and Intel Nehalem microarchitecture Advanced Topics in computing.

a) Petascale Computing.
b) Optics in Parallel Computing.
c) Quantum Computers.
d) Recent developments in Nanotechnology and its impact on HPC.

Total L (Lecture) **48 Hours**

Text Books :
1. Introduction to High Performance Computing for Scientists and Engineers byGeorg Hager Gerhard Wellein.
2. Programming Massively Parallel Processors: A Hands-on Approach by David Kirk and Wen-meiHwu.
3. Heterogeneous Computing with Open CL by Benedict R. Gaster.

Reference Books :
1. "Advanced Computer Architecture: Parallelism, Scalability, Programmability", by Kai Hwang, McGraw Hill 1993.
2. "Parallel Computer Architecture: A hardware/Software Approach", by David Culler Jaswinder Pal Singh, Morgan Kaufmann, 1999.
3. "Scalable Parallel Computing", by Kai Hwang, McGraw Hill 1998.
4. "Principles and Practices on Interconnection Networks", by William James Dally and Brian Towles, Morgan Kauffman 2004.
5. GPU Gems 3 --- by Hubert Nguyen (Chapter 29 to Chapter 41).
6. Introduction to Parallel Computing, AnanthGrama, Anshul Gupta, George Karypis, and Vipin Kumar, 2nd edition, Addison-Welsey, © 2003.
7. Petascale Computing: Algorithms and Applications, David A. Bader (Ed.), Chapman & Hall/CRC Computational Science Series, © 2007.

Course Outcomes : Upon completion of the course, learner should be able to
1. Describe what is HPCand how HPC can be attained and what are barriers.
2. Exhibit the understanding of different HPC architectures and this functionality.
3. Compare the performance of various HPC techniques.
4. Exhibit understanding of commercial HPC architecture.
5. Evaluate performance of HPC in comparison to conventional computer.

Note: A list of assignments will be provided in the beginning of semester and evaluated for 20 Marks.

PCS003E

DIGITAL IMAGE PROCESSING
4 CREDITS (4-0-0)

Unit-I	**L-12 Hours**
Introduction:	12 Hours

What is digital image processing? Origins of Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System A Simple Image Formation Model, Basic Concepts in Sampling and Quantization, Representing Digital Images, Zooming and Shrinking Digital Images, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Image Enhancement in the Spatial Domain:
Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods.

Unit-II	**L-12 Hours**
Image Enhancement in the Frequency Domain:	12 Hours

Background, Introduction to the Fourier Transform and the Frequency, Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering.

Image Restoration:
A Model of the Image degradation/Restoration process, Noise Models, Restoration in the Presence of Noise Only–Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations , Estimating the Degradation Function, Inverse Filtering ,Minimum Mean Square Error (Wiener) Filtering.

Unit-III	**L-12 Hours**
Color Fundamentals:	12 Hours

Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images.

Morphological Image Processing:
Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms.

Unit-IV	**L-12 Hours**
Image Segmentation:	12 Hours

Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation.

Representation and Description: Representation, boundary descriptors, regional descriptors, use of principal components and description.

Object Recognition: Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods.

Total L (Lecture)	**48 Hours**

Text Books :

1. Rafel C Gonzalez and Richard E. Woods, "Digital Image Processing", PHI 2nd Edition 2005.
2. Scott.E.Umbaugh, "Computer Vision and Image Processing", Prentice Hall, 1997.

Reference Books :

1. S. Jayaraman, s. Esakkirajan, T. Veerakumar, “Digital Image Processing”, Tata McGraw-Hill Education.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, PHI 2008.

Course Outcomes :

1. List the fundamentals steps in digital image processing both in spatial and frequency domains.
2. Develop new algorithms to improve the quality of digital images by applying enhancement and restoration techniques.
3. Identify various color models to represent color images and transformation among the different color models.
4. Analyze the techniques available in morphological image processing.
5. Apply several image processing techniques to solve real world problems by employing modern engineering tools.

PCS006E

MACHINE LEARNING
4 CREDITS (4-0-0)

Unit-I **L-12 Hours**

Introduction, What Is Machine Learning? Examples of Machine Learning Applications. 12 Hours

Supervised Learning:

Learning a Class from Examples Vapnik-Chervonenkis (VC) Dimension, Probably Approximately Correct (PAC) Learning, Noise, Learning Multiple Classes, Regression, Model Selection and Generalization, Dimensions of a Supervised Machine Learning Algorithm.

Bayesian Decision Theory:

Introduction, Classification, Losses and Risks, Discriminant Functions, Utility Theory, Value of information, Bayesian Networks, Influence Diagrams, Association Rules.

Unit-II **L-12 Hours**

Parametric Methods: 12 Hours

Introduction, Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Regression, Tuning Model Complexity: Bias/Variance Dilemma, Model Selection Procedures.

Multivariate Methods:

Multivariate Data, Parameter Estimation, Estimation of Missing Values, Multivariate Normal Distribution, Multivariate Classification, Tuning Complexity, Discrete Features, Multivariate Regression.

Dimensionality Reduction:

Introduction, Subset Selection, Principal Components Analysis, Factor Analysis, Multidimensional Scaling, Linear Discriminant Analysis.

Unit-III **L-12 Hours**

Clustering: 12 Hours

Introduction, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm, Mixtures of Latent Variable Models, Supervised Learning after Clustering, Hierarchical Clustering, Choosing the Number of Clusters.

Nonparametric Methods:

Introduction, Nonparametric Density Estimation. Generalization to Multivariate Data Nonparametric Classification, Condensed Nearest Neighbor, Nonparametric Regression: Smoothing Models, How to Choose the Smoothing Parameter.

Decision Trees:

Introduction, Univariate Trees, Pruning, Rule Extraction from Trees, Learning Rules from Data, Multivariate Trees.

Unit-IV **L-12 Hours**

Linear Discrimination: 12 Hours

Introduction, Generalizing the Linear Model, Geometry of the Linear Discriminant, Two Classes, Multiple Classes, Pairwise Separation, Parametric Discrimination Revisited, Gradient Descent, Logistic Discrimination, Discrimination by Regression, Support vector machines.

Combining Multiple Learners:

Rationale, Voting, Error-Correcting Output Codes, Bagging, Boosting, Mixture of Experts Revisited, Stacked Generalization, Cascading.

Reinforcement Learning:

Introduction, Single State Case: K-Armed Bandit, Elements of Reinforcement Learning, Model-Based Learning, Temporal Difference Learning, Generalization, Partially Observable States.

Total L (Lecture) **48 Hours**

Text Books : 1. EthemAlpaydin, 2004, ‘Introduction to machine Learning’, PHI.

Reference Books : 1. Tom M Mitchell, 1996, Machine Learning McGraw Hill Publications.

Course Outcomes :

1. Understand the fundamentals of machine learning techniques.
2. Apply the learning techniques to solve classification problems.
3. Choose and differentiate the supervised, reinforcement and analytical learning techniques.
4. Identify the significance of decision theory, dimensionality reduction and clustering.
5. Apply effectively parametric and non- parametric methods for appropriate applications.

PCS037E

WIRELESS AD-HOC NETWORKS
4 CREDITS (4-0-0)

Unit-I	**L-12 Hours**
Ad-hoc Wireless Networks Introduction, Issues in Ad-hoc Wireless Networks, Ad-hoc Wireless Internet; MAC Protocols for Ad-hoc Wireless Networks: Issues in Designing a MAC Protocol, Design Goals of MAC Protocols, Classification of MAC protocols, Contention-Based Protocols, Reservation Mechanisms: Distributed packet reservation, Time allocation, Hop Reservation, Soft reservation.	12 Hours
Unit-II	**L-12 Hours**
Routing Protocols for Ad-hoc Wireless Networks Introduction, Issues in Designing a Routing Protocol for Ad-hoc Wireless Networks; Classification of Routing Protocols; Table Driven Routing Protocols; On-Demand Routing Protocols, Hybrid Routing Protocols, Hierarchical Routing Protocols and Power-Aware Routing Protocols.	12 Hours
Unit-III	**L-12 Hours**
Transport Layer and Security Protocols for Ad-hoc Networks: Issues in Designing a Transport Layer Protocol; Design Goals of a Transport Layer Protocol; Classification of Transport Layer Solutions; TCP over Transport Layer Solutions; Other Transport Layer Protocols for Ad-hoc Networks; Security in Ad-hoc Wireless Networks, Issues and Challenges in Security Provisioning, Network Security Attacks, Key Management and Secure Touting Ad-hoc Wireless Networks.	12 Hours
Unit-IV	**L-12 Hours**
Quality of Service In AdHoc Wireless Networks: Issues and challenges in providing QoS in AdHoc Wireless Networks, Classification QoS solutions, MAC layer Solutions, Network layer Solutions, Wireless Sensor Networks: Architecture, Data Dissemination, Data Gathering, MAC Protocols for sensor Networks, Location Discovery, Quality of a sensor Network, Evolving standard.	12 Hours
Total L (Lecture)	**48 Hours**

Text Books :
1. C. Siva Ram Murthy & B. S. Manoj: Ad-hoc Wireless Networks, 2nd Edition, Pearson Education, 2011.

Reference Books :
1. Ozan K. Tonguz and Gianguigi Ferrari: Ad-hoc Wireless Networks, John Wiley, 2007.
2. Xiuzhen Cheng, Xiao Hung, Ding-Zhu Du: Ad-hoc Wireless Networking, Kluwer Academic Publishers, 2004.
3. C.K. Toh: Ad-hoc Mobile Wireless Networks- Protocols and Systems, Pearson Education, 2002.

Course Outcomes :
1. Design AdHoc wireless network.
2. Evaluate the existing AdHoc network and improve its quality of service.
3. Choose appropriate protocol for various applications.
4. Examine security measures present at different level.
5. Know the operation of AdHoc network.

PCS244L **COMPUTING LAB-2**
1 CREDIT (2-0-0)

LAB ASSIGNMENT LIST FOR ADVANCED COMPUTER NETWORKS

Note: The following programs can be executed on any tool / language.

1. Design and write a program to implement Extended Euclid’s algorithm to compute the, greatest common divisor of integers *a* and *b*, also the coefficients of Bézout's identity, which are integers *x* and *y* such that ax+ by= gcd (a,b).
2. Design and write a program to implement a Miller Rabin / Monte Carlo algorithm to test the primality of a given integer and determine its performance.
3. Design and write a program to calculate pow(x,n) i.e for given two integers x and n, compute x^n. Assume that x and n are small and overflow doesn’t happen.
4. Design and write a program to implement the Bellman-Ford algorithm to solve the single-source shortest-paths problem and determine its performance.
5. Design and write a program to implement Johnson's algorithm to solve the all pairs shortest path problem, i.e. given an input graph with general edge weights (can be negative) with no negative cycles, find the shortest (u, w) path for all pairs of vertices (u, w). If the input graph has any negative cycles, the program will report this.
6. Design and write a program to implement Ford Fulkerson algorithm to find maximum flow and determine its performance.
7. Design and write a program to solve string matching problem using naïve approach and Boyer Moore approach. Compare the performance.
8. Design and write a program to solve string matching problem using the KMP algorithm. Determine the performance.
9. Design and write program to solve string matching problem using Robin Karp algorithm and determine its performance.
10. Design and write a program to solve string matching problem using Finite Automata and determine its performance.

PCS023E

STORAGE AREA NETWORKS
4 CREDITS (4-0-0)

Unit-I **L-12 Hours**

Introduction: 12 Hours

Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks The Data Storage and Data Access problem; The Battle for size and access

Intelligent Disk Subsystems

Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

Unit-II **L-12 Hours**

I/O Techniques: 12 Hours

The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack: FC0,FC1,FC2,FC3,FC4, Fibre Channel SAN: Point-to-ponit topology, Fabric topology, Arbitrated loop, Hardware components, InetrSANs, IP Storage

File System and NAS:

Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

Unit-III **L-12 Hours**

Storage Virtualization: 12 Hours

Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network; Symmetric and Asymmetric storage virtualization in the Network

SAN Architecture and Hardware devices:

Overview, Creating a Network for storage; SAN Hardware devices; The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective.

Unit-IV **L-12 Hours**

Software Components of SAN: 12 Hours

The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

Management: Planning Business Continuity; Managing availability; Managing Serviceability; Capacity planning; Security considerations.

Total L (Lecture) **48 Hours**

Text Books : 1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: "**Storage Networks Explained",** Wiley India, 2007.

Reference Books : 1. Richard Barker and Paul Massiglia: "**Storage Area NetworkEssentialsACompleteGuide to understanding and Implementing SANs"**, John Wiley India, 2002.

2. Robert Spalding: "**Storage Networks The Complete Reference"**, Tata McGraw-Hill, 2003.

Course Outcomes :

1. Explain the fundamentals of storage centric and server centric systems.
2. Realize the Architecture of Intelligent Disk Subsystems and RAID technologies.
3. Describe files sharing operations on NAS and IP-SAN of the different network.
4. Identify the key role of Fibre Channel Protocol Stack in communication with storage system.
5. Analyze the Software Components to develop effective Storage Area Network.

PCS341I

INTERNSHIP
08 CREDITS (0-0-16)

Regulations for Industry Internship

The student shall undergo Internship as per the Scheme of Teaching and Examination.

1. The internship can be carried out in any industry/R&D Organization/Research Institute/Institute of national repute/ University recognized research centre.
2. The Department/college shall nominate a faculty to facilitate, guide and supervise students under internship.
3. The students shall report the progress of the internship to the internal guide in regular intervals and seek his/her advise.
4. The Internship shall be completed during the period specified in Scheme of Teaching and Examination.
5. After completion of Internship, students shall submit a report to the Head of the Department with the approval of both internal and external guides.
6. There will be 50 marks for CIE (Seminar: 25, Internship report: 25) and 50 marks for Viva – Voce conducted during SEE.
7. The internal guide shall award the CIE marks for seminar and internship report after evaluation. He/she will also be the internal examiner for Viva – Voce conducted during SEE.
8. The Department/college shall appoint the external examiner either the external guide from the industry/ Examiner from other institute for the viva voce on Internship. The Examiners shall jointly award the Viva - Voce marks.
9. In case the external Guide/ external examiner expresses his inability to conduct viva voce, the Chief Superintendent is permitted to make alternate arrangements with the permission of the concerned BOE Chairperson.
10. The students are permitted to carry out the internship anywhere in India or Abroad. The College will not provide any kind of Financial Assistance to any student for internship.

Failing to undergo Internship:

Internship is one of the head of passing. Completion of internship is mandatory. If any student fails to undergo/complete the internship, he/she shall be considered as fail in that Course and shall not be permitted to appear for SEE in that Course. However, such students shall appear for SEE after satisfying the conditions prescribed for Internship. The reappearance shall be considered as an attempt.

Industry Internship

All the students have to undergo mandatory internship of **6 weeks** during the vacation of I and II semesters and/or II and III semesters. A Semester End Examination (SEE) shall be conducted during III semester and the prescribed credit shall be counted for the same semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared as failed and have to complete during the subsequent examination after satisfying the internship requirements.

Sl.No.	**Course**	**Course Code**	**Credits**	**CIE Marks**	**SEE Marks**
1	Internship	PCS431I	08	50	50

PCS342P

PROJECT PHASE-I
10 CREDITS (0-0-20)

COURSE OUTCOMES

After completion of the Project Phase- I the student is able to

CO1 Explain the state-of-the art in the domain.
CO2 Identify the issues and challenges in the domain.
CO3 Define the statement of the problem.
CO4 Survey the different solutions to the problem.
CO5 Explore the new technologies.
CO6 Propose possible framework of the solution.

The Phase-I include

1. Deciding the broad area for project work.
2. Sufficient literature Survey (Minimum of 20-25 literatures includes Research papers, Technical Reports, White Papers, Manuals and Survey Reports).
3. Identification of Issues and defining problem.
4. A report containing summary of survey made covering issues and problem definition with print outs of all literature documents.
5. Presentation on survey made, issues/challenges identified and possible framework of the solution.

Scheme of Evaluation for Project Phase-I

Sl. No.	Course Component	CIE Evaluation (Max. 50 Marks)	SEE Evaluation (Max. 50 Marks)
1	Project Phase-I	Respective Guide (Survey and Report Writing)	(Report Evaluation: 25 Marks and Seminar/Presentation : 25 Marks) Conducted by Departmental Committee consisting of 1. HOD/Nominee 2. PG Coordinator/Project Coordinator 3. Examiner
Total Marks			**100**

PCS441P

PROJECT PHASE-II
20 CREDITS (0-0-40)

Guidelines for Project Phase II and Scheme of Evaluation

CIE: 50 Marks

Project progress Presentation I	10 Marks
Project progress Presentation II	10 Marks
Project progress Presentation III	10 Marks
Project Presentation IV	10 Marks
Report Writing	10 Marks
TOTAL	**50 Marks**

SEE out of 100 Marks:

Report Evaluation and Viva voce Examination by Three Examiners

1. **Internal Examiner**
2. **External Examiner**
3. **HOD/Nominee**

70 Marks for Report Evaluation (Average of Marks given by three examiners)

30 Marks for Viva Voce examination (Joint evaluation by three examiners)

Total 100 Marks.

Final Marks= CIE Marks out of 50 + 50% of SEE (50% of out of 100)

Scheme of Evaluation for Project Phase-II

Sl. No.	Course Component	CIE Evaluation (Max. 50 Marks)	SEE Evaluation (Max. 50 Marks)
1	Project Phase-II	Departmental Committee consisting of 1. HOD/Nominee 2. Project Coordinator/PG Coordinator 3. Respective Guide (Based on progress of the project evaluated periodically)	(Report Evaluation: 70 Marks and Viva Voce Examination: 30 Marks) **(50% of out of 100)** Conducted by project Evaluation Committee consisting of 1. Internal Examiner 2. External Examiner 3. HOD/Nominee

Note: * SEE to be conducted as per Calendar of Events.

** Final CIE marks of Project Phase-II entered by respective guide.

Basaveshwar Engineering College(Autonomous), Bagalkot
Department of Civil Engineering

M. Tech. Environmental Engineering

Scheme of Teaching and Examination 2020-21

I SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV121C	Environmental Chemistry and microbiology	4	3	2	0	50	50	100
2	PEV122C	Water Treatment Technology	4	3	2	0	50	50	100
3	PEV123C	Wastewater Treatment	4	3	2	0	50	50	100
4	PEV00XE	Elective - I	4	3	2	0	50	50	100
5	PEV00XE	Elective – II	4	3	2	0	50	50	100
6	PEV00XE	Elective – III	3	2	2	0	50	50	100
7	PEV124S	Seminar	1	0	0	2	50	50	100
		Total	**24**	**21**	**4**	**2**	**350**	**350**	**700**

II SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	p	CIE	SEE	Total
1	PEV221C	Air Pollution and Control	4	3	2	0	50	50	100
2	PEV222C	Industrial Wastewater Management	4	2	2	0	50	50	100
3	PEV00XE	Elective – IV	4	3	2	0	50	50	100
4	PEV00XE	Elective – V	4	2	2	0	50	50	100
5	PEV00XE	Elective – VI	4	3	2	0	50	50	100
6	PEV00XE	Elective - VII	3	2	2	0	50	50	100
7	PEV223T	Term paper	1	0	0	2	50	50	100
		Total	**24**	**21**	**4**	**2**	**350**	**350**	**700**

III SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C				Marks for		
				L	T	P	CIE	SEE	Total
1	PEV00XE	Elective - VIII	4	3	2	0	50	50	100
2	PEV 321 I	Industrial Training	4	0	0	4	50	50	100
3	PEV 301L	Environmental Engg. lab	2	0	0	4	50	50	100
4	PEV 312P	Project phase-I	10	0	0	20	50	50	100
		Total	**20**	**5**	**2**	**28**	**200**	**200**	**400**

IV SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV 431P	Project phase-II	20	0	0	40	50	50	100
		Total	**20**	**0**	**0**	**40**	**50**	**50**	**100**

Sri B.V.V. Sangha's

Basaveshwar Engineering College (Autonomous)

Bagalkot-587102

Department of Civil Engineering

SYLLABUS FOR POST GRADUATE PROGRAMME

M. Tech.

ENVIRONMENTAL ENGINEERING

2020-2021

VISION OF THE INSTITUTION

To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions and inspiring inventions for holistic socioeconomic developments

VISION OF THE DEPARTMENT

To be a Centre of Excellence of Higher learning and Research in Civil Engineering encompassing Ethical Environmental and Economical aspects of the Society

MISSION OF THE DEPARTMENT

The Department of Civil Engineering is committed to prepare globally competent engineers, in response to rapid economical and technological growth, through dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community.

Programme Educational Objectives (PEOs)

PEO1: To Possess knowledge , attitude and skills needed for a professional career development in the field of Environmental Engineering and Management

PEO1: To Create, select, learn and apply appropriate techniques, resources and modern engineering tools, including prediction and modeling, to environmental Engineering activities with an understanding of limitations.

PEO1: To Critically think and analyse complex engineering problems and apply independent judgment to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy contest.

Programme Outcomes(POs)

PO1: An ability to independently carry out research /investigation and development work to solve practical problems

PO2: Ability to write and present a substantial technical report/document

PO3: Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program

Justification of consistency of the Department Vision and Mission with the Institute Vision and Mission

Vision

Institution Vision → / **Department Vision ↓**	To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions	Inspiring inventions for holistic socioeconomic developments
To be center of excellence of higher learning and research in civil engineering	*	*
To encompass the graduates ethical, environmental and economical aspect of the society		*

Mission

Institution Mission → / **Department Mission ↓**	To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change	To carry out innovative cutting edge research and transfer technology for industrial and societal needs.	To imbibe moral and ethical values and develop compassionate, humane professionals
To prepare globally competent engineers, in response to rapid economical and technological growth	*	*	
Dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community	*	*	*

BASAVESHWAR ENGINEERING COLLEGE, BAGALKOT (AUTONOMOUS)

SCMEME OF TEACHING AND EXAMINATION FOR
MASTER OF TECHNOLOGY (M. Tech.)
ENVIRONMENTAL ENGINEERING

I SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV131C	Environmental Chemistry and microbiology	4	4	0	0	50	50	100
2	PEV132C	Water Treatment Technology	4	4	0	0	50	50	100
3	PEV133C	Wastewater Treatment	4	4	0	0	50	50	100
4	PEV00XE	Elective – A	4	4	0	0	50	50	100
5	PEV00XE	Elective – A	4	4	0	0	50	50	100
6	PEV00XE	Elective – B	3	3	0	0	50	50	100
7	PEV134S	Seminar	1	0	0	2	50	50	100
		Total	**24**	**23**	**00**	**2**	**350**	**350**	**700**

II SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV231C	Integrated Solid waste Management	4	4	0	0	50	50	100
2	PEV232C	Industrial Wastewater Management	4	4	0	0	50	50	100
3	PEV00XE	Elective – A	4	4	0	0	50	50	100
4	PEV00XE	Elective – A	4	4	0	0	50	50	100
5	PEV00XE	Elective – A	4	4	0	0	50	50	100
6	PEV00XE	Elective – B	3	3	0	0	50	50	100
7	PEV233T	Term paper	1	0	0	2	50	50	100
		Total	**24**	**23**	**00**	**2**	**350**	**350**	**700**

III SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV00XE	Elective – A	4	4	0	0	50	50	100
2	PEV 331 I	Industrial Training	4	0	0	8	50	50	100
3	PEV 331L	Environmental Engg. Lab	2	0	0	4	50	50	100
4	PEV 332P	Project phase-I	10	0	0	20	50	50	100
		Total	**20**	**4**	**0**	**32**	**200**	**200**	**400**

IV SEMESTER

Sl.No.	Sub. Code	Name of the Subject	C	Hours/week			Marks for		
				L	T	P	CIE	SEE	Total
1	PEV431P	Project phase-II	20	0	0	40	50	50	100
		Total	**20**	**0**	**0**	**40**	**50**	**50**	**100**

LIST OF ELECTIVES

Credits-04

Sl. No	**Sub. Code**	**Name of the subject**
1.	PEV002E	Water Resources Engineering and Applied Hydraulics
2.	PEV007E	Environmental Planning and Management
3.	PEV008E	Hazardous Waste Management
4.	PEV012E	Ecology and environmental Impact Assessment
5.	PEV019E	Air pollution and control
6.	PEV013E	Energy and Environmental
7.	PEV021E	Global warming and climate change

Credits-03

Sl. No	**Sub. Code**	**Name of the subject**
1.	PEV016E	Biological Treatment of Wastewater
2.	PEV018E	Remote Sensing and GIS applications in geo-environmental Engineering
3.	PEV020E	Non – point sources of pollution and management

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY
4 Credits
(4-0-0)

Sub Code : PEV121C **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

Course Outcomes:

1. Design the appropriate technology on applying basics of environmental chemistry and micrology to solve the environmental problems.
2. Apply the principles of Physical, Electrochemistry and Analytical chemistry in Environmental Engineering process.
3. Conduct experiments to evaluate water quality parameters.

UNIT-I

Importance of Environmental Chemistry, types of reactions, redox reactions, reaction kinetics, Electrochemistry and its application.
Physical and equilibrium chemistry fundamentals and applications, Trace Contaminants and their analyses. pH- Principle, Measurement, Numerical Examples, Buffers and Buffer index.

UNIT-II

Colloidal Chemistry **-** Properties of colloids, colloidal dispersions, stability of colloids and applications. Applications of Organic Chemistry in Environmental Engineering.
Colourimetry- Principles and applications.Applications of Analytical Chemistry- emission and absorption techniques.

UNIT -III

Microbiology – Microorganisms of importance in air, water and soil environment. Principles and applications of microscopy, microscopic flora and fauna of importance. Metabolism and metabolic pathways, Bioconcentration, Biomagnifiction and Bioaccumulation.

UNIT - IV

Bacteria **-** Morphology, typical growth curve and generation time, Measurement Techniques- APC, MPN (Probability and Thomas methods). MFT, Monod’s equation and its applications. Algae-morphology, classification and their importance. Fungi- Protozoa- morphology, classification and their importance, enzymes- classification, kinetics- Michaelis- Menten equation, factors, influencing enzyme reaction. Virology **-** Types, characteristics and enumeration methodology.

REFERENCES :

1. McKinney R.E. (1962) “Microbiology for Sanitary Enginers”, Newyork McGraw Hill.

2. Sawyer C.N. and McCharty P. L., (2003) “Chemistry for Environmental Engineering and Science. 5th Edition, Tata McGraw Hill Publishing Co.Ltd., New Delhi.

3. Pelczar M.J. Chan ECS, Krieg, NR (1998) “Textbook of Microbiology” 5th edition Tata McGraw Hill Publishing Co.Ltd., New Delhi.

4. Gaudy and Gaudy (1980) “Microbiology for Environmental Scientists and Engineers” McGraw Hill.

5. APHA,(2002) “Setandard Methods for Examination of Water and Wastewater” 21st Edition.

6. Stumn and Morgan (1970), “Aquatic Chemistry”, John Willey & Sons New York.

Course outcome	Statement	PO1	PO2	PO3
1	Design the appropriate technology on applying basics of environmental chemistry and micrology to solve the environmental problems.	3	1	1
2	Apply the principles of Physical, Electrochemistry and Analytical chemistry in Environmental Engineering process.	2	1	3
3	Conduct experiments to evaluate water quality parameters.	3	3	2
Average		2.6667	1.667	2

WATER TREATMENT TECHNOLOGY
4 Credits
(3-2-0)

Sub Code : PEV122C **CIE MARKS : 50**

Hrs/Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES:

1. Demonstrate the understanding of wholesomeness of water and design a appropriate treatment unit.
2. Create the efficient distribution system of drinking water depending upon the sources of water.
3. Optimize all the necessary parameters by thoroughly understanding the water quality standards and principles of treatment systems for supplying the wholesome water to the population residing in that area.

UNIT – I

Wholesomeness of water, Sources of water, Necessity of treatment, objective of various water uses, Water quality guidelines and standards for various water uses. Principles and design of aeration systems – two film theory, mass transfer coefficients with various units and dimensionless parameters for mass transfer with numericals. Water in air systems, Air in water systems,

UNIT – II

Principles of Sedimentation – Types of settling and settling equations, design criteria and design of settling tanks with emphasis on numerical examples. Principles of coagulation and flocculation – types of coagulants, coagulant aids, coagulation theory, effects of pH, alkalinity etc., optimum dosage of coagulant, design criteria and numerical examples. Filtration – theory, types, hydraulics of filter bed, design criteria and design of filters, filter backwash with numerical examples. Operational problems and trouble shooting. Adsorption process – types, factors affecting adsorption, kinetics and equilibrium with numerical examples and problem solving.

UNIT - III

Disinfection – different types, disinfectants, factors affecting disinfection, effect of pH, methods of disinfection, chemistry of chlorination and numerical. Water softening – ions causing hardness, Langelier index, various methods. Fluoridation and Defiuoriation, Principles and Design.

UNIT - IV

Water quality in distribution systems, Operation and Distribution of treatment system. Bench scale and Pilot plant studies in water treatment, Rural water supply systems.

REFERENCES:

1. Fair, G. M., Gayer J.C and Okum, (1966), Water and Waste Water Engineering, Vol. II, John Wiley Publications.
2. Webber, W. J., (1975), Physico – Chemical Processes for Water Quality Control
3. Peavy, H.S., Rowe and Tchobonoglous, G., (1985), Environmental Engineering, McGraw – Hill.
4. Raju, B.S.N., (1995), Water Supply and Waste Water Engineering, Tata McGraw Hill
5. Santosh kumar Garg, Water Supply Engineering, Khanna Publishers, New-Delhi
6. World Health Organization, Geneva, (2004), Guidelines for Drinking Water Quality, Third Edition, Volumes 1 – 3.

Course outcome	Statement	PO1	PO2	PO3
1	Demonstrate the understanding of wholesomeness of water and design a appropriate treatment unit.	3	1	1
2	Create the efficient distribution system of drinking water depending upon the sources of water.	2	1	1
3	Optimize all the necessary parameters by thoroughly understanding the water quality standards and principles of treatment systems for supplying the wholesome water to the population residing in that area.	3	3	1
Average		2.6667	1.667	1

WASTEWATER TREATMENT
4 Credits
(3-2-0)

Sub Code : PEV123C **CIE Marks : 50**

Hrs/ Week : 05 **SEE Marks : 50**

COURSE OUTCOMES

1. Design Appropriate treatment methods for municipal and certain industrial effluents.
2. Critically think about the operational problems of treatment units..
3. Apply simple design equations for water and wastewater treatment plant.

UNIT – I

Introduction to wastewater treatment with objectives. Types, composition, properties and analysis of wastewater. Effluent standards for disposal into water bodies and land. Fundamentals of process analysis, reaction kinetics, mass balance analysis. Types of reactors and analysis - batch, plug flow, completely mixed, packed and fluidized bed reactor.

UNIT – II

Unit operations – Screens, grit chamber, primary settling and oil & grease removal – Theory and design. Chemical unit processes – Coagulation and precipitation, oxidation and. Neutralization.

UNIT – III

Biological unit process – Aerobic processes: Theory and design of activated sludge process, trickling filter, rotating biological contactor, oxidation pond, oxidation ditch and lagoons. Anaerobic processes: Fundamentals, up flow anaerobic sludge blanket (UASB) reactor and anaerobic filter (AF)

UNIT – IV

Sludge characteristics and treatment – Thickening, digestion (detailed), conditioning, dewatering, drying and incineration. Nutrient removal: Nitrogen and phosphorous removal.

12hrs

REFERENCES:

1. Metcalf and Eddy- Wastewater Engineering, Tata McGlaw Hill Publishing Company Ltd., New Delhi 2003

2. Eckenfelder and 0' Conner - Biological Waste treatment.
3. Gaudy – Advanced Waste Water treatment
4. Ramalho, R. S. 1983. Introduction to Wastewater Treatment Processes. New York: Academic Publishers
5. Karia G.L. and Christian R.A. "Wastewater Treatment Concepts and Design Approach" Prentice Hall of India Pvt., Ltd., New Delhi (2001)
6. Santoshkumar Garg. "Sewage Disposal and Air Pollution Engineering" Khanna Publishers New Delhi 2006
7. Punmia B. C. and Arunkumar Jain, "Environmental Engineering II", Laxmi Publishers Pvt. Ltd, New Delhi, 2000
8. Howard S. Peavy, Donald R. Rowe, George T, "Environmental Engineering", McGraw Hill, International editions, 1985.

Course outcome	Statement	PO1	PO2	PO3
1	Design Appropriate treatment methods for municipal and certain industrial effluents.	3	1	2
2	Critically think about the operational problems of chemical and biological treatment units..	2	2	3
3	Apply simple design equations for water and wastewater treatment plant.	2	1	1
Average		2.333	1.33	2

SOLID WASTE MANAGEMENT
4 Credits
(3-2-0)

Sub Code : PEV221C **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Apply the basic scientific and sustainability principles behind waste management, for solving practical waste management challenges
2. Evaluate the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of value from waste.
3. Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.

UNIT – I

Land pollution**-** Definition and scope, necessity and importance, solid waste - definition, sources, classification and characteristics, Generation and Quantification.
Collection & Transport-Collection equipments, systems of collection, transfer stations, bailing and compacting.

UNIT – II

Sanitary land filling**-** Definition, methodology, trench, area, ramp, pit method, site selection, basic steps involved, cell design, prevention of site pollution, Leachate treatment, gas collection and recirculation.
Disposal Methods- Types and suitability selection of site, Ocean disposal, feeding to hogs- merits and demerits.

UNIT – III

Composting**-** Aerobic and anaerobic. composting, Factors affecting composting Indore and Bangalore processes of composting. Incineration**-** Processes 3Ts to control high temperature incinerators, design approach prevention of air pollution. Pyrolysis**-** Process, basic steps involved, end product, Pyrolysis of specific solid waste.

UNIT – IV

Recycle and reuse**-** material and energy recovery operation, pyrolysis of specific solid waste.
Management of toxic solid waste recent innovations. Biomedical waste and E-Waste Management.

REFERENCES:

1. J.L Pavoni, Hand Book of Solid Waste Disposal.New York .1975
2. Solid Waste Management, Van Nostrand Reinhold Co. 1975.

3. G. Tchobanoglous, H. Theisen and R. liliaissen, Solid waste Engineering, Principles and Management issues, McGraw Hill, New York 1977.
4. C.L. ell, Solid Waste Management, John Wiley, 1975.
5. P.W. Powers. How to dispose of toxic substances and industrial Waste, Noyes Data Corporation, England, 1976.
6.CPHEEO manual on solid waste management. 2010

Course outcome	Statement	PO1	PO2	PO3
1	Apply the basic scientific and sustainability principles behind waste management, for solving practical waste management challenges	3	1	2
2	Evaluate the fundamental principles of existing and emerging technologies for the treatment of waste and recovery of value from waste.	2	3	3
3	Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.	3	1	2
Average		2.6667	1.667	2.333

INDUSTRIAL WASTEWATER MANAGEMENT
4 Credits
(3-2-0)

Sub Code : PEV222C **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality. Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.
2. Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost effective practice. Utilize the byproducts generated in these techniques to enhance the economics of the treatment process.
3. Demonstrate the understanding of green environment and practicing the environmental friendly processes for the manufacture of various industrial products like diary, Pharmaceuticals, petroleum etc, and also implementing the state-of-art technologies for wastewater treatment.

UNIT – I

Effects of industrial waste water on receiving water bodies, Effect of organic wastes on the DO profile of the stream, Streeter Phelps model, oxygen sag curve and numericals thereupon. Receiving water quality protection measures – receiving water quality standards and stream quality control, Sample-Grab, composite and integrated samples, stream sampling. Economics of industrial waste water treatment systems –primary/secondary benefits, intangible benefits, Quantification of benefits, Relationship of treatment cost to benefits.

UNIT – II

Waste minimizing techniques– Volume reduction, Strength reduction, Neutralization, Equalization and Proportioning, Removal of suspended, colloidal, inorganic and organic dissolved solids. Treatment and disposal of sludge solids, Sludge characteristics, Sludge volume and solids content relationship.

UNIT – III

Manufacturing process, waste water characteristics, treatment and disposal of waste water of following industries: Dairy, Distillery, Sugar, Textile, Paper and pulp, Pharmaceutical, Fertilizer.

UNIT – IV

Effects of industrial waste water on sewage treatment plants, Limiting values for discharge into municipal sewer systems, Joint treatment of industrial and domestic waste water, Membrane filter, electro dialysis and bioremediation techniques of waste water treatment. Radioactive waste treatment, Environmental auditing, Regulatory norms for waste water treatment, present scenario of waste water treatment in India.

REFERENCES

1. Nemerow N. N., Liquid waste of industry theories, practices and treatment, Addison Willey, New York, 1971.

2. Azad N. S., Industrial waste water management handbook, Mc Graw Hill book, co. New York.

3. Ross R. D., Industrial waste disposal, Reinhold environmental series, New York, 1968

4. Eckenfelder, W.W., “Industrial Water Pollution Control”, McGraw-Hill, 1999.

Course outcome	Statement	PO1	PO2	PO3
1	Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality. Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.	3	2	2
2	Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost effective practice. Utilize the byproducts generated in these techniques to enhance the economics of the treatment process.	2	3	3
3	Demonstrate the understanding of green environment and practicing the environmental friendly processes for the manufacture of various industrial products like diary, Pharmaceuticals, petroleum etc, and also implementing the state-of-art technologies for wastewater treatment.	3	1	2
Average		2.6667	2	2.333

ENVIRONMENTAL ENGINEERING LAB
Credits
(0-0-4)

Sub Code : PEV301L **CIE MARKS : 50**
Hrs/Week: 4 **SEE Marks : 50**

LIST OF EXPERIMENTS

1.Testing of water and wastewater

i)Physical characteristics

ii)Chemical characteristics

iii)Biological characteristics

2.Sampling and analysis of Ambient air

3.Solid waste and leachate analysis

4. Demonstration of Arc-GIS and its applications in environmental Engineering

REFERENCES:

1. US EPA publication SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, 1996.

2. BIS Compendium on Engineering Properties of Soil

3.AWWA and APHA new edition –standard procedures for analysis of water and wastewater samples.

4.CPHEEO manual on solid waste management. 2015

ELECTIVES

WATER RESOURCES ENGINEERING AND APPLIED HYDRAULICS
4 Credits
(3-2-0)

Sub Code : PEV002E **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Evaluate and analyze hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment, natural hazard assessment and mitigation, and environmental planning and management.
2. Estimate rainfall, optimum rain gauges and consistency with the concept hydrology, Analysis of hydrograph, low and high flows, Estimate discharge in rivers, streams and overland peak flows, design of storm drains and outfall sewer.
3. Apply the concepts of hydraulics to design water mains, steady state groundwater problems.

UNIT – I

Water resources of the world. Surface and ground water resources of India and Karnataka National Water Policy Act. Multiple uses of water resources.

Hydrology**-** Introduction, Hydrologic cycle including quantity and quality, estimation of precipitation and rain guage density.

UNIT – II

Hydrograph Theory**-** Unit hydrograph, assumptions, Derivation of unit hydrographs, S-hydrograph and synthetic hydrograph, Flow routing –Muskingham method, Lowflow analysis.

Urban Hydrology**-** Run- off estimation, design of Storm water drains. Basics and applications of Remote Sensing in Water Resources.

UNIT – III

Unsteady Flow through Conduits-Water hammer analysis - Analytical and Graphical methods, Water hammer protection methods.

Flow Measurements**-** Stream gauging, weir method, End - Depth method, Chemical method, Tracer method, Ultrasonic method, Flumes etc.

UNIT – IV

Groundwater-Basic equations of flow. Flow into wells in unconfined and confined aquifers under steady and unsteady conditions, Sea water intrusion. Artificial recharge, Groundwater pollution. Bore wells - types and design principles.

REFERENCES:

1. Ven TE. Chow - Hand book of Applied hydrology.
2. Todd - Ground water hydrology, John Willey New York 2001
3. Ranganath .H.M. - Advanced hydrology.
4. Subramnya.K.S. - Advanced hydrology.
5. Ven .TE. Chow - Open channel hydraulics, Mc Graw Hill Book Co-Singapur 1973
6. Hammer M.J. and Mackichan .K.A. - Hydrology and quality of water resources.
7. Sabins - Remote Sensing.
8. Thomann and Muller - Principles of Water quality modeling, Estuary section 3.l.
9. Ram S. Gupta, Hydrology and Hydraulic System,
10. John Permankian, Water Hammer Analysis.

Course outcome	Statement	PO1	PO2	PO3
1	Evaluate and analyze hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment, natural hazard assessment and mitigation, and environmental planning and management.	3	2	1
2	Estimate rainfall, optimum rain gauges and consistency with the concept hydrology, Analysis of hydrograph, low and high flows, Estimate discharge in rivers, streams and overland peak flows, design of storm drains and outfall sewer.	2	3	3
3	Apply the concepts of hydraulics to design water mains, steady state groundwater problems.	3	1	2
Average		2.6667	2	2

TRANSPORT PROCESSES AND MODELLING OF AQUATIC SYSTEMS

4 Credits
(3-2-0)

Sub Code : PEV003E | **CIE Marks : 50**
Hrs/ Week : 05 | **SEE Marks : 50**

COURSE OUTCOMES

1. Develop the most appropriate comprehensive tools in environmental management for prediction and analysis about the water quality of the river bodies' vis-à-vis industrial waste discharge into the surface water.
2. Develop the state of art modeling for prediction and analysis by applying the techniques of I-D Oxygen balance models, steady state 2-D analysis etc.
3. Management of surface water bodies by application of various techniques like specialized water quality surveys, Parameter estimation etc.

UNIT – I

Models as Comprehensive tools in Environmental Management Advection, Diffusion and Dispersion - Definition, Molecular turbulent and shear diffusion, Derivation of Fick's laws of diffusion and convective - diffusion equations for turbulent and shear flow regimes.

UNIT – II

Steady state water quality modeling. Models for decaying pollutants (bacteria, phenol, ammonia) in rivers. I-D Oxygen balance models -Streeter- Phelps equation, critical point method. Calibration and verification of I-D Oxygen model. Mixing Zones in rivers- definition, steady state 2-D analysis with pipe and diffuser outfalls.

UNIT – III

Data collection specialized water quality surveys based on statistical average concepts. Estimation of parameters - decay and re-aeration rates. field study methodology. Parameter estimation - Lateral Mixing co- efficient - critical point method - derivation and examples.

Dissolved Oxygen models for lakes under completely mixed and stratified conditions, Ocean disposal of wastewater - siting and design of outfalls. Near field and far field mixing with simple examples.

UNIT – IV

Eutrophication Models - simplified nutrient loading models for rivers and lakes. Ground water quality modeling concepts - formulation of 1-D and 2-D models with decay and retardation for instantaneous sources, Non point sources of pollution, Analytical modeling for plume delineation studies from point sources.

REFERENCES:

1. RichLG. EnvironmentalSystemsEngineeringMcGrawHill-1972.
2. Thomas R.V. - Systems Approach to water quality management McGrawHill-1980.
3. Biswas A.K. – Models for water quality management- McGraw Hill 1980.
4. Rinaldi S.D.and Soncini, R- Modelling and Control of river water quality McGraw HilI-1979.
5. Gower A.M. - Water quality in catchment ecosystems john wiley - 1980.
6. Thomann and Mueller 1986., Principles of water quality management and control- Harper and Row pubs.
7. Hazen and Cherry, Ground Water Quality.
8. Velz LZ. Applied Stream Sanitation.

Course outcome	Statement	PO1	PO2	PO3
1	Develop the most appropriate comprehensive tools in environmental management for prediction and analysis about the water quality of the river bodies' vis-à-vis industrial waste discharge into the surface water.	3	2	2
2	Develop the state of art modeling for prediction and analysis by applying the techniques of I-D Oxygen balance models, steady state 2-D analysis etc.	3	3	3
3	Management of surface water bodies by application of various techniques like specialized water quality surveys, Parameter estimation etc	1	2	2
Average		2.3333	2.333	2.333

ADVANCED COMPUTATIONAL METHODS AND OPTIMIZATION

4 Credits

(3-2-0)

Sub Code : PEV004E — **CIE Marks : 50**

Hrs/ Week : 04 — **SEE Marks : 50**

COURSE OUTCOMES

1. Apply statistical techniques to examine data.
2. Solve engineering problems that involve constrained resource allocation.
3. Solve the governing equations of partial differential in nature applied to engineering problems.

UNIT – I

Numerical Methods-Newton - Raphson method for solution of simultaneous equations. Numerical solutions of partial differential equations. Finite difference, Finite element method and method of characteristics. Explicit and implicit methods to solve simple parabolic differential equations, convergence, Boundary value problems and successive over relaxation methods.

UNIT – II

Optimization-Definition and classification of optimization problems. Its importance in Environmental Studies. Single and multivariable optimization without and with constraints. Linear Programming - standard form of problems - pivotal reduction of equations. Single and Two phase simplex methods. Piece wise linear approximation of non - linear optimization.

UNIT – III

Statistics and Probability-Frequency Distribution - Characteristics of Distributions: Central Tendency and Dispersion, Concepts of Probability-Binomial, Poisson and Normal Distribution – Applications.

UNIT – IV

Method of Least Square and Regression - Multiple Regression - The Chi- squared test, F test, T-test. Analysis problems using Computer Programming.

REFERENCES:

1. Antony Raiston Philip Rabinowitz - A First Course in Numerical Analysis, Mc Graw Hill New Delhi 1984
2. Brice, Luther N.A. and James O. Wilkes - Applied Numerical Methods.
3. Stanton. R.G.- Numerical Methods for Science and Engineers.
4. Beveridge- Optimization techniques.

5. Rao. S.S. – Optimization New Age International (P) Ltd., New Delhi 2003
6. Desai C.S. and John FAbel - Introduction to the Finite Element Method, CBS, New Delhi 1987
7. Sienk iowics O.C. - The Finite Element Method, Zienkiewica,O.C. Butter Worth. Boston 2000 Statistical Hydrology
9. Ram S. Gupta ,Hydrology and Hydraulic Systems, “3rd” Edition.,Prentice- Hall. Taha,Optimization.

Course outcome	Statement	PO1	PO2	PO3
1	Apply statistical techniques to examine data.	2	2	2
2	Solve engineering problems that involve constrained resource allocation.	3	3	3
3	Solve the governing equations of partial differential in nature applied to engineering problems.	1	2	2
Average		2	2.33	2.33

ENVIRONMENTAL PLANNING AND MANAGEMENT

4 Credits

(3-2-0)

Sub Code : PEV007E **CIE Marks : 50**

Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Create the awareness in the concerned management about the significance of sustainable environment, resource utilization, regional planning etc, and make the environmental decisions about new projects keeping in view the above factors.
2. Develop the most appropriate policies and planning for environmental protection by making proper environmental cost benefit analysis.
3. Develop the skills and knowledge for the certification of industrial units from the reputed international certifying agencies like ISO14000 and also carry out the environmental auditing of air, water and soil.

UNIT – I

Environmental and Sustainable Development**-** Concept of Carrying capacity, Relation among quality of life, carrying capacity and resource utilization.
Engineering Methodology in Planning and its Limitations: Carrying capacity based short and long term regional planning.

UNIT – II

Environmental Protection**-** Economic development and social welfare consideration in socio economic developmental policies and planning. Total cost of development and environmental protection cost. Case studies on Regional carrying capacity - National Capital Region – Delhi area.

UNIT – III

Engineering Economics**-** Value Engineering, Time value of Money, Cash Flows. Budgeting and Accounting. Cleaner Technologies and their roles in Environmental Protection.

UNIT – IV

Total Quality Management in Environmental Management and Protection- ISO 14000 Series of Standards. Environmental Audit - Air, Water, Solid and its importance in Environmental Management.

REFERENCES:

1. Danoy G. E. and Warner R.F., "Planning and Design of Engineering Systems". Unwin Hyman Publications. 1969.
2. Chanlett, "Environmental Protection" .McGraw Hill Publication, New Delhi 1975
3. Lohani B. N. , "Environmental Quality Management", South Asian Publications
4. Heinke et aI., "A Text book of Environmental Engineering".
5. Journal of Indian Association for Environmental Management, 1995-1997.

6. MOEF. Government of India, Carrying Capacity Based Developmental Planning Studies for the National Capital Region,1995-96.
7. NEERI, Nagpur, Annual Reports 1995 and 1996.
8. Peurifoy R.L., Construction Planning Equipment and Methods, 1979.McGraw Hill.
9. Environmental Engineering and Management, Suresh. K. Dhaneja.2000 S.K. Kataria and Sons.

Course outcome	Statement	PO1	PO2	PO3
1	Create the awareness in the concerned management about the significance of sustainable environment, resource utilization, regional planning etc, and make the environmental decisions about new projects keeping in view the above factors.	1	2	1
2	Develop the most appropriate policies and planning for environmental protection by making proper environmental cost benefit analysis.	3	3	2
3	Develop the skills and knowledge for the certification of industrial units from the reputed international certifying agencies like ISO14000 and also carry out the environmental auditing of air, water and soil.	2	3	2
Average		2	2.667	1.667

HAZARDOUS WASTE MANAGEMENT

4 Credits
(3-2-0)

Sub Code : PEV008E **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks :50**

COURSE OUTCOMES

1. Assess the special characteristics of hazardous waste material generated from different industries. Understand the rules and regulations for management of hazardous wastes and take suitable steps for recover and rehabilitate abandoned the hazardous waste sites.
2. Reduce the risks of handling and managing the hazardous waste by scientifically understanding and practicing the treatment of hazardous waste by various physico-chemical treatment methods like air stripping, aerobic and anaerobic treatment etc.
3. Demonstrate the understanding of the various rules and regulations for safe transportation, handling and management of hazardous waste materials.

UNIT – I

Introduction- Definition, Sources and Classification , Land mark episodes (DDT, Mercury, PCB and PBB, Bhopal Gas Tragedy) Large and Small quantity Generators, Hazardous Waste Characterization, Corrosivity, Reactivity, Toxicity, EPA-designated hazardous wastes, Assessment of Hazardous Sites. Waste Minimization and Resource Recovery- Approaches to waste Reduction, Benefits of hazardous waste reduction, priorities in hazardous waste management, Regulations for Hazardous Waste Management - The superfund, CERCLA and SARA Acts, The Superfund process, NPL, Hazard Ranking system (HRS), Cleanup standards,

UNIT – II

Physico-Chemical treatment processes – Air stripping, Carbon adsorption, Steam stripping, Chemical oxidation, Biological treatment. Biodegradation of Xenobiotics, Compound biodegradability, Aerobic Vs Anaerobic treatment, Microbial Growth requirements. Thermal methods, Chemistry of incineration, Thermodynamics of incineration, Design factors for incineration, Three T's, Stochiometry and Combustion calculations, Incinerators-Merits and Demerits, TSCA and RCRA Incineration standards, Liquid Injection Incinerators, Atomizers, Design considerations, Solid waste Incinerators, Grate type and Hearth type, Rotary kiln incinerator with horizontal and vertical secondary combustion chambers, Fluidized Bed Incinerator

UNIT – III

Transportation of Hazardous Waste **-** Regulations, Containers for Hazardous Materials, Bulk and Non-bulk Transport, Hazardous Substances Emergency Response.

UNIT – IV

Land-Fill Disposal-Landfill as disposal sites, Developing a new facility. Siting a Landfill, Design considerations, Operating a landfill. Site Remediation- Site Assessment and inspection, The hazardous system and the national priority list. Remedial Action, Monitoring of Disposal Sites

REFERENCES:

1. Wentz CA., "Hazardous Waste Management", McGraw Hill, 1989.

2. LaGrega M.D., Mercer, "Hazardous Waste Management", 2ndEdition, McGraw Hill 2001.

3. Davis. Cornwell, "Introduction to Environmental Engineering" 3rd edition, McGraw Hill 1998.

Course outcome	Statement	PO1	PO2	PO3
1	Assess the special characteristics of hazardous waste material generated from different industries. Understand the rules and regulations for management of hazardous wastes and take suitable steps for recover and rehabilitate abandoned the hazardous waste sites.	2	2	2
2	Reduce the risks of handling and managing the hazardous waste by scientifically understanding and practicing the treatment of hazardous waste by various physico-chemical treatment methods like air stripping, aerobic and anaerobic treatment etc.	3	3	2
3	Demonstrate the understanding of the various rules and regulations for safe transportation, handling and management of hazardous waste materials.	3	2	2
Average		2.6667	2.333	2

OCCUPATIONAL SAFETY AND HEALTH

4 Credits

(3-2-0)

Sub Code : PEV011E **CIE Marks :50**

Hrs/ Week : 05(3+2) **SEE Marks :50**

COURSE OUTCOMES

1. **Design policies and regulations for** the development and maintenance of a healthy and safe work environment.

2. To interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces and apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.

3. To affect/manage change by advancing OH&S principles within management systems, cultures, practices, and priorities.

UNIT – I

Introduction-History and Development, Occupational Safety and Health Act. Occupational Safety and Health Administration, Right to know Laws.

Accident Causation-Need for Accident Investigation, Accident investigation plan, Methods of acquiring Accident Facts, Correcting Missing Skills, Investigator Tendencies and Characteristics, Supervisory Role in Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models.

Ergonomics- Ergonomics at work place, Ergonomic Task Analysis, Preventing Ergonomic Hazards, Setting up of Ergonomics Programme.

UNIT – II

Occupational Hazard and Control- Hazard Analysis, Human Error Analysis in Causation with Hazard Analysis, Fault Tree Analysis, Emergency Response. Decision for Action, Purpose and Considerations, Right Decision, Wrong Remedy, Hazard Control Measures, Hazards and their Control in Pharmaceutical, Construction, Textiles, Petroleum Refineries and LPG Bottling, Iron and Steel industries.

UNIT – III

Fire prevention and Protection- Fire Development and its Severity effects. Enclosure, need for early Detection of Fire, Extinguishing Fire Electrical Safety Product Safety, Technical Requirements of Product Safety Programme. Environmental Safety and ISO 14000 ISO series of standards, ISO 14001 Standards, Environmental Management systems. (EMS) Total quality Management (TQM) and Total safety Management (TSM).

UNIT – IV

Occupational Health-Health and Safety Considerations, Personal Protective Equipments, Effects of Exposure and Treatment for Metal Working Trades, Municipal Solid Waste, Epoxy Resins, Foundries. Occupational Health and Safety Considerations in Wastewater Treatment Plants.

REFERENCES:

1. David L. Goetsch. "Occupational Safety and Health" for Technologists, Engineers and Managers, 3rd Edition. Prentice Hall.

2. David. A. Calling - Industrial Safety Management and Technology, Prentice Hall, New Delhi.

3. Della D. E. and Giustina, Safety and Environmental Management. Van Nostrand Reinhold International Thomson Publishing Inc, 1996.

4. Trevethick R. A. Environmental and Industrial Health Hazards,William Heinemann Medical Books Ltd., London (1973).

Course outcome	Statement	PO1	PO2	PO3
1	**Design policies and regulations for** the development and maintenance of a healthy and safe work environment.	1	2	2
2	To interpret and apply legislative requirements, industry standards, and best practices in a variety of workplaces and apply risk management principles to anticipate, identify, evaluate and control physical, chemical, biological and psychosocial hazards.	3	3	2
3	To affect/manage change by advancing OH&S principles within management systems, cultures, practices, and priorities.	2	3	2
Average		2	2.667	2

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

4 Credits

(3-2-0)

Sub Code : PEV012E **CIE Marks : 50**

Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Identify different Components of ecosystem and their interactions and interrelationships.
2. Outline the systematic process for environmental impact assessment along with different methodologies.
3. Identify and assess the impacts on environmental attributes from developmental projects, Explain importance of Public participation, EMP and DMP in EIA process.

UNIT – I

Ecology-Classification of Ecosystem, terminology concepts of Ecology. Sub-divisons in Ecology. Biotic and Abiotic components, Structure and functions of ecosystems. Energy flow in Ecosystems. Measurement of primary production. Ecological Niche and succession. Population Ecology community Ecology, Habitat Ecology. Biogeochemical cycles, Ecological pyramids.

UNIT – II

Aquatic and Terrestrial Ecosystems, Dominance and Diversity Indices Adaptations, Biogeography, Systems Ecology and Ecosystem modeling. Oligotrophy, Eutrophic status, Nutrient enrichment - Analysis of Eutrophication - Vollenweider and Dillon models of Phosphorous loading on lakes. Control of Eutrophication.

UNIT – III

Environmental Impact Assessment- Developmental Activity and Ecological factors. EIA, EIS, FONSI, Need for EIA Studies, Base line information, Step - by-step procedure for conducting EIA, limitations of EIA. Frame work of Impact Assessment, development projects in environmental setting. Objective and scope of EIA. Contents of EIA, Methodologies, techniques of EIA.

Assessment and Prediction of impacts on Attributes air, water, noise, land, ecology soil, cultural and socio-economic environment, IAA guidelines for development projects, REIA-CEIA.

UNIT – IV

Public participation in environmental decision making. Practical considerations in preparing Environmental Impact Assessment and Statements.

Salient features of the project activity - Environmental parameter - Activity relationships - matrices. EIA for water resource development projects, Nuclear power plant project, Mining project (Coal, Aluminium, iron ore, Bauxite) Thermal Power Plant (Coal-based) project, Pharmaceutical industries, etc.

REFERENCES:

1. Odum - Fundamentals of Ecology- Addition Co.2004

2. Kormondy - Concepts of Ecology - Printce hall publication PHI New Delhi 2005

3. AnantakrishnaanT. N- Bio-resources Ecology- Oxford and IBM.

4. Krebs J. - Ecology - The experimental analsis of distribution and abundance-II Edition Harper international.

5. Munn RE. (ed) Environmental Impact Assessment John Willey. 1975

6 .Canter L - Environmental Impact Assessment McGraw Hill, Newyork 1977.

7. Clark B. c. Bisett and Tomlinsan P - Perspective on environmental Impact Assessment - Allied Publishers - 1985

Course outcome	Statement	PO1	PO2	PO3
1	Identify different Components of ecosystem and their interactions and interrelationships.	1	2	1
2	Outline the systematic process for environmental impact assessment along with different methodologies.	3	3	2
3	Identify and assess the impacts on environmental attributes from developmental projects, Explain importance of Public participation, EMP and DMP in EIA process.	2	2	2
Average		2	2.333	1.667

ENERGY AND ENVIRONMENT

4 Credits

(3-2-0)

Sub Code : PEV013E **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Outline the need and application of various alternative fuels
2. Apply various methods/technologies to harness various renewable energy sources and non-renewable energy sources.
3. Collect data to understand the energy scenario of renewable and non-renewable energy sources.
4. Critically think about the global climatic changes-causes and effects

UNIT- I

Introduction-Global energy, Environmental resources, energy needs, energy crisis. Indian scenario**-** Energy consumption, needs and crisis.

UNIT-II

Energy production, utilization, Laws and Principles. Renewable sources of energy and Environmental aspects -- Bio gas, Bio- Mass. Wind Energy. Hydro power, ocean energy, solar energy, agricultural waste derived energy.

UNIT-III

Non renewable sources of energy and Environmental aspects – energy from coal, oil, natural gas, Nuclear energy, geothermal energy.

UNIT-IV

Global temperature, Green house effects, global warming. Acid rain **-** Causes, effects and control methods. Regional impacts of temperature change.

REFERENCES:

1. Wilber LC. "Hand book of Energy Systems" Engineering Wiley and Sons 1989
2. Master G.M. "Introduction to Environmental Engineering and Science" Gilber M Masters Publisher Pearson New Delhi 2006
3. Sincero and Sincero, Environmental Engineering - A design approach: Prentice Hall of India, (1999)
4. Rao and Parulekar RR Energy Technology- Non-conventional Renewable and Conventional, Second Edition Khanna Publication 1997.

Course Articulation Matrix				
Course outcome	**Statement**	**PO1**	**PO2**	**PO3**
1	Outline the need and application of various alternative fuels	1	2	-
2	Apply various methods/technologies to harness various renewable energy sources and non-renewable energy sources.	3	2	2
3	Collect data to understand the energy scenario and demonstrate the understanding the concept of climatic changes.	1	3	2

APPLIED STATISTICS AND PROBABILITY

4 Credits

(3-2-0)

Sub Code : PEV015E **CIE Marks : 50**
Hrs/ Week : 05(3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Understand systems, analysis, concepts and techniques applied to engineering problems.
2. Effectively communicate systems methods and modeling results
3. Solve challenging engineering problems that involve constrained resource allocation.

UNIT – I

Empiricial statistics-Measures of central tendency, dispersion, Skewness and Kurtosis – Principle of least squares – correlation and regression – rank correlation.

12hrs

UNIT – II

Sampling distributions and estimation-Sampling distributions – Point and interval estimates for population proportions, mean and variance- Maximum likelihood estimate method – Method of moments.

13hrs

UNIT – III

Testing of hypothesis -Basic definitions of statistical hypothesis – Tests based on Normal, t, Chi-square and F distributions – Analysis of variance – One way and Two way Classifications.
Design of experiments- Completely randomized design – Randomised block design – Latin square design – 22 factorial design.

14hrs

UNIT – IV

Probability and random variables -Probability - Random Variables - Moments – Standard Distributions – Moment Generating Function – Functions of random variables – Two dimensional random variables – Multiple and partial correlation and Regression.

13hrs

REFERENCES:

1. Brethouex, P.U., "Statistics for Environmental Engineers", Lewis Publ., 1994.
2. Johnson, R.J. "Miller & Freund's Probability and Statistical for Engineers" 6th Edition, Prentice – Hall of India, Private Ltd., New Delhi, 2002.
3. Ang, A.H.S. and Tang W.H., "Probability concepts in Engineering Planning and Design" – Basic principles Vol. John Wiley and Sons, Inc. New Delhi, 1975.
4. Gupta, S.C. and Kapoor, V.K. "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 2001.
5. Taha, H.A., "Operations Research: An Introduction", Seventh Edition, Pearson Education Edition, Asia, New Delhi, 2002.

Course Articulation Matrix				
Course outcome	**Statement**	**PO1**	**PO2**	**PO3**
1	Understand systems, analysis, concepts and techniques applied to engineering problems.	3	2	2
2	Effectively communicate systems methods and modeling results	1	3	2
3	Solve challenging engineering problems that involve constrained resource allocation.	3	2	2

AIR POLLUTION AND CONTROL

4 Credits

(3-2-0)

Sub Code : PEV019E **CIE Marks : 50**
Hrs/ Week : 05 **SEE Marks : 50**

COURSE OUTCOMES

Identify anthropogenic sources and atmospheric effects to pollutions.

Demonstrate the Understanding of Regional, global pollution transport mechanisms.

develop the pollution control devices:

UNIT – I

Introduction**-** Definitions, Different Classification of air pollution sources, emission inventory classification Case histories of Air Pollution Episodes, Air Pollution Laws, Characterization and sampling of atmospheric pollutants (Sampling train).
Monitoring of particulates, Procedures, carbon monoxides, Hydrocarbons, Oxides of Sulphur and Oxides of Nitrogen as per CPCB.
Analytical methods for quantifying particulates, organic vapours and metals of environmental concern. Effects of Air Pollutants on materials and human health and injury to vegetation, National ambient Air quality standards, criteria and indices.

14hrs

UNIT – II

Meteorology**-** Composition and structure of the atmosphere, wind circulation, solar radiation, Adiabatic Lapse Rate, ELR, Atmospheric stability conditions, wind velocity profile, Maximum Mixing Depth (MMD), Temperature inversions, Heat island effect, wind rose diagram,' General Characteristics of stack emission, plume behavior.

12hrs

UNIT – III

Air Quality Modeling**-** Fixed box models, Gaussian Dispersion model, plume rise, stack design, Maximum Ground level Pollutant concentrations, Concentrations along plume line, calculation of effective stack height, Down wind pollutant concentrations under temperature inversion.
Particulates-Collection mechanism and efficiency, deposition of particulates from stacks, Hood and Duct design. Particulate Pollution Control equipment Design considerations of setting chambers, Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators.

14hrs

UNIT – IV

General Control-General Control of gases and vapors processes and their kinetics, Introduction to indoor air pollution Hydrocarbons in atmospheric photochemistry, Oxidants in Photochemical smog. Introduction to noise pollution and its control.

12hrs

REFERENCES:

1. Perkins- Air Pollution.,McGraw Hill Higher Education (1 Jan 1974)
2. Kenneth Wark and Cecil F Warner - Air Pollution - its origin and control, Harper and Row, Publishers, New York.
3. Environmental Engineers Hand Book, Edition- Liptak Chilton Book Co. USA
4. Magill, Holden and Ackley - Air Pollution hand book, Mc Graw Hill New York 1956
5. Stern A.c. (ed) Vol. V- Air Quality Management.
6. Seinfeld N.J. - Air Pollution McGraw Hill 1975.
7. M N Rao and HVN Rao, Air Pollution" Tata Mc Graw Hill publication

Course outcome	Statement	PO1	PO2	PO3
1	Identify anthropogenic sources and atmospheric effects to pollutions.	3	2	2
2	Demonstrate the Understanding of Regional, global pollution transport mechanisms.	3	3	2
3	develop the pollution control devices:	3	2	2
Average		3	2.333	2

GLOBAL WARMING AND CLIMATE CHANGE

4 Credits

(3-2-0)

Sub Code : PEV021E **CIE Marks : 50**

Hrs/ Week : 05 **SEE Marks : 50**

COURSE OUTCOMES

1. Measure climate factors and how they change
2. Identify effects of climate change on biodiversity and ecosystems in different biomes and aquatic systems and the model possible scenarios for future climate change
3. Achieve possible ways to deal with climate change , energy Issues and Alternate Energy Sources.

UNIT-I

Green-House Effect as a Natural Phenomenon, Green House Gases GHGs) and their Emission Sources Quantification of CO_2 Emission, Global Warming Potential (GWP) of GHGs

UNIT-II

Modeling Climate change, Ozone layer depletion and its control, Impacts of climate change: Global and India, Temperature Rise, Sea Level rise, Coastal Erosion and landslides, Coastal Flooding, Wetlands and Estuaries loss Impact of ocean current on global climate, EL-NINO & LA-NINA effects.

UNIT-III

Kyoto Protocol: Importance, Significance and its role in Climate Change Carbon Trading - Mechanisms , Various Models (European, Indian) Global and Indian Scenario

UNIT-IV

Cleaner Development Mechanisms: Various Projects related to CO_2 Emission Reduction Alternatives of Carbon Sequestration: Conventional and non-conventional techniques , Role of Countries and Citizens in Containing Global Warming.

REFERENCES

1. Barry R.G., and Chorley R.L., “Atmosphere, Weather and Climate”, 4th Edition, ELBS Publication.
2. Bolin B., (Ed.), “Carbon Cycle Modelling”, John Wiley and Sons Publications.
3. Corell R.W., and Anderson P.A., (Eds.), “Global Environmental Change”, Springler Verlog Publishers.
4. Francis D., “Global Warming: The Science and Climate Change”, Oxford University Press.
5. Frame B., Medury Y., and Joshi Y., (Eds.), “Global Climate Change: Science, Impact and Responses”.
6. Linden E.,, “The Winds of Change: Climate, Weather and the Destruction of Civilizations”, Simon and Schuster Publications.

7. Mintzer I.M., (Ed.), "Confronting Climate Change, Risks, Implications and Responses", Cambridge University Press.
8. Srivatsava A.K., "Global Warming", APH Publications.
9. Wyman R.L., (Ed.), , "Global Climate Change and Life on Earth", Chapman and Hall Publications.
10. Yadav, Chander and Bhan, "Global Warming: India's Response and Strategy", RPH Publications.

Course outcome	Statement	PO1	PO2	PO3
1	Measure climate factors and how they change	3	2	2
2	Identify effects of climate change on biodiversity and ecosystems in different biomes and aquatic systems and the model possible scenarios for future climate change	3	2	2
3	Achieve possible ways to deal with climate change , energy Issues and Alternate Energy Sources.	3	2	3
Average		3	2	2.33

ADVANCED ATMOSPHERIC ENVIRONMENTAL ENGINEERING
4 Credits
(3-2-0)

Sub Code : PEV022E **CIE Marks : 50**

Hrs/ Week : 05 (3+2) **SEE Marks : 50**

COURSE OUTCOMES

1. Understand Atmospheric Processes and Chemical Reactions.
2. Effectively utilize knowledge of design on Industrial Ventilation Systems
3. Learn Urban Air Quality Simulation Modeling

UNIT-I

Atmospheric Processes and Chemical Reactions: Definition of terms aerosols, particle, photolysis, gas to particle conversion, condensation, evaporation, dissolution, sublimation, specific heat, conduction, radiation. Mechanical turbulence, forced convection, advection, equation of state, first law of thermodynamics. Reaction Rates (Gas Phase Species) Atmospheric gases and their molecular structures, chemical reactions and photo processes, reaction rates, reaction rate coefficients, sets of reactions, stiff systems.

Atmospheric Boundary Layer: Characteristics of atmospheric boundary layer-boundary layer depth, mean velocity power-law profile, Log-Log velocity profile, spectral description of turbulence, turbulence intensity, Reynolds stress parameter, spectral density function, integral length scale, inertial subrange and small scales. Turbulent fluxes of momentum, turbulent fluxes of energy and water vapour, friction velocity, surface roughness lengths, bulk aerodynamic equations for eddy diffusion, monin-obukhov similarity theory, eddy diffusion above the surface layer, ground surface temperature and moisture.

UNIT-II

Urban Air Quality Simulation Modeling: General need, alternative approaches, basic model applications, general composition of models, Numerical modeling approaches-Gaussian diffusion models, physical basis of the mass conservation approach, mathematical foundation of the mass conservation approach.

Inherent problem in air quality simulation modeling: Boundary conditions, spatial resolution and compatibility with available data. Transportation related modeling-street canyon models, highway models, airport models. Air quality simulation models for Quasi-Inert pollutants-sulfur dioxide and particulate models, carbon monoxide models. Air quality simulation models for photochemical pollutants-background, features of photochemical air quality simulation models, model evaluation, model validation.

UNIT-III

Dispersion of Heavy Gases: Introduction, characteristics of heavy gas flow, introduction to numerical modeling of heavy gas dispersion, requirements for physical models (non-dimensional parameters, choice of scaling variables).

Mobile Sources of Pollution: Introduction, emission standards for automobiles, Gasoline, origin exhaust emissions from gasoline engines, crankcase and evaporative emissions, alternative fuels and their utilization.

UNIT-IV

Indoor Air Pollution: Introduction, the IAQ problem, diagnosis and remediation of IAQ problems, the interdisciplinary approaches. Industrial hygiene and its application to IAQ, industrial hygiene methodology. Indoor air quality and industrial hygiene, sampling, analysis and interpretation. Industrial hygiene methodology, architectural and construction aspects.

Design of Industrial Ventilation Systems: Introduction, ventilation by dilution, hood specifications, hoods of simple geometry, experimental velocity contours, complex hood design, duct design, fan selection and performance.

REFERENCES

1. Jacobson. Z. A., **Fundamental of Atmospheric modeling,** Cambridge University Press, Cambridge.
2. Warren B. Johnson et. al. , **Air Pollution**, Arthur C. Stern, third edition, Volume I, Academic Press, New York, .
3. Krogstad and Jacobsen, **Dispersion of heavy gases, in encyclopedia of environmental control technologies**, edited by Cheremioinoff, Volume-2, Rulf publishing company, Houston.
4. Crawford Martin**, "Air pollution control theory"**, Tata McGraw- Hill publishing company Ltd. New Delhi, .
5. Stull B. Roland, **Boundary Layer Meteorology**, Kluwer Academic Publishers.
6. Snyder H. William, "**Guideline for fluid modeling of atmospheric diffusion",** U.S. Environmental Protection Agency research Triangle Park, NC 27711.
7. Wark K., Warner C.F., and Davis. W.T., "**Air Pollution, its origin and control**", Third Edition, Harper and Row Publication.
8. Steve M. Hays, Ronald V. Gobbell & Nicholas R. Ganick, "**Indoor Air Quality"-** Tata McGraw-Hill.

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Course outcome	Statement	PO1	PO2	PO3

1	Understand Atmospheric Processes and Chemical Reactions.	3	2	2
2	Effectively utilize knowledge of design on Industrial Ventilation Systems	3	2	2
3	Learn Urban Air Quality Simulation Modeling	3	2	3
Average		3	2	2.33

REUSE AND RECYCLE TECHNOLOGY
3 Credits
(2-2-0)

Sub Code : PEV109E **CIE MARKS : 50**
Hrs/Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Understand the different wastes as fuel and conversion devices to convert waste to energy.
2. Apply the existing technologies for the treatment of biomass and design the devices
3. Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.

UNIT- I

Waste as a resource: Resource Economics, Disposed materials (Paper, plastic, metals, solvents), Collection and recycling of plastics, Potential for reuse.
Appropriate technologies for wastewater treatment and reuse: Reuse applications, appropriate technologies, types of systems (Centralised, Individual, and Community system), Performance expectations.

UNIT - II

Metals recovery: Ferrous metals, properties, principles of magnetic field-ferrous material interactions, magnetic separation, eddy-current separation- theory and types, Extraction of material from a bed.

UNIT- III

Reuse of industrial effluent, Urban effluent reuse for agriculture in arid and semiarid zones, Uses of Sewage in Pisciculture, Groundwater Recharge of sewage effluents, Reuse for Amenity.
Water Reuse: Direct and indirect Reuse, intentional reuse, Examples of water reuse, Close cycle and open cycle reuse, Recreational reuse.

UNIT- IV

Sludge as soil conditioner, vegetable oil as fuels, Biodiesel, Refuse derived fuel, Waste oil recycling, waste utilization in cement kilns.

REFERENCES:

1. Springer, “Recycling and Resource Recovery Engineering”, Springer-Verlag Berlin Heidelberg(1996)

2. ICE:Reuse of Sewage Effluents, Proceedings of the International Symposium Thomas Felford London(1985)
3. Dean R.B and E., Water Reuse problems and solutions ,Academic Press(1981)
4. Kut D.,and Hase G Waste Recycling for Energy Conservation ,John Wiley and Sons Inc
5. John T.Aquino Waste Age/Recycling Times'Recycling Handbook
6. Jawad Al-Sulaimi Takashi Asano Wastewater Reclamation and Reuse

Course outcome	Statement	PO1	PO2	PO3
1	Understand the different wastes as fuel and conversion devices to convert waste to energy.	3	2	2
2	Apply the existing technologies for the treatment of biomass and design the devices	3	3	2
3	Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.	1	2	2
Average		2.3333	2.333	2

ENVIRONMENTAL BIOCHEMISTRY AND BIOTECHNOLOGY
3 Credits
(2-2-0)

Sub Code : PEV010E **CIE Marks : 50**
Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Design the methods and techniques for analysis of environmental samples
2. Apply the technologies for bioremediation of soil, water and air.
3. understand-Metabolism - Stoichiometry arid Energetics, Thermodynamic Principles, Metabolic Reaction and Coupling, EMP Pathway.

UNIT – I

Introduction-Metabolism - Stoichiometry arid Energetics, Thermodynamic Principles, Metabolic Reaction and Coupling, EMP Pathway and other Carbohydrate Catabolic Pathways.

Respiration and Photosynthesis, Biosynthesis, Transport across Cell Membranes, End Products of Metabolism. Stoichiometry of Cell Growth and Product Formation, Medium Formulation and Yield Factors, Material Balances for Cell Growth, Product Formulation Stochiometry, Heat Generation, Yield Factor Estimate.

UNIT – II

Molecular Genetics and Control Systems -Molecular Genetics, Alteration of Cellular DNA, Recombinant DNA Technology, Growth and Reproduction of Single Cell.

Kinetics of Substrate Utilization, Product Utilization and Biomass Production in Cell Cultures, Ideal Reactors for Kinetics Measurement, Kinetics for Balanced Growth, Transient Growth Kinetics, Structured Kinetic Models.

UNIT – III

Biotechnology- Introduction to Microbial Biotechnology, Uses of Enzymes, Isolation and Purification of Enzyme Engineering, Protein Engineering, immuno toxins, Metabolic Engineering for Over Production of Metabolites.

Uses of Microbes- Isolating and Culturing of Microorganisms, Production of Organic Compounds like Ethanol and Acetone by Microbial Fermentation, Production of Enzymes by Microorganism, Production of Antibiotics, Single Cell Protein, Sewage Treatment using Microbial Systems.

UNIT – IV

Biotechnology and Environment- Pollution Control, Restoration of degraded lands, biodiversity and its conservation, Biosensors, immobilized Cell Technology for Wastewater Treatment.

REFERENCES:

1. Bailey and Ollis, Biochemical Engineering and Fundamentals, McGraw Hill International, 1986.

2. Smith, Principles of Biochemistry, 7th Edition, McGraw Hill international.

3. Agarwal's A Text book of Biochemistry, Goel Publishing House, Meerut2002

4. P.K. Guptha, Elements of Biotechnology, Restogi Publishers, Meerut,2003.

Course outcome	Statement	PO1	PO2	PO3
1	Design the methods and techniques for analysis of environmental samples	3	2	2
2	Apply the technologies for bioremediation of soil, water and air.	3	3	3
3	understand-Metabolism - Stoichiometry arid Energetics, Thermodynamic Principles, Metabolic Reaction and Coupling, EMP Pathway.	3	1	1
Average		3	2	2

BIOLOGICAL TREATMENT OF WASTEWATER
3 Credits
(2-2-0)

Sub Code : PEV016E **CIE Marks : 50**
Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Identify various parameters of biological methods of analysis of waste water
2. Select and design the appropriate biological wastewater treatment processes and discuss pros and cons of each process
3. Critically analyze the various problems encountered in aerobic and anaerobic treatment of waste water

UNIT – I

Introduction: Objectives of biological treatment – significance – aerobic and anaerobic treatment - kinetics of biological growth – Factors affecting growth -attached and suspended growth – Determination of Kinetics coefficients for organics removal – Biodegradability assessment - selection of process.

UNIT – II

Aerobic treatment of wastewater: Design of sewage treatment plant units – screen chamber, Grit chamber with proportional flow weir, sedimentation tank - Trickling filters, Rotating Biological contactor, activated sludge process & variations, aerated lagoons, waste stabilization ponds – nutrient removal systems – natural treatment systems – Disinfected disposal options – reclamation and reuse - Flow charts, layout, hydraulic profile - Recent advances.

UNIT – III

Anaerobic treatment of wastewater: Attached and suspended growth, Design of units – UASB, up flow filters, Fluidised beds – septic tank and disposal – Nutrient removal systems – Layout and Hydraulic profile – Recent advances.

UNIT – IV

Sludge treatment and disposal: Design of Sludge management facilities, sludge thickening, sludge digestion, Biogas generation, sludge dewatering (mechanical and gravity) – upgrading existing plants – ultimate residue disposal – Recent Advances.
Operations, maintenance, management and case studies: Operational problems – Trouble shooting, Planning, Organising and Controlling of plant operations – capacity building, Case studies on sewage treatment plants – sludge management facilities.

REFERENCES:

1. Arceivala, S.J., Wastewater treatment for pollution control, TMH, New Delhi, 1998.

2. Manual on "Sewerage and Sewage Treatment" CPHEEO, Ministry of Urban Development, GoI, New Delhi, 1999.

3. METCALF & EDDY, INC. 'Wastewater Engineering, Treatment and Reuse. Third Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.

4. Qasim, S.R, Wastewater Treatment Plant, Planning, Design & Operation Technomic Publications, New York, 1994.

Course outcome	Statement	PO1	PO2	PO3
1	Identify various parameters of biological methods of analysis of waste water	3	2	2
2	Select and design the appropriate biological wastewater treatment processes and discuss pros and cons of each process	3	3	2
3	Critically analyze the various problems encountered in aerobic and anaerobic treatment of waste water	3	2	2
Average		3	2.33	2

OPERATION AND MAINTENANCE OF ENVIRONMENTAL FACILITIES

3 Credits

(2-2-0)

Sub Code : PEV006E **CIE Marks : 50**

Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Apply basic principles, organizational structure, work planning and scheduling and cost estimates of O&M
2. Prepare drawings, plans, record keeping, need for operational manual and SOP.
3. Solve operational problems in water treatment and supply facilities, wastewater collection and treatment facilities, air pollution control systems.

UNIT – I

Introduction- Importance of Operation and Maintenance, Basic Principles of Operation and Maintenance - Corrective and Preventive Maintenance, Data Base of Facilities for O and M - Detailed Plans, Drawings, Operation Manuals, Computer Applications in O and M.

12hrs

UNIT – II

O and M of Water Supply Facilities-Intakes, Pumps, Rising Mains, Water Treatment Process Control, Water Quality and Water Quality Monitoring, Loss of Carrying Capacity of Pipes. Causes, Leak Detection, Projection of pipe Break Rates, Record Keeping, Appurtenances - Valves, Hydrants and Fittings. Use of Network Models in O and M. Safety aspects.

14hrs

UNIT – III

O and M of Wastewater Facilities- Sewer Network: Inspection Methods for Sewers and Appurtenances -Manual and Television, cleaning. Rehabilitation - Sealing, Repair and Replacement. Safety in Sewer inspection. O and M of Wastewater Treatment plant. Monitoring, Operational Problems and Corrective Measures in Different Units of Treatment.

12hrs

UNIT – IV

O and M of Air Pollution Control Facilities- Regular inspection of Devices, SPM Control Equipment, Gravity Settlers, Cyclone Separators, Bag Filters, Scrubbers, Electrostatic Precipitators, Gaseous Emission Control Devices - Absorption Beds and Adsorption Columns, Thermal Oxidisers, Incinerators and their Trouble Shooting. Safety measures during O and M. Operation and Maintenance Planning-Organizational Structure, work planning, Preparation and Scheduling Cost Estimates. **14hrs**

REFERENCES:

1. Water and Wastewater Technology, Hammer M.J. - 1985

2. Water Treatment Plants, Syed R. Quasim, Holt Rinchart and Winston - 1985

3. Neumann W.L. Industrial Air Pollution Control Systems, 1997, McGraw Hill

4. CPHEEO Manual on Water Supply and Treatment, GO! Publication, 1991.

5. CPHEEO Manual on Sewerage and Sewerage Treatment, GOI Publication. 1995

6. Training Manual on OandM for Municipal staff, Asian Development Bank Project, Government of Karnataka.

7. Walski T. M. Analysis of Water Distribution systems, CBS, Publications, New Delhi, 1987.

Course outcome	Statement	PO1	PO2	PO3
1	Apply basic principles, organizational structure, work planning and scheduling and cost estimates of O&M	2	2	2
2	Prepare drawings, plans, record keeping, need for operational manual and SOP.	1	3	2
3	Solve operational problems in water treatment and supply facilities, wastewater collection and treatment facilities, air pollution control systems.	3	2	2
Average		2	2.33	2

REMOTE SENSING AND GIS APPLICATIONS IN GEO-ENVIRONMENTAL ENGINEERING

3 Credits

(2-2-0)

Sub Code : PEV017E **CIE Marks : 50**

Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.
2. Apply available Remote Sensing technologies and be able to match these to particular kinds of Geoenvironmental engineering problem.

3. Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.

UNIT-1

Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, BlackBody Radiation, Energy Interactions with earth atmosphere and surface features, spectral reflectancecurves-For Vegetation, soil & water.

Sensors: Definition, Types (Typical Sensor used in optical remote sensing, Thermal sensor, Synthetic Aperture Radar) Classification Plat Forms: Definition & Types: Airborne & Space Borne platforms, Plat form characteristics. Indian Remote Sensing Programme: Definition, Objectives, Data Products of Launch Program Satellite Specifications for IRS-1C, 1D, P4, CARTOSAT-1 & CARTOSAT-2

UNIT-2

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation. Digital Image Processing (DIP): Definition, Need, Stages of DIP-Image rectification & restoration, Image Enhancement-Contrast Mnipulation-Grey Level Thresholding, Classification-Brief discussion of classification procedure for Supervised & Unsupervised Classification Techniques.

GIS: Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Application. GIS functions. Brief Procedure of integrating Remote Sensing Data into GIS.

UNIT-3

GIS Advanced Concepts: Network Analysis & Virtual GIS. Modeling problems for demonstrating use of GIS functions for civil applications – Site selection for urban development, development of business center and wild life Sanctuary Park.

Computer Concepts of GIS: Coding of attribute data in computer (Binary system & Hexadecimal System), Coding of vector & Raster data in GIS, File Listing & Data Access, Raster data compression techniques, Data Base Structures. Basics of Photogrammetry : Acquisition of Arial photographs, Aerial Camera, Flight Planning, Photograph processing & feature extraction. (Brief Discussion Only)

Application of GIS in Geotechnical Engineering:-Introduction, Remote Sensing & GIS assisted geotechnical investigations, Determination of volumetric shrinkage of expansive soils, 3D mapping for sub surface stratum.

UNIT-4

Advanced Applications GIS assisted seismic hazard studies, study of soil drainage characteristics assisted with remote sensing, study of ground water prospects, soil mapping, and rock spectra for mineral identification- Relevant case studies

Applications In Environmental Engineering: Solid waste collection & transport, water quality assessment, water resource management, mapping of ground water potability status, GIS based master plan for water supply project, Ground water Vulneribility assessment, GIS based master plan for sewage collection & transport system.

REFERENCES:

I. Pater A Burraugh Rachal A Mc Donnas "Principle of GIS" (Oxford)

2. Christopher Jones "GIS and Computer Cartography"publication Prentice-Hall(2009)

3. Lilly Sand, "Remote sensing and Image interpretation, John Willey and Sons, New York 1999.

Course outcome	Statement	PO1	PO2	PO3
1	Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.	2	2	2
2	Apply available Remote Sensing technologies and be able to match these to particular kinds of Geoenvironmental engineering problem.	3	3	2

3	Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.	3	2	2
Average		2.6667	2.333	2

NON – POINT SOURCES OF POLLUTION AND MANAGEMENT

3Credits

(2-2-0)

Sub Code : PEV020E **CIE Marks : 50**

Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES

1. Utilize Simulation Models for tracing nonpoint source pollution
2. Develop management solutions for nonpoint source pollution control

3. Select best management solutions for nonpoint source pollution control

UNIT-I

Introduction: Non-point Pollution, Problem, definitions, magnitude of Non-point Pollution, Non-point Pollution Control Laws, Waste Assimilative Capacity and Stream Standards

Pollution From the Atmosphere: Atmospheric Inputs – fall out, rainfall, Overland routing of the precipitation excess, interflow ground water flow.

UNIT-II

Groundwater Pollution: Sources of Groundwater Contamination, Groundwater Movement.

Pollution from impervious urban areas: Introduction Deposition and Accumulation of Pollutants on Impervious Surfaces, Removal of Solids from street Surfaces, Porous Pavement.

UNIT-III

Non point Pollution Simulation Models: Basic Concepts Brief Description available Nonpoint Pollution Simulation Models.

Land use and non-point pollution: Effects , Comparative Assessment of Pollution Impact from land use, agricultural runoff, mining area runoff, Effect of hydrologic Modifications

UNIT-IV

Management Practices of Non-point pollution control: Introduction, Source Control Measures Collection Control and Reduction of Delivery.

Planning for Nonpoint Pullution Control: Introduction, Water Quality Planning Process, Selection of Best Management Practices for Non Point Source Pollution Control – detention ponds, exfiltration and infiltration trenches, vegetative swales.

REFERENCES

1. Novotny V., and Chesters G., " **Hand Book of Non-point Pollution, Sources and Management",** Van Nostrand Reinhold Environmental Engineering Series, New York.

2. Pavoni J L, (Ed) "Hand Book of **Water Quality Management Planning"**, Van Nostrand Reinhold, Environmental Engineering Series.New York

2. Pluarg, Pollution from Land Use Activities Reference Group Novotny V and Chesters G, , “**Hand Book of Non-point Pollution, Sources and Management”**, Van Nostrand Reinhold Company.

Course outcome	Statement	PO1	PO2	PO3
1	Utilize Simulation Models for tracing nonpoint source pollution	2	2	2
2	Develop management solutions for nonpoint source pollution control	3	3	2
3	Select best management solutions for nonpoint source pollution control	3	2	2
Average		2.6667	2.333	2

Sri BVV Sangha's

Basaveshwar Engineering College, (Autonomous) Bagalkot-587103

Department of Civil Engineering

SYLLABUS FOR POST GRADUATE PROGRAMME
M. Tech.
GEOTECHNICAL ENGINEERING

2020-2021

Vision of the Institution

To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions and inspiring inventions for holistic socioeconomic developments

Mission of the Institution

To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change.

To carry out innovative cutting-edge research and transfer technology for industrial and societal needs. To imbibe moral and ethical values and develop compassionate, humane professionals.

Vision of the Department

To be a center of excellence of higher learning and research in civil engineering encompassing ethical environmental and economical aspect of the society.

Mission of the Department

The department of civil engineering is committed to prepare globally competent engineers, in response to rapid economic and technological growth, through a dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community.

Programme Educational Objectives

PEO 1

Graduates of the programme will become effective Geotechnical Engineers in Government, industry, or other organizations; designing, improving and implementing efficient, sustainable Geotechnical engineering practices.

PEO 2

Graduates of the programme will provide solutions to Geotechnical Engineering problems that account for economical, societal, ethical, as well as with standards both as individuals and in team environments, by applying acquired engineering knowledge.

PEO 3

Graduates of the programme will continue their lifelong learning to remain effective professionals to maintain and enhance technical and professional growth.

Programme Outcomes

PO 1

An ability to independently carry out research /investigation and development work to solve practical problems.

PO 2

An ability to write and present a substantial technical report/document.

PO 3

Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

Justification of consistency of the Department Vision and Mission with the Institute Vision and Mission

Vision

Institution Vision → / Department Vision ↓	To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions	Inspiring inventions for holistic socioeconomic developments
To be center of excellence of higher learning and research in civil engineering	*	*
To encompass the graduates ethical, environmental and economical aspect of the society		*

Mission

Institution Mission → / Department Mission ↓	To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change	To carry out innovative cutting edge research and transfer technology for industrial and societal needs.	To imbibe moral and ethical values and develop compassionate, humane professionals
To prepare globally competent engineers, in response to rapid economical and technological growth	*	*	
Dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community	*	*	*

Basaveshwar Engineering College, Bagalkot
Department of Civil Engineering

M. Tech. Geotechnical Engineering 2020-21

Scheme of Teaching and Examination

Semester –I

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PGT 121C	Geomechanics and Engineering	4	3	2	0	50	50	100
2	PGT 122C	Soil Exploration and Field testing	4	3	2	0	50	50	100
3	PGT 133C	Advanced Foundation Engineering	4	3	2	0	50	50	100
4	PGT 00XE	Elective -1	4	3	2	0	50	50	100
5	PGT 00XE	Elective – 2	4	3	2	0	50	50	100
6	PGT 00XE	Elective – 3	3	2	2	0	50	50	100
7	PGT124S	Seminar	1	0	0	2	50	50	100
		Total	**24**	**17**	**12**	**2**	**350**	**350**	**700**

Semester –II

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PGT 221C	Reinforced Earth Structure and Geosynthetics	4	3	2	0	50	50	100
2	PGT 222C	Dynamics of Soils and Foundation	4	3	2	0	50	50	100
3	PGT 00XE	Elective – 4	3	2	2	0	50	50	100
4	PGT 00XE	Elective – 5	4	3	2	0	50	50	100
5	PGT 00XE	Elective – 6	4	3	2	0	50	50	100
6	PGT 00XE	Elective – 7	4	3	2	0	50	50	100
7	PGT 224T	Term Paper	1	0	0	2	50	50	100
		Total	**24**	**17**	**12**	**2**	**350**	**350**	**700**

Semester –III

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PGT 00XE	Elective -8	4	3	2	0	50	50	100
2	PGT 321 I	Industrial training	4	0	0	8	50	50	100
3	PGT 312 P	Project phase- 1	10	0	0	20	50	50	100
4	PGT 304L	Geotechnical Engg.Lab	2	0	0	4	50	50	100
		Total	**20**	**3**	**2**	**32**	**200**	**200**	**400**

Semester –IV

Sl. No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PGT 431P	Project phase- II	20	0	0	40	50	50	100
		Total	**20**	**0**	**0**	**40**	**50**	**50**	**100**

LIST OF ELECTIVES

Sl No	Subject Code	Subject	Credits
01	PGT 003E	Theory of Elasticity and Plasticity	04
02	PGT 004E	Advanced Pavement Design	04
03	PGT 018E	Numerical Methods for Civil Engineers	04
04	PGT 009E	Finite Element Method	04
05	PGT 023E	Pile foundation Analysis and Design	04
06	PGT015E	Structural Design of Foundations	04
07	PGT016E	Earth and Rock-fill dams	04
08	PGT017E	Soil Structure Interaction Problems	04
09	PGT020E	Design of Earth Retaining Structures	04
10	PGT024E	Critical State Soil Mechanics	04

Sl No	Subject Code	Subject	Credits
1	PGT 008E	Ground Improvement Techniques	03
2	PGT 005E	Environmental Geo-Techniques	03
3	PGT 010E	Construction Management Techniques	03
4	PGT 011E	Design of Machine Foundations	03
5	PGT019E	Remote Sensing and GIS application in Geo-environmental Engineering	03
6	PGT014E	Geotechnical Earthquake Engineering	03

GEOMECHANICS AND ENGINEERING
04 Credits (3-2-0)

Subject Code: **PGT121C** IA Marks: 50
Duration of Exam: 3Hrs Maximum marks: 100

Course outcomes:

1. Students should understand the concept of stress, direction cosines, stress transformation, principal stresses.
2. Students will learn the concept of strain , compatibility conditions and fundamentals of Elasticity including Generalized Hooke's law. The students should understand elastic, elasto plastic and plastic behavior of soils. They must also understand limit equilibrium concept, Mohr – Coulomb failure theory, stress paths and yield criteria as applicable to soils.
3. The students will understand consolidation theory, classification of soils based on stress history, coefficients used in consolidation theory and their significance, determination of Time factor and coefficient of consolidation. Calculation of total and time rate settlements. They should also learn significance of settlement, components of settlement, permissible settlements for various civil engineering structures.
4. The students will understand mechanism of shear strength mobilization, factors influencing shear strength, measurement of shear strength, choice of tests based on drainage conditions.
5. The students will clearly understand shear strength of cohesive and cohesionless soils in drained and undrained conditions and stress paths.

UNIT 1:
Stability analysis of slope ; Effective vs Total stress analysis (Approach), shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wegde analysis method, stability during critical condition.

UNIT 2:
Soil behavior- Elastic, Plastic and Elasto-plastic. Mohr's stress circle concept; Limit equilibrium-Mohr coulomb theory; Failure criteria for cohesive and cohesionless soils; Concept of stress paths – Total and Effective stress paths in different spaces; Yield criteria- Tresca, Von mises and Mohr coulomb criteria.

UNIT 3:
Basics of consolidation theory; Soil classification based on stress theory, Estimation of compression index, preconsolidation pressure; Settlement analysis- Components of Settlement, Calculation of total settlements, time rate settlement; Total and differential settlements, permissible settlements.

UNIT 4:
Shear strength – Physical components, Factors influencing shear strength, Mohr-Coulomb strength theory, Mechanism of shear strength mobilization, Measurement of shear strength, Drainage conditions, Pore pressure parameters, Choice of test conditions, Shear strength of cohesionless soils, Shear strength of saturated cohesive soils, Determination of Insitu shear strength and Stress paths for drained and undrained shear tests.

References

1. Scott R F., "Theoretical soil mechanics" Prentice Hall, New Jersy (1965).
2. Lambe and Whitman. "Soil Mechanics", Wiley Eastern Pvt Ltd., New Delhi (3rdEd ,1979).
3. Mitchell J K., "Principles of Soil Behaviour", John Willey and sons (1976).
4. Leornards G A., "Foundation Engineering ", McGraw Hills, New York, (1962).
5. Yong R N., Warkentin B P., "Soil Properties and Behaviour", Elsevier Publication (1975).

6. Bishop A W., and Henkal D J., “Measurement of Soil Properties in Triaxial Test. Edward Arnod (Pub) Ltd London(1962).
7. M.E.Harr., “Foundation of Theoretical Soil Mechanics”, McGraw Hill (1966).

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students should understand the concept of stress, direction cosines, stress transformation, principal stresses.	1	2	3
2	Students will learn the concept of strain , compatibility conditions and fundamentals of Elasticity including Generalized Hooke’s law. The students should understand elastic, elasto plastic and plastic behavior of soils. They must also understand limit equilibrium concept, Mohr – Coulomb failure theory, stress paths and yield criteria as applicable to soils.	2	2	3
3	The students will understand consolidation theory, classification of soils based on stress history, coefficients used in consolidation theory and their significance, determination of Time factor and coefficient of consolidation. Calculation of total and time rate settlements. They should also learn significance of settlement, components of settlement, permissible settlements for various civil engineering structures	2	1	3
4	The students will understand mechanism of shear strength mobilization, factors influencing shear strength, measurement of shear strength, choice of tests based on drainage conditions.	2	2	3
5	The students will clearly understand shear strength of cohesive and cohesionless soils in drained and undrained conditions and stress paths.	2	2	3

SOIL EXPLORATION AND FIELD TESTING
04 Credits (3-2-0)

Subject Code: **PGT 122C** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Comprehend the significance of soil exploration and study the various approaches of soil/rock investigation.
2. Apply appropriate sampling techniques as per site condition.
3. Interpret the importance of insitu tests and collect data independently, integrate it with remote sensing,GIS and also prepare the investigation report.

UNIT 1:
Role of engineer in the systematic exploration of a site; Relevance of geology to civil engineering, Soil profiles of various regions. Rock and soil types and their formation; Basics of structural geology; In-situ state of stress in soils and rocks; In situ permeability; Engineering classification of intact and fissured rocks – RQD.

UNIT 2:
Geological exploration of an engineering site; Field reconnaissance, Applied geophysical surveys; Drilling and accessible explorations; Sampling methods and equipments; Factors considering in selection sampler, Factors affecting sample quality, Sample disturbance, Spacing and Depth of boring, Handling, preservation and transportation of samples.

UNIT 3:
Importance of In-situ testing, performing various In-situ tests: standard penetration test, static and dynamic cone penetration tests, pressure meter test, plate load test and field vane shear test (VST), Ground water exploration, site evaluation and reporting.

UNIT 4:
Importance of photogrammetry and remote sensing in geological and geotechnical investigations. Photo interpretation–Basic elements in photo interpretation, Interpretation of rock forms and bed rocks. Basic concepts of remote sensing, remote sensing system, energy interaction mechanism on ground, Earth's emission, spectral response and spectral signature and spectra of rock and soils.

References

1. Hvorslev M J., "Subsurface Exploration and Sampling of Soil for Civil Engineering Purposes", Waterways Experiment station, Missisippi, 1949
2. Hunt R.E. "Geotechnical Engineering: Analysis and Evaluation" McGraw Hill Book Company 1986
3. H. F. Winterkorn and H Y Fang, Foundation Engineering Hand Book, Galgotia Booksource.
4. McLean A.C. and Gribble C.D., "Geology for Civil Engineering's" Unwin Hyman, London, 1988.
5. Floyd F Sabins Jr., "Remote Sensing – Principles of Interpretation", 2nd Ed. W H Freeman and Co.
6. Michael Hord R., "Remote Sensing – Methods and Applications", John Wiley and Sons, New York.,
7. Ravi P Gupta., "Remote Sensing Geology", Springer Verlog
8. Wolf P R., "Photogrammetry"., McGraw Hill Publication New York.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Comprehend the significance of soil exploration and study the various approaches of soil/rock investigation.	3	2	2
2	Apply appropriate sampling techniques as per site condition.	3	2	2
3	Interpret the importance of insitu tests and collect data independently, integrate it with remote sensing, GIS and also prepare the investigation report.	3	3	3

ADVANCED FOUNDATION ENGINEERING
04 Credits (3-2-0)

Subject Code: **PGT133C** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Judge the appropriate shallow foundation type ,depth and required design.
2. Design required type of deep foundations.
3. Analyze and suggest remedial measures against foundation failures.

UNIT 1:
Assessment of foundation loads for Engineering structures – Dead load, Live load, wind and seismic load combinations for the Design, Code requirements. Bearing Capacity Settlement analysis, immediate settlements, Consolidation settlements, Total settlements, Relative settlements, various methods of estimation.

UNIT 2:
Shallow Foundations - Conventional structural design of Individual footings, combined footings and Rafts.
Pile Foundations – Analysis and Conventional Design of pile foundations for vertical and lateral loads including design of pile cap.

UNIT 3:
Piers and Well Foundations: Analysis and design of pier and well foundations. Caissons.
Foundations on expansive soils, under reamed piles.

UNIT 4:
Special foundations. Design of Sheet piles
Foundation Failures - Types and causes of failures, Remedial measures, Shoring and Underpinning.

References

1. Bowels J E. “Foundation Analysis and design”, McGraw Hill Book Co., New York.
2. Winterkorn and Fang, “Foundation Engineering Hand book”-Von Nostrand Reinhold Co
3. Shamsher Prakash, Gopal Ranjan and Swami Saran “Analysis and design of Foundation and Retaining structures”, K. A. Rastogi Prakashan, Meerut, India.
4. Jain, G.R. S., “Hand Book on Underreamed and Bored Compaction Pile Foundations”, Published by G. S. Jain Associates, Roorkee.
5. Das, B. M., “Principles of Foundation Engineering”, Cengage Learning (2011)
6. Tomlinson, “Foundation Design and Construction”, ELBS, Longman Group Ltd.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Judge the appropriate shallow foundation type, depth and required design.	1	1	3
2	Design required type of deep foundations	2	2	3
3	Analyze and suggest remedial measures against foundation failures.	2	2	3

REINFORCED EARTH STRUCTURES AND GEOSYNTHETICS
04 Credits (3-2-0)

Subject Code: **PGT 221C** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Identify and select different geosynthetics for intended purpose.
2. Evaluate properties of geosynthetics and design reinforced soil structures to fulfill various functions.
3. Apply geocomposite systems to solve contemporary geotechnical problems.

UNIT 1:
Historical background – Introduction to reinforced soil structures; Need for Geosynthetics; Comparison with reinforced cement concrete structures, Principles, Concepts and Mechanisms of reinforced earth.

UNIT 2:
Material properties, laboratory testing and manufacturing details of Geosynthetics; Metallic strips, Metallic grids, Geotextiles, Geogrids, Geonet, Geomembranes, Geocell, Geocomposites, PVD's, GCL, Geofoam - Functions and Design principles.

UNIT 3:
Application of reinforced soil structures in the design of pavements, Embankments, Slopes and Foundations; Reinforced soil structures for soil erosion control problems.

UNIT 4:
Design of MSE Wall using Geotextile and Geogrid; Applications of Geosynthetics in Geoenvironmental engineering; Application of Geosynthetics in various Civil Engineering projects; Case studies on Application of Geosynthetics.

References

1. Koerner R M., "Designing with geosythetics", Prenetice- Hall pub 1994
2. Jones C.J.E P., "Earth Reinforcement and soil structures", Butterworth's, London,1996.
3. Koerner R.M., and Welsh. J P., " Construction and Geotechinical Engineering using synthetic Fabric", Wiley Inteterseince, New York, 1980
4. Hidetoshi Ochiai, Shigenori Hayshi and jun Otani, "Earth Reinforecement Practice, Vol.I A.A. Balkema, Rotterdam, 1992
5. Bell F G., " Ground Engineer's reference Book", Butterworths, London 1987
6. Ingod T S., " Reinforced Earth", Thomas Telford publications, London
7. S K Shukla., "Fundamentals of Geosynthetics", Taylor and Francis Group, UK
8. R W Sarsby., "Geosynthetics in Civil Engineering", Woodhead Publishing, CRC Press.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Identify and select different geosynthetics for intended purpose.	1	1	3
2	Evaluate properties of geosynthetics and design reinforced soil structures to fulfill various functions	2	2	3
3	Apply geocomposite systems to solve contemporary geotechnical problems.	2	2	3

DYNAMICS OF SOILS AND FOUNDATION
04 Credits (3-2-0)

Subject Code: **PGT 222C** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Know the occurrence of earthquake and its effects.
2. Demonstrate the theory of vibration and apply them to solve soil dynamics problems.
3. Predict the liquefiable area & its mitigation,and also the importance of Vibration isolation.

UNIT 1:
Types of dynamic loads encountered in civil engineering. Occurrence of earthquakes, seismic waves generated by earthquakes and their properties. Types of surface waves and their uses in subsoil exploration, effect of depth below ground level on amplitudes of ground vibrations due to R waves.
Free and forced Vibration of single degree of freedom system with and without damping. Coulomb (friction) damping, viscous (proportional) damping, radiational (geometric) damping. Two degree of freedom systems with and without damping. Natural frequency and resonance and its effects.

UNIT 2:
Propagation of shear waves through layered media. Dynamic stress-strain characteristics of cohesionless soils, cohesive soils and c-ϕ soils.
Laboratory equipments for dynamic soil tests; In-situ measurements and field tests for evaluation of seismic wave velocity: SASW, MASW, cross bore hole, down hole, etc.

UNIT 3:
Liquefaction of soils: Occurrence of liquefaction and its significance in geotechnical engineering; examples of liquefaction under field conditions due to seismic vibrations; factors affecting liquefaction; liquefaction analysis; measures for reducing the damage to structures due to liquefaction.Site characterization using seismic consideration, Numerical evaluation of wave amplification for 2 and 3 layer soils, determination of liquefaction. Potential of sites.

UNIT 4:
Vibration isolation and measures for vibration isolation.
Special topics in Geotechnical Engineering: Microzonation and base isolation.

References
1. Prakash, S. (1981) “Soil Dynamics”, McGraw Hill Book Co., New York.
2. Kramer, S. L. (1996)”Geotechnical Earthquake Engineering”, Prentice Hall International Series.
3. Okamoto, S.(1973), “Introduction to Earthquake Engineering”, John Wiley & Sons, New York.
4. Richarts, F. E., Hall Jr., J. R. and Woods, R. D. (1970) “Vibrations of Soils and Foundations”, Prentice Hall International Series.
5. Barkan, D. D. (1962) “Dynamics of Bases and Foundations”, McGraw Hill Book Co., New York.
6. Kameshwar Rao, (1998) “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Know the occurrence of earthquake and its effects.	1	2	3
2	Demonstrate the theory of vibration and apply them to solve soil dynamics problems.	2	2	3
3	Predict the liquefiable area & its mitigation and also the importance of Vibration isolation.	1	2	3

THEORY OF ELASTICITY AND PLASTICITY
04 Credits (3-2-0)

Subject Code: **PGT 003E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying elasticity and plasticity theory, and how the two fields are underpinned by mathematics and physics.
2. Apply wider multidisciplinary context of the underlying theory, including applications of both elasticity and plasticity to engineering design.
3. Demonstrate creative and innovative ability in the synthesis of theoretical solutions, and linking them to the design of real-world structures.

UNIT 1:

Definition of stress components of stress at a point, Cartesian and polar co-ordinates, Equilibrium equations, Transformation of stress, Principal stresses, invariants of stress, hydrostatic and deviatric stress.

Definition of strain, components of strain at a point, Cartesian and polar co-ordinates, Equilibrium equations, transformation of strain, principal strain, invariant of strain, spherical and deviatoric strains, maximum shear strain, compatibility equations.

UNIT 2:

Compatibility equations, stress strain relations, constitutive relations- plane stress and plane strain. Problems in polar coordinates (2D)

Problems in rectangular coordinates (2D) – boundary conditions Airy's stress function approach to 2-D problems of elasticity, simple problems on bending of beams. Solution of axi-symmetric problems, stress concentration due to the presence of a circular hole in plates.

UNIT 3:

3D problems: Elementary problems of elasticity in three dimensions, stretching of a prismatical bar by its own weight, twist of circular shafts.

Torsion: torsion of non-circular sections.

UNIT 4:

Theory of plasticity: Plastic stress – strain relations, Failure theories, Criterion of yielding, Theories of plastic flow, Plastic deformation

Bending of prismatic beams, residual stresses, Plastic torsion.

References

1. Timoshenko & Goodier, "Theory of Elasticity", McGraw Hill
2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers
3. Chenn W.P and Hendry D.J, "Plasticity for Structural Engineers", Springer Verlag
4. Sadhu Singh, "Applied Stress Analysis", Khanna Publishers
5. Srinath L.S. Advanced Mechanics of Solids, Third Edition, Tata McGraw Hill publishing company. New Delhi, 1994.
6. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.
7. T.G. Sitharam and L. Govinda Raju, "Applied Elasticity" – Interline Publishing, 2005.
8. Chakrabarthy J, Theory of Plasticity, McGraw Hill.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying elasticity and plasticity theory, and how the two fields are underpinned by mathematics and physics	1	2	3
2	Apply wider multidisciplinary context of the underlying theory, including applications of both elasticity and plasticity to engineering design	2	2	3
3	Demonstrate creative and innovative ability in the synthesis of theoretical solutions, and linking them to the design of real-world structures	2	2	3

ADVANCED PAVEMENT DESIGN
04 Credits (4-0-0)

Subject Code: **PGT 004E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Demonstrate the importance of sub grade soil properties on pavement performance.
2. Design of flexible pavements and rigid pavements using different methods.
3. Demonstrate the understanding of behaviour of the stresses and deflections at different loading and soil conditions

UNIT 1:
Introduction – Desirable characteristics of Pavement;Types of Pavements;Pavement Components;Comparision of Rigid,semirigid and Flexible Pavements;Points of difference between Highway and Airfield Pavements; Functions of Pavement components;Factors influencing design and Performance of Pavements
Fundamentals of Pavement Design – Soil as highway material; Desirable properties;soil classificatiom- HRB classification system and FAA classification system; soil compaction;Subgrade soil strength ;Evaluation of soil strength by Direct shear and Triaxial shear tests,Plate load test and CBR tests.

UNIT 2:
Stresses and Deflections in Flexible Pavements – Vertical stress determination using Boussinesq's single layer theory ,assumptions and limitations;Solution to the problem using single layer theory ;Burmister's two layer theory, assumptions and limitations;problems solving using two layer theory ;Introducing concept of multilayer theory for calculation of stresses and deflections.
Design of flexible highway pavements- Triaxial and Kansas method;Burmister method; CBR method; California R Value method
Design of flexible Airport Pavements-FAA method and McLeod method

UNIT 3:
Stresses in Rigid Pavements- Types of joints in cement concrete (CC) pavements; Reinforcements in CC pavements; Factors affecting design and performance of rigid pavements; Determination of ESWL for Rigid pavements for dual wheels and Tandom axles-LCN and FAA methods; Critical Locations for wheel loads placements; Calculation of wheel load stresses using Westergaard's Analysis;Modified Westergaard's equations;Temperature stresses –warping stresses and Frictional stresses;combined stresses.
Design of Rigid Highway Pavements- Design of slab thickness of CC Pavements;Design of Joints- Design of spacings of Expansion and Contraction joints;Design of reinforcements in CC Pavements – Design of Dowel bars and Tie Bars-Design steps as per IRC Guidelines

UNIT 4:
Pavement Failure – Types of failures of flexible and rigid pavements; Causes for failures and remedial measures for the same
Maintenance of Pavements – Condition and evaluation survey. Functional evaluation – uneveness measurements,serviceability index; Structural evaluation of pavements; Objectives and types of Maintenance works; Types of overlays ; Overlay design by Benkleman beam deflection method;Falling weight deflectometer method.

References

1. Yoder E.J. and Witezok M.W., "Principles of pavement design" Wiley international (1975)
2. Yang , "Design of Functional Pavements"- McGraw Hill.
3. Khanna and Justo "Highway Engineering", Nem Chand & Bros; 10th Edition (2015)
4. Huang H Y , "Pavement Analysis and Design" Pearson , New Delhi (2008)
5. Mallick R, El-Korchi Tahar " Pavement Engineering: Principles and Practice (2009)
6. R Srinivas Kumar "Pavement Evaluation and Maintenance Mangement System" University Press (2014)
7. IRC Publication, "Guidelines for Design of Flexible pavement for Highways" (2012).

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the importance of sub grade soil properties on pavement performance.	1	2	3
2	Design of flexible pavements and rigid pavements using different methods.	2	2	3
3	Demonstrate the understanding of behaviour of the stresses and deflections at different loading and soil conditions	2	2	3

ENVIRONMENTAL GEOTECHNIQUES
03 Credits (3-0-0)

Subject Code: PGT005E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Identify possible susceptibility of soil properties to environmental effects .
2. Identify contaminant transport mechanisms in soils.
3. Apply various techniques or remedial measures for polluted zones and reuse of various waste materials engineering constructions
4. Analyze the stability of various components of a landfill, load bearing capacity of compacted landfill, stability of liquid waste disposal system.
5. Apply environmental changes to soil stabilization and landfill engineering.

UNIT 1:

Introduction to Environmental Geotechnology; Source, Production and Classification of Wastes; Soil Pollution Processes Physical-chemical and Biological Interaction in Soil, Effects on geotechnical Properties.

UNIT 2:

Disposal and Containment of Solid waste- Landfill design, Liner systems etc.; Surface Impoundments, Slurry Walls, etc.

UNIT 3:

Barrier systems-Basic concepts, design and construction, stability, compatibility and performance; Contaminant Transport in subsurface, Monitoring sub surface contamination.

UNIT 4:

Soil Remediation Techniques- Stabilization/Solidification, Soil Washing, Bioremediation etc.; Additional Aspects-Beneficial Reuse of waste Materials.

References

1. Daniel, D.E. Geotechnical practice for Waste Disposal, Chapman and Hall, London, 1993
2. Rowe, R.K. Quigley R.M. and Booker, Clay Barrier systems for waste disposal facilities, J.R.E. & FN Spon, London, 1995.
3. Reddi, L.N. and lnyang, H.F. Geo environmental Engineering-Principles and Applications Marcel Dekker, Inc. 2000.
4. Bagchi, A. Design, Construction and Monitoring of Landfills, John Wiley & Sons, Inc. New York, 1994.
5. Sharma H.D. and Lewis, S.P. Waste Containment systems, Waste stabilization and landfills: Design and evaluation, John Wiley & sons, Inc. New York, 1994.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Identify possible susceptibility of soil properties to environmental effects.	1	2	3
2	Identify contaminant transport mechanisms in soils	1	2	3
3	Apply various techniques or remedial measures for polluted zones and reuse of various waste materials engineering constructions	2	2	3
4	Analyze the stability of various components of a landfill, load bearing capacity of compacted landfill, stability of liquid waste disposal system.	2	2	3
5	Apply environmental changes to soil stabilization and landfill engineering	3	2	3

GROUND IMPROVEMENT TECHNIQUES
03 Credits (2-2-0)

Subject Code: PGT008E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Demonstrate the understanding and knowledge of underlined concepts, facts and principles of ground improvement techniques
2. Identify different ground improvement techniques based on assessment of soil properties.
3. Propose Site specific method of improvement and its design.

UNIT 1:
Principles and objectives of ground improvement; History of ground improvement developments. Classification of ground improvement techniques. Factors affecting ground improvement.
Mechanical modification method of ground improvement; Theory of compaction, moisture-density relationship, optimum moisture content and maximum dry density; Laboratory compaction test using Proctor's mould and modified Proctor Mould, Factors affecting compaction.

UNIT 2:
Field compaction – Dead weight surcharge for compaction;; Equipment for field compaction: smooth wheel rollers, pneumatic rollers, sheep foot rollers, grid rollers, Power rammers. Role of vibrations in dynamic compaction; Dynamic Field Compaction Equipment: Impact type of compaction, Vibratory rollers, Vibratory pneumatic tyre, compaction piles, vibroflotation, vibratory probes, compaction sand columns and sand piles, underground blasts.
Hyd. Modification: Preloading by lowering ground water table, Filters, Control of ground water seepage, Sand drains and wick drains, Well point system, Vertical drains, Electrosmosis and its application in ground improvement.

UNIT 3:
Chemical Modification: Factors affecting chemical modification, Lime stabilization, Cement stabilization, Bitumen stabilization, Chemical Stabilization. Methods of construction- mix in place method, traveling plant and stationary plant methods.
Grouting: Factors affecting grouting, Groutability, Grouting materials and their properties, Pressure grouting, Compaction grouting, Grouting procedures, Applications of grouting.

UNIT 4:
Applications of Geosynthetics for ground improvement;
Miscellaneous: Rock cutting, anchoring, heating, soil nailing.

References

1. Manfired R.H. (1990) "Engineering Principles of Ground Modification", McGraw-Hill Pub.
2. Koerner R M. (1985) "Construction and Geotechnical Methods in Foundation Engineering"., McGraw Hill Pub Co New York.
3. Hausmann, M R (1990) "Engineering Principles of Ground Modifications", McGraw Hill Pub Co New York.
4. Ingles O G and Metcalf J B., "Soil Stabilization: Principles and practice", Butterworths, London, 1972
5. Nelson J D and Miller D J., "Expansive soils", John Wiley and sons. Inc new

6. P. Purushothama Raj., "Ground Improvement Techniques", Laxmi Publications Pvt Ltd.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding and knowledge of underlined concepts, facts and principles of ground improvement techniques	1	1	3
2	Identify different ground improvement techniques based on assessment of soil properties.	1	2	3
3	Propose Site specific method of improvement and its design	2	1	3

FINITE ELEMENT METHOD
04 Credits (3-2-0)

Subject Code: **PGT009E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying various finite element methods and analysis.
2. Generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with isoparametric concepts in the analysis of plane stress and plane strain problems.
3. Determine the behaviors and analyze various structures by adopting basic principals of FEM.

UNIT 1:
Basic concepts of elasticity – kinematic and static variables, approximate methods of structural analysis: Rayleigh-Ritz method, finite difference method, finite element method. Principles of finite element method, advantages and disadvantages, finite element procedure.
Discretization of structures:Finite elements used for one, two and three dimensional problems, element aspect ratio, mesh refinement versus higher order elements, numbering of nodes to minimize band width.

UNIT 2:
Displacement Model: Nodal displacement parameters, convergence criterion, compatibility requirements, geometric invariance, shape function, polynomial form of displacement function.
generalized and natural coordinates, Lagrangian interpolation function, shape functions for one, two and three dimensional elements.

UNIT 3:
Concept of Isoperimetric Elements: Internal nodes and higher order elements, serendipity and Lagrangian family of finite elements, sub parametric and super parametric elements, condensation of internal nodes, Jacobian transformation matrix, variation method and minimization of energy approach of element formulation (development of strain – displacement matrix and stiffness matrix) consistent load vector, numerical integration.

UNIT 4:
Application of finite element method for the analysis of one and two dimensional problems: Analysis of simple beams and plane trusses, application to plane stress, strain and axi-symmetric problems using CST and quadrilateral elements. Application to plates and shells – Choice of displacement function (C^o, C^1, C^2 type), techniques for nonlinear analysis.

References

1. Bathe K J, Finite Element Procedures in Engineering Analysis, Prentice Hall
2. Cook R D, Malkan D S & Plesta M.E, Concepts and Application of Finite Element Analysis, 3rd Edition, John Wiley and Sons Inc., 1989
3. Daryl L.Logan, Finite Element Method, Thomson Brooks/Cole, 2007
4. Krishnamoorthy C S, Finite Element Analysis, Tata McGraw Hill, 1995
5. Rajasekaran. S, Finite Element Analysis in Engineering Design, Wheeler Publishing, 1993 .

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying various finite element methods and analysis.	2	1	3
2	Generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with isoparametric concepts in the analysis of plane stress and plane strain problems.	2	2	3
3	Determine the behaviors and analyze various structures by adopting basic principles of FEM	3	2	3

CONSTRUCTION MANAGEMENT
03 Credits (2-2-0)

Subject Code: **PGT010E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Apply independently ISO standards in quality and safety for construction.
2. Prepare feasible report for a construction project.
3. Students skilled with inventory management techniques.

UNIT 1:
Stages of construction - estimating, tendering, pricing and contracting, equipment planning and waiting line situations, inventory management.
Engineering economics and Economic feasibility – budget, break-even analysis, Balance sheets, cost benefit analysis, discounted cash flow, Life cycle costing, cost control optimization.

UNIT 2:
Principles and practice of project management; work breakdown structures, critical path networks, PERT, resource charts, cost charts, S-curves,
Performance ratios updating of plans - purpose, frequency and methods of updating, common causes of time and cost overruns and corrective measures.

UNIT 3:
Design tree and decision analysis, construction simulation and simulation models, Appraisal of public investment projects, techno-economics of projects project investment analysis and decisions.

UNIT 4:
Quality control - concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control, ISO standards.
Safety and health on project sites - accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health, ISO standards.

References

1. Varma, M., “Construction planning and management through system techniques: Metropolitian Book Company , New Delhi 1983.
2. Kumar Neeraj Jha, “Construction Project Management”,
3. Punmia B. C., Khandelwal K. K., “Project Planning and Control with CPM and PERT”, Laxmi Publication Private Ltd., New Delhi, 2004
4. Shrivastva U. K., “Construction Planning and Management”, Galgotia Publications Pvt. Ltd., New Delhi, 2010
5. Peurifoy R. J., “Construction planning, equipment and methods, McGraw Hill Book company, New York, 2006.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Apply independently ISO standards in quality and safety for construction	3	2	1
2	Prepare feasible report for a construction project.	3	3	2
3	Students skilled with inventory management techniques.	1	2	3

DESIGN OF MACHINE FOUNDATIONS
03 Credits (3-0-0)

Subject Code: **PGT011E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Demonstrate the understanding of theory of vibration single and two degree of freedom systems with and without damping.
2. Analyze the dynamic response of block foundation
3. Design Machine Foundations using Spring Mass dashpot idealization and elastic half space method
4. Design framed foundations, vibration control and isolation, use of IS codes provision

UNIT 1:
Introduction – Consideration in the design of machine foundation – Dynamic loads, Types of machine foundations. Single and Two degree of freedom systems with and without damping. Natural frequency and resonance and its effects.

UNIT 2:
Dynamic response of block foundation subjected to vertical, horizontal, rocking and torsional modes of vibrations of vibrations. Dynamic elastic constants and their evaluation in the field. Methods of evaluation of damping in soils.
Permissible amplitudes of machine vibrations, factors affecting resonant frequency and amplitudes of vibrations.

UNIT 3:
Design of Machine foundations using spring-mass-dashpot idealization; Static and dynamic design criteria, Foundations subjected to reciprocating loads;
Hammer Foundations, classification, natural frequencies and amplitudes of foundation vibrations, Design Principles, permissible amplitudes.

UNIT 4:
Framed Foundations: Their advantages for high speed machines, permissible amplitudes, design principles. Design of TG foundations.IS Code of Practice and Critical review of IS Code provisions.Structural Design, General Principles of design and construction.
Use of vibration isolators for machines, vibration absorber.
Special topics in Geotechnical Engineering: Microzonation and base isolation.

References

1. Barkan, D. D. (1962) “Dynamics of Bases and Foundations”, McGraw Hill Book Co., New York.
2. Richart, F. E. Jr, Hall, J. R. and Woods, R. D. (1970) “Vibrations of Soils and Foundations”, Prentice Hall Inc, New York.
3. Shamsher Prakash (1980) “Soil Dynamics”, McGraw Hill Book Co., New York.
4. Rao, Kameshwar (1998) “Vibration Analysis and Foundation Dynamics”, Wheeler Publishing.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding of theory of vibration single and two degree of freedom systems with and without damping.	1	2	3
2	Analyze the dynamic response of block foundation	2	1	3
3	Design Machine Foundations using Spring Mass dashpot idealization and elastic half space method.	2	2	3
4	Design framed foundations, vibration control and isolation, use of IS codes provision	2	2	3

GEOTECHNICAL EARTHQUAKE ENGINEERING
03 Credits (3-0-0)

Subject Code: **PGT014E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Demonstrate the understanding of Engineering seismology and dynamic behavior of the soil.
2. Analyze and design slopes, embankments, foundations and earth retaining structures for seismic conditions.
3. Interpret the case histories, mitigation techniques and computer aided analysis.

UNIT 1:
Introduction to Engineering seismology, plate tectonic, Earthquake magnitude.
Ground motion and Effect of local soil condition on Ground motion.

UNIT 2:
Dynamic behavior of soils. Analysis of seismic site response. Liquefaction phenomena and analysis of pore pressure development.

UNIT 3:
Analysis and design of slopes,embankments, foundation and earth retaining structures for seismic loading.

UNIT 4:
Case histories. Mitigation techniques and computer-aided analysis.

References

1. Kramer, S. L. (1996)"Geotechnical Earthquake Engineering", Prentice Hall International Series.
2. Okamoto, S.(1973), "Introduction to Earthquake Engineering", John Wiley & Sons, New York.
3. Richards, F. E., Hall Jr., J. R. and Woods, R. D. (1970) "Vibrations of Soils and Foundations", Prentice Hall International Series.
4. Day, Handbook of Earthquake Geotechnical engineering.
5. Geotechnical Earthquake Engineering Handbook, McGraw Hill, New York, 2002.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding of Engineering seismology and dynamic behavior of the soil	1	2	3
2	Analyze and design slopes, embankments, foundations and earth retaining structures for seismic conditions.	1	2	3
3	Interpret the case histories, mitigation techniques and computer aided analysis.	2	3	3

STRUCTURAL DESIGN OF FOUNDATIONS
04 Credits (3-2-0)

Subject Code: **PGT015E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Acquire the knowledge about the principles of designing foundations.
2. Design and detail the shallow foundations according to codal provisions.
3. Design foundation for retaining walls and also deep foundations
4. Design and detail the foundation for special structure like Chimneys, Power plants and towers.

UNIT 1:
Introduction to Engineering Design: Concepts, Principles and Applications.
Fundamentals of Geotechnical and Structural Design: Concepts and Principles.

UNIT 2:
Introduction to RC Design - Codal provisions: A review and A few examples.
Shallow Foundations: Geotechnical and Structural Design of Individual footings, Combined footings, Rafts, Ring foundations, etc. Detailing, Examples and Case Studies.
Beams and Plates on Elastic Foundation.

UNIT 3:
Deep Foundations: Geotechnical and Structural Design of Piles and Pile groups, Piers and Caissons. Detailing, Examples and Case Studies.
Foundations for Retaining Structures: Examples and Case Studies.

UNIT 4:
Special Foundations: Towers, Chimneys, High-Rise Buildings, Power Plants, etc.
Earthquake Resistant Design of Foundations – A few Examples and Case Studies.
Usage of Softwares.

References

1. Peck, R. B., Hanson, W. E. and Thornburg, T. H. (1974). *Foundation Engineering*, John Wiley and Sons, New York.
2. Bowles, J. E. (1996). *Foundation Analysis and Design*, McGraw-Hill, New York
3. Hemsley, J. A. (1998). *Elastic Analysis of Raft Foundations*, Thomas Telford, London.
4. Hemsley, J. A. (Ed.), (2000). *Design Applications of Raft Foundations*, Thomas Telford, London.
5. Murthy, V. N. S. (2007). *Advanced Foundation Engineering*, CBS Publishers and Distributors, Poulos, H. G. and Davis, E. H. (1980). *Pile Foundation Analysis and Design*, John Wiley and Sons, New York.
6. Prakash, S. and Puri, V. K. (1988). *Foundation for Machines Analysis and Design*, John Wiley and Sons, New York.
7. Wight, J. K. and MacGregor, J. G. (2008). *Reinforced Concrete Mechanics and Design*, Prentice-Hall, New Jersey.
8. McCormac, J. C. and Brown, R. (2008). *Design of Reinforced Concrete*, John Wiley and Sons,
9. Reynolds, C. E., Steedman, J. C. and Threlfall, A. J. (2008). *Reynolds's Reinforced Concrete Designer's Handbook*, Taylor and Francis, London.
10. Day, D. W. (2010). *Foundation Engineering Handbook*, McGraw-Hill, New York.

11. Fang, H.-Y. (1990). *Foundation Engineering Handbook*, Kluwer Academic, Dordrecht.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Acquire the knowledge about the principles of designing foundations.	2	1	2
2	Design and detail the shallow foundations according to codal provisions.	2	3	3
3	Design foundation for retaining walls and also deep foundations	2	3	3
4	Design and detail the foundation for special structure like Chimneys, power plants and towers.	2	2	3

EARTH AND ROCK FILL DAMS
04 Credits (4-0-0)

Subject Code: **PGT016E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Comprehend the importance of earth – rock fill dams and select a suitable site, materials and equipment for construction of earth/rockfill dams .
2. Analyze the stability of Earth and Rockfill Dams and design.
3. Analyze seepage through a given earth/rockfill dam section and select effective seepage control measures for the prevailing site conditions.

UNIT 1:
Introduction: Why earth and Earth-Rock fill dams. Homogeneous earth dams zoned earth, earth – rock fill dams. Typical embankment, dam sections
Site selection and exploration: Influence of topography and subsoil conditions on location and alignment of the dam. Sub surface exploration and studies on embankment construction material.

UNIT 2:
Factors influencing design: Material available for embankment construction, character of foundation, climate, shape and size of the valley, river diversion, and probable wave action time available for construction function of reservoir and earthquake activity.
Design details: Material, location and inclination of earth core and shell materials, embankment side slopes, free board and crest width. Filter zones, design provisions, draw down pore pressures. Berms, upstream and downstream slope protection. Internal drainage systems.

UNIT 3:
Stability analysis: Zones of planes of weakness in foundation, stability analysis of embankment by Taylor’s method, Swedish’ method including side forces between slices, simplified method suggested by Sherard et. al.; Morgenstern-price method, wedge method, stability during construction, full reservoir and drawdown, settlement and horizontal movements. Special design problems and details.

UNIT 4:
Earth dams on pervious soil foundation: Methods of foundation treatment, preventing under seepage with complete vertical barriers and grouting, Reducing under seepage with partial vertical cutoffs and horizontal upstream impervious blankets, controlling under seepage by regulation of leaks and relief wells.
Embankment construction: Equipments for excavating, hauling spreading, blending, compacting and separating over sized rocks and cobbles, construction procedures and quality control of impervious and semi pervious embankments sections, handling dry and wet materials. Construction procedures and quality control of pervious embankment sections, construction problems caused by fines, construction procedures of hard and soft rockfill embankments, field test on rockfill embankments, slope treatment and riprap.

References

1. Sherard J.C. Woodward. R.J, Gizienski, S.F and Clevenger W.A “Earth and Earth- Rock Dams”, John Wiley, Inc. New York.
2. Sowers. G.P and Sally, H.L earth and Rockfill “Dam Engineering” Asia Publishing house,

3. Ereager. W.P., Justin, J.D and Hinds. J “Engineering for Dams” John Wiley, London
4. Stage W.L., “Indian storage resources with earthen dams”, Rand F.N. Spon Ltd.., London.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Comprehend the importance of earth – rock fill dams and select a suitable site, materials and equipment for construction of earth/rockfill dams .	1	2	3
2	Analyze the stability of Earth and Rockfill Dams and design	2	2	3
3	Analyze seepage through a given earth/rockfill dam section and select effective seepage control measures for the prevailing site conditions.	2	2	3

SOIL STRUCTURE INTERACTION
04 Credits (3-2-0)

Subject Code: **PGT017E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Analyse the behaviour of the soil under elastic and plastic condition and demonstrate the understanding of Elastic and Elasto plastic analysis of footing and Raft foundations.
2. Predict the behaviour of the pile under static and dynamic loads.

UNIT 1:
Introduction to linear algebra, Mathematical modelling, Differential equations in solid mechanics and soil mechanics, Fundamentals of continuum mechanics, Stresses and displacements in soils, solids and structures, Constitutive relations, Fundamentals of soil plasticity, Mechanics of soil-structure interaction, Methods of analysis – FDM, FEM, BEM, DEM.

UNIT 2:
Beams and plates on elastic foundation, Elastic and elasto-plastic analyses of footings and raft foundations. Interaction analysis of pavements.
Static interaction analysis of structures founded on shallow and deep foundations.

UNIT 3:
Analysis of axially and laterally loaded single pile and pile groups, Pile-cap-pile-soil interaction, Behaviour of piled-raft foundations.

UNIT 4:
Dynamics of foundations: Foundation input motion, Foundation embedded in a layered half-space, Seismic soil-structure interaction analysis in time domain for buildings and bridges.
Examples and Case studies.

References

1. Wolf, J. P. and Deeks, A. J. (2004). Foundation Vibration Analysis: A Strength-of-Materials Approach, Elsevier, Amsterdam.
2. Wolf, J. P. (1988). Soil-Structure-Interaction Analysis in Time Domain, Prentice-Hall, New Jersey.
3. Wolf, J. P. and Song, C. (1996). Finite Element Modelling of Unbounded Media, John Wiley and Sons, New York.
4. Zaman, M., Gioda, G. and Booker, J. (2001). Modelling in Geomechanics, John Wiley and Sons, New York.
5. Maekawa, K., Pimanmas, A. and Okamura, H. (2003). Nonlinear Mechanics of Reinforced Concrete, Spon Press, London.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Analyse the behaviour of the soil under elastic and plastic condition and demonstrate the understanding of Elastic and Elasto plastic analysis of footing and Raft foundations.	1	2	3
2	Predict the behaviour of the pile under static and dynamic loads.	2	2	3

NUMERICAL METHODS FOR CIVIL ENGINEERS
04 Credits (3-2-**0)**

Subject Code: **PGT018E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to

1. Apply the solution of linear system of equations to civil engineering problems,construction planning, slope deflection method applied to eams,frames and truss analysis.
2. Apply numerical integration for solving simple beam problems and application of finite difference technique in structural mechanics.
3. Apply New-Marks method for computation of slopes and deflections in statically determinate beams.
4. Develop algorithm and application of solution of ordinary differential equation to civil engineering problems by Eulers method and Runge Kutta 4^{th} order method.

UNIT 1:
Introduction: Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering.
Development of algorithm/ flow charts for following methods for solution of linear Simultaneous equation: a) Gaussian elimination method b) Gauss-Jordan matrix inversion method c) Gauss-Siedel method d) Factorization method

UNIT 2:
Application of root finding to civil engineering problems: Development of algorithm for Bisection method and Newton-Raphson method and its applications for solution of non linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.
Application of numerical integration for solving simple beam problems: Development of algorithm for Trapezoidal rule and Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

UNIT 3:
New Marks method for computation of slopes and deflections in statically determinate beams.
Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method and Runge Kutta 4^{th} order method .

UNIT 4:
Application of finite difference technique in structural mechanics:

i. Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences.

ii. Application of finite difference method for analysis of statically determinate indeterminate beams

Application of Finite difference technique in structural mechanics (Contd..): Buckling of columns and Beams on elastic foundation

References

1. Chapra S.C. &Canale R.P., Numerical Methods for Engineers, McGraw Hill, 1990.
2. Krishna Raju N, Muthu K.U., Numerical methods in Engineering Problem, McMillan Indian Limited, 1990.

3. Iqbal H.Khan, Q. Hassan, Numerical methods for Engineers and Scientists, Galgotia, New Delhi, 1997
4. Ghosh Pallab., Numerical methods in computer programs in C++ , Prentice Hall of India Private Limited, New Delhi,2006.
5. Numerical methods for engineers using MATLAB and C – I Edition SCHILLING “ Thomson Publications”

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Apply the solution of linear system of equations to civil engineering problems,construction planning, slope deflection method applied to eams,frames and truss analysis.	2	1	2
2	Apply numerical integration for solving simple beam problems and application of finite difference technique in structural mechanics.	2	3	3
3	Apply New-Marks method for computation of slopes and deflections in statically determinate beams.	2	3	3
4	Develop algorithm and application of solution of ordinary differential equation to civil engineering problems by Eulers method and Runge Kutta 4th order method.	2	1	3

REMOTE SENSING AND GIS APPLICATION IN GEO-ENVIRONMENTAL ENGINEERING
03 Credits(2-2-0)

Subject Code: **PGT019E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of course students will be able to
1.Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.
2.Apply available Remote Sensing technologies and be able to match these to particular kinds of Geoenvironmental engineering problem.
3. Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.

UNIT 1:
Basics: Fundamentals of Remote Sensing, Electromagnetic Spectrum, Process of remote sensing, Black Body Radiation, Energy Interactions with earth atmosphere and surface features, spectral reflectance curves-For Vegetation, soil & water.
Sensors: Definition, Types (Typical Sensor used in optical remote sensing, Thermal sensor, Synthetic Aperture Radar) Classification.
Plat Forms: Definition & Types: Airborne & Space Borne platforms, Plat form characteristics.
Indian Remote Sensing Programme: Definition, Objectives, Data Products of Launch Program Satellite Specifications for IRS-1C, 1D, P4, CARTOSAT-1 & CARTOSAT-2.

UNIT 2:
Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.
Digital Image Processing (DIP): Definition, Need, Stages of DIP-Image rectification & restoration, Image Enhancement-Contrast Manipulation-Grey Level Thresholding, Classification-Brief discussion of classification procedure for Supervised & Unsupervised Classification Techniques.
GIS: Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) &Non spatial data, rectification, processing, verification & Data Editing, Application. GIS functions. Brief Procedure of integrating Remote Sensing Data into GIS.

UNIT 3:
GIS Advanced Concepts: Network Analysis & Virtual GIS. Modeling problems for demonstrating use of GIS functions for civil applications – Site selection for urban development, development of business center and wild life Sanctuary Park.
Computer Concepts of GIS: Coding of attribute data in computer (Binary system & Hexadecimal System), Coding of vector & Raster data in GIS, File Listing & Data Access, Raster data compression techniques, Data Base Structures.
Basics of Photogrammetry: Acquisition of Arial photographs, Aerial Camera, Flight Planning, and Photograph processing & feature extraction. (Brief Discussion Only)
Application of GIS in Geotechnical Engineering:-Introduction, Remote Sensing & GIS assisted geotechnical investigations, Determination of volumetric shrinkage of expansive soils, 3D mapping for sub surface stratum.

UNIT 4:

Advanced Applications GIS assisted seismic hazard studies, study of soil drainage characteristics assisted with remote sensing, study of ground water prospects, soil mapping, and rock spectra for mineral identification- Relevant case studies

Applications In Environmental Engineering: Solid waste collection & transport, water quality assessment, water resource management, mapping of ground water portability status, GIS based master plan for water supply project, Ground water Vulnerability assessment, GIS based master plan for sewage collection & transport system.

References

1. Pater A Burraugh Rachal A Mc Donnas "Principle of GIS" (Oxford)
2. Christopher Jones "GIS and Computer Cartography"publication Prentice-Hall(2009)
3. Lilly Sand, "Remote sensing and Image interpretation, John Willey and Sons, New York 1999.
4. S. Kumar,"Basics of Remote sensing and GIS" 1st Edition, 2001
5. BasudebBhatta,"Remote sensing and GIS", Oxford, 2nd Edition, 2011.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.	2	2	2
2	Apply available Remote Sensing technologies and be able to match these to particular kinds of Geoenvironmental engineering problem.	3	3	2
3	Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.	3	2	2

DESIGN OF EARTH RETAINING STRUCTURES
04 Credits (3-2-0)

Subject Code: **PGT020E** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Demonstrate the understanding and knowledge of underlined concepts, facts and principles of earth retaining structures.
2. Analyze and determine earth pressures based on various methods and field conditions.
3. Analyze and design different earth retaining structures by adopting basic principles.

UNIT 1:
Importance of retaining structures in geotechnical engineering; Lateral earth pressures and earth pressure coefficients; Variation of lateral earth pressure at a certain depth.
Lateral earth pressure at rest; Classical theory of earth pressure proposed by Rankine; Rankine active pressure: Derivation and Problems; Rankine passive pressure; Rankine passive pressure: Vertical back face and inclined backfill; Coulomb's active earth pressure; Coulomb's passive earth pressure; Active earth pressure due to surcharge-Line load and Strip load.

UNIT 2:
Dynamic earth pressures, Monopole-Okabe method; Active earth pressure for seismic conditions; Passive pressure for seismic conditions; Active earth pressure for wall rotation about top: Braced cut; Active earth pressure for translation of retaining wall – Granular backfill; Influence of wall friction on the shape of the surface of sliding.

UNIT 3:
Types of retaining walls; Proportioning of retaining walls; Application of lateral earth pressure theories to design; Stability of retaining walls; Check for sliding along the base; Check for overturning; Check for bearing capacity failure; Construction joints and drainage from backfill; Design problems of cantilever and gravity retaining walls.

UNIT 4:
Mechanically Stabilized retaining walls – Basic concepts and step by step design procedure for stabilized reinforced and metallic strip reinforced retaining walls; Analysis of sheet pile walls in uniform soil; Analysis of sheet pile walls in mixed soil; Analysis of cantilever sheet pile wall; Analysis of anchored sheet pile wall; Braced Excavation; Other types of retaining walls – Modular gravity walls, Insitu reinforced walls, Chemically stabilized retaining walls; Design problems on MSE walls.

References
1.Terzaghi, K and Peck, R. B. and Mesri G (1996), "Soil Mechanics in Engineering Practice", 3rd Edition, John Wiley.
2. Das, B.M. (2011), "Principals of Foundation Engineering", 7th Edition, Cengage Learning.
3. Budhu, M. (1981), "Soil Mechanics and Foundations", 3rd Edition John Wiley and Sons.
4. Lambe, T. W. and Whitman, R. V. (1969),"Soil Mechanics", John Wiley.
5. Clayton, Woods and Bond," Earth pressure and Earth retaining structure", CRC press (2014).

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding and knowledge of underlined concepts, facts and principles of earth retaining structures	1	1	3
2	Analyze and determine earth pressures based on various methods and field conditions.	2	1	3
3	Analyze and design different earth retaining structures by adopting basic principles.	2	1	3

PILE FOUNDATION ANALYSIS AND DESIGN
04 Credits (3-2-0)

Subject Code: **PGT023E** | IA Marks: 50
Duration of Exam: 3 Hrs | Maximum marks: 100

Course outcomes: At the end of the course the students will be able to
1. Demonstrate the understanding and knowledge of underlined concept, facts and principles of pile foundation.
2. Analyze bearing capacity, settlement of foundations and also design pile foundation. Perform pile testing.
3. Analyze and Design of deep foundations subjected to different types of loads. Analyze and suggest remedial measures against foundation failures.

UNIT 1:
Shallow v/s deep foundations, classification, economics and capacity of a pile
Single pile: analysis and design

UNIT 2:
Pile group: Problems related to load on each pile
Battered piles: Laterally loaded (seismic).

UNIT 3:
Pile cap design;
Under reamed piles

UNIT 4:
Pile sinking by vibroflotation, Construction equipments: Bored and cast-in-situ piles, case studies on failure of piles
Pile testing: Integrity of piles, corrosion resistance, durability, damage protection to wooden and concrete piles.

References

1. Tomlinson M j., “Foundation design and construction”-sir IsacPirman& sons Ltd. London (1963) 1st edition
2. Poulos and Davis. “Pile foundation analysis and design”- Elastic solution for soil & Rock Mechanics. John Wiley sons. (1974)
3. Chellis R.D., “ Pile foundation – Theory – Design – Practice”- McGraw Hill (1963)
4. Bowels J.E., “Analytical and computer methods in foundation engineering”(1974)
5. Willkern and Fang., “Foundation engineering Hand Book”-Von No strand and remhold Co(1975)
6. Tomlinson, M. J. and Woodward, J. (2007). Pile Design and Construction Practice, Taylor and Francis, London.
7. Fleming, K., Weltman, A., Randolph, M. and Elson, K. (2009). *Piling Engineering*, Taylor and Francis, London.
8. Prakash, S. and Sharma, H. D. (1990). Pile Foundations in Engineering Practice, John Wiley and Sons, New York.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding and knowledge of underlined concept, facts and principles of pile foundation	3	3	3
2	Analyze bearing capacity, settlement of foundations and also design pile foundation. Perform pile testing.	3	2	3
3	Analyze and Design of deep foundations subjected to different types of loads. Analyze and suggest remedial measures against foundation failures.	3	2	3

CRITICAL STATE SOIL MECHANICS
04 Credits (4-0-0)

Subject Code: PGT024E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes: At the end of the course students will be able to
1.Relate behaviour of soils subjected to various loading and drainage conditions within unified framework of critical state soil mechanics.
2.Apply theory of elasticity and plasticity to characterize the stress-strain behavior of soils.
3.Demonstrate the understating of basic elsato plastic models based on critical state soil mechanics like Cam-Clay and Granta Gravel.

UNIT 1:
Stress and strain in a continuum, elasticity and plasticity in soils, principle of effective stress and its significance, increment of stress and strain in soils. Principle stresses and principle planes, Mohr circle of total and effective stress, Normal and shear strain. invariants of stresses, Stress paths, Representation of stress paths in different spaces, invariants of strain and strain paths.

UNIT 2:
Darcy's law, Discharge and Seepage velocity, Hydraulic gradient and critical hydraulic gradient, Laplace theory for seepage problems, Flow nets and their applications; Compression and Consolidation – Isotropic compression test, isotropic compression of clay and sands, possible and impossible states.

UNIT 3:
Introduction to critical state concept, Families of undrained and drained shear tests, Representation of critical state lines, Drained and undrained planes in 2 and 3 dimensional spaces. Roscoe surface, Roscoe surface as state boundary surface. Drained test for O.C soils. Hvorslev's surface, critical state lines for O.C soils and complete state boundary surface.

UNIT 4:
Elastic and plastic deformation, calculation of elastic and plastic strains, essentials plasticity theory, Yield surface, Cam clay model. Mohr coulomb failure criteria, general stress states.

References

1 Schofield, A.N. and Wroth, C.P., Critical state soil mechanics, McGraw-Hill, 1968
2 Wood, D.M., Soil behaviour and critical state soil mechanics, Cambridge University Press
3 Atkinson, J.H., An introduction to the mechanics of soils and foundations, McGraw-Hill,
4 Atkinson, J.H. and Bransby, P.L., The mechanics of soils: an introduction to critical state soil mechanics, McGraw-Hill, 1978.
5 Potts, D.M. and Zdravkovic, L., Finite element analysis in geotechnical engineering, Vol. 1: Theory, Thomas Telford, 1999.
6 Muir Wood, D., Geotechnical Modelling, Spon Press, 2004.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Relate behaviour of soils subjected to various loading and drainage conditions within unified framework of critical state soil mechanics.	2	1	3
2	Apply theory of elasticity and plasticity to characterize the stress-strain behavior of soils.	2	1	3
3	Demonstrate the understating of basic elsato plastic models based on critical state soil mechanics like Cam-Clay and Granta Gravel.	3	2	3

SEMINAR
01 Credit (0-0-2)

Subject Code: **PGT 124S** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 50

Course outcomes: At the end of the course the students will be able to

1. Reach across diverse disciplines to apply theories,methods and knowledge bases from multiple fields to a single question or problem.
2. Show competence in identifying relevant information,defining and explaining topics under discussion.
3. Evaluate, synthesize information and use and apply relevant theories.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Reach across diverse disciplines to apply theories,methods and knowledge bases from multiple fields to a single question or problem.	3	2	2
2	Show competence in identifying relevant information,defining and explaining topics under discussion.	1	3	3
3	Evaluate, synthesize information and use and apply relevant theories.	1	3	2

TERM PAPER
01 Credit (0-0-2)

Subject Code: **PGT 224T** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 50

Course outcomes: At the end of the course the students will be able to

1. Make extensive literature survey in a specific topic.
2. Focus on specific research area.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Make extensive literature survey in a specific topic	3	1	3
2	Focus on specific research area.	2	2	3

GEOTECHNICAL ENGINEERING LABORATORY
01 Credit (0-0-2)

Subject Code: **PGT 304L** IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 50

Course outcomes: At the end of the course students will be able to

1. Specify the appropriate test and drainage conditions for different geotechnical condition.
2. Determine engineering properties of soils.
3. Conduct experiments analyze and interpret results for geotechnical engineering design. Develop an appreciation the use of field tests in the engineering of civil infrastructure
4. Prepare geotechnical report.

List of experiments

1. Grain size analysis of soil: wet and dry analysis.
2. Determination of relative density.
3. Triaxial test: UU, CU and CD.
4. Determination of compression index and coefficient of consolidation.
5. Determination of Swelling Pressure.
6. Determination of California Bearing Ratio(CBR).
7. Electrical Resistivity
8. Standard Penetration Test (SPT)
9. Static Cone Penetration test (SCPT).
10. Plate load test.
11. Determination of dynamic properties and damping coefficient.
12. Geotechnical investigation report.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Specify the appropriate test and drainage conditions for different geotechnical condition.	3	1	3
2	Determine engineering properties of soils.	3	1	3
3	Conduct experiments analyze and interpret results for geotechnical engineering design. Develop an appreciation the use of field tests in the engineering of civil infrastructure	3	1	3
4	Prepare geotechnical report.	3	3	3

INDUSTRIAL TRAINING
04 Credits (0-0-8)

Subject Code: **PGT321I** CIE Marks: 50
Contact hours/week: 08

Course outcomes: At the end of the course students will be able to
1. Identify, formulate and model problems and find engineering solution based on a system approach and conduct research in their respective field of specialization.
2. Be a multi skill engineer with good technical knowledge, management, leadership and entrepreneurship skills.
3. Become master in one’s specialized technology and update with all the latest changes in technological world.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Identify, formulate and model problems and find engineering solution based on a system approach and conduct research in their respective field of specialization.	3	2	2
2	Be a multi skill engineer with good technical knowledge, management, leadership and entrepreneurship skills.	1	1	3
3	Become master in one’s specialized technology and update with all the latest changes in technological world.	1	1	3

PROJECT PHASE-I
10 Credits (0-0-20)

Subject Code: PGT312P CIE Marks: 50
SEE Marks: 100 Contact Hours – hours/week:20

Course outcomes: At the end of the course students will be able to
1. Show competence in identifying relevant information, defining and explaining thesis statement under consideration.
2. Demonstrate depth of understanding, complexity, insight, cogency, independent thought, relevance, and persuasiveness of the thesis statement.
3. Show competence in working with a methodology, structuring their work, and synthesizing information.
4. Able to demonstrate clarity, the strength of their thesis statement, and develop their topic with appropriate signposting.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Show competence in identifying relevant information, defining and explaining thesis statement under consideration.	3	2	2
2	Demonstrate depth of understanding, complexity, insight, cogency, independent thought, relevance, and persuasiveness of the thesis statement	3	1	2
3	Show competence in working with a methodology, structuring their work, and synthesizing information.	3	2	1
4	Able to demonstrate clarity, the strength of their thesis statement, and develop their topic with appropriate signposting.	2	2	3

PROJECT PHASE-II
20 Credits(0-0-40)

Subject Code: PGT431P CIE Marks: 50
SEE Marks: 100 Contact Hours – hours/week:40

Course outcomes: At the end of the course students will be able to
1. Evaluate information and use and apply relevant theories.
2. Develop skill to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and also ability to synthesize, evaluate and reflect on information.
3. Demonstrate problem-solving skills and apply theoretical knowledge.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Evaluate information and use and apply relevant theories.	2	1	2
2	Develop skill to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and also ability to synthesize, evaluate and reflect on information.	1	3	3
3	Demonstrate problem-solving skills and apply theoretical knowledge.	1	1	3

Sri BVV Sangha's

Basaveshwar Engineering College, (Autonomous) Bagalkot-587102

Department of Civil Engineering

SYLLABUS FOR POST GRADUATE PROGRAMME

M. Tech.

STRUCTURAL ENGINEERING

2020-2021

Vision of the Institution

To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions and inspiring inventions for holistic socioeconomic developments

Mission of the Institution

To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change.

To carry out innovative cutting-edge research and transfer technology for industrial and societal needs. To imbibe moral and ethical values and develop compassionate, humane professionals.

Vision of the Department

To be a center of excellence of higher learning and research in civil engineering encompassing ethical environmental and economical aspect of the society.

Mission of the Department

The department of civil engineering is committed to prepare globally competent engineers, in response to rapid economic and technological growth, through a dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community.

Programme Educational Objectives

PEO 1

Graduates of the programme will become effective Structural engineers in government, industry, or other organizations; designing, improving and implementing efficient, sustainable Structural engineering practices.

PEO 2

Graduates of the programme will provide solutions to Structural engineering problems that account for economical, societal, ethical, as well as with standards both as individuals and in team environments, by applying acquired engineering knowledge.

PEO 3

Graduates of the programme will continue their lifelong learning to remain effective professionals to maintain and enhance technical and professional growth.

Programme Outcomes

PO 1

An ability to independently carry out research /investigation and development work to solve practical problems.

PO 2

An ability to write and present a substantial technical report/document.

PO 3

Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

Justification of consistency of the Department Vision and Mission with the Institute Vision and Mission

Vision

Institution Vision → / Department Vision ↓	To be recognized as the premier technical institute committed to developing exemplary professionals offering research based innovative solutions	Inspiring inventions for holistic socioeconomic developments
To be center of excellence of higher learning and research in civil engineering	*	*
To encompass the graduates ethical, environmental and economical aspect of the society		*

Mission

Institution Mission → / Department Mission ↓	To pursue excellence through student centric dynamic teaching-learning processes, encouraging freedom of inquiry and openness to change	To carry out innovative cutting edge research and transfer technology for industrial and societal needs.	To imbibe moral and ethical values and develop compassionate, humane professionals
To prepare globally competent engineers, in response to rapid economical and technological growth	*	*	
Dynamic process of teaching-learning, research and sharing professional experiences for the betterment of the community	*	*	*

Basaveshwar Engineering College, Bagalkot
Department of Civil Engineering

M. Tech. Structural Engineering

2020-21 Scheme of Teaching and Examination

Semester –I

Sl.No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PSE 122C	Design of RCC Structures	3	2	2	0	50	50	100
2	PSE 123C	Theory of Elasticity & Plasticity	4	3	2	0	50	50	100
3	PSE124C	Dynamics of Structures	4	3	2	0	50	50	100
4	PSE00XE	Elective – 1	4	3	2	0	50	50	100
5	PSE00XE	Elective – 2	4	3	2	0	50	50	100
6	PSE00XE	Elective – 3	4	3	2	0	50	50	100
7	PSE 114 S	Seminar	1	0	0	2	50	50	100
		Total	**24**	**17**	**12**	**2**	**350**	**350**	**700**

Semester –II

Sl.No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PSE 221C	Pre-stressed Concrete Mechanics and Design	4	3	2	0	50	50	100
2	PSE 222C	Finite Element method	4	3	2	0	50	50	100
3	PSE00XE	Elective – 4	4	3	2	0	50	50	100
4	PSE00XE	Elective – 5	4	3	2	0	50	50	100
5	PSE00XE	Elective – 6	4	3	2	0	50	50	100
6	PSE00XE	Elective – 7	3	2	2	0	50	50	100
7	PSE 201L	Structural Engg. Laboratory	1	0	0	2	50	50	100
		Total	**24**	**17**	**12**	**2**	**350**	**350**	**700**

Semester –III

Sl.No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PSE00XE	Elective - 8	3	2	2	0	50	50	100
2	PSE 331I	Industrial training	5	0	0	10	50	50	100
3	PSE 312P	Project phase- I	10	0	0	20	50	50	100
4	PSE313D	Design Studio Laboratory	2	0	0	4	50	50	100
		Total	**20**	**2**	**2**	**34**	**200**	**200**	**400**

Semester –IV

Sl.No	Code	Subject	C	Hours/Week			Exam Marks		
				L	T	P	CIE	SEE	Total
1	PSE 431P	Project phase- II	20	0	0	40	50	50	100
		Total	**20**	**0**	**0**	**40**	**50**	**50**	**100**

LIST OF ELECTIVES

Sl.No	Code	Subject	Credits
1	PSE 001E	Earthquake resistant design of structures	4
2	PSE 002E	Stability analysis of structures	4
3	PSE 008E	Advances in Concrete technology	4
4	PSE 011E	Design of Bridges	4
5	PSE 015E	Repair and Rehabilitation of Structures	4
6	PSE 016E	Matrix methods of Structural Analysis	4
7	PSE 017E	Advanced Design of Steel Structures	4
8	PSE 018E	Numerical Methods for Civil Engineers	4
9	PSE 019E	Structural Design of Foundations	4
10	PSE 021E	Optimization Techniques in Civil Engineering	4
11	PSE 022E	Advanced Foundation Engineering	4

Sl.No	Code	Subject	Credits
1	PSE 003E	Design of Tall structures	3
2	PSE 005E	Theory of Plates and Shells	3
3	PSE 014E	Masonry Structures	3
4	PSE 020E	Construction Management	3

DESIGN OF RCC STRUCTURES

3 Credits

(2-2-0)

Subject Code: PSE 122C IA Marks: 50

Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Students able to analyze and design individually special RC structures as per relevant IS codes.
2. Students are capable of preparing independent report on reinforcement details and estimation of structures.
3. Students able to analyse and design the special precast structures.

UNIT 1:

Design of deep beams, Design of folded plates

UNIT 2:

Design of water tanks: Underground and above ground

UNIT 3:

Design of bunkers and silos

UNIT 4:

Prefabricated Construction – necessity, advantages and disadvantages, modular coordination, basic module, planning and design module, modular grid system. National building code specifications – standardization, dimensioning of products, preferred dimensions and sizes.

References:

1. Krishnaraju N, “Advanced Design of RC Structures”, New Age International, 2007.
2. Park A and Paulay, “Reinforced Concrete Structures”, John Wiley and Sons, 1975.
3. Punmia B.C., Ashok Kumar Jain and Arun Kumar Jain, “Comprehensive RCC Design”.
4. Unnikrishna S and Pillai Menon Devadas, “Reinforced Concrete Design”, Tata McGraw-Hill, 2010.
5. Hass A. M., “Precast Concrete – Design and applications”, Applied science, 1983
6. David Shepherd, “Plant cast, precast and prestressed concrete”, Mc Graw Hill, 1989
7. Bruggeling A. S. G., “ Prefabrication with concrete”, Taylor & Francis, 1991

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students able to analyze and design individually special RC structures as per relevant IS codes.	3	2	3
2	Students are capable of preparing independent report on reinforcement details and estimation of structures.	2	3	1
3	Students able to analyse and design the special precast structures.	1	2	3

THEORY OF ELASTICITY AND PLASTICITY
4 Credits
(3-2-0)

Subject Code: PSE 123C IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying elasticity and plasticity theory, and how the two fields are underpinned by mathematics and physics.
2. Apply wider multidisciplinary context of the underlying theory, including applications of both elasticity and plasticity to engineering design.
3. Demonstrate creative and innovative ability in the synthesis of theoretical solutions, and linking them to the design of real-world structures.

UNIT 1:

Definition of stress components of stress at a point, Cartesian and polar co-ordinates, Equilibrium equations, Transformation of stress, Principal stresses, invariants of stress, hydrostatic and deviatric stress.
Definition of strain, components of strain at a point, Cartesian and polar co-ordinates, Equilibrium equations, transformation of strain, principal strain, invariant of strain, spherical and deviatoric strains, maximum shear strain, compatibility equations.

UNIT 2:

Compatibility equations, stress strain relations, constitutive relations- plane stress and plane strain. Problems in rectangular coordinates (2D) – boundary conditions Airy’s stress function approach to 2-D problems of elasticity, simple problems on bending of beams. Solution of axi-symmetric problems, stress concentration due to the presence of a circular hole in plates. Problems in polar coordinates (2D)

UNIT 3:

3D problems: Elementary problems of elasticity in three dimensions, stretching of a prismatical bar by its own weight, twist of circular shafts, Torsion: torsion of non-circular sections

UNIT 4:

Theory of plasticity: Plastic stress – strain relations, Failure theories, Criterion of yielding, Theories of plastic flow, Plastic deformation, Bending of prismatic beams, residual stresses, Plastic torsion.

References:

1. Timoshenko & Goodier, “Theory of Elasticity”, McGraw Hill, 1951
2. Sadhu Singh, “Theory of Elasticity”, Khanna Publishers, 1988
3. Chenn W.P and Hendry D.J, “Plasticity for Structural Engineers”, Springer Verlag, 1988
4. Sadhu Singh, “Applied Stress Analysis”, Khanna Publishers, 2000
5. Srinath L.S. Advanced Mechanics of Solids, Third Edition, Tata McGraw Hill publishing company. New Delhi, 2008.
6. Valliappan S. "Continuum Mechanics Fundamentals" (1982), Oxford IBH, N D. New Delhi.
7. T.G. Sitharam and L. Govinda Raju, “Applied Elasticity” – Interline Publishing, 2005.
8. Chakrabarthy J, Theory of Plasticity, Elsevier Butterworth – Heinemann 2006
9. Venkataraman and Patel “Structural Mechanics with introduction to Elasticity and Plasticity” – Mcgraw Hill, 1990.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying elasticity and plasticity theory, and how the two fields are underpinned by mathematics and physics.	1	2	3
2	Apply wider multidisciplinary context of the underlying theory, including applications of both elasticity and plasticity to engineering design.	2	2	3
3	Demonstrate creative and innovative ability in the synthesis of theoretical solutions, and linking them to the design of real-world structures.	3	2	3

DYNAMICS OF STRUCTURES
4 Credits
(3-2-0)

Subject Code: PSE 124C — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes:

1. The students will be able to describe fundamental theory of structural dynamics and derive equations of motion for free and forced vibrations and determine dynamic responses of SDOF systems.
2. The students will be able to write a report on various methods of dynamic analyses of structures and apply other numerical methods in finding natural frequency and mode shapes.
3. The students will be able to evaluate the natural frequency and mode shapes for MDOF and continuous systems.

UNIT 1:
Introduction to dynamics, concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles. Single-degree-of-freedom systems (SDOF): Mathematical model, free vibration response of damped and undamped systems, response to harmonic loading, support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces, principle of vibration-measuring instruments – Seismometer and Accelerometer.

UNIT 2:
Duhamel integral and its numerical evaluation, Multi-degree freedom systems (MDOF): mathematical model, free vibration of systems with and without damping - natural frequencies and mode shapes – orthogonality conditions, modal analysis of MDOF system – Shear building and Stodola's method.

UNIT 3:
Modal analysis of MDOF systems: Dunkarley's, Rayleigh's, Rayleigh-Ritz and matrix methods. Forced vibrations of systems without damping – mode superposition method. Response spectrum, time history and equivalent force concepts.

UNIT 4:
Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions, response of beams under moving loads, Introduction to random vibrations – Random variables and Stochastic processes, models of random dynamic loads.

References:

1. Anil K. Chopra, "Dynamics of Structures", Prentice Hall of India, 4th edition 2011
2. Clough R W & Penzien J, "Dynamics of Structures", McGraw Hill, 2003
3. Mario Paz, "Structural dynamics – Theory and Computation", CBS Publishers, 2nd Ed. 2004
4. S. Rajasekaran,"Structural dynamics of earthquake engineering - Theory and application using MATHEMATICA and MATLAB", Woodhead publishing limited, 2009
5. Paolo L. Gatti, "Applied structural and mechanical vibrations", CRC Press Taylor & Francis Group, 2014
6. Mukyopadhyaya, "Vibration and Structural Dynamics", Ane Books Pvt Ltd, 2008

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	The students will be able to describe fundamental theory of structural dynamics and derive equations of motion for free and forced vibrations and determine dynamic responses of SDOF systems.	2	1	3
2	The students will be able to write a report on various methods of dynamic analyses of structures and apply other numerical methods in finding natural frequency and mode shapes.	1	3	3
3	The students will be able to evaluate the natural frequency and mode shapes for MDOF and continuous systems.	2	1	3

PRE-STRESSED CONCRETE MECHANICS AND DESIGN
4 Credits
(3-2-0)

Subject Code: PSE 221C IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Students will be able to design the members for flexure according to stress range approach, Lins approach, Magnels approach.
2. Students can find the deflections in beams; can design the members for shear and torsion. They can design for shear in PSC beams and flanged beams.
3. The students can analyse the prestressed indeterminate structures and can design one way and two way slabs.

UNIT 1:
Analysis for Flexure: General concept of stresses, resultant compression line, load balancing concept. Analysis of members under axial load, analysis at transfer, analysis at services loads, analysis at ultimate strength. Design philosophy: Limit state of collapse and serviceability. Design for flexure: Stress range approach, Lin's approach, Magnel's approach.

UNIT 2:
Design for shear and torsion: Mechanism of shear resistance in PSC beams, design for shear in PSC beams, shear in flanged beams and failure of concrete elements under torsion. Anchorage zone stresses: Pre-tensioned and Post-tensioned pre-stressed concrete elements, detailing of reinforcement in general.

UNIT 3:
Statically indeterminate structures: analysis of pre-stressed indeterminate structures, continuous beams, linear transformation and concordancy of cable profiles, frames. Design of one way slab.

UNIT 4:
Composite construction: Need for composite construction, types of composite construction, flexural stresses, longitudinal and transverse shear transfer, creep and shrinkage effects in composite construction.

References

1. Krishnaraju, "Pre-Stressed Concrete", Tata Mcgraw Hill, 2007
2. N Rajagopalan, "Prestressed Concrete", Narosa, 2nd Ed., 2006
3. Naaman, A. E. – "Pre-Stressed Concrete Analysis and Design: Fundamentals", 2nd Edition, Techno Press, 2005
4. Nilson, "Design of Pre-Stressed Concrete", 2nd Edition, John Wiley, 1987.
5. Lin And Burns – "Design of Pre-Stressed Concrete Structures", 3rd Editions, John Wiley, 1981
6. Nawy - "Pre-Stressed Concrete – A Fundamental Approach", 5th Ed. 2009

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to design the members for flexure according to stress range approach, Lins approach, Magnels approach.	2	1	3
2	Students can find the deflections in beams; can design the members for shear and torsion. They can design for shear in PSC beams and flanged beams.	1	3	3
3	The students can analyse the prestressed indeterminate structures and can design one way and two way slabs.	2	1	3

FINITE ELEMENT METHOD
4 Credits
(3-2-0)

Subject Code: PSE 222C IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying various finite element methods and analysis.
2. Generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with isoparametric concepts in the analysis of plane stress and plane strain problems.
3. Determine the behaviors and analyze various structures by adopting basic principles of FEM.

UNIT 1:

Basic concepts of elasticity – kinematic and static variables, approximate methods of structural analysis: Rayleigh-Ritz method, finite difference method, finite element method. Principles of finite element method, advantages and disadvantages, finite element procedure. Discretization of structures: Finite elements used for one, two and three dimensional problems, element aspect ratio, mesh refinement versus higher order elements, numbering of nodes to minimize band width.

UNIT 2:

Displacement Model: Nodal displacement parameters, convergence criterion, compatibility requirements, geometric invariance, shape function, polynomial form of displacement function, generalized and natural coordinates, Lagrangian interpolation function, shape functions for one, two and three dimensional elements.

UNIT 3:

Concept of Isoperimetric Elements: Internal nodes and higher order elements, serendipity and Lagrangian family of finite elements, sub parametric and super parametric elements, condensation of internal nodes, Jacobian transformation matrix, variation method and minimization of energy approach of element formulation (development of strain – displacement matrix and stiffness matrix) consistent load vector, numerical integration.

UNIT 4:

Application of finite element method for the analysis of one and two dimensional problems: Analysis of simple beams and plane trusses, application to plane stress, strain and axi-symmetric problems using CST and quadrilateral elements. Application to plates and shells – Choice of displacement function (C^o, C^1, C^2 type), techniques for nonlinear analysis.

References:

1. Bathe K J, “Finite Element Procedures in Engineering Analysis”, Prentice Hall, 1982
2. Cook R D, Malkan D S & Plesta M.E, “Concepts and Application of Finite Element Analysis”, 3rd Edition, John Wiley and Sons Inc., 1989
3. Daryl L.Logan, “Finite Element Method”, Thomson Brooks/Cole, 2007
4. Krishnamoorthy C S, “Finite Element Analysis”, Tata McGraw Hill, 2007
5. Rajasekaran. S, “Finite Element Analysis in Engineering Design”, Wheeler Publishing, 1994

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate knowledge and understanding of the essential facts, concepts, theories and principles underlying various finite element methods and analysis.	2	1	3
2	Generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with isoparametric concepts in the analysis of plane stress and plane strain problems.	2	2	3
3	Determine the behaviors and analyze various structures by adopting basic principles of FEM.	3	2	3

SEMINAR
1 Credit
(0-0-2)

Subject Code: PSE 114S IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Students will be able to reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem.
2. Students will be able to show competence in identifying relevant information, defining and explaining topics under discussion.
3. Students will be able to evaluate, synthesize information and use and apply relevant theories.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to reach across diverse disciplines to apply theories, methods and knowledge bases from multiple fields to a single question or problem.	3	2	2
2	Students will be able to show competence in identifying relevant information, defining and explaining topics under discussion.	1	3	3
3	Students will be able to evaluate, synthesize information and use and apply relevant theories.	1	3	2

STRUCTURAL ENGINEERING LABORATORY
1 Credit
(0-0-2)

Subject Code: PSE 201L IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Demonstrate knowledge and understanding of use of various IS codes in the design and testing of fresh and hardened concrete like strength and durability.
2. Demonstrate knowledge and understanding of underlying principles of design and analysis of RC structures subjected to various loads.
3. Demonstrate knowledge and understanding of underlying principles of design and analysis of steel structures subjected to various loads.

List of experiments

1. Concrete mix design as per IS:10262-2009
2. Computer aided concrete mix design as per IS:10262-2009
3. Concrete and RCC specimens testing using Non-Destructive Testing (NDT) equipment to evaluate below mentioned parameters
   a. Strength (Schmidt rebound hammer test)
   b. Permeability (Rapid chloride penetration test)
   c. Resistivity (Half-cell electrical potential method/ Resistivity measurement)
4. Acid test on concrete specimen
5. Evaluation of Modulus of elasticity and Poison’s ratio of concrete specimen
6. Evaluation of flexure strength of RCC beam specimen
7. Demonstration on evaluation of fatigue strength of concrete specimens
8. Earthquake engineering laboratory
   a. Dynamics of a three storied building frame subjected to harmonic base motion
   b. Dynamics of one-span and two-span beams
   c. Earthquake induced waves in rectangular water tanks
9. Analysis and design of RC buildings using ETABS/SAP2000
10. Analysis and design of Steel structures using ETABS/SAP2000

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate knowledge and understanding of use of various IS codes in the design and testing of fresh and hardened concrete like strength and durability.	3	1	3
2	Demonstrate knowledge and understanding of underlying principles of design and analysis of RC structures subjected to various loads.	2	2	3
3	Demonstrate knowledge and understanding of underlying principles of design and analysis of steel structures subjected to various loads.	2	2	3

EARTHQUAKE RESISTANT DESIGN OF STRUCTURES
4 Credits
(3-2-0)

Subject Code: PSE 001E | IA Marks: 50
Duration of Exam: 3 Hrs | Maximum marks: 100

Course outcomes:

1. Able to demonstrate knowledge understanding of earthquake, its effects on structures.
2. Student able to analyze design and make report independently earthquake resistant structures using relevant IS code specifications.
3. Students are capable of designing ductile masonry and RCC structures.

UNIT 1:

Introduction to engineering seismology, seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments.

Seismic response of buildings, structural properties, study of response of buildings and structures during past earthquakes.

UNIT 2:

The Response Spectrum – tripartite plot, importance of response quantities, elastic design spectra, inelastic response spectra.

Dynamics of multi-storeyed buildings – natural frequencies and mode shapes, Analysis of multi-storeyed buildings, obtaining seismic forces using IS-1893, P-Δ effect in framed structure

UNIT 3:

Structural Configuration for earthquake resistant design, frames, shear walls and dual systems, Effect of infill masonry walls on frames, problems of the soft first-storey, Capacity design procedures.

Behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, concepts for earthquake resistant masonry buildings – codal provisions

UNIT 4:

Ductility and energy absorption in buildings, Reinforced concrete for earthquake resistance, confinement of concrete for ductility, ductility of columns, beams and beam-column joint – codal provisions

Design of RC frame building for earthquake resistance (Beam and column members of frame)

References:

1. Agarwal P and Shrikande M, “Earthquake Resistant Design of Structures”, PHI, 2006.
2. Paulay T. and Priestly M. J. N., “Seismic design of reinforced concrete and masonry buildings”, Wiley India Pvt. Ltd., 2013
3. Duggal S K (2007), “Earthquake Resistant Design of Structures”, Oxford University Press, New Delhi 2007.
4. Rajasekaran S., “Structural dynamics of earthquake engineering”, Woodhead Publishing Limited, 2009
5. Vinod Hosur, “Earthquake Resistant Design of Building Structures”, Wiley India Pvt. Ltd, 2012
6. IS – 1893 (Part I): 2016, IS – 13920: 2016, IS – 4326: 2013, IS-13828: 1993
7. Andreas Kappos, G.G. Penelis, “Earthquake Resistant Concrete Structures”, CRC Press, 2010

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Able to demonstrate knowledge understanding of earthquake, its effects on structures.	3	2	1
2	Student able to analyze design and make report independently earthquake resistant structures using relevant IS code specifications.	1	3	2
3	Students are capable of designing ductile masonry and RCC structures.	2	2	3

STABILITY ANALYSIS OF STRUCUTRES
4 Credits
(3-2-0)

Subject Code: PSE 002E | IA Marks: 50
Duration of Exam: 3 Hrs | Maximum marks: 100

Course outcomes:

1. Demonstrate the knowledge and understanding of the application of various mathematical equations in the analysis of column of different end conditions.
2. Able to identify and analyse critical loads for various cases by using different methods.
3. Students will be able to apply the knowledge of finite element approach in the study of stability analysis and behavior of individual components of structures.

UNIT 1:

Beam – column: Differential equation. Beam column subjected to lateral concentrated load, several concentrated loads and continuous lateral loads. Application of trigonometric series, Euler's formulation using fourth order differential equation for pined-pinned, fixed-fixed, fixed-free and fixed-pined column.

UNIT 2:

Buckling of frames and continuous beams. Elastic Energy method – Approximate calculation of critical loads for a cantilever. Exact critical load for hinged-hinged column using energy approach. Buckling of bar on elastic foundation. Buckling of cantilever column under distributed loads. Determination of critical loads by successive approximation. Bars with varying cross section. Effect of shear force on critical load. Column subjected to non- conservative follower and pulsating forces.

UNIT 3:

Stability analysis by finite element approach – deviation of shape function for a two nodded Bernoulli-Euler beam element (lateral and translation) – element stiffness and element geometric stiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised column with different boundary condition – calculation of critical loads for a discretised (two elements) column(both ends built in). Buckling of pin jointed frames (maximum of two active dof) – symmetrical single way portal frame.

UNIT 4:

Lateral buckling of beams – differential equation – pure bending – cantilever beam with tip load – simply supported beam of I section subjected to central concentrated load. Pure Torsion of thin-walled bars with of cross section. Non-uniform Torsion of thin-walled bars of open cross section. Expression for strain energy in plate bending with in plate forces (linear and non-linear). Buckling of simply supported rectangular plate-uniaxial load and biaxial load. Buckling of uniformly compressed rectangular plate simply supported along two opposite sides perpendicular to the direction of compression and having various edge condition along the other two sides.

References:

1. S. Rajasekaran, G. Sankarasubramanian, "Computations and Structural Mechanics", PHI, 2001
2. M.L. Gambhir, "Stability Analysis and Design of Structures", Springer Science & Business Media, 2004
3. Stephen P. Timoshenko, James M Gere, "Theory of Elastic Stability", Courier Corporation, 2012
4. Zeigler H, "Principles of Structural Stability", Birkhäuser, 2013
5. Alexander Chajes, "Principles of Structural Stability theory", PHI, New Delhi, 1974.
6. Bažant Z. P., Luigi Cedolin, "Stability of Structures: Elastic, Inelastic, Fracture and Damage Theories", World Scientific, 2010
7. Robert D. Cook, Malkus, Plesha, Witt, "Concepts and Applications of Finite Element Analysis", 4rd Edition, John Wiley and Sons, 2007
8. Vazirani V N and Ratwani M M, "Advanced theory of structures and matrix methods". 5th Edition, Khanna publishers, Delhi (1995).

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the knowledge and understanding of the application of various mathematical equations in the analysis of column of different end conditions.	1	1	3
2	Able to identify and analyse critical loads for various cases by using different methods.	2	1	3
3	Students will be able to apply the knowledge of finite element approach in the study of stability analysis and behavior of individual components of structures.	2	1	3

DESIGN OF TALL STRUCTURES
3 Credits
(2-2-0)

Subject Code: PSE 003E — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes:

1. Demonstrate the knowledge and understanding of the concepts and facts in the behaviors, analysis and design process of various structural systems and buildings.
2. Identify and adopt the various modelling reduction techniques by describing the behaviors and effects of various factors in structural systems.
3. Analyse and design tall structures considering the factors which affect the design and its service life.

UNIT 1:

Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading, Construction loads Wind loading: static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, model analysis, combinations of loading, working stress design, Limit state design, Plastic design.

UNIT 2:

Behaviour of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Outrigger – braced and hybrid mega system.

UNIT 3:

Analysis and Design: Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces; drift and twist, computerized general three dimensional analysis. Structural elements: sectional shapes, properties and resisting capacities, design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creep and shrinkage effects, temperature effects and fire.

UNIT 4:

Stability of Tall Buildings, overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability, effect of foundation rotation.

References:

1. Bryan Stafford Smith & Alexcoull, “Tall building structures, Analysis and Design”, John Wiley, 1991
2. Dr. Gupta Y P – Editor, “Proceedings National Seminar on High Rise Structures - Design and Construction practices for middle level cities”, New Age International Limited.
3. Lin T N & .Stotes Burry D, “Structural concepts and system for Architects and Engineers”, John Wiley, 1998
4. Lynn S.Beedle, “Advances in Tall Buildings”, CBS Publishers and Distributors, 1996
5. Taranath B.S, “Structural Analysis and Design of Tall Buildings”, McGraw Hill, 1998 Wilf gang Schuller, “High rise building structures”, John Wiley, 1977.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the knowledge and understanding of the concepts and facts in the behaviors, analysis and design process of various structural systems and buildings.	1	2	3
2	Identify and adopt the various modelling reduction techniques by describing the behaviors and effects of various factors in structural systems.	2	1	3
3	Analyse and design tall structures considering the factors which affect the design and its service life.	3	2	3

THEORY OF PLATES AND SHELLS
3 Credits
(2-2-0)

Subject Code: PSE 005E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Able to demonstrate knowledge and understanding of the plate theory and use governing differential equations viz., Navier's and Levy's solutions for the analysis of plates subjected to various loading and end conditions.
2. Able to classify and identify various types of shells.
3. Able to prepare a detailing report for plates and simple shells.

UNIT 1:
Introduction to plate theory, small deflection of laterally loaded thin rectangular plates. Theory of pure bending of plates; Navier's and Levy's solution of plates for various loading and boundary conditions

UNIT 2:
Use of energy methods for solution of plates with all edges clamped, symmetric loading of circular plates with various edge conditions for both solid and annular plates, design principles and detailing of folded plates.

UNIT 3:
Introduction to curved surfaces and classification of shells, membrane theory of spherical shells, cylindrical shells, hyperbolic paraboloids, elliptic, paraboloid and conoids, axi-symmetric bending of shells of revolution.

UNIT 4:
Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation, bending theory of doubly curved shallow shells, detailing simple shell – spherical domes, water tanks, barrel vaults and hyperbolic paraboloid roofs

References:

1. Chandrashekhar K, Analysis of thin Concrete Shells, New Age International, 1995.
2. Chatterjee. B. K. – Theory and Design of Concrete Shell, – Chapman & Hall, Newyork - third edition, 1988.
3. Ramaswamy G.S. – Design and Constructions of Concrete Shell Roofs, – CBS Publishers and Distributors – New Delhi – 2005
4. Szilard R, Theory and analysis of plates - classical and numerical methods, Prentice Hall, 2010.
5. Timosheko S.P. and Woinowsky-Krieger W, Theory of Plates and Shells 2nd Edition, McGraw-Hill Co., New York, 1959.
6. Ugural, A. C. Stresses in Plates and Shells, 2nd edition, McGraw-Hill, 1999

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Able to demonstrate knowledge and understanding of the plate theory and use governing differential equations viz., Navier’s and Levy’s solutions for the analysis of plates subjected to various loading and end conditions.	1	1	3
2	Able to classify and identify various types of shells.	1	1	3
3	Able to prepare a detailing report for plates and simple shells.	1	2	3

ADVANCED FOUNDATION ENGINEERING
4 Credits
(3-2-0)

Subject Code: PSE 022E — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes: At the end of the course the student will be able to
1. Select the type of foundation, depth and design depending upon the type of soil.
2. Decide and analyze geometric configuration and safety, and economy of foundation.
3. Analyze and suggest remedial measures against foundation failures.

UNIT 1:
Assessment of foundation loads for Engineering structures – Dead load, Live load, wind and seismic load combinations for the Design, Code requirements. Bearing Capacity
Settlement analysis, Immediate settlements, Consolidation settlements, Total settlements, Relative settlements, Various methods of estimation.

UNIT 2:
Shallow Foundations - Conventional structural design of Individual footings, combined footings and Rafts.
Pile Foundations – Analysis and Conventional Design of pile foundations for vertical and lateral loads including design of pile cap.

UNIT 3:
Piers and Well Foundations: Analysis and design of pier and well foundations. Caissons.
Foundations on expansive soils, under reamed piles.

UNIT 4:
Special foundations. Design of Sheet piles
Foundation Failures - Types and causes of failures, Remedial measures, Shoring and Underpinning.

References:

1. Bowels J E. "Foundation Analysis and design", McGraw Hill Book Co., New York.
2. Winterkorn and Fang, "Foundation Engineering Hand book"-Von Nostrand Reinhold Co
3. Shamsher Prakash, Gopal Ranjan and Swami Saran "Analysis and design of Foundation and Retaining structures", K. A. Rastogi Prakashan, Meerut, India.
4. Jain, G.R. S., "Hand Book on Underreamed and Bored Compaction Pile Foundations", Published by G. S. Jain Associates, Roorkee.
5. Das, B. M., "Principles of Foundation Engineering", Cengage Learning (2011)
6. Tomlinson, "Foundation Design and Construction", ELBS, Longman Group Ltd.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Select the type of foundation, depth and design depending upon the type of soil.	1	1	3
2	Decide and analyze geometric configuration and safety, and economy of foundation.	2	2	3
3	Analyze and suggest remedial measures against foundation failures.	2	2	3

ADVANCES IN CONCRETE TECHNOLOGY
4 Credits
(3-2-0)

Subject Code: PSE 008E — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes:

1. The students will be able to identify the characteristics of different ingredient materials of concrete and various types of concrete mixes for their suitable use in construction.
2. The students will be able to distinguish the properties of special concrete mixes in their fresh and hardened states and prepare a detailed report.
3. The students will be able to evaluate different mix ingredients and parameters for making concrete for high performance and suggest mix design for specific construction project.

UNIT 1:

Components of modern concrete and developments in process and constituent materials- Role of Mineral and chemical admixtures, corrosion inhibitors, adhesives and coatings, recycled aggregates. Concrete mix design procedure, Ready Mixed Concrete

Light weight concrete – Introduction, classification, properties, strength and durability, mix design

UNIT 2:

High density concrete - Radiation shielding ability of concrete, materials for high density concrete, properties in fresh and hardened state, placement methods

Ferrocement - materials, mechanical properties, cracking of ferrocement, strength and behavior in tension, compression and flexure, design of ferrocement in tension, ferrocement constructions, durability and applications

UNIT 3:

Fibre reinforced concrete – Constituent materials, distribution and orientation of fibers, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications, self compacting concrete, polymer concrete, Introduction to fiber reinforced polymer composites

UNIT 4:

High strength concrete – constituents, mix proportioning, properties in fresh and hardened states, applications and limitations, high performance concrete, reactive powder concrete, bacterial concrete, Roller compacted concrete, Foam concrete, chemicals, Concept of composites and smart concrete

References:

2. Aitcin P.C., “High performance concrete”, E and FN, Spon, London, 1998
3. Kumar Mehta P, Panlo J. N. Monterio, “Concrete, Microstructure, Properties and Materials”. Tata McGraw Hill
4. Neville A.M, “Properties of Concrete”, Pearson Education Asis, 2000
5. Santhakumar A R, (2007) “Concrete Technology”, Oxford University Press, New Delhi,

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	The students will be able to identify the characteristics of different ingredient materials of concrete and various types of concrete mixes for their suitable use in construction.	2	2	2
2	The students will be able to distinguish the properties of special concrete mixes in their fresh and hardened states and prepare a detailed report.	2	3	2
3	The students will be able to evaluate different mix ingredients and parameters for making concrete for high performance and suggest mix design for specific construction project.	3	2	3

DESIGN OF BRIDGES
4 Credits
(3-2-0)

Subject Code: PSE011E — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes:

1. Analyze and predict the behavior of various types of bridges and design them with detailed report as per relevant codes.
2. Demonstrate the knowledge of understanding various types of bridges and their principles of design.
3. Design and analysis of PSC bridges with different loadings using relevant codes.

UNIT 1:

Introduction: site selection for bridges, classification of bridges, review of IRC and IRS loadings, bridge substructures: abutments, piers, wingwalls and their foundations, bearings, expansion joints. Design of slab culvert and box culvert for different IRC loading cases

UNIT 2:

T-beam bridge design using COURBON'S method, HENDRY-JAEGER and MORICE-LITTLE methods for IRC loading

UNIT 3:

Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simply supported portion and design of cantilever portion, design of articulation.

UNIT 4:

PSC Bridges: Introduction, proportioning of components, analysis and structural design of slab and main girder using COURBON's method for IRC Class AA tracked vehicle, calculation of pre-stressing force, cable profile and calculation of stresses, design of end block and detailing of main girder

References:

2. Krishna Raju N, "Design of Bridges", Oxford & IBH Publishing Co New Delhi, 1998
3. Ponnuswamy . S, "Bridge Engineering", Tata McGraw Hill, 2007.
4. Raina V.K., "Concrete Bridge Practice", Tata McGraw Hill, 2002
5. Johnson D, Victor "Essentials of Bridge Engineering", Oxford & IBH Publishing Co New Delhi, 2010.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Analyze and predict the behaviour of various types of bridges and design them with detailed report as per relevant codes	3	2	3
2	Demonstrate the knowledge of understanding various types of bridges and their principles of design.	2	3	2
3	Design and analysis of PSC bridges with different loadings using relevant codes.	1	2	3

MASONRY STRUCTURES
3 Credits
(2-2-0)

Subject Code: PSE 014E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Students will acquire the knowledge about various material types, characteristics and properties of the materials used in the masonry structures.
2. Students will be able to design the load bearing masonry for buildings using BIS codal provisions.
3. Students will be able to predict the effect of the masonry on the behavior of the building subjected to earthquake forces and will be able to design earthquake resistant masonry

UNIT 1:

Introduction, Masonry units, materials and types, history of masonry, characteristics of Brick, stone, clay block, concrete block, stabilized, mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – classification and properties of mortars, selection of mortars. Strength of masonry in compression, behaviour of masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context, failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength

UNIT 2:

Flexural strength and shear strength, bond between masonry unit and mortar, tests for determining flexural, shear and bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength. Permissible stresses, stress reduction and shape reduction factors, increase in permissible stresses for eccentric, vertical and lateral loads.

UNIT 3:

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric, vertical and lateral loads, permissible tensile and shear stresses, effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.

UNIT 4:

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions, masonry arches, domes and vaults, components and classification of masonry arches, domes and vaults, historical buildings, construction procedure. In-plane and out of plane behavior, behavior of masonry walls and piers: axial and flexure behavior of masonry buildings: unreinforced masonry buildings, importance of bands and corners and vertical reinforcement, reinforced masonry building- cyclic loading and ductility of masonry walls, behavior of infills in RC frames, strut action

References:

1. Curtin, “Design of Reinforced and Prestressed Masonry”, Thomas Telford, 1998
2. Dayaratnam P, “Brick and Reinforced Brick Structures”, Oxford & IBH, 1997
3. Hendry A.W., “Structural masonry”, Macmillan Education Ltd., 2nd edition, 1990
4. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, “Alternative Building Materials and Technologies”, New Age International.
5. Sinha B.P & Davis S.R., “Design of Masonry structures”, E & FiN, 1996

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will acquire the knowledge about various material types, characteristics and properties of the materials used in the masonry structures.	2	1	2
2	Students will be able to design the load bearing masonry for buildings using BIS codal provisions.	2	3	2
3	Students will be able to predict the effect of the masonry on the behavior of the building subjected to earthquake forces and will be able to design earthquake resistant masonry	3	2	3

REPAIR AND REHABILITATION OF STRUCTURES
4 Credits
(3-2-0)

Subject Code: PSE 015E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Student will acquire the knowledge on different NDT techniques.
2. Identify the suitable repair method in different distress condition.
3. Able to identify the different types of distress caused in the concrete structures.

UNIT 1:

Introduction: Causes of deterioration of concrete structures, diagnostic methods & analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping and core drilling and other instrumental methods. Quality assurance for concrete construction, strength, permeability, thermal properties and cracking. Influence on serviceability and durability: Effects due to climate, temperature, chemicals, wear and erosion

UNIT 2:

Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Maintenance and Repair Strategies: repair and rehabilitation, facets of maintenance, importance of maintenance, preventive measures on various aspects, inspection, assessment procedure for evaluating a damaged structure, causes of deterioration - testing techniques.

UNIT 3:

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fiber reinforced concrete.
Techniques for Repair: Rust eliminators and polymers coating for rebar during repair, foamed concrete, mortar and dry pack, vacuum concrete, shotcrete, epoxy injection, shoring and underpinning.

UNIT 4:

Examples of Repair to Structures: Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering wear, fire, leakage, marine exposure, engineered demolition techniques for dilapidated structures - case studies

References:

1. Allen R. T and Edwards S. C., “Repair of Concrete Structures”, Blakie and Sons, 1987
2. Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”, Longman Scientific and Technical, 1991
3. Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”, R&D Center (SDCPL), 1987
4. Sidney., M. Johnson “Deterioration, Maintenance and Repair of Structures”, 1981

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Student will acquire the knowledge on different NDT techniques.	2	2	2
2	Identify the suitable repair method in different distress condition.	2	3	3
3	Able to identify the different types of distress caused in the concrete structures.	3	2	3

MATRIX METHODS OF STRUCTURAL ANALYSIS
4 Credits
(3-2-0)

Subject Code: PSE 016E — IA Marks: 50
Duration of Exam: 3 Hrs — Maximum marks: 100

Course outcomes:

1. The students will be able to describe the fundamental concepts and modern methods of structural analysis and apply flexibility matrix method by element approach for the analysis of beams, frames and trusses.
2. The students will be able to apply stiffness matrix method for the analysis of beams, frames and trusses by element and direct approach and present the analysis report.
3. The students will be able to analyze grid and space frames by stiffness matrix method.
4. The students will be able to analyze the trusses subjected to temperature changes and lack of fit. The students will be able to apply numerical techniques to solve simultaneous equations by Gauss elimination and Cholesky methods.

UNIT 1:

Review of the basic concepts: static and kinematic indeterminacy, linear and non-linear structural behavior, concepts of stiffness and flexibility, energy concepts, principle of minimum potential energy and minimum complementary energy.

Flexibility method: Introduction, transformation of information from system forces to element forces, application to trusses, continuous beams and portal frames.

UNIT 2:

Stiffness method: Introduction, stiffness matrix for trusses, beams and portal frames. Assembly of structure stiffness matrix by direct stiffness method, analysis of orthogonal and non orthogonal skeletal structures, transformation of information from local to global axes and vice versa

UNIT 3:

Stiffness matrices for grid and beam elements in three dimensions, transformation of displacements and forces from local to global axes, analysis of grid and space frames, basic concepts associated with computer implementation by stiffness method.

UNIT 4:

Effects of temperature change and lack of fit, numerical techniques for simultaneous equations, Gauss elimination and Cholesky methods and bandwidth consideration

References:

1. Aslam Kassimali, “Matrix analysis of structures”, Brooks/Cole, 1999
2. Bhatt P, “Problems in structural analysis by matrix methods”, Construction press, 1981
3. Devdas Menon, “Advanced Structural Analysis”, Alpha Science International, 2009
4. Pandit G.S. and Gupta S.P., “Structural analysis: a matrix approach”, Tata McGraw Hill, 2007.
5. Rajasekaran S., “Computational Structural Mechanics”, PHI, New Dehi 2001.
6. Reddy C.S., “Basic Structural Analysis”, TMH, New Delhi 2001.
7. Weaver W. and J.H.Gere, “Matrix Analysis of Framed Structures”, Van Nastran, 1980.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	The students will be able to describe the fundamental concepts and modern methods of structural analysis and apply flexibility matrix method by element approach for the analysis of beams, frames and trusses.	2	1	3
2	The students will be able to apply stiffness matrix method for the analysis of beams, frames and trusses by element and direct approach and present the analysis report.	1	2	3
3	The students will be able to analyze grid and space frames by stiffness matrix method.	1	1	3
4	The students will be able to analyze the trusses subjected to temperature changes and lack of fit. The students will be able to apply numerical techniques to solve simultaneous equations by Gauss elimination and Cholesky methods.	3	1	3

ADVANCED DESIGN OF STEEL STRUCTURES
4 Credits
(3-2-0)

Subject code: PSE 017E — IA Marks: 50
Duration of Exam: 3Hrs — Maximum marks: 100

Course outcomes:

1. Demonstrate the understanding and knowledge of underlying principles, concepts and components in the design of steel structures by elastic methods for various special structures and plastic methods of analysis.
2. Analyse steel structures like industrial structures, bunkers, silos, light gauge structures etc., for various loadings as per different IS codes by adopting suitable method of analysis.
3. Demonstrate the use of various IS codes in the design with the knowledge of minimum weight design.

UNIT 1:
Plastic Methods of Analysis: Stress strain relation for steel, Formation of plastic hinges, redistribution of stress; Section modulus, Fully plastic moment for selected cross section shapes; Theorems of plastic collapse; Collapse load for frames; Factors affecting fully plastic moment of a section.
Plastic Methods of Design: Plastic design of continuous beams; Trial and error method; Method of combining mechanisms; Plastic moment distribution for design of portal frames and pitched roof frames; Design of continuous beams.

UNIT 2:
Design of Frames for Industrial Structures : Design of frames for gravity and wind loads.

UNIT 3:
Design of Bunkers, Silos and Chimneys : Design of bunkers, silos and chimneys.

UNIT 4:
Minimum weight design : Minimum weight design; Design for strong column-weak beam and strong beam-weak column; Theorems of minimum weight design.
Design of Light Gauge Structural Steel Sections : Design of light gauge structural steel sections for axial, flexural and combined axial compression and flexure.

References:

1. Ram Chandra, “Design of Steel Structures”, Vol. II, Standard Book House, New Delhi,
2. Neal, B.G., “The Plastic Methods of Structural Analysis”, 2ed., Chapman & Hall, London, 1963.
3. Baker, J.F., Horne, M.R. and Heyman, J., “The Steel Skeleton”, Vol. II – “Plastic Behavior and Design”, ELBS & Cambridge University Press, London, 1961.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Demonstrate the understanding and knowledge of underlying principles, concepts and components in the design of steel structures by elastic methods for various special structures and plastic methods of analysis.	2	1	2
2	Analyse steel structures like industrial structures, bunkers, silos, light gauge structures etc., for various loadings as per different IS codes by adopting suitable method of analysis.	2	3	3
3	Demonstrate the use of various IS codes in the design with the knowledge of minimum weight design.	2	3	3

NUMERICAL METHODS FOR CIVIL ENGINEERS
4 Credits
(3-2-0)

Subject Code: PSE 018E — IA Marks: 50
Duration of Exam: 3 Hrs — Examination of Marks: 100

Course outcomes:

1. The students will be able to apply the solution of linear system of equations to civil engineering problems: Construction planning, slope deflection method applied to beams, frames and truss analysis.
2. Able to apply numerical integration for solving simple beam problems and Application of Finite difference technique in structural mechanics.
3. Able to apply New-Mark's method for computation of slopes and deflections in statically determinate beams.
4. Able to develop algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method and Runge Kutta 4th order method.

UNIT 1:

Introduction: Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering.

Development of algorithm/ flow charts for following methods for solution of linear Simultaneous equation: a) Gaussian elimination method b) Gauss-Jordan matrix inversion method c) Gauss-Siedel method d) Factorization method

Application of solution of linear system of equations to civil engineering problems: Construction planning, slope deflection method applied to beams, frames and truss analysis.

UNIT 2:

Application of root finding to civil engineering problems: Development of algorithm for Bisection method and Newton-Raphson method and its applications for solution of non linear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.

Application of numerical integration for solving simple beam problems: Development of algorithm for Trapezoidal rule and Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

UNIT 3:

New-Mark's method for computation of slopes and deflections in statically determinate beams.

Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method and Runge Kutta 4^{th} order method

UNIT 4:

Application of finite difference technique in structural mechanics:

i. Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences.
ii. Application of finite difference method for analysis of statically determinate indeterminate beams

Application of Finite difference technique in structural mechanics (Contd..): Buckling of columns and Beams on elastic foundation.

Reference Books:

1. Chapra S.C. & Canale R.P., Numerical Methods for Engineers, McGraw Hill, 1990.
2. Krishna Raju N, Muthu K.U., Numerical methods in Engineering Problem, McMillan Indian Limited, 1990.
3. Iqbal H.Khan, Q. Hassan, Numerical methods for Engineers and Scientists, Galgotia, New Delhi, 1997.
4. Numerical methods in Computer Programs in C ++" - Pallab Ghosh : Prentice Hall of India Private Limited, New Delhi, 2006.
5. Numerical methods for engineers using MATLAB and C – I Edition SCHILLING " Thomson Publications"

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	The students will be able to apply the solution of linear system of equations to civil engineering problems: Construction planning, slope deflection method applied to beams, frames and truss analysis.	2	1	2
2	Able to apply numerical integration for solving simple beam problems and Application of Finite difference technique in structural mechanics.	2	3	3
3	Able to apply New-Mark's method for computation of slopes and deflections in statically determinate beams.	2	3	3
4	Able to develop algorithm and application of solution of ordinary differential equation to civil engineering problems by Euler's method and Runge Kutta 4th order method.	2	1	3

STRUCTURAL DESIGN OF FOUNDATIONS
4 Credits
(3-2-0)

Subject Code: PSE 019E — IA Marks: 50
Duration of Exam: 3 Hrs — Examination of Marks: 100

Course outcomes:
1. Students will acquire the knowledge about the principles of designing foundations.
2. Able to do design and prepare detailing the shallow foundations according to codal provisions.
3. Able to design retaining walls foundation and piles, pile group, caissons.
4. Able to do design and prepare detailing of the foundations for special structures like chimneys, power plants and towers.

UNIT 1:

Introduction to Engineering Design: Concepts, Principles and Applications.
Fundamentals of Geotechnical and Structural Design: Concepts and Principles.

UNIT 2:

Introduction to RC Design - Codal provisions: A review and A few examples.

Shallow Foundations: Geotechnical and Structural Design of Individual footings, Combined footings, Rafts, Ring foundations, etc. Detailing, Examples and Case Studies. Beams and Plates on Elastic Foundation:

UNIT 3:

Deep Foundations: Geotechnical and Structural Design of Piles and Pile groups, Piers and Caissons. Detailing, Examples and Case Studies.

Foundations for Retaining Structures: Examples and Case Studies.

UNIT 4:

Special Foundations: Towers, Chimneys, High-Rise Buildings, Power Plants, etc.

Earthquake Resistant Design of Foundations – A few Examples and Case Studies. Usage of Software.

References:

1. Coduto, D. P. (2000). Foundation Design: Principles and Practices, Prentice-Hall, New Jersey.
2. Peck, R. B., Hanson, W. E. and Thornburn, T. H. (1974). Foundation Engineering, John Wiley and Sons, New York.
3. Bowles, J. E. (1996). Foundation Analysis and Design, McGraw-Hill, New York
4. Hemsley, J. A. (1998). Elastic Analysis of Raft Foundations, Thomas Telford, London.
5. Hemsley, J. A. (Ed.), (2000). Design Applications of Raft Foundations, Thomas Telford, London.
6. Murthy, V. N. S. (2007). Advanced Foundation Engineering, CBS Publishers and Distributors, New Delhi.
7. Poulos, H. G. and Davis, E. H. (1980). Pile Foundation Analysis and Design, John Wiley and Sons, New York.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will acquire the knowledge about the principles of designing foundations.	2	1	2
2	Able to do design and prepare detailing the shallow foundations according to codal provisions.	2	3	3
3	Able to design retaining walls foundation and piles, pile group, caissons.	2	3	3
4	Able to do design and prepare detailing of the foundations for special structures like chimneys, power plants and towers.	2	2	3

CONSTRUCTION MANAGEMENT
3 Credits
(2-2-0)

Subject Code: PSE 020E — IA Marks: 50
Duration of Exam: 3 Hrs — Examination of Marks: 100

Course outcomes:

1. Students capable to apply independently ISO standards in quality and safety for construction.
2. Students capable prepare feasible report for a construction project.
3. Students skilled with inventory management techniques.

UNIT 1:

Stages of construction - estimating, tendering, pricing and contracting, equipment planning and waiting line situations, inventory management.

Engineering economics and Economic feasibility – budget, break-even analysis, Balance sheets, cost benefit analysis, discounted cash flow, Life cycle costing, cost control optimization

UNIT 2:

Principles and practice of project management; work breakdown structures, critical path networks, PERT, resource charts, cost charts, S-curves, performance ratios Updating of plans - purpose, frequency and methods of updating, common causes of time and cost overruns and corrective measures.

UNIT 3:

Decision tree and decision analysis, construction simulation and simulation models, Appraisal of public investment projects, techno-economics of projects project investment analysis and decisions.

UNIT 4:

Quality control - concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control, ISO standards.

Safety and health on project sites - accidents; their causes and effects, costs of accidents, occupational health problems in construction, organizing for safety and health, ISO standards

References:

1. Varma, M., “Construction planning and management through system techniques: Metropolitian Book Company , New Delhi 1983
2. Kumar Neeraj Jha, “Construction Project Management”,
3. Punmia B. C., Khandelwal K. K., “Project Planning and Control with CPM and PERT”, Laxmi Publication Private Ltd., New Delhi, 2004
4. Shrivastva U. K., “Construction Planning and Management”, Galgotia Publications Pvt. Ltd., New Delhi, 2010
5. Peurifoy R. J., “Construction planning, equipment and methods, McGraw Hill Book company, New York, 2006
6. Wlest J D and Levy F K A Management gaide to PEET/CAM with CERT/PDM/DCPM and other networks PHI – London, 1977
7. Pilcher, R. Principles of Construction Management 3rd Ed McGraw Hill, 1992

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students capable to apply independently ISO standards in quality and safety for construction.	3	2	1
2	Students capable prepare feasible report for a construction project	3	3	2
3	Students skilled with inventory management techniques	1	2	3

OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING
4 Credits
(3-2-0)

Subject Code: PSE 021E IA Marks: 50
Duration of Exam: 3 Hrs Maximum marks: 100

Course outcomes:

1. Able to acquire the knowledge of engineering application of optimizations and different techniques of optimizations.
2. Able to learn linear, non-liner and geometric programming, solution of system of liner simultaneous equations, simplex algorithms and pivotal production of general system of equations.
3. Able to apply the different minimization methods for one dimensional, elimination, Fibonacci, golden section, interpolation, quadratic and cubic methods.
4. Able to use geometric programming in optimization, convert NLP as a sequence of LP/geometric programming, dynamic programming conversion of NLP as a sequence of LP/dynamic programming.

UNIT 1:
Introduction to optimization, engineering applications of optimization, formulation of structural optimization problems. Optimization techniques: classical optimization techniques, single variable optimization, multivariable optimization with no constraints, unconstrained minimization techniques and algorithms constrained optimization solutions by penalty function techniques, Lagrange multipliers techniques and feasibility techniques.

UNIT 2:
Linear programming, standard form of linear programming, geometry of linear programming problems, solution of a system of linear simultaneous equations, pivotal production of general systems of equations, simplex algorithms, revised simpler methods, duality in linear programming.

UNIT 3:
Non-linear programming, one dimensional minimization methods, elimination methods, Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods, Unconstrained optimization methods, direct search methods, random search methods, descent methods, constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems.

UNIT 4:
Geometric programming, conversion of NLP as a sequence of LP/geometric programming, Dynamic programming conversion of NLP as a sequence of LP/ Dynamic programming, Structural Optimization Formulation and solution of structural optimization problems by different techniques

References:

1. Bhavikatti S.S.,- "Structural optimization using sequential linear programming", Vikas publishing house, 2003
2. Rao S. S., "Optimization – Theory and Practice", Wiley Eastern Ltd, 1996
3. Richard Bronson, "Operation Research", Schaum's Outline Series, 2003
4. Spunt, "Optimum Structural Design", Prentice Hall, 1971
5. Uri Krisch, "Optimum Structural Design", McGraw Hill, 1981

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Able to acquire the knowledge of engineering application of optimizations and different techniques of optimizations.	2	1	2
2	Able to learn linear, non-liner and geometric programming, solution of system of liner simultaneous equations, simplex algorithms and pivotal production of general system of equations.	2	2	3
3	Able to apply the different minimization methods for one dimensional, elimination, Fibonacci, golden section, interpolation, quadratic and cubic methods.	2	2	1
4	Able to use geometric programming in optimization, convert NLP as a sequence of LP/geometric programming, dynamic programming conversion of NLP as a sequence of LP/dynamic programming.	1	2	2

DESIGN STUDIO
2 Credits
(0-0-4)

Subject Code: PSE313D CIE Marks: 50
Max. Marks: 100 Contact Hours – hours/week:04

Course outcomes:

1. Students will be able to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and develop their ability to synthesize, evaluate and reflect on information.
2. Students will be able to demonstrate use of appropriate methodologies, test the strength of their problem statement, show insight into a topic, appropriate signposting, and clarity of purpose.
3. Students will be able to demonstrate problem-solving skills, use new tools and apply theoretical knowledge.

Planning, Analysis, Design, Detailing and Estimation of any Residential/Commercial/Industrial Structure using available Software Package.

Complete report to be submitted at the end of the semester. CIE and SEE are evaluated by the committee.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and develop their ability to synthesize, evaluate and reflect on information.	2	3	1
2	Students will be able to demonstrate use of appropriate methodologies, test the strength of their problem statement, show insight into a topic, appropriate signposting, and clarity of purpose.	2	1	3
3	Students will be able to demonstrate problem-solving skills, use new tools and apply theoretical knowledge.	3	2	2

INDUSTRIAL TRAINING
5 Credits
(0-0-10)

Subject Code: PSE331I CIE Marks: 50
Max. Marks: 100 Contact Hours – hours/week:10

Course outcomes:

1. Students will be able to identify, formulate and model problems and find engineering solution based on a system approach and conduct research in their respective field of specialization.
2. Students will be able to be a multi skill engineer with good technical knowledge, management, leadership and entrepreneurship skills.
3. Able to become master in one's specialized technology and update with all the latest changes in technological world.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to identify, formulate and model problems and find engineering solution based on a system approach and conduct research in their respective field of specialization.	3	2	2
2	Students will be able to be a multi skill engineer with good technical knowledge, management, leadership and entrepreneurship skills.	1	1	2
3	Able to become master in one's specialized technology and update with all the latest changes in technological world.	1	1	3

PROJECT PHASE-I
10 Credits
(0-0-20)

Subject Code: PSE312P CIE Marks: 50
Max. Marks: 100 Contact Hours – hours/week:20

Course outcomes:

1. Students will be able to show competence in identifying relevant information, defining and explaining thesis statement under consideration.
2. Students will demonstrate depth of understanding, complexity, insight, cogency, independent thought, relevance, and persuasiveness of the thesis statement.
3. Students will be able to show competence in working with a methodology, structuring their work, and synthesizing information.
4. Students will be able to demonstrate clarity, the strength of their thesis statement, and develop their topic with appropriate signposting.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to show competence in identifying relevant information, defining and explaining thesis statement under consideration.	3	2	2
2	Students will demonstrate depth of understanding, complexity, insight, cogency, independent thought, relevance, and persuasiveness of the thesis statement.	3	1	2
3	Students will be able to show competence in working with a methodology, structuring their work, and synthesizing information.	3	2	1
4	Students will be able to demonstrate clarity, the strength of their thesis statement, and develop their topic with appropriate signposting.	2	2	3

PROJECT PHASE-II
20 Credits
(0-0-40)

Subject Code: PSE431P | CIE Marks: 50
Max. Marks: 100 | Contact Hours – hours/week:40

Course outcomes:

1. Students will be able to evaluate information and use and apply relevant theories.
2. Students will develop skill to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and also ability to synthesize, evaluate and reflect on information.
3. Students will be able to demonstrate problem-solving skills and apply theoretical knowledge.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3
1	Students will be able to evaluate information and use and apply relevant theories.	2	1	2
2	Students will develop skill to present information in a compelling, well-structured, and logical sequence and show depth of knowledge of complex subjects, and also ability to synthesize, evaluate and reflect on information.	1	3	3
3	Students will be able to demonstrate problem-solving skills and apply theoretical knowledge.	1	1	3

B. V. V. Sangha's
Basaveshwar Engineering College (Autonomous), Bagalkot.
(Electrical and Electronics Engineering)
M. Tech in Energy Science and Technology

Scheme and Syllabus

Semester Wise Credit Distribution for Semester-I to IV (range as per VTU/AICTE)

Course category	Credits allocated	% of credits	% range (as per VTU)
4 Core + 3 Labs [4x4+1x3]	19	21.5	15 to 25
6 Electives [4x6] 2 Online course [6]	30	34.09	25 to 35
Term paper-I & II [2+2] Seminar [1] Project phase-I & II [8+18]	31	35.2	30 to 45
Internship	8	9	5 to 10
Total	88		

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI

Scheme of Teaching and Examinations – 2020 - 21

M.Tech in Energy Science and Technology

Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER-I												
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical	Skill Development Activities/Tutorials	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA/T					
1	PCC	PET101C	Solar Energy Conversion Systems	4	-	-	03	50	50	100	4
2	PCC	PET102C	Energy Audit and Demand Side Management	4	-	-	03	50	50	100	4
3	PCC	PET103C	Wind Energy Conversion Systems	4	-	-	03	50	50	100	4
4	PCC	PET104C	Research Methodology	3	-	2	03	50	50	100	4
5	PEC	PETXXXE	Elective - I	4	-	-	03	50	50	100	4
6	PCC	PET110L	Energy Lab - I	-	2	-	03	50	50	100	1
7		PET115P	Term Paper-I	-	4	-	03	50	50	100	2
			TOTAL	20	06	--		350	350	700	23
Note: PCC: Professional Core Course, PEC: Professional Elective Course.											

Skill development activities/Tutorials:
Students and course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills. The students should interact with industry (small, medium and large), understand their problems or foresee what can be undertaken for study in the form of research/ testing / projects, and for creative and innovative methods to solve the identified problem. Under tutorials students will engage themselves in advanced problem solving in the respective subjects. Further, mathematical modelling, survey and related analysis can also be taken up.

Energy Lab – I:
Students will conduct 10-12 experiments in each semester. The experiments will be drawn from the subjects taught in respective semesters. The experiments will directly provide practical learning experience to students. The laboratory and research facilities from EE, ME, IP, AE and EC will be used for conducting experiments.

Term Paper I:
It is a precursor to the final M.Tech project. It is activity-based learning offered at First and Second semester. Term paper is a critical survey/ investigation study on specific issue/topic of current interest in the field of energy systems and related technology. Students are expected select an internal guide/ subject expert for the term paper, under whose guidance the term paper shall be submitted. The students have to submit a certified report in the form of a paper at the end of the semester.

CIE evaluation will be made by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. This evaluation will be a Technical Seminar on the prepared term paper. Marks awarded for, term paper presentation shall be based on the evaluation of Paper, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech in Energy Science and Technology
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

SEMESTER-II												
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination					Credits
				Theory	Practical	Skill Development Activities/Tutorials	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	P	SDA/T						
1	PEC	PET201C	Elective – II	4	-	-	03	50	50	100		4
2	PEC	PET202C	Elective - III	4	-	-	03	50	50	100		4
3	PEC	PETXXXE	Elective - IV	4	-	-	03	50	50	100		4
4	PEC	PETXXXE	Elective - V	4	-	-	03	50	50	100		4
5	PEC	PETXXXE	Elective – VI	4	-	-	03	50	50	100		4
6	PCC	PET210L	Energy Lab – II	-	2	-	03	50	50	100		1
7		PET215P	Term Paper-II	-	4	-	03	50	50	100		2
			TOTAL	20	06	--		350	350	700		23
Note: PCC: Professional Core Course, PEC: Professional Elective Course.												

Energy Lab – II:
Students will conduct 10-12 experiments in each semester. The experiments will be drawn from the subjects taught in respective semesters. The experiments will directly provide practical learning experience to students. The laboratory and research facilities from EE, ME, IP, AE and EC will be used for conducting experiments.

Term Paper II:
It is a precursor to the final M.Tech project. It is activity-based learning offered at First and Second semester. Term paper is a critical survey/ investigation study on specific issue/topic of current interest in the field of energy systems and related technology. Students are expected select an internal guide/ subject expert for the term paper, under whose guidance the term paper shall be submitted. The students have to submit a certified report in the form of a paper at the end of the semester.

CIE evaluation will be made by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. This evaluation will be a Technical Seminar on the prepared term paper. Marks awarded for, term paper presentation shall be based on the evaluation of Paper, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

List of Professional Elective Courses Offered

PET001E- Energy Conversion Technologies
PET002E- Electric Smart Grid
PET003E- Fundamentals of Energy Engineering-I
PET004E- IOT and Applications
PET005E- Autotronics (Automotive Electronics)
PET006E- Power System SCADA
PET007E- Battery Management System
PET008E- Electric Vehicles
PET009E- Fundamentals of Energy Engineering-II
PET010E- Reliability Evaluation of Engg. Systems
PET011E- Carbon Capture and Storage
PET012E- SPV Powered Irrigation Systems
PET013E- Embedded System Design
PET014E- Energy Pricing and Economics
PET015E- Energy Conversion and Energy Efficiency
PET016E- MEMS
PET017E- Integration Of Distributed Generation
PET018E- Solar Photovoltaic System Design

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2020 - 21
M.Tech in Energy Science and Technology
Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

SEMESTER-III												
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination					Credits
				Theory	Practical	Skill Development Activities/Tutorials	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	P	SDA						
1	PCC	PET301I	Internship	*			-	50	50	100		8
2	PCC	PET302S	Seminar		02	-		50	50	100		1
3	PCC	PET310L	Energy Lab - III	-	02	-	03	50	50	100		1
4	PCC	PET315P	Project Phase - I	-	16	-	-	50	50	100		8
5			Online Course-1									3
			TOTAL	--	20	--		200	200	400		21

Internship
All the students have to undergo mandatory internship/training in any one of the reputed industry/ research institute. The training program has to be taken up during the vacation between 2nd and 3rd semester. The duration of the training program should be for period of 8 weeks. A report on the training is to be submitted. The supervisor/ guide from industry shall allot 50 marks of the CIE and the other 50% by the internal supervisor/guide. SEE evaluation will be made by a committee comprising of HoD as Chairman, PG coordinator and internal supervisor/guide.. The SEE will be a Technical Seminar on the industrial training. Marks awarded shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

Energy Lab – III:
SCADA for distribution automation facility will be used for Energy Management, Energy Audit, Demand Side of the Management, Energy Data Representation and Energy Data Analytics. List of experiments under this lab are as follows:
Distribution SCADA system automation & control unit, Modes of communication using TP-link device, Draw the single line diagram of 11kv distribution system with updated data, Energy auditing of BEC campus, Monitor and record the renewable sources in college, Record and draw the energy consumption for a specific time of year, Determination of load curve of dtc-4 at BEC campus

Project Phase – I:
Phase-I of the project is part of the final M.Tech project. Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. A report certified by the guide must be submitted and a seminar is to be presented by the students. Evaluation of the project phase-I is to be conducted by internal examiners, a committee comprising of HoD as Chairman, PG coordinator, and a senior faculty of the department. The seminar should highlight – Broad project area, literature survey, problem definition, project objectives and implementation schedule of the project. Marks awarded shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

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SEMESTER-IV												
Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination					Credits
				Theory	Practical	Skill Development Activities/Tutorials	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	P	SDA/T						
1			Online Course-II									3
2	PCC	PET415P	Project Phase – II	-	36	-	-	50	50	100		18
			TOTAL	--	36	--	-	50	50	100		21

Note:
1. Project Work Phase-2:
Project work, based on the problem defined in 3rd semester should be continued and implemented in 4th semester. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the norms.

Question paper pattern: (Common to all Core and Elective Subjects)
The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50. Total of eight questions with two from each unit to be set uniformly covering the entire syllabus. Each question carries 20 marks. Each question should not have more than 3 sub divisions. Any five full questions are to be answered choosing at least one from each unit

Project Phase – 1			
Course Code	PET315P	CIE Marks	50
Teaching/Contact Hours/Week (L:T:P)	0:0:16	SEE Marks	50
Credits	08	Exam Hours	03

Course objectives:

- Support independent learning.
- Guide to select and utilize adequate information from varied resources maintaining ethics.
- Guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- Develop interactive, communication, organisation, time management, and presentation skills.
- Impart flexibility and adaptability.
- Inspire independent and team working.
- Expand intellectual capacity, credibility, judgement, intuition.
- Adhere to punctuality, setting and meeting deadlines.
- Instil responsibilities to oneself and others.
- Train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas.

Project Phase-1 Students in consultation with the guide/s shall carry out literature survey/ visit industries to finalize the topic of the Project. Subsequently, the students shall collect the material required for the selected project, prepare synopsis and narrate the methodology to carry out the project work.

Course outcomes:

At the end of the course the student will be able to:

1. Demonstrate a sound technical knowledge of their selected project topic.
2. Undertake problem identification, formulation and solution.
3. Design engineering solutions to complex problems utilising a systems approach.
4. Communicate with engineers and the community at large in written an oral forms.
5. Demonstrate the knowledge, skills and attitudes of a professional engineer

Phase-I of the project is part of the final M.Tech project. Students have to take up literature survey, formulate the problem of the project, define the project objectives and prepare the project implementation schedule. A certified report and a seminar is to be presented by the students. Evaluation of the project phase-I is to be conducted by internal examiners, a committee comprising of HoD as Chairman, PG coordinator, and a senior faculty of the department. The seminar should highlight – Broad project area, literature survey, problem definition, project objectives and implementation schedule of the project. Marks awarded for presentation shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

Internship			
Course Code	PET301I	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:16	SEE Marks	50
Credits	08	Exam Hours	03

Course objectives:

Internship/Professional practice provide students the opportunity of hands-on experience that include personal training, time and stress management, interactive skills, presentations, budgeting, marketing, liability and risk management, paperwork, equipment ordering, maintenance, responding to emergencies etc. The objective are further,

- To put theory into practice.
- To expand thinking and broaden the knowledge and skills acquired through course work in the field.
- To relate to, interact with, and learn from current professionals in the field.
- To gain a greater understanding of the duties and responsibilities of a professional.
- To understand and adhere to professional standards in the field.
- To gain insight to professional communication including meetings, memos, reading, writing, public speaking, research, client interaction, input of ideas, and confidentiality.
- To identify personal strengths and weaknesses.
- To develop the initiative and motivation to be a self-starter and work independently

Course outcomes:

At the end of the course the student will be able to:

1. Gain practical experience within industry in which the internship is done.
2. Acquire knowledge of the industry in which the internship is done.
3. Apply knowledge and skills learned to classroom work.
4. Develop a greater understanding about career options while more clearly defining personal career goals.
5. Experience the activities and functions of professionals.
6. Develop and refine oral and written communication skills.
7. Identify areas for future knowledge and skill development.
8. Expand intellectual capacity, credibility, judgment, intuition.
9. Acquire the knowledge of administration, marketing, finance and economics.

All the students have to undergo mandatory internship/training in any one of the reputed industry/ research institute. The training program has to be taken up during the vacation between 2nd and 3rd semester. The duration of the training program should be for period of 8 weeks. A report on the training is to be submitted. The supervisor/ guide from industry will allot 50 marks of the CIE, where the student undergoes training. SEE evaluation will be made by a committee comprising of HoD as Chairman, PG coordinator, and a senior faculty of the department. The SEE will be a Technical Seminar on the industrial training. Marks awarded for presentation shall be based on the evaluation of Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

Project Phase - II			
Course Code	PET415P	CIE Marks	50
Teaching Hours/Week (L:T:P)	0:0:36	SEE Marks	50
Credits	18	Exam Hours	03

Course objectives:

- To support independent learning.
- To guide to select and utilize adequate information from varied resources maintaining ethics.
- To guide to organize the work in the appropriate manner and present information (acknowledging the sources) clearly.
- To develop interactive, communication, organisation, time management, and presentation skills.
- To impart flexibility and adaptability.
- To inspire independent and team working.
- To expand intellectual capacity, credibility, judgement, intuition.
- To adhere to punctuality, setting and meeting deadlines.
- To instil responsibilities to oneself and others.
- To train students to present the topic of project work in a seminar without any fear, face audience confidently, enhance communication skill, involve in group discussion to present and exchange ideas

Course outcomes:

At the end of the course the student will be able to:

1. Present the project and be able to defend it.
2. Make links across different areas of knowledge and to generate, develop and evaluate ideas and information so as to apply these skills to the project task.
3. Habituated to critical thinking and use problem solving skills
4. Communicate effectively and to present ideas clearly and coherently in both the written and oral forms.
5. Work in a team to achieve common goal.
6. Learn on their own, reflect on their learning and take appropriate actions to improve it.

Project work, based on the problem defined in 3rd semester should be continued and implemented in 4th semester. The implementation of the project work can be done either in a reputed industry/ research organization/ parent institute.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a Senior faculty of the department. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report subjected to plagiarism check, Project Presentation skill and performance in Question and Answer session in the ratio 50:25:25.

SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the norms.

Syllabus of Core Subjects

Solar Energy Conversion Systems

Course Code	**PET101C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit - 1

- Properties of Solar Radiation: Glossary of Key PV Terms, Sun and Earth, Extraterrestrial Radiation, Radiation on the Horizontal Plane of the Earth's Surface, Simple Method for Calculating Solar Radiation on Inclined Surfaces, Radiation Calculation on Inclined Planes with Three Component Model.

Unit - 2

- Approximate Annual Energy Yield for Grid-Connected PV Systems, Composition of Solar Radiation, Solar Radiation Measurement.
- Solar Cells: Their Design Engineering and Operating Principles, The Internal Photoelectric Effect in Semiconductors, A Brief Account of Semiconductor Theory.

Unit - 3

- The Solar Cell: A Specialized Semiconductor Diode with a Large Barrier Layer that is Exposed to Light. Solar Cell Efficiency, The Most Important Types of Solar Cells and the Attendant Manufacturing Methods, Bifacial Solar Cells, Examples
- Solar Units and Solar Generators: Solar Units, Potential Solar Cell Wiring Problems, Interconnection of Solar Units and Solar Generators.
- Solar Generator Power Loss Resulting from Partial Shading and Mismatch Loss - Power Loss Induced by Unit Shading, Mismatch Loss Attributable to Manufacturing Tolerances, Mismatch Loss Attributable to String Inhomogeneity, Examples, PV Energy Systems: Stand-alone PV Systems, Grid-Connected Systems -Grid-Connected Operation, Design Engineering and Operating Principles of PV System Inverters

Unit - 4

- Standards and Regulations for Grid-Connected Inverters, Avoidance of Islanding and Stand-alone Operation in Grid Inverters. Operating Performance and Characteristics of PV Grid Inverters - Conversion Efficiency, MPP Tracking Efficiency and MPP, PV Energy Systems (continued): Control Characteristics, Overall Inverter Efficiency, Dynamic MPP Tracking Test - Simple Dynamic MPP Tracking Test Using Quasi-square Test Patterns

Course outcomes:

At the end of the course the student will be able to:

- Students shall be able to list and define various parameters, features involved/related to Solar radiation, Solar cells- Units-arrays, solar generator, Grid connected inverters
- Students shall be able to explain different theories and concepts related to Solar radiation, Solar cells- Units-arrays, solar generator, Grid connected inverters
- Students shall be able to relate/articulate the concepts and theories of Solar radiation, Solar cells-Units-arrays, solar generator, Grid connected inverters
- Students shall be able to compare and contrast the features of Solar radiation, Solar cells- Units-arrays, solar generator, Grid connected inverters
- Students shall be able to evaluate/calculate various parameters related to Solar radiation, Solar cells-Units-arrays, solar generator, Grid connected inverters
- Students shall be able to discuss/choose/test issues relating to Solar radiation, Solar cells- Units-arrays, solar generator, Grid connected inverters

Reference Books

1. S P Sukhatme, J K Nayak, Solar Energy, 4th Edition, Mc Graw Hill Education, 2017
2. Jeffrey Brownson, Solar Energy Conversion Systems, 1st Edition, Elsevier, 2014
3. Richard.C. Neville, Solar Energy Conversion Systems, 2nd Edition, Elsevier, 2012
4. B. H. Khan, Non-Conventional Energy Resources, 2nd edition, Tata McGraw Hill Publishing Company Ltd.

Energy Audit and Demand Side Management			
Course Code	**PET102C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Energy Definitions & Forms: Potential Energy – chemical, stored mechanical, nuclear and gravitational; Kinetic Energy – electrical, radiant, thermal, sound, and motion energies (only definitions); Units and Conversions; GDP, GNP and Per Capita Energy Consumption; Renewable Energy Act, International Energy Agency, OECD and Kyoto Protocol (only overview)

Economic analysis of investment, Cash Flows and CF diagrams, Economic analysis technique – Simple payback period method, Discounted cash flow method or Time adjustment technique, Net present value method, Present value index method or Profitability index method, Internal rate of return method, Accounting on average rate of return method;

Unit - 2

Interest Factors – Single Payment Compound Amount (SPCA), Single Payment Present Worth (SPPW), Uniform Series Compound Amount (USCA), Sinking Fund Payment (SFP), Uniform Series Present Worth (USPW), Capital Recovery (CR). (Simple Numerical problems).

Energy management, Energy audit – Need for energy audit, Scope of energy audit, methodology; TyPET of energy audit – Preliminary energy audit, Detailed energy audit; Material and energy balance – Material balance, Energy balance, Sankey Diagram; Energy auditing instruments, Developing energy use profiles – Case studies

Unit – 3

Determination of energy saving, Determination of load, Assessment of economic feasibility, Choice of energy efficient motor, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load, Power factor, unbalance phase voltage, Motor improvement program

Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Colour rendering index(CRI); Characteristic of different tyPET of lamps, Aspects of lighting system designing, Installed load efficacy ratio, Various means of energy savings – Use of natural day light, Reduction in light fixture, High efficiency lamps and luminaries, Effect of reduction in supply voltage on energy consumption, Electronic ballast and low loss electromagnetic choke, Timers and occupancy sensors, Fluorescent tube light,

Unit – 4

Introduction, Results of energy conservation, Principles of energy conservation, Energy conservation planning, Energy conservation Act,;Energy conservation in residential and commercial sectors, Energy conservation in transportation, considerations for Energy conservation in industry, Energy conservation in electricity generation, transmission and distribution, Energy conservation in agricultural sector. Energy efficiency and DSM, Motivation for DSM, Institutional requirements and Incentives, DSM Techniques, Load control, Effects of DSM on load shape, DSM program approaches, Analysis of DSM options, Delivery mechanism for DSM program, DSM program design and implementation, Implementation issues, International experience of DSM, Utility-Initiated DSM action in India.

Course outcomes:

At the end of the course the student will be able to:

- Students should be able to define/list different energy resources, energy management/audits, energy efficient motors, lighting terminologies and demand side management terminologies.
- Students should be able to describe/explain energy economic methods, energy audit methods, lighting criteria and DSM techniques
- Students should be able to compute/determine numerical problems & interpret outcomes related to energy economics and energy efficient motors
- Students should be able to compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques

• Students should be able to evaluate various methods of energy conservation and DSM in different sectors like agriculture, commercial, transpiration and domestic • Students should be able to design and develop methods/techniques for energy conservation, audit & management
Reference Books
1. Suresh Kumar Soni and Manoj Nair, Energy Conservation and Audit, Satya Prakashan, New Delhi, 2010 2. Larry C. White, Philip S. Schmidt, David R. Brown, “Industrial Energy Management Systems”, Hemisphere Publishing Corp, New York. 3. Rajiv Shankar, Energy Auditing in Electrical Utilities, Viva Books, New Delhi 2010 4. Albert Thumann, “Fundamentals of Energy Engineering”, Prentice Hall Inc, Englewood Cliffs, New Jersey.

Wind Energy Conversion Systems			
Course Code	**PET103C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit- 1

Introduction: Nature of wind, historical uses of wind, history of wind electric generation, working principle of wind turbines (lift and drag mechanism), components of horizontal and vertical axis wind turbines, classification, applications, advantages and disadvantages.

Unit - 2

Wind Data Analysis: Wind velocity – measurement and representation, wind speed statistics, probability distribution functions – Weibull and Raleigh.

Performance of Wind Turbine Generators: Basics of fluid mechanics (simple terms & definitions), elementary fluid flow concepts,

Unit - 3

Power in the wind, maximum power output of wind turbine (Betz limit), axial force and thrust on blades, torque developed by turbine, dynamic matching for maximum power extraction - tip speed ratio & blade pitch angle, power vs wind speed characteristics, electrical power output from wind energy conversion system, capacity factor, energy production.

Unit - 4

Electric Generators for WECS: Classification, basic working principle, advantages and disadvantages.

Grid-connected and Self-excited Induction Generator Operation: Constant-voltage, constant-frequency generation, reactive power compensation, variable-voltage, variable-frequency generation, effect of wind generator on the network.

Wind Energy Conversion Systems (WECS): Stand-alone and grid connected wind farms, simulation model of WECS. Site matching of wind turbine generators. Economics of wind systems: Reliability consideration, estimation of O&M costs, capital costs, cost of energy, estimation of payback period

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Course outcomes:

At the end of the course the student will be able to:

1. Students shall be able to list and define various parameters, features involved/related to Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems
2. Students shall be able to explain different theories and concepts related to Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems
3. Students shall be able to relate/articulate the concepts and theories of Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems
4. Students shall be able to compare and contrast the features of Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems
5. Students shall be able to evaluate/calculate various parameters related to Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems
6. Students shall be able to discuss/choose/test issues relating to Wind energy basics, Wind data analysis, Performance of Wind Turbine Generators, different schemes of wind energy conversion systems

Reference Books

1. Bhadra, S. N., Kashta, D., and Bannerjee, S., Wind Electrical Systems, Oxford University Press, New Delhi, 2009.
2. Gary L. Johnson, Wind Energy Systems, Prentice hall Publication.
3. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers New Delhi, 2007.
4. B. H. Khan, Non-Conventional Energy Resources, 2nd edition, Tata McGraw Hill Publishing Ltd. New Delhi, 2009
5. D. Mukhaerjee and S. Chakrabarti, Fundamentals of Renewable Energy Systems, New Age International Publishers New Delhi, 2007.

Research Methodology			
Course Code	**PET104C**	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:2	SEE Marks	50
Credits	04	Exam Hours	03

Unit-1

Research Methodology: Introduction, Meaning of Research, Objectives of Research, TyPET of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem, An Illustration.

Unit-2

Reviewing the literature: Place of the literature review in research, Bringing clarity and focus to research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Unit-3

Design of Sample Surveys: Design of Sampling: Introduction, Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey, TyPET of Sampling Designs.

Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Techniques, Multidimensional Scaling, Deciding the Scale.

Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Unit-4

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis Testing for Mean, Proportion, Variance, for Difference of Two Mean, for Difference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis.

Chi-square Test: Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautions in Using Chi Square Tests.

Course outcomes:

At the end of the course the student will be able to:

- Discuss research methodology and the technique of defining a research problem
- Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
- Explain various research designs, sampling designs, measurement and scaling techniques and also different methods of data collections.
- Explain several parametric tests of hypotheses, Chi-square test, art of interpretation and writing research reports
- Discuss various forms of the intellectual property, its relevance and business impact in the changing global business environment and leading International Instruments concerning IPR.

Textbooks

1. Research Methodology: Methods and Techniques, C.R. Kothari, Gaurav Garg, New Age International, 4th Edition, 2018.
2. Research Methodology a step-by-step guide for beginners, Ranjit Kumar, SAGE Publications, 3rd Edition, 2011.
3. Research Methods: the concise knowledge base, Trochim, Atomic Dog Publishing, 2005.
4. Conducting Research Literature Reviews: From the Internet to Paper, Fink A, Sage Publications, 2009.

Syllabus of Elective Subjects

Energy Conversion Technologies

Course Code	PET001E	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit - 1

Energy and Energy Efficiency: Energy Sources, Energy Efficiency and Contemporary Trends. Storage and Usage of Energy: Overview, Storage of Energy as Electrochemical Energy, Storage of Energy as Electromagnetic Energy, Storage of Energy as Electrostatic Energy, Storage of Energy as Mechanical Energy, Using the Energy as Electrical Energy.

Unit - 2

Power Electronics and Its Role in Effective Conversion of Electrical Energy: Overview, Principles of Conversion of Electrical Energy, Computer-Aided Design of Power Electronic Converters in Power Electronics. AC/DC Conversion: Basic Indicators in Respect to the Supply Network, Single-Phase and ThreePhase Uncontrolled Rectifiers, Single-Phase and Three-Phase Controlled Rectifiers, Bidirectional AC/DC Conversion, Methods to Improve Power Efficiency in AC/DC Conversion,

Unit - 3

AC/AC Conversion: Basic Indicators in Respect to the Supply Network, Single-Phase and ThreePhase AC Regulators, Methods to Improve Power Efficiency in AC/AC Conversion. DC/DC Conversion: Basic Indicators, Conversion Without Galvanic Isolation, Conversion with Galvanic Isolation, Bidirectional DC/DC Conversion, Methods to Improve Power Efficiency in DC/DC Conversion.

DC/AC Conversion: Basic Indicators, Single-Phase and Three-Phase Converters, Methods to Improve Power Efficiency in DC/AC Conversion. Conversion of Electrical Energy in the Processes of Its Generation and Transmission: Conversion in the Process of Electrical Generation, Static VAR Compensators, (SVC), (STATCOM), (TCSC), (SSSC), (UPFC), Interline Power Flow Controller (IPFC), High Voltage DC Transmission

Unit - 4

Uninterruptible Power Supply Systems: Introduction, Basic Schemas and Their Indicators, Methods to Increase the Reliability, Communication between UPS Systems and Different Systems. Other Applications of Converters and Systems of Converters: Industrial Applications, Transport Applications, Home Appliances, Elevators, Applications in Communication, Medical Applications

Course outcomes:

At the end of the course the student will be able to:

- Students shall be able to list and define various parameters, features involved/related to Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems
- Students shall be able to explain different theories and concepts related to Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems
- Students shall be able to relate/articulate the concepts and theories of Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems
- Students shall be able to compare and contrast the features of Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems
- Students shall be able to evaluate/calculate various parameters related to Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems
- Students shall be able to discuss/choose/test issues relating to Energy and Energy Efficiency, AC/DC and DC/AC conversions, Uninterruptible Power Supply Systems

Reference Books

1. Mihail Hristov Antchev, Technologies for Electrical Power Conversion, Efficiency, and Distribution: Methods and Processes, Engineering science reference 2010
2. Kiefer, Johannes, Hillerbrand, Rafaela, Energy Conversion, 1st Edition, Springer-Verlag London, 2020
3. Dr. Adesola Lajide, Energy Conversion Technologies, Smartlaj Publishing House, Nigeria, 2014.
4. D. Yogi Goswami, Frank Kreith, Energy Conversion, 2nd Edition, CRC Press, 2017.

Electric Smart Grid			
Course Code	PET002E	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit - 1

Introduction: Introduction to Smart Grid, Architecture of Smart Grid, Smart Grid standards and policies, Smart Grid control layer and elements. Distributed generation resources, Smart Grid components control elements, Smart Grid Technologies, Plug-in-Hybrid Vehicles (PHEV).

Unit – 2

State Estimation: State Estimation for low voltage networks, Smart Grid Monitoring, Phasor measurement units, Phasor estimation, Dynamic Phasor estimation. Islanding detection, Islanding relays, Fault Detection, Isolation, and Service Restoration. Digital relays for Smart Grid protections; relay co-ordination.

Unit – 3

Modelling of AC Smart Grid components: Modelling of AC Smart Grid components, Modelling of DC Smart Grid components, Modelling of DC Smart Grid components, Modelling of storage devices. Operation and control of AC Smart Grid, Operation and control of DC Smart Grid, Simulation and case study of AC microgrid.

Unit – 4

DC Microgrid and Demand Response Analysis: Simulation and case study of DC microgrid, Operation and control of hybrid Smart Grid-I, Operation and control of hybrid Smart Grid-II, System analysis of AC/DC Smart Grid, Simulation and case study of hybrid microgrid.

Demand side management of Smart Grid, Demand response analysis of Smart Grid, Energy Management, Design and Practical study of Smart Grid test bed, Conclusions

Course outcomes:

At the end of the course the student will be able to:

- List the low carbon technologies, AC-DC smart grid & its architecture
- Describe the smart grid architecture and its efficient usage
- Apply the modelling techniques for DC & AC smart grid
- Analyse the various AC-DC microgrid technologies and its architecture
- Compare and contrast the AC-DC microgrid technologies and its architecture
- Design & Develop the modelling of SC-DC microgrid according to standards

Reference Books

1. Yokoyama, Nick Jenkins, “Smart Grid: Technology and Applications”- Wiley, 2012.
2. James Momoh, “Smart Grid: Fundamentals of Design and Analysis”-Wiley, IEEE Press, 2012.
3. Stuart Borlase ‘Smart Grid: Infrastructure, Technology and Solutions’, CRC Press 2012.
4. Vehbi C. Güngör, DilanSahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, ‘Smart Grid Technologies: Communication Technologies and Standards’ IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011

Fundamentals of Energy Engineering-I			
Course Code	**PET003E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Fundamental concepts and definitions: Units and dimensions; Thermodynamics; Thermodynamic system: closed system, open system and isolated system; Thermodynamic property: intensive property and extensive property; Thermodynamic state; Thermodynamic process (change of state); Thermodynamic cycle; Point and path function.

Work and Heat: Thermodynamic definition of work; Work done in frictionless quasi-equilibrium process; Pdv work; various quasi-static processes, Heat: definition, Comparison of heat and work, difference between heat and work; simple numerical on heat and work.

Unit – 2

Laws of Thermodynamics: First law of thermodynamic for a closed system under going a cyclic process; First law of thermodynamic for a closed system under going a non-cyclic process; First law of a closed system for different process; Simple numerical; First law of thermodynamic for an open system (SFEE) and its applications; Simple numerical; Second law of thermodynamic and its applications (Heat engine and reversible heat engine); Reversible and irreversible process; Basic power generating cycles: Carnot cycle and Ranking cycle.

Unit – 3

Fluid Mechanics: Continuity equation; classification of flows; Euler's equation of motion; Bernoulli's equation: assumptions, statement, equation, for real fluids, practical applications of Bernoulli's equation, simple numerical; Flow through piPET: major losses, Darcy-Weibach formula; Minor losses: sudden expansion, sudden contraction, bend, pipe fitting and an obstruction in piPET; Simple numerical.

Unit – 4

Modes of heat transfer: conduction, convection and radiation; Basic laws governing heat transfer; Simple numerical; Combined heat transfer mechanism; One dimensional conduction heat transfer: in rectangular co-ordinate for plane wall, hollow cylinder and hollow sphere;

Heat Exchanger: Definition; parallel flow, counter flow, cross flow and shell & tube type; Over all heat transfer co-efficient (U): Wall and hollow cylinder; Analysis of a heat exchanger: energy balance, LMTD for parallel and counter flow heat exchanger; Simple numerical on above topics

Course outcomes:

At the end of the course the student will be able to:

- Students should be able to define all the terms associated with thermodynamics principles
- Students should be able to explain the laws of thermodynamics, fluid mechanics, heat transfer and heat exchangers
- Students should be able to solve numerical problems on thermodynamic laws, fluid mechanics, heat transfer systems and energy balance.
- Students should be able to compare and contrast the types of fuels, carnot & ranking cycles, modes of heat transfer,
- Students should be able to operate / simulate different combustion systems to conduct tests, observe and draw the inference based on the results
- Students should be able to design / Model / develop innovative technologies in heat transfer

Reference Books

1. M.W. Zemansky, Heat and Thermodynamics, 7th edition,Mc Graw Hill, 1977.
2. Yunus A. Cenegal and Michael A. Boles, Thermodynamics an Engineering Approach, 5th edition, Tata McGraw hill Pub. 2006
3. B.K.Venkanna, Applied Thermodynamics, Ellite Publisher, Mangalore/ PHI Learning Private Limited, New Delhi
4. B.K.Venkanna, Basic Thermodynamics, PHI Learning Private Limited, New Delhi, 2005.
5. John F. Douglas et al., Fluid Mechanics, 4th Edition, Pearson Education, 2003.
6. A.K.Mohanty, Fluid Mechanics, 2nd edition, PHI Learning Private Limited, 1994.
7. Frank P. Incropera and David P. De Witt, Fundamentals of Heat and Mass Transfer, Willey Stdent Edition, 2008

IOT and Applications			
Course Code	**PET004E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics

Unit – 2

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit – 3

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model-Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture-Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit – 4

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization

IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Course outcomes:

At the end of the course the student will be able to:

- Understand the concepts of Internet of Things
- Analyze basic protocols in wireless sensor network
- Implement basic IoT applications on embedded platform
- Design IoT applications in different domain and analyze their performance
- Understand the different architecture of IoT.
- Design IoT applications in different domain and analyze their performance

Reference Books

1. Vijay Madisetti and Arshdeep Bahga, “Internet of Things (A Hands-on-Approach)”, 1 st Edition, VPT, 2014
2. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013 limited, second edition.
3. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"

Autotronics (Automotive Electronics)			
Course Code	PET005E	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Introduction: Need For Electronics In Automotive Control Systems, Structure Of Vehicle Electronics Systems, Common Features Of Vehicle Systems, Measurement System, Sensors And Actuators.

Introduction To Electronics: Electronic Components, Diodes, Transistors, Electronic Circuits, Analog Circuits, Digital Circuits, Integrated Circuits, Microprocessor Systems, Systems Approach To Control And Instrumentation.

Unit – 2

Electronic Ignition Systems: Types Of Ignition Systems, Conventional Ignition System, Cdi, Programmed Ignition System, Distributor-Less Ignition System, Direct Ignition.

Electronic Fuel Control: Electronic Control Of Carburetion, Petrol Injection System, Single And Multi Point Injection System, Components, Flow Diagram, Diesel Fuel Injection.

Unit – 3

Engine Management System: Combined Ignition And Fuel Management System, Exhaust Emission Control, Digital Control Techniques, Complete Vehicle Control Systems, Artificial Intelligence And Engine Management

Chassis Electrical Systems: Anti-Lock Brakes, Active Suspension, Traction Control, Electronic Control Of Automatic Transmission.

Unit – 4

Electronics For Comfort, Safety And Security: Electric Seats, Mirrors And Sun-Roof Operation, Central Looking And Electric Windows, Cruise Control, In Car Entertainment (Ice) And Communications, Adaptive Noise Control, Airbags And Seatbelt Tensioners, Obstacle Avoidance Radar, Security Systems - Engine Immobilizer, Icat.

Course outcomes:

At the end of the course the student will be able to:

- Justify the need of Autotronic systems and explain the construction of various electronically controlled chassis and vehicle safety systems.
- analyze the working of electronic control systems used in modern automobiles
- apply the knowledge of working of various sensors in the control of vehicular systems
- compare the working of programmed control systems with conventional vehicular control systems
- evaluate the performance of vehicle embedded with engine management systems

Reference Books

1. Automotive electrical and electronic systems: Tom Denton, 3rd edition, SAE International.
2. Automotive electronics: Eric Chowanietz, Newnes, 1995.
3. Understanding automotive electronics, William B Ribbens, Butterworth-Heinemann.
4. Automotive Electrics Automotive Electronics, Robert Bosch.

Power System SCADA			
Course Code	PET006E	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

State Estimation in Energy Control Centers (ECC): Introduction, power system measurements, states of power systems, components of modern ECC, overview of different state estimator techniques, bad data handling, observability analysis.

What is a SCADA System? History of Critical Infrastructure Directives, SCADA System Evolution, Definitions, SCADA System Architecture, SCADA Applications, SCADA System Security Issues Overview, SCADA System Desirable Properties.

SCADA Systems in the Critical Infrastructure: Employment of SCADA Systems

Unit – 2

The Evolution of SCADA Protocols: Background Technologies of the SCADA Protocols, SCADA Protocols(The MODBUS Model, The DNP3 Protocols, UCA 2.0 and IE61850 Standards, Control area Network, Control and Information Protocol, Device Net, Control Net, Ether Net/IP,FFB, Profibus, The Security Implications of the SCADA Protocols, Demilitarized Zone.

SCADA Vulnerabilities and Attacks: The Myth of SCADA Invulnerability, SCADA Risk Components, Risk Management Components, Assessing the Risk, Mitigating the Risk, SCADA Threats and Attack Routes, SCADA Honeynet Project. SCADA Security Methods and Techniques: SCADA Security Mechanisms, SCADA Intrusion Detection Systems. SCADA Security Standards and Reference Documents

Unit – 3

Power System Automation: Introduction, Overview of - power system instrumentation, power system metering, power plant automation, substation automation, transmission management, distribution management – SCADA/distribution management, distribution automation – feeder automation, demand side management, load management.

Unit – 4

Substation Automation and Protocol Standards for Power Systems: Need for Automation, Definition of Integration and Automation, Substation control panels – with electromechanical devices, with Intelligent Electronic Devices (IED), Automatic load restoration – intelligent bus fail over, supply line sectionalizing.

Substation : Monitoring of equipment condition, alarm processing, power quality, switched feeder capacitor banks, equipment rating. Integrated protection functions – adaptive relaying.

Course outcomes:

At the end of the course the student will be able to:

- List the state estimation techniques and SCADA protocols
- Illustrate the SCADA architecture, evolution and automation
- Obtain the protocols and evolution of SCADA and automation
- Analyse the protocols and evolution of SCADA and automation
- Compare and contrast theSCADA in power system and distribution system
- combine and revise various protocols and its standard of power system SCADA

Reference Books

1. Krutz , Ronald L , Securing Scada Systems 2ndedition, Wiely publishers, 2005.
2. Michael Wiebe, A Guide to Utility Automation: Amr, SCADA, and It Systems for Electric Power, Wiely Publishers, 2005.
3. Green, J. N, Wilson, R, “Control and Automation of Electric Power Distribution, Taylor and Francis, 2007.
4. Handschin, E. “Real Time Control of Electric Power Systems”, Elsevier, 1972
5. Wood, A. J and Wollenberg, B. F, “Power Generation Operation and Control”, 2 nd Edition John Wiley and Sons, 2003.

Battery Management System			
Course Code	**PET007E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Battery-Management-System Requirements: Introduction and BMS functionality. Requirements: Sensing, High-voltage contactor control, Isolation sensing and thermal control, Protection and interface, State-of-charge estimation and Energy & power estimation.

Simulating Battery Packs: Modeling approach: Equivalent-circuit models, Physics-based, Simulating an electric vehicle, Equations for vehicle dynamics, Vehicle range calculations, example, Simulating constant power and voltage, Simulating battery packs.

Unit –2

Battery State Estimation: Preliminary definitions, approaches to estimate state of charge, Review of probability, Overview of vector random (stochastic) processes, Sequential-probabilistic-inference solution, The six-step process, Deriving the linear Kalman filter, Visualizing the Kalman filter, MATLAB code for the Kalman filter steps, Practical considerations, The extended Kalman filter (EKF), An EKF example, with code, Preparing to implement EKF on ESC model, Implementing EKF on ESC model, Problems with EKF, improved with sigma-point methods, The SPKF steps, An SPKF example, with code, mplementing SPKF on ESC model, Real-world issues pertaining to sensors, initialization, Real-world issues: Speed, solved by "bar-delta" filtering, Bar-delta filtering using the ESC cell model, Example of bar-delta, using desktop validation.

Unit – 3

Battery Health Estimation: Introduction, Lithium-ion aging: Negative electrode, Lithium-ion aging: Positive electrode, Sensitivity of voltage to ESR and total capacity, A Kalman filter framework for estimating parameters, EKF for parameter estimation, Simultaneous state and parameter estimation, Robustness and speed, The problem with least-squares capacity estimates, Derivation of weighted ordinary least squares, Derivation of weighted total least squares, Goodness of the model fit and confidence intervals, Simplified method with proportional confidence on xi and yi, Approximate full solution: Cost function, Approximate full solution: Derivation, Example simulations, HEV cases, Example simulations, BEV cases.

Three Phase DC-AC Inverters: 180-Degree Conduction with Star Connected load.

Voltage Control of DC-AC Inverters Using PWM: Need for PWM in Voltage Source Inverters, Sinusoidal Pulse Width Modulation.

Unit – 4

Cell Balancing: Causes (and not causes) of imbalance, Design choices when implementing balancing, Circuits for balancing (1): Passive, Circuits for balancing (2): Active, capacitive, Circuits for balancing (3): Active, inductive and dc-dc, How quickly must I balance a pack? And results of balancing simulations.

Voltage-Based Power-Limit Estimation: Problem definition, Voltage-based rate limits, using simple cell model, Voltage-based rate limits, using comprehensive cell model, Bisection search and Power-limits estimation example.

Physics-Based Optimal Controls: Degradation as basis for power limits, Full-order model of SEI formation and growth, Simplifying the model, Simplifying the calculation, Comparing the models, Lithium deposition on overcharge, Simulation and results, Optimized controls for power estimation, Plug-in charging., Fast-charge example and Dynamic power calculation.

Course outcomes:

At the end of this course

- Students should be able to define all the terms associated with battery terminologies, Electric vehicles and different filters and methods of optimal control
- Students should be able to explain the tyPET of battery tests and methods employed to determine

SoC and SoH.

- Students should be able to solve numerical problems on Fundamental aspects of a Rechargeable Battery, Performance Parameters & Specifications, Battery Cell Voltage Equalization
- Students should be able to compare and contrast the tyPET of battery state of charge & health estimation methods and control methods for optimal performance of battery
- Students should be able to operate the batteries to conduct tests, observe and draw the inference based on the test results on existing batteries
- Students should be able to develop innovative technologies and battery management system for energy conservation

Reference Books

1. A.R. JHA, Next-Generation Batteries and Fuel Cells for Commercial, Military, and Space Applications, CRC Press, 2012.
2. Sheldon S. Williamson, Energy Management Strategies for Electric and Plug-in Hybrid Electric, Springer, 2013.
3. Gregory L. Plett, Battery Management Systems, Volume 1: Battery Modeling, Artech House September 2015

Electric Vehicles			
Course Code	**PET008E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Motion and dynamic equations for vehicles: General description of vehicle movement; Total driving resistance & Dynamic equation, Adhesion, Dynamic wheel radius and slip.

Vehicle Power Plant and Transmission Characteristics: Drive train Configuration, Electric Motor and Vehicle performance

Introduction to EVs: Historical Journey of Hybrid and Electric Vehicles, Historical development (root) of Automobiles, Economic and Environmental Impact of Electric Hybrid Vehicle

Unit – 2

Basic Architecture of Hybrid Drive Trains and Analysis of Series Drive Train: The Hybrid Electric Vehicle (HEV), Energy Use in Conventional Vehicles, Energy Savings Potential of Hybrid Drivetrains and HEV Configurations.

Power Flow in HEVs: Power Flow Control, Power Flow Control in Series, Parallel Hybrid, Series-Parallel and Complex Hybrid.

Torque Coupling and Analysis of Parallel Drive Train: Parallel Hybrid Electric Drive Trains.

Basic Architecture of Electric Drive Trains: Electric Vehicle (EV) Configuration & Drivetrain, Alternatives Based on Drivetrain Configuration and Power Source Configuration

Unit – 3

DC-DC Converters for EV and HEV Applications: EV and HEV Configurations, Classification of Converters, Principle of Step Down Operation, Boost and Buck-Boost Converters: Principle of Step-Up Operation (Boost Converter), Multi Quadrant DC-DC Converters I, Multi Quadrant DC-DC Converters II,

DC-DC Converters for EV and HEV Applications: Multi-input DC-DC Converters, Flux Additive DC-DC Converter. DC-AC Inverter for EV and HEV Applications: DC-AC Converters, Principle of Operation of Half Bridge DC-AC Inverter, Single Phase Bridge DC-AC Inverter.

Unit – 4

Three Phase DC-AC Inverters: 180-Degree Conduction with Star Connected load.

Voltage Control of DC-AC Inverters Using PWM: Need for PWM in Voltage Source Inverters, Sinusoidal Pulse Width Modulation.

Permanent Magnet Motors: Introduction, Principle of Operation of PM Machine, Operation of PM Machine Supplied by DC-AC Converter with 120^o, 180^o Mode of Operation

Course outcomes:

At the end of this course

- Students should be able to define all the terms associated with Electric vehicles and converter switches
- Students should be able to explain the types of EVs, converter topologies, Motor Drive Technologies, EV & HEV Subsystems
- Students should be able to solve numerical problems on Fundamental aspects of a Rechargeable Battery, Performance Parameters & Specifications, Battery Cell Voltage Equalization and Electric Vehicles
- Students should be able to compare and contrast the tyPET of EVs based on applications, battery requirements and converter topologies.
- Students should be able to operate / simulate EVs to conduct tests, observe and draw the inference based on the test results on existing EVs
- Students should be able to design / Model / develop innovative technologies in energy management system for EVs.

Reference Books

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Fundamentals of Energy Engineering-II			
Course Code	PET009E	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Fuels: Introduction to fuels, properties of liquid fuels, coal classification, properties of coal; physical properties, chemical properties. Properties of gaseous fuel, LPG, Natural gas.

Combustion Thermodynamics: Combustion- complete, incomplete; Air for combustion- Theoretical, excess, problems; Exhaust gas analysis; Enthalpy of formation, enthalpy and energy of combustion, combustion efficiency, Adiabatic flame temperature.

Unit – 2

Boilers: Introduction, Boiler specification, Indian boiler regulation, IBR steam boilers, IBR steam pipe. Boiler systems. Boiler tyPET and classification- Fire tube, water tube.

Performance Evaluation of Boilers: Boiler efficiency – The direct method, The indirect method, Problems. Boiler evaporation ratio. Intermittent blow down- Continuous blow down, blow down calculation, Benefits of blow down. Energy conservation opportunities.

Unit – 3

Steam System: Introduction, properties of steam, PT and PV diagrams, triple point, critical point, sub cooled liquid, saturated liquid, wet steam, saturated vapour, superheated vapour. Enthalpy, sensible heat, latent, total, superheat; Dryness factor, T.S and H.S diagrams and representations of various processes on these diagrams. Numerical problems. Steam distribution, features of steam piping, steam pipe sizing and design.

FBC Boilers: Introduction, mechanism of fluidized bed combustion, tyPET of fluidized bed combustion boilers, Advantages of fluidized bed combustion boilers

Unit – 4

Cogeneration: Need for cogeneration, principal of cogeneration, technical potions for cogeneration – Steam turbine cogeneration systems, gas turbine cogeneration systems, reciprocating engine cogeneration systems. Classification of cogeneration systems: Topping cycle, bottoming cycle. Important technical parameters for cogeneration, Prime movers for cogeneration, case study.

Waste Heat Recovery: Introduction, Heat losses- quality and quantity. Commercial waste heat recovery devices – Recuperators, convective hybrid Recuperators, ceramic Recuperators, regenerators, case study.

Course outcomes:

At the end of the course,

- Students should be able to define all the terms associated with fuels, boilers, steam systems (T.S & H.S), combustion process & cogeneration
- Students should be able to explain all the types of fuels boilers, steam systems and cogeneration & waste heat recovery
- Students should be able to solve numerical problems on boiler tubes, combustion efficiency, T.S and H.S and cogeneration systems
- Students should be able to compare and contrast the types of Boilers, cogeneration systems and recuperators
- Students should be able to operate / simulate different combustion systems to conduct tests, observe and draw the inference based on the results
- Students should be able to design / Model / develop innovative technologies in waste heat management technologies

Reference Books

1. P. K. Nag, Basic and Applied Thermodynamics, Tata Mcgraw Hill.
2. Rajaput, Engineering Thermodynamics, 6th edition, Laxmi Publication Pvt Ltd, 2008.
3. B. K. Venkanna, Applied Thermodynamics, Ellite Publisher, Mangalore/ PHI Learning Private Limited, New Delhi
4. B. K. Venkanna, Basic Thermodynamics, PHI Learning Private Limited, New Delhi, 2005.
5. John F. Douglas et al., Fluid Mechanics, 4th Edition, Pearson Education, 2003.
6. A.K.Mohanty, Fluid Mechanics, 2nd edition, PHI Learning Private Limited, 1994.
7. B. K. Venkanna, Heat and Mass Transfer, Ellite Publisher, Manglaore/ PHI Learning Private Limited, New Delhi, 2010.

Reliability Evaluation of Engineering Systems			
Course Code	**PET010E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit - 1

Introduction: TyPET of systems, qualitative and quantitative assessment, reliability definitions and concepts, reliability indices and criteria, reliability and availability, absolute and relative reliability, reliability evaluation techniques, reliability improvements, reliability activities in system design, reliability economics.

Unit - 2

Basic Probability Theory: Probability concepts, Permutations and combinations, Practical engineering concepts, Venn diagrams, Rules for combining probability, Probability distributions.

Applications of Binomial Distribution: Binomial distribution concepts, Properties of the binomial distribution, engineering applications.

Unit - 3

Network Modeling and Evaluation of Simple Systems: Network modeling concepts, Series systems, Parallel systems, series-parallel systems, partially redundant systems.

Network Modeling and Evaluation of Complex Systems: Modeling and evaluation concepts, Conditional probability approach, Cut set method, Application and comparison of previous techniques, Tie set method, Connection matrix technique, Event trees, and Fault trees.

Unit - 4

Probability Distribution in Reliability Evaluation: Distribution concepts, Terminology of distribution, General reliability functions, Evaluation of the reliability functions, Shape of reliability functions, The poisson distribution, Normal distribution, Exponential distribution , weibull. Data analysis: Concepts, frequency distributions.

System Reliability Evaluation using Probability Distribution: Introduction, Series systems, Parallel systems, partially redundant systems, Mean time to failure. Standby systems: General concepts, perfect switching, imperfect switching, effect of spare components, Non identical components, failures in the standby mode. Wear out and component reliability, Maintenance and component reliability.

Course outcomes:

At the end of the course the student will be able to:

- Students shall be able to list and define various parameters, features involved/related to tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions
- Students shall be able to explain different theories and concepts related to tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions
- Students shall be able to relate/articulate the concepts and theories of tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions
- Students shall be able to compare and contrast the features of tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions
- Students shall be able to evaluate/calculate various parameters related to tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions
- Students shall be able to discuss/choose/test issues relating to tyPET of systems, reliability concepts, Network modelling of simple and complex systems, Probability distributions

Reference Books

1. Billinton and Allan, Reliability Evaluation of Engineering Systems, 2nd edition, Springer (India) Private Limited, 2008 (India) Private
2. Alessandro Birolini, Reliability Engineering- Theory and Practice, 8th Edition, Springer, 2010
3. Meyer, Introductory Probability and Statistical Applications, 2nd edition, Addison Wesley Publishing Company.
4. Irwin Miller, John E. Freund, Probability and Statistics for Engineers, 3rd edition, Prentice Hall International Publication, 2006.

Carbon Capture and Storage			
Course Code	**PET011E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Introduction: The carbon cycle, Mitigating growth of the atmospheric carbon inventory, The process of technology innovation. Overview of carbon capture and storage: Carbon capture, Carbon storage. Power generation fundamentals: Physical and chemical fundamentals, Fossil-fueled power plant, Combined cycle power generation, Future developments in power-generation technology

Unit – 2

Carbon capture from power generation: Introduction, Precombustion capture, Postcombustion capture, Oxyfuel combustion capture, Chemical looping capture systems, Capture-ready and retrofit power plant, Approaches to zero-emission power generation. Carbon capture from industrial processes: Cement production, Steel production, Oil refining, Natural gas processing.

Unit – 3

Absorption capture systems: Chemical and physical fundamentals, Absorption applications in postcombustion capture, Absorption technology RD&D status

Adsorption capture systems: Physical and chemical fundamentals, Adsorption process applications, Adsorption technology RD&D status. Membrane separation systems

Unit – 4

Cryogenic and distillation systems: Physical Fundamentals, Distillation column configuration and operation, Cryogenic oxygen production for oxyfuel combustion, Ryan–Holmes process for CO2 – CH4 separation, RD&D in cryogenic and distillation technologies. Mineral carbonation: Physical and chemical fundamentals, Current state of technology development, Demonstration and deployment outlook. Geological storage: Introduction, Geological and engineering fundamentals, Enhanced oil recovery, Saline aquifer storage, Other geological storage options

Course outcomes:

At the end of the course the student will be able to:

- Discuss the impacts of climate change and the measures that can be taken to reduce emissions.
- Discuss carbon capture and carbon storage.
- Explain the fundamentals of power generation.
- Explain methods of carbon capture from power generation and industrial processes.
- Explain different carbon storage methods: storage in coal seams, depleted gas reservoirs and saline formations.
- Explain Carbon dioxide compression and pipeline transport.

Reference Books

1. Stephen A. Rackley, “Carbon Capture and Storage”, Elsevier 2010.

SPV Powered Irrigation Systems			
Course Code	**PET012E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit- 1

Irrigation: Need for Irrigation, History of Irrigation in India, Ill effects of irrigation, Type of Irrigation methods (Surface, Drip, Sprinkler) pros and cons of each method, TyPET of pumps employed in agriculture-pros and cons.

Introduction: Agriculture: Energy Management in Agriculture, Govt. Initiatives in Agriculture, Farm Power-Sources of power in Agriculture, Energy conservation opportunities in agriculture.

Unit- 2

Sizing of Grid Connected Irrigation Pumps: Crop water assessment: Concept of Evapotranspiration, Growth stages of crops, Different methods for assessment of evapotranspiration, Crop factors. Assessment of hydraulic head and HP rating of Pumps, Assessment of energy conservation and saving potential, Numerical problems.

Unit- 3

SPV based Irrigation Pumps: Different tyPET of SPV irrigation systems and components, Advantages of SPV pumps, Issues in sizing the SPV based pumps, Govt. schemes for SPV irrigation systems. Methodology for assessment of flowrate, hydraulic head for SPV based systems, Sizing of pumps, selection of SPV array capacity & connection configuration and economic analysis, Numerical Problems.

Unit- 4

Design of Drip Irrigation Systems: Components used, Layout of drip irrigation, Selection of lateral pipelines, Sizing of pumping unit, Cost and Energy Analysis, Numerical problems.

Design of Sprinkler Irrigation Systems: Required resources and conditions, Layout, Selection of Sprinkler and spacing, Capacity of Sprinkler pumping unit, Cost and Energy Analysis, Numerical Problems.

Course outcomes:

At the end of the course the student will be able to:

- List and explain the different terms associated with agriculture and SPV based irrigation systems
- Illustrate the different tyPET of irrigation methods, components used and their working principle
- Derive and solve the mathematical equations for the hydraulic and electrical elements in irrigation systems
- Identify and analyze the SPV and Grid connected irrigation systems and energy conservation opportunities in irrigation systems
- Design the irrigation system to satisfy the requirements of agriculture lands
- Identify the challenges faced by farmers and shall be able to suggest probable solution

Reference Books

1. A.M.Michael, “Irrigation Theory and Practice”, Vikas Publishers, Second Enlarged Edition, 2011.
2. S.K.Garg., “Water Supply Engineering”, Khanna Publishers, Environmental Engineering, Vol 1, 20th Revised Edition, 2010.
3. R.K.Bansal, “Fluid Mechanics and Hydraulic Machines”, Comprehensive Textbook, LAXMI Publications, Delhi, 2008.
4. Pradip Narale, Narendra Singh Rathore, “Design and Techno Economics of Solar Water Pumping System”, Lambert Academic Publishing, 2013.
5. M.Kay, N.Hatcho, “Small-Scale Pumped Irrigation: Energy and Cost”, Irrigation Water Management Training Manual, Food and Agriculture Organization of United States, Rome, 1992.
6. Design of Small Photovoltaic (PV) Solar-Powered Water Pump Systems, Technical Note No. 28, United States Department of Agriculture, Portland, October 2010.

<table>
<tr><th colspan="4">Embedded System Design</th></tr>
<tr><td>Course Code</td><td>PET013E</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L:T:P)</td><td>4:0:0</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Credits</td><td>04</td><td>Exam Hours</td><td>03</td></tr>
<tr><td colspan="4">Unit – 1</td></tr>
<tr><td colspan="4">Introduction to embedded systems: Definition of embedded system, embedded system vs. general computing system, history of embedded system, classifications, purpose of embedded system, major application areas including some novel applications. The typical embedded system: Core of embedded system, memory, sensors and actuators, communication interface, embedded firmware, other system components, PCB and passive components</td></tr>
<tr><td colspan="4">Unit – 2</td></tr>
<tr><td colspan="4">Characteristics and quality attributes of embedded systems: Characteristics of embedded system, quality attributes of embedded systems, embedded systems applications like washing machine and automotive. Designing embedded systems with 8-bit microcontrollers: factors to be considered in selecting a controller, features of 8051 microcontroller, designing with MCS-51 family microcontrollers</td></tr>
<tr><td colspan="4">Unit – 3</td></tr>
<tr><td colspan="4">Hardware software co-design and program modeling: fundamental issues in hardware software co-design, computational models in embedded system, introduction to unified modeling language (UML), hardware software trade-offs. Embedded firmware design and development: design approaches, development languages.</td></tr>
<tr><td colspan="4">Unit – 4</td></tr>
<tr><td colspan="4">The embedded system development environment: Integrated Development Environment (IDE), tyPET of files generated on cross compiler, disassembler/decompiler, simulators, emulators and debugging, target hardware debugging, boundary scan, case study: counting system in an exhibition, digital clock, intelligent cruise controller, air bag trigger system.
Real-Time Operating System Based Embedded System: operating system basics, need for RTOS, tyPET operating system, tasks, process and threads, multiprocessing and multitasking, task scheduling, threads,processes and scheduling : putting altogether, task communication, task synchronisation, device drivehow to choose an RTOS, identify one open source RTOS using that demonstrate the concepts of RTOS</td></tr>
<tr><td colspan="4">.</td></tr>
<tr><td colspan="4">Course outcomes:
At the end of the course the student will be able to:
Student should able to describe the differences between the general computing system and the embedded system, also recognize the classification of embedded systems.
Student should able to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
Student should able to write the programs for interfacing the hardware.
Student should able to understand the design concept of embedded systems.
Student should able to understand the role of embedded systems in industry.
Design real time embedded systems using the concepts of RTOS.</td></tr>
<tr><td colspan="4">Reference Books</td></tr>
<tr><td colspan="4">1. Shibu K V, “Introduction to embedded systems”, Tata McGraw Hill private limited, 2010.
2. Rajkamal, “Embedded systems: architecture, programming and design”, Tata McGraw Hill private limited, second edition.
3. Frank Vahid, Tony Givargis “Embedded system design: A unified hardware/software introduction</td></tr>
</table>

Energy Pricing And Economics			
Course Code	**PET014E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Introduction: Distinguishing Between Cost and Price, Cost and Price in Our Daily Vocabulary, The Credibility of Cost, Total Cost of the Operation as a Whole, Joint-Product Costs, Price Relationships: The Baker Revisited - The Quantity Discount, The Economics of Fixed (Overhead) Costs, A Closer Look at Two-Part Pricing, Competitive Pricing (Value to the Purchaser), From Wonderland to Reality, Cost and Price-A Primer. The Cost Approach to Pricing-The Direction of Cost: Preface, Fixed and Variable Costs, Decreasing, Constant, and Increasing Costs Conditions, Decreasing Costs, The Base System, Future Additions, The Small Base-Load Plant, The Peaking or Firming-Up Plant, Power Purchases by Electric Utilities from Non-utility Sources, Bypass, and Discounts, Variable Costs, Matters of Judgment, A Note on Generating Plants, A Note on the Level of Costs.

Unit – 2

The Cost Approach to Pricing - Joint Cost Allocations: Direct and Joint/Common Costs, Cost Causation, Utility Cost Allocation Theory, The Functionalization of Costs, Methods of Allocation, Distribution, Rate Schedule Divisions of Cost, Sub allocations, The Total Cost and Incremental Cost Methods, The Separable Costs-Remaining Benefits Method of Cost Allocation in Federal Multi-purpose Projects, Limits on the Ascertainment of Costs, Definitions of Cost. The Cost Approach to Pricing - The Tenneco Pattern: Tenneco Pattern, The Issues, The Regulatory Scheme in Brief, Assignment of Fixed and Variable Costs, The Demand Charge, Zoning, A Resume, The Minimum Bill, Tenneco Allocations for Rate Design

Unit – 3

The Value Approach to Pricing - Demand Influence: Preface, Value of Service Defined, Cost vs. Value in Juxtaposition, The “Upper and Lower Limit of Rates” Concept, Economic Demand, Direct and Derived Demand, Option Demand, The Price Elasticity of Demand, The Crucial Importance of Price Elasticity, The Revenue Effects of Elasticity, Immediate, Short-Run and Long-Run Price Elasticities of Demand, Repression and Stimulation, The Principle of Diminishing Utility, Economics of Pricing on a Value of Service Basis, Monopoly Pricing, The Theory of Class Price, Bases of Rate Classes, The Cost and Value Approaches Compared, Unreasonable Discrimination, Predatory Pricing, Is There a Problem?, Concluding Observations on Cost vs. Value, Marketing and Advertising

Unit – 4

The Value Approach to Pricing - Planning for Demand: Units of Measurement, Procedure, Planning: Short-Run Demand Forecasts, Planning: Long-Range Demand Forecasts, Final Results, Public Policy Forecasts, Concluding Comments, The Public Policy/Social Engineering Approach to Pricing: California’s Lifeline/ Baseline Rate, Cost Components of Rates, Timed Pricing, The Colour GREEN, Venture into Marginal Cost Regulation, Wind Rates on an Integrated Electric System.

Introduction to Rates: The Unregulated Marketplace, The Marketplace Under Regulation, The Customer Viewpoint, The Management Viewpoint, The Public Viewpoint, Related Objectives, Some Expert Opinions, Definitions.

Course outcomes:

At the end of the course the student will be able to:

- Understand the different tyPET of energy pricing of day today in power sectors.
- Apply the micro economics concepts for energy pricing decisions.
- Understand the theoretical energy pricing concepts to the energy sector in India.
- Comprehend various market structures and its real world application.
- Know the application of tools of energy pricing.
- Understand the basics of cost calculation for electricity and power plants

Reference Books

1. Roger L. Conkling, “Energy Pricing - Economics and Principles”, Springer 2011.
2. Stern, J. (2014). International gas pricing in Europe and Asia: A crisis of fundamentals. Energy Policy, 64, 43-48.
3. Stern, J. (2006). The Russian-Ukrainian gas crisis of January 2006. Oxford Institute for Energy Studies, 16, 5-12.
4. Stern, J. (2012). The pricing of internationally traded gas. Oxford University Press.

Energy Conversion and Energy Efficiency			
Course Code	**PET015E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Mechanical Energy and Electrical Energy: Mechanical Energy, Kinetic Energy, Potential Energy, Pressure Energy, Surface Energy, Sound Energy, Mechanical Work, Electric Energy, Other Forms of Work. Internal Energy and Enthalpy: Internal Energy, Enthalpy, Heat, Effect of Temperature on the Heat of Reaction, Standard Enthalpy Changes, Adiabatic Flame Temperature, Air Pollution from Combustion Processes, Heat of Mixing, Heat Measurements by Calorimeter, Psychrometric Diagram, Heat Transfer, Entropy, Energy, Fluid

Unit – 2

Energy Balances: Balance Equations, Mass Balance, Energy Balance, Entropy Balance, Energy Balance, Fluid-Flow Processes, Energy Balance in a Cyclic Process. Energy Production: Energy Production, Electric Power Production, Transmission of Energy, Power Producing Engine Cycles, Improving the Power Production in Steam Power Plants, Geothermal Power Plants, Cogeneration, Nuclear Power Plants, Hydropower Plants, Wind Power Plants, Solar Power Plants, Hydrogen Production, Fuel Cells, Biomass and Bioenergy Production, Other Energy Production Opportunities, Levelized Energy Cost, Thermodynamic Cost, Ecological Cost.

Unit – 3

Energy Conversion: Energy Conversion, Series of Energy Conversions, Conversion of Chemical Energy of Fuel to Heat, Thermal Efficiency of Energy Conversions, Ideal Fluid-Flow Energy Conversions, Lost Work, Efficiency of Mechanical Conversions, Conversion of Thermal Energy by Heat Engines, Improving Efficiency of Heat Engines, Hydroelectricity, Wind Electricity

Unit – 4

Geothermal Electricity, Ocean Thermal Energy Conversion, Thermoelectric Effect, Efficiency of Heat Pumps and Refrigerators, Efficiency of Fuel Cells, Energy Conversions in Biological Systems.

Energy Storage: Energy Storage and Regulation, TyPET of Energy Storage, Thermal Energy Storage, Electric Energy Storage, Chemical Energy Storage, Mechanical Energy Storage. Energy Conservation: Energy Conservation and Recovery, Conservation of Energy in Industrial Processes, Energy Conservation in Home Heating and Cooling.

Course outcomes:

At the end of the course the student will be able to:

- Explain different tyPET of systems, properties, variables energy and tyPET of energy.
- Explain different forms of external and internal energy and compute different forms of energy.
- Explain about energy balance and energy production by different means.
- Explain different methods of energy conversion, storage and conservation.

Reference Books

1. Yasar Demirel, Energy Production, Conversion, Storage, Conservation, and Coupling, Springer, 2012.

Micro Electro Mechanical Systems (MEMS)			
Course Code	**PET016E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

MEMS and Microsystems: Applications – Multidisciplinary nature of MEMS – principles and examples of Micro sensors and micro actuators – micro accelerometer –comb drives - Micro grippers – micro motors, micro valves, micro pumps, Shape Memory Alloys.

Review of Mechanical concepts: Stress, Strain, Modulus of Elasticity, yield strength, ultimate strength – General stress strain relations – compliance matrix. Overview of commonly used mechanical structures in MEMS - Beams, Cantilevers, Plates, Diaphragms – Typical applications

Unit – 2

Scaling laws in miniaturization - scaling in geometry, scaling in rigid body dynamics, Trimmer force scaling vector, scaling in electrostatic and electromagnetic forces, scaling in electricity and fluidic dynamics, scaling in heat conducting and heat convection Materials for MEMS – Silicon – Silicon compounds – Silicon Nitride, Silicon Dioxide, Silicon carbide, Poly Silicon, GaAs , Silicon Piezo resistors

Unit – 3

Flexural beams: TyPET of Beams, longitudinal strain under pure bending – Deflection of beams – Spring constant of cantilever – Intrinsic stresses Actuation and Sensing techniques-Thermal sensors and actuators, Electrostatic sensors and actuators, Piezoelectric sensors and actuators, magnetic actuators

Unit – 4

Polymers in MEMS – SU-8, PMMA, PDMS, Langmuir – Blodgett Films, Micro System fabrication – Photolithography – Ion implantation- Diffusion – Oxidation – Chemicalvapour deposition – Etching, Overview of Micro manufacturing – Bulk micro manufacturing, Surface micro machining , LIGA process – Microstereo lithography, Micro system Packaging: general considerations in packaging design – Levels of Micro system packaging,

Bonding techniques for MEMS : Surface bonding , Anodic bonding , Silicon - on - Insulator , wire bonding , Sealing – Assembly of micro systems Overview of MEMS areas : RF MEMS, Bio-MEMS, MOEMS, NEMS

Course outcomes:

At the end of the course the student will be able to:

- Understand the MEMS technology present and future challenges
- Explain micro sensors, micro-actuators, their tyPET and applications.
- Understand about fabrication processes for producing micro-sensors and actuators.
- Apply the MEMS concept in real time applications in industry.
- Understand the different type of polymers and Micro system fabrication.
- Identifying the techniques of Bonding for MEMS

Reference Books

1. Chang Liu, Foundations of MEMS, Pearson 2012
2. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, TMH, 2002
3. Chang C Y and Sze S. M., VLSI Technology, McGraw-Hill, New York, 2000
4. Julian W Gardner, Microsensors: Principles and Applications, John Wiley & Sons, 1994
5. Mark Madou, Fundamentals of Micro fabrication, CRC Press, New York, 1997
6. Stephen D. Senturia, Microsystem design, Springer (India), 2006.
7. Thomas B. Jones, Electromechanics and MEMS, Cambridge University Press, 2001

Integration of Distributed Generation			
Course Code	**PET017E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit – 1

Distributed Generation: Introduction, Sources of Energy - Wind Power, Solar Power, Combined Heat-and-Power, Hydropower, Tidal Power, Wave Power, Geothermal Power, Thermal Power Plants

Unit – 2

Distributed Generation (continued): Interface with the Grid.

Power System Performance: Impact of Distributed Generation on the Power System, Aims of the Power System, Hosting Capacity Approach, Power Quality, Voltage Quality and Design of Distributed Generation, Hosting Capacity Approach for Events, Increasing the Hosting Capacity.

Unit – 3

Overloading and Losses: Impact of Distributed Generation, Overloading: Radial Distribution Networks, Overloading: Redundancy and Meshed Operation, Losses

Overloading and Losses (continued): Increasing the Hosting Capacity.

Voltage Magnitude Variations: Impact of Distributed Generation, Voltage Margin and Hosting Capacity, Design of Distribution Feeders, A Numerical Approach to Voltage Variations, Tap Changers with Line-Drop Compensation, Probabilistic Methods for Design of Distribution Feeders

Unit – 4

Voltage Magnitude Variations (continued): Statistical Approach to Hosting Capacity, Increasing the Hosting Capacity.

Power Quality Disturbances: Impact of Distributed Generation, Fast Voltage Fluctuations, Voltage Unbalance.

Course outcomes:

At the end of the course the student will be able to:

- Explain energy generation by wind power and solar power.
- Discuss the variation in production capacity at different timescales, the size of individual units, and the flexibility in choosing locations with respect to of wind and solar systems.
- Explain the performance of the system when distributed generation is integrated to the system.
- Discuss effects of the integration of DG: the increased risk of overload and increased losses.
- Discuss effects of the integration of DG: increased risk of overvoltages, increased levels of power quality disturbances.
- Discuss effects of the integration of DG: incorrect operation of the protection
- Discuss the impact the integration of DG on power system stability and operation.

Reference Books

1. Integration of Distributed Generation in the Power System, Math Bollen, Wiley, 2011.

Solar Photovoltaic System Design			
Course Code	**PET018E**	CIE Marks	50
Teaching Hours/Week (L:T:P)	4:0:0	SEE Marks	50
Credits	04	Exam Hours	03

Unit- 1

Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation, sun-earth angles and solar radiation measurement. Numerical problems.
Solar Cells – Technologies; Parameters; Factors affecting electricity generated; I-V & P-V characteristics; equivalent circuit, series, parallel and series & parallel connections; Numerical problems.

Unit- 2

SPV Unit – Ratings, standard parameters; factors affecting electricity generated; measuring Unit parameters; I-V & P-V characteristics; connection of Units in series, parallel and series & parallel; Modeling SPV Units, Mismatch in series and parallel connections, Introduction to arrays.

Unit- 3

SPV system design and integration – TyPET of SPV systems; Design Methodology for Stand-alone SPV systems. Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, tyPET, features, typical specifications and cost). Numerical problems
SPV system design and integration – TyPET of SPV systems; Design Methodology for Stand-alone SPV systems.
Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants

Unit- 4

Wires – Introduction, basics of current conduction, tyPET of wires, measurement of wire dimensions, wire sizing; Junction box; Installation, Troubleshooting of stand-alone and grid connected solar PV power systems;
Safety of SPV power plants; Solar PV plant installation check list – Electrical testing of PV array, inverter, islanding protection, commissioning and system functioning. Field visits within campus to study installations

Course outcomes:

At the end of the course the student will be able to:

- Students should be able to define various parameters & features of solar cell, Unit, panel, array and SPV systems
- Students should be able to describe working of SPV systems and their components
- Students should be able to compute performance of SPV systems for different loads and applications based on numerical problems
- Students should be able to compare and analyze different SPV systems for specific applications based on performance
- Students should be able to operate and test working of SPV systems and their components
- Students should be able to design & discuss a solar PV system – stand alone or grid connected – based on typical loads

Reference Books

1. Chetan Singh Solanki, Solar Photovoltaics – Fundamentals, Technologies and Applications, PHI Learning Private Limited, New Delhi, 2009
2. Chetan Singh Solanki, Solar Photovoltaic Technology and Systems – A Manual for Technicians, Trainers and Engineers, PHI Learning Private Limited, New Delhi, 2014
3. Tiwari, G. N and Ghosal, M. K., Fundamentals of Renewable Energy Sources, Narosa Publishing House, New Delhi, 2007
4. M S Imamuaa and P. Helm Photovoltaic System Technology A European Hand book.

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF BIOTECHNOLOGY

M. Tech Food Biotechnology
Scheme and Syllabus
2020-2021

M. Tech. FOOD BIOTECHNOLOGY - I SEMESTER

2020-21

Sl. No.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	PFB101C	Food Chemistry and Nutrition	4	4	0	0	4	50	50	100
2	PFB102C	Food Microbiology and Spoilage	4	4	0	0	4	50	50	100
3	PFB103C	Food Safety and Toxicology	4	4	0	0	4	50	50	100
4	PFB104C	Nutraceuticals and Functional Foods	4	4	0	0	4	50	50	100
5	PFB105C	Principles of Food Analysis and Food Laws	4	4	0	0	4	50	50	100
6	PFB106S	Seminar	1	0	0	2	2	50	50	100
7	PFB107L	Food Analysis Lab	1.5	0	0	3	3	50	50	100
8	PFB108L	Nutraceuticals Lab	1.5	0	0	3	3	50	50	100
		Total	24	**20**	**0**	**8**	**28**	**400**	**400**	**800**

PFB101C: Food Chemistry and Nutrition
4 Credits (4-0-0)

UNIT 1

Water **16 Hours**

Structure, Water content in foods, physical properties, Hydrogen bonding, Types of water in foods, Water activity- Water activity and food spoilage. Interaction of water with food components, moisture determination.

Carbohydrates

Definition, nomenclature and classification; physical and chemical properties of sugar; food source, nutritional requirement, deficiency and symptoms. Modified starch, starch hydrolysates, polyols, glycogen, fibre, gums. Artificial and non-nutritive sweeteners. Effect of cooking on carbohydrates.

UNIT 2

Lipids and Fats **12 Hours**

Classification, fatty acid chemistry, physical chemistry, food source, nutritional requirement, deficiency and symptoms. Fat constant – saponification number, acid number, iodine number, acetyl number, Reichert Meissel number, effect of freezing, flavor reversion, oxidative and hydrolytic rancidity, hydrogenation, inter-esterification, application in food processing, food emulsions and fat replacers.

UNIT 3

Proteins **12 Hours**

Classification and structure proteins Physical and chemical properties of amino acids, food source, nutritional requirement, deficiency and symptoms, function and properties of protein, effect of processing. Enzymes employed in food industry.

Minerals

Classification; food source, nutritional requirement, deficiency and symptoms, minerals in meat, milk, plants and their interactions with other components; Losses during processing;

UNIT 4

Vitamins **12 Hours**

Vitamins – classification, food source, nutritional requirement, deficiency and symptoms and effect of food processing. Latest concepts in nutitional dietary recommendations, RDA- ICMR and WHO: their uses and limitations.

Food additives

Flavors and aromas, additives and anti-oxidants, preservatives, anticaking agents, bulking agents, food colorants, emulsifiers, stabilizers, gelling agents, thickeners, humectants

Total : 52 hours

References:

1. Damodran, S., Parkin, K.L and Fennema, D.R. (2007). Fennema's Food Chemistry. 5th edition. CRC Press.
2. Guthrie, H.A. (1983). Introductory nutrition. 5th Edition. Mosby, St. Louis.
3. Meyer, L.H. (2004). Food Chemistry. Textbook Publishers. ISBN: 0758149204.
4. Shakuntla, M.N and Shadaksharaswamy, M. (2013). Food Facts and Principles. New Age International.
5. Mahindru, S.N.(2000) Food Additives- Characteristics – Detection and Estimation Tata McGraw Hill Publishing Co. Ltd.
6. Duckworth, R.B. (Ed) (1978)Water Relation to Foods, Academic Press, London
7. Handbook of Analytical Techniques Vol. I, Gunzler and Williams, Wiley-VCH, 2002.

PFB102C: Food Microbiology and Spoilage
4 Credits (4-0-0)

UNIT 1

Food as a Source of Microorganism **14 Hours**

Importance and significance of microorganisms in food science. Micro-organisms importance in food – Factors affecting the growth of microorganisms in food – Intrinsic and Extrinsic parameters that affect microbial growth.

Food as a substrate for microorganisms - Hydrogen ion concentration - acidophilic, neutrophilic and basophilic microbes, Water activity - principle groups of foods and their aW, Redox Potential - aerobic, anaerobic and facultative microbes.

UNIT 2

Microbial Growth **12 Hours**

Factors affecting the growth of microorganisms- Growth curve and generation time. Important microorganism in food - yeast, mold and bacteria. Microbial metabolism of food components - degradation of carbohydrates, fat and protein.

Food spoilage: characteristic features, dynamics and significance of spoilage of different groups of foods – Cereal and cereal products, vegetables and fruits, meat poultry and sea foods, milk and milk products, packed and canned foods. Spoilage and preservation of different kinds of food products - Fruit and vegetable products, meat and poultry products, certified dairy products, endo and exo toxins - spoilage of canned foods.

UNIT 3

Microbial Spoilage **14 Hours**

Meat, Poultry, and Seafood; Milk and Dairy Products; Fruits, Vegetables and Grains Food borne diseases: Bacterial food borne diseases (Staphylococcal intoxification, Botulism, Salmonellosis, Shigellosis, Enteropathogenic Escherichia Coli Diarrhoea, Clostridium Perfringens gastroenteritis, Bacillus cereus Gastroenteritics) Food Borne Viral Pathogens (Norwalk virus, Norovirus, Reovirus, Rotavirus, Astrovirus, Adenovirus, Parvovirus, Hepatitis A Virus) Food Borne Animal Parasites Protozoa – Giardiasis, Amebiasis, Toxoplasmosis, Sarcocystosis, Crypotosporiodiosis. Cysticercosis/Taeniasis. Roundworm – Trichinosis, Anisakiasis. Mycotoxins: Aflatoxicosis, Deoxyni valenol Mycotoxicosis, Ergotism

UNIT4

Methods to Control Spoilage **14 Hours**

Antimicrobial Preservatives, Biologically Based Preservation and Probiotic Bacteria, Physical Methods of Food Preservation, Industrial Strategies for Ensuring Safe Food

Detecting Foodborne Pathogens and Their Toxins- Conventional versus Rapid and Automated Methods; Genetic and Immunologic Techniques for Detecting Foodborne Pathogens and Toxins

Predictive Modeling

Methods for microbial examinations of foods - indicator organisms, direct examinations, cultural techniques, enumeration techniques, alternative and rapid methods for the detection of specific organisms and toxins - food borne infectious diseases. Advanced technologies in food microbiology

Total: 52 Hours

Textbooks

1. Pelczar Jr., M. J., Chan, E.C.S. and Krieg, N.R. Microbiology, (TMH Book Company, 1993)
2. Jay, J. M. Modern Food Microbiology, (CBS Publishers Delhi, 1993)
3. Frazier, W. C. and Westhoffs, D.C. Food Microbiology, (TMH Book Company, 1993)

References:

1. Beltz, H.D. 2005. “Food Chemistry”. Springer Verlag.
2. Fennema, O.R, 2006, Food Chemistry, Academic Press.
3. .Meyer, L.H. 1987. “Food Chemistry”. CBS publishers and Distributors, New Delhi.
4. Adams, M.R. and M.G. Moss 2009. “Food Microbiology”, 1st Edition, New Age
5. International (P) Ltd.
6. Doyle, P., Bonehat, L.R. and Mantville, T.J. 2010. “Food Microbiology, Fundamentals and
7. Frontiers”, ASM Press, Washington DC
8. Fennema, O.R.2006. Food Chemistry. Marcel Dekker.

PFB103C: Food Safety and Toxicology
4 Credits (4-0-0)

UNIT 1

Food Toxicology **14 hours**

History of Toxicology, Branches of Toxicology, Toxicity and classification of Toxins, Toxication Stages involved in Toxication, factors that affect the rate of metabolism, The effect mechanism of Toxins, Special toxic effects- Mutagenesis, Carcinogenesis and Teratogenesis.

Food Allergy and Food Intolerance

Food allergy and allergens -symptoms of food allergy, management of food allergy, Food allergy tests, Food intolerance- causes and types.

UNIT 2

Natural Food toxins and Derived food toxicants **14 hours**

Bacterial toxins- Food Intoxication-Toxicity due to microbial toxins including botulinum and staphylococcal toxins. Fungal Toxins Occurring in Foods. Natural Toxins in Animal foods-marine animals-brevitoxin, cigauters, fugu, scombroid and shell fish poisoning. Natural Toxins in Plant food stuffs- Alkaloids, Cyanogens, Favism, Goitrogens, Gossyppol, Lathyrogens.

Food contaminants

Chemicals from processing such as fumigants, Trace metals, pesticides and herbicides. Toxicants generated during food processing and packaging such as Perchlorates, nitrosamines, acrylamide, benzene, dioxins, furans.

UNIT 3

Food safety Hazards **12 hours**

Types of food hazards: biological, chemical and physical; Risk assessment; Existing and emerging pathogens due to globalization of food trade; Newer systems of safety evaluation such as HACCP. Food additives- types- usage, permissible limits, Food Quality Evaluation.

Food Toxicity tests

Toxicity tests- Invivo toxicity tests, acute toxicity tests, subacute toxicity tests, chronic toxicity tests.

UNIT 4

Food Safety Programs **12 hours**

Good Manufacturing Practices (GMPs), Good Lab Practices (GLPs), Standard Operating Procedure (SOP), Facility Maintenance, Personal Hygiene.

Pest Control Program

Pest Control Program, Pest Classification (insects, rodents and birds), Prevention and control. Procedures for Raw Material Reception, Storage and Finished Product Loading and Sanitation Program.

Total: 52 hours

Textbooks

1. S. S. Deshpande, (2002), Handbook of Food Toxicology. CRC Press.
2. Tannenbaum SR, (1979), Nutritional and Safety Aspects of Food Processing. Marcel
1. Dekker Inc
2. Hobbs BC, Christian J.H.B. (1974), Microbiological Safety of Food. Academic Press Inc
3. Galli, C.L, (1978), Chemical Toxicology of Food. Elsevier-North- Holland Biomedical Press

Reference Books

1. William Helferich, Karl Winter, (2001), Food Toxicology. CRC Press.
2. Cynthia A. Robert, (2009), The food Safety Information Handbook. Greenwood.

PFB104C: Nutraceuticals and Functional foods
4 Credits (4-0-0)

Unit I

Introduction to Nutraceuticals **12 hours**

Basics of nutraceuticals, Relationship between nutraceuticals, food and medicine. Market trends in nutraceuticals, Major nutraceuticals and their applications. Classification of nutraceuticals, General and specific properties of nutraceuticals. Basics of energy metabolism. Metabolism , bioavailability and pharmacokinetics of nutraceuticals.

Unit 2

Role of Nutraceuticals in nutrition related diseases and disorders **14 hours**

Role of nutraceuticals with special reference to diabetes mellitus, hypertension, hypercholesterolemia, cancer, obesity. Formulation of nutraceuticals in pediatrics, skin health, mental health, Bone health, geriatrics, sports, and Women health. Concept of antioxidants - use of antioxidants as dietary supplements in prevention and treatment of cancer, obesity and stress.

Unit 3

Nutraceuticals of microbial, plant and animal origin **12 hours**

Concept of prebiotics and probiotics - principle, mechanism, production and technology involved, applications - examples of bacteria used as probiotics, use of prebiotics in maintaining the useful microflora - extraction from plant sources. Synbiotics for maintaining good health. Algae as source of omega - 3 fatty acids, antioxidants and minerals - extraction and enrichment. Plant secondary metabolites, classification and sub-classification - Alkaloids, phenols, Terpenoids. Animal metabolites - Sources and extraction of nutraceuticals of animal origin. Examples: chitin, chitosan, glucosamine, chondroitin sulphate and other polysaccharides

Unit 4

Functional foods **14 hours**

Introduction, health attributes of functional foods – role of functional foods in CVD, Cancer, obesity, immunity, Anti-aging, medical foods. The potential role of functional foods in medicine and public health, The role of marketing communication in the introduction of functional foods to the consumer. The food industry's role in functional foods, Consumers' view on functional foods, Future prospects for functional foods.

Total: 52 hours

Text Books

1. Israel Goldberg (Ed.) (1999) Functional foods, designer foods, pharma foods, Nutraceuticals, Aspen publishers Inc., USA
2. L. Rapport and B. Lockwood,Nutraceuticals,Pharmaceutical Press.,2 nd Edition,2002.

Reference Books

1. M. Maffei ,Dietary Supplements of Plant Origin, Taylor & Francis,1 st Edition,2003.
2. Shahidi and Weerasinghe, Nutraceutical beverages Chemistry, Nutrition and health Effects, American Chemical Society,1 st Edition, 2004.
3. Richard Neeser & J. Bruce German (2004) Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Jean, Marcel Dekker, Inc.
4. Timotht S. Tracy, Richard L. Kingston, Herbal Products 2nd Edition, 2007

UFB105C: Principle of Food Analysis and Food Laws
4 Credits (4-0-0)

UNIT 1

Introduction to food analysis **12 hours**

Types of food samples analysed, steps in food analysis, choice of methods; sampling procedures, considerations and sample preparation; Evaluation of analytical data – accuracy and precision, sources of errors, specificity, sensitivity and detection limits, regression analysis, reporting results.

Characteristics of food analysis

Analysis of chemical constituents, their characterization and significance – moisture, ash, minerals, lipids, fat, proteins, fibre, titratable acidity, starch, reducing sugars.

UNIT 2

Spectroscopic methods in food analysis **13 hours**

Spectroscopic analysis of foods – basic principles, UV, visible, fluorescence, IR, AAS, MS, NMR.

Chromatographic methods in food analysis

Chromatographic analysis of foods – basic principles, HPLC, GC, GLC, principles and applications. Analysis of vitamins, pigments, flavours, extraneous matter, pesticides and mycotoxins;

UNIT 3

Advanced techniques in food analysis **13 hours**

Microscopic analysis of foods, SEM and XRD; other methods- potentiometry, enzymatic, immunoassays, thermal analysis; Techniques for sensory analysis of foods and electronic tongue/ nose; Analysis of genetically modified foods.

Regulations and Certifications

Various laws, regulations and Certifications for food processing, Essential Commodity Act, Prevention of Food Adulteration Act (PFA), Fruit Products Order (FPO).

UNIT 4

Food Safety and Standards **13hours**

Meat Food Products Order (MFPO), Vegetable Oil Control Order, Agricultural Marketing and Grading Standards (AGMARK).Bureau of Indian Standards (BIS) and their certifications, Food Safety and Standards Authority of India (FSSAI), Food Safety and Standards Act and Regulations of India

Food Laws

Food Codex laws, Food and Drug Administration (FDA), International Organization for Standardization (ISO), Food Laws and Regulations in the United States of America, (USDA), Food Laws and Regulations in the European Union. The principles of food laws and regulations in the European Union; regulations on chemicals in food,

Total: 52 Hours

Reference Books

1. Food analyses by S Suzanne Nielsen, Fourth edition, Springer publisher,
2. Rheology and Texture in Food Quality J.M.DeMan
3. Food Analysis :Theory and practice IS: 6273 (Part-1& Part-2) Y.Pomeranz
4. Principles of Sensory Analysis of Food M.A. Amerine

PFB107L: Food Analysis Lab
1.5 Credits (0-0-3)

1. Writing of Standard operating procedures (SOPs).
2. Writing of GLPs and GMPs with respect to food and nutraceutical industry – a case study.
3. Proximate analysis of foods.
4. Nutritional profiling of food samples for labelling (carbohydrates, proteins and fats)
5. Nutritional profiling of food samples for labelling (Vitamins)
6. Nutritional profiling of food samples for labelling (Minerals)
7. Determination of calories in foods
8. Sensory evaluation tests for processed foods.
9. Determination of viscosity of food samples (porridge, custards, batters etc) using viscometer.
10. Detection of pathogens in food using biochemical analysis
11. Detection of microbial load in processed food and nutraceutical sample.
12. Preparation of certificate of analysis of Food microbes

PFB108L: Nutraceuticals lab
1.5 Credits (0-0-3)

1. Principle and practice of various extraction procedures used in herbal industry.
2. Phytochemical profiling of plant sample and extract.
3. Extraction and quantification of alkaloids.
4. Extraction and quantification of polyphenols, flavonoids, saponins.
5. Isolation and purification of colors from different sources
6. Extraction of chitin, chitosan and glucosamine from prawn shells/mushrooms.
7. Analysis of non-alcoholic beverages for caffeine content.
8. Preparation of certificate of analysis of nutraceutical raw material – curcumin.
9. Detection of Antioxidant property of rice flour
10. Detection of Antioxidant property of turmeric
11. Detection of Antioxidant property of Coffee and tea powder
12. preparation and characterization of Fructo oligosaccharides (FOS)
13. preparation and characterization of probiotics
14. Marine super food

M. Tech. FOOD BIOTECHNOLOGYT – II SEMESTER

Sl. No.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	PFB201C	Food Business Management and Bioentrepreneurship	4	4	0	0	4	50	50	100
2	PFB202C	Food Processing and Preservation	4	4	0	0	4	50	50	100
3	PFB206C	Research Methodology & IPR	2	2	0	0	2	50	50	100
4	PFB21XE	Professional Elective-1	4	4	0	0	4	50	50	100
5	PFB22XE	Professional Elective-2	4	4	0	0	4	50	50	100
6	PFB23XE	Professional Elective-3	4	4	0	0	4	50	50	100
7	PFB207T	Term paper	1	0	0	2	1	50	50	100
8	PFB208L	Food Processing & Product Development Lab	1	0	0	2	2	50	50	100
		Total	**24**	**22**		**4**	**26**	**400**	**400**	**800**

List of Professional Electives

Professional Elective 1		Professional Elective 2	
Course Code	**Course title**	**Course Code**	**Course title**
PFB211E	Grain Processing and Baking Technology	PFB221E	Dairy Technology
PFB212E	Genetics & Cell Culture Techniques	PFB222E	Automation & Robotics in food Processing
PFB213E	Food Packaging and Storage Engineering	PFB223E	Genomics, Proteomics & Bioinformatics
PFB214E	Food Allergies and Allergens	PFB224E	Secondary Processing in Food Biotechnology
Professional elective 3			
Course Code	**Course title**		
PFB231E	Nanotechnology in Food Industry	PFB233E	Food Additives and Preservatives
PFB232E	Biotechnology of Fermented Foods	PFB234E	Crop improvement & Molecular breeding

PFB201C: Food Business Management and Entrepreneurship
4 Credits (4-0-0)

UNIT-I

Fundamentals of Entrepreneurship and project management **14 hours**

Entrepreneur and Entrepreneurship, definition of entrepreneur. Project management fundamentals of project management and entrepreneurship. Scope of bio entrepreneurship and dynamics of biosectors Opportunities for innovation and entrepreneurship in bio-sectors, and the business implications of those opportunities. Why entrepreneurship?, characteristics of entrepreneur, approaches to entrepreneurship development. Soft skills required for entrepreneur- communication, creativity and problem solving. Barriers to entrepreneurs

Project Planning:

Planning of the small scale unit – project identification, project report a forecast plan, Requirement to start a business-selection of location, land & building, government formalities/procedures. Various agencies to assist entrepreneurs. Identification/Selection of business opportunities, classification of opportunities in food processing sector, criteria to decide the opportunity

UNIT- 2

Project Formulation **12 hours**

Market survey – definition, process of conducting market survey tools, preparation of schedule use of CPM, PERT in project scheduling. Techniques of data collection, Model questionnaire preparation – for consumer, supplier (trader), manufacture, Criteria to select production programme and plant capacity, Manpower requirements, selection of location /site and plant layout plan

UNIT 3

Business plan for micro and small enterprises **14 hours**

The financials of a project report and analysis- Preparation of feasibility report/project report/business plan. Financial viabilities and cash flow of an enterprise - Case studies (min of 5 food enterprises) Assessing financial viability of the project. Bookkeeping and accounting and financial statements. Costing and pricing of the product. Working capital management

UNIT 4

Marketing management **12 Hours**

Supply chain management. Applied management in business – learning from existing businesses
Legal requirements Government policies for promotion of entrepreneurship in food processing.
Support institutions for promotion of SMEs.

Total: 52 Hours

Reference Books

1. O.P. Khanna - "Industrial Engineering & Management", Dhanpat Rai & Sons, 1992.
2. T. R. Banga & S. C. Sharma - "Industrial Engineering & Management Science", 6th. Edn, Khanna Publications, 2003
3. Veerabhadra Havinal -Management and Entrepreneurship- New Age International,2009
4. Study material for Entrepreneurship Development Programme by EDI, Ahamdabad
   Dinesh Awasthi, Raman Jaggi and V Padmanand

PFB202C: Food Processing and Preservation
4 Credits (4-0-0)

UNIT 1

14 hours

Introduction- Principles of food preservation and food processing, Purpose and importance of food processing and preservation, careers in food processing.

Processing and preservation by heat: Blanching, pasteurization, sterilization and UHT processing, canning, extrusion cooking, dielectric heating, microwave heating, baking, roasting and frying. Retort processing of Ready to eat (RTE) products. Dehydration of fruits, vegetables, milk, animal products. Newer methods of thermal processing – batch and continuous process.

UNIT 2

14 hours

Processing and preservation by low Temperature and irradiation – refrigeration, freezing and dehydrofreezing. Food irradiation, history and mechanism, the electro-magnetic spectrum, forms of radiant energy. Principles of using electromagnetic radiation in food processing. ionizing radiations and non ionizing radiations, advantages and disadvantages. Controlling undesirable changes in food during irradiation.

UNIT 3

14 hours

Processing and preservation by drying, concentration and evaporation : Various methods employed in production of dehydrated commercial products , selection of methods based on characteristics of foods to be produced, advantages and disadvantages of different methods, sun-drying , tray drying, tunnel drying , spray drying , drum drying , freeze drying and fluidized bed drying. Physical and chemical changes during drying control of chemical changes, desirable and undesirable changes. Packaging and storage of dehydrated products. Ultra-filtration, reverse osmosis, Freeze drying and freeze concentration.

UNIT 4

12 hours

Processing and preservation by non-thermal methods: High pressure, pulsed electric field, hurdle technology. Generally Regarded as Safe (GRAS)and permissible limits for chemical preservatives and legal aspects for gamma irradiation. Types of preservatives used in fruits and vegetables processing industry, permissible limits and safety aspects. Controlled Atmosphere and Modified Atmosphere preservation technology.

Total: 52 hours

References

1. Desrosier, N.W. and James, N. 2007. “Technology of food preservation”. AVI. Publishers
2. Fellows, P.J. 2009. “Food Processing Technology: Principle and Practice”. 3rd Ed.CRC Publishers
3. Potter, N.N. and Hotchikiss, J.H. 2006, “Food Sciences”, Fifth edition, CBS publishers and Distributors, New Delhi.
4. Jelen, P. 2015. “Introduction to Food Processing” Prentice Hall.

PFB206C: Research Methodology and IPR
2 Credits (2-0-0)

UNIT-1

6 Hours

Introduction, Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method.

UNIT-2

Reviewing the literature **6 Hours**

Place of the literature review in research, Bringing clarity and focus to your research problem, Improving research methodology, Broadening knowledge base in research area, Enabling contextual findings, Types of Reports, Mechanics of Writing a Research Report

UNIT-3

Intellectual Property **7 Hours**

The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999, , Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001, IPR and Biodiversity.

UNIT-4

7 Hours

Competing Rationales for Protection of IPRs, Leading International Instruments Concerning IPR, World Intellectual Property Organisation (WIPO), WIPO and WTO, Paris Convention for the Protection of Industrial Property, National Treatment and Right of Priority.

Total: 26 hours

Textbooks/Reference Books

1. Debbie Holmes, Peter Moody, and Diana Dines (2006) Research Methods for the Biosciences,
2. 2nd Edition, Oxford University Press.
3. Oxford University Press Inc., New York. 38
4. Kothari, C.R. (2002) Research Methodology, 7th Print, 2nd Edition, New Age International, Bangalore.

PFB211E: Grain Processing and Baking Technology
4 Credits (4-0-0)

UNIT-1

Grain processing and milling **14 Hours**

Production, Economics, and processing scenario of Food grains. Classification, structure and physicochemical properties and thermal properties of Food grains; Unit operations and equipment for Food Grain Processing, Processing and storage of cereals, pulses and oil seeds. Commercial processing of Paddy, wheat, Corns, Barley, Millets, Pulses and Oil seeds, Dry Milling (Rice and Wheat), Wet Milling (Maize) and parboiling of rice.

UNIT-2

Baking Technology **12 Hours**

Introduction of bakery products-bread, biscuit, cake, pastries, rusk, crackers. PFA specifications of bakery products. Bread types; role of major and minor ingredients; processes of bread making; problems associated with bread making; equipment for bread manufacturing; processing steps for biscuit, cookies, cracker, cakes and their major and minor ingredients. Nutritional aspect of bakery products; quality evaluation of baked products.

UNIT-3

Confectionary **14 Hours**

Historical development; classification of confectionary products; basic technical considerations for confectionary products- TS, TSS, pH, acidity, ERH, RH etc. raw materials and their role in confectionary products; traditional confectionary products.

Chocolate & Vanilla processing: Historical development in chocolate processing; ingredients and their role in chocolate; Steps of chocolate processing- mixing, refining, conching, tempering, molding, cooling, coating, enrobing, etc. Vanilla- Production, processing and packaging.

UNIT-4

Candies and Toffee **12 Hours**

High boiled sweets/candy-composition, production and preparation of high boiled sweets- traditional, batch and continuous methods; toffee composition, types, ingredient and their role, batch and continuous methods of toffee manufacturing.

Rural Marketing of FMCG's: Indian FMCG industry, characteristics of Indian FMCG sector, Challenges in the FMCG industry, Rural Marketing of FMCG's: Select case studies

Total: 52 hours

Text book

1. Bakery Science & Cereal Technology. Neelam Khetarpaul, Daya Books, 1st Edition, 2005.
2. Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture.
3. N.L. Kent, Woodhead Publishing Imprint, 4th Edition, 1994
4. Post-Harvest Technology of Cereals, Pulses and Oil Seeds. A. Chakravarty, Oxford & IBH Publishing Co. Pvt. Ltd., 1st Edition, 1989.
5. Bakery Products Science and Technology. Weibiao Zhou and Y. H. Hui, Wiley Blackwell, 2nd Edition, 2014.
6. The Complete Technology Book on Bakery Products. NIIR Board of Consultants & Engineers, NPCS, Kamla Nagar, New Delhi, 3rd Edition, 2014.

PFB212E: Genetics and Cell Culture Techniques
4 Credits (4-0-0)

UNIT 1

Overview of genetics **12 Hours**

Chemical structure of nucleic acids, proteins; introduction to Genetics, DNA replication, transcription and translation; DNA repair mechanism; modifying enzymes; Genetic code, Regulation of gene expression in Prokaryotes and Eukaryotes.

UNIT 2

Genetic engineering **12 Hours**

Recombinant DNA technology- Methodology Involved PCR, RT-PCR, electrophoresis, electro blotting and capillary blotting; microbial gene transfer mechanisms, mutation, types of mutations, molecular mechanism of mutations, applications to produce genetically modified foods.

UNIT 3

Cell culture technology **12 Hours**

Introduction to plant and animal tissue cultures and cell cultures in general; Cell culture lab design and equipments, Media and reagents; Animal, mammalian and other cell lines for in vitro testing of drugs, toxicity of environmental pollutants, production of vaccines and therapeutic proteins & production of stem cells; Principles of cryobiology and molecular diagnostics, Technological aspects for commercial utilization of cell cultures: Reactor studies, scale up and biosafety.

UNIT 4

Cell Lines **14 Hours**

Primary culture – Mechanical and enzymatic mode of desegregation, establishment of primary culture. Subculture -passage number, split ratio, seeding efficiency, criteria for subculture. Cell lines -definite and continuous cell lines, characterization, authentication, maintenance and preservation of cell lines. Contamination -bacterial, viral, fungal and mycoplasma contaminations, detection and control, cell transformation – normal vs. transformed cells.

Reference books / Text books

1. Culture of Animal Cells, (3rd Edn) R Ian Fredhney. Wiley-Liss Animal Cell Biotechnology, 1990- Spier, RE and Griffith, JB Academic Press, London
2. Animal Biotechnology by Murray Moo-Young (1989), Pergamon Press, Oxford Animal Cell Technology, Principles and practices, 1987, Butter, M Oxford press
3. Molecular Biotechnology by Primrose.
4. Plant Cell Culture: A Practical Approach by R.A. Dixon & Gonzales, IRL Press.
5. Plant biotechnology in Agriculture by K. Lindsey and M.G.K. Jones (1990), Prentice hall, New Jersey
6. Principles of gene manipulation - An introduction to genetic engineering, Old R.W.,
7. Primrose S.B., Blackwell Scientific Publications, 1993.

PFB213E: Food Packaging and Storage Engineering
4 Credits (4-0-0)

UNIT 1

14 hours

Introduction: Function of packaging, marketing consideration for a package and types of packaging, Packaging systems. Packaging materials: Packaging materials for foods, Selection criteria of packaging materials for raw and processed food products. Machinery for Packaging: Form fill and seal machines, vacuum packaging machine, shrink wrap packaging machine and multilayer packaging system. Package labeling: functions, nutrition labeling, ingredient characterization, handling instruction, and regulations; Shelf life of packaged food: water activity and prediction of shelf life.

UNIT 2

12 hours

Storage engineering-I: Food Storage: Importance of scientific storage systems, Postharvest Physiology of semi-perishables and perishables, climacteric and non-climacteric fruits, respiration, ripening, changes during ripening, ethylene biosynthesis. Product damages during storage. Storage structures: Traditional, improved and modern storage, Farm silos: Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos.
Stored grain management and aeration: moisture and temperature changes in stored grains; conditioning of environment inside through ventilation.

UNIT 3

12 hours

Storage Engineering-II: Storage pests and control: Damage due to storage insects, pests, rodents and its control. Storage of perishables: cold storage, controlled and modified atmospheric storage, hypoboric storage, evaporative cooling storage, conditions for storage of perishable products, control of temperature and relative humidity inside perishable storage. functional, structural and thermal design of cold stores.

UNIT 4

14 hours

Biodegradable packaging: Types of packaging, classification, advantages and limitations of each type of packaging, economics of various packaging materials; Specifications for packaging various food products, testing standards, testing agencies. Types of natural polymers used for developing food packaging, properties of natural polymers for food packaging applications, chemical modifications of natural polymers for food applications; Methods of manufacturing biodegradable packaging, testing and evaluation; Synthetic biopolymers used for packaging applications. Properties of the polymers and specifications; Methods of manufacturing synthetic polymer films, testing and evaluation.

Total: 52 hours

Textbook:

1. Food Packaging: Principles and Practice. Gordon L. Robertson.
2. Food Packaging Technology, Hand book, 2004. NIIR Board, New Delhi.
3. Food Packaging Technology by Harsh Sharma.
4. Packaging Materials and Containers by Paine, F. A. Publisher: Blackie and sons Ltd.., London, 1967.
5. Handbook of Food Packaging by F.A. Paine and H.Y. Paine Publisher: Blackie and son Ltd. London. (1983)

PFB214E: Food Allergies and Allergens
4 Credits (4-0-0)

UNIT-1

Introduction to food allergies and allergens **12 Hours**

Overview of food allergies, allergens, immune system, antigen antibody interactions; sign & symptoms of food allergy; global prevalence of food allergies; classification of hypersensitivity reactions, use of bioinformatics in understanding and identification of potential cross allergens.

UNIT 2

Factors **12 Hours**

Food allergies and allergens Factors affecting food allergenicity, issues related to food additives and ingredients, genetic inheritance of food allergy, Immunological response, Oral allergy syndrome, GM foods and risk of allergy.

UNIT 3

Characteristics of food allergenictiy **14 Hours**

Natural sources and chemistry of food allergens, handling of food allergies; Detection & Diagnostic techniques for allergy, limitations of food allergy diagnostic techniques; Characterization of allergens, food sensitivities (anaphylactic reactions, metabolic food disorders and idiosyncratic reactions).

Management of food allergenicity: Principles of management of food allergens including detailed knowledge of avoidance measures; Application of Genetic modification to reduce allergenicity; Methods used in safety evaluation-risk assessments.

UNIT 4

14 Hours

Preventive measures for food allergies and Regulatory and labelling procedures: Prevention of allergic disease by primary, secondary and tertiary methods including aspects of epidemiology, hygiene and allergic march hypotheses; Case studies of reported food allergies and related food recalls. Hypoallergenic foods and dietary management of allergy, effect of processing treatments on food allergenicity; Regulatory procedures for food allergens at national and international level; Labelling guidelines.

Total: 52 Hours

Text books

1. Judy Owen, Jenni Punt, Sharon Stranford. (2013). Immunology by Kuby. 7th edition
2. S Flanagan. (2014). Handbook of Food Allergen Detection and Control, Simon Flanagan. 1st edition Woodhead publishing

Reference Books

1. Scott H. Sicherer. (2013). Food Allergy: Practical Diagnosis and Management. 1st edition CRC Press.
2. Ebisawa M. Sagamihara, Ballmer-Weber B.K. Zurich, Vieths S. Langen and Wood.
3. R.A. Baltimore, Md. (2015). Food Allergy: Molecular Basis and Clinical Practice. Karger Publishing.

PFB221E: Dairy Technology
4 Credits (4-0-0)

UNIT-1

Introduction **14 Hours**

Understanding about milk, milk - composition, food and nutritive value, physico-chemical properties; milk reception at dairies, quality and quantity tests at reception. Equipments used in liquid milk processing.

Unit Operations in Milk Processing

Principles of milk processing: Filtration, milk storage, bulk cooling, stirring and mixing, standardization, pasteurization, sterilization, centrifugation, homogenization, evaporation and condensation.

UNIT-2

Production of Milk Products **12 Hours**

Drying of milk, principle and equipment: spray dryer, cyclone separator. Manufacturing of milk products and principles of processing of cheese, ice-cream, butter, special milk products, casein, whey, curd, butter milk etc. Equipment for indigenous milk products manufacturing. Enzymes and their role in the manufacture of dairy products.

UNIT-3

Non-thermal processing and packaging **12 Hours**

UV, High pressure, Ultrasound, Membrane, High intensity pulsed electric field applications in milk processing. Packaging: Filling Operations: Principles and working of different types of bottle filters and capping machine, pouch filling machine, pre-pack and aseptic filling. Filling and Packaging machines for milk and milk products, aseptic packaging.

UNIT-4

Dairy plant maintenance **14 Hours**

Bulk milk handling system, care and maintenance, Hygienic design concepts, sanitary pipes and fittings, CIP system. Preventive maintenance program for Dairy Plant, Maintenance organization, development of optimum organization planned overhaul and PERT planning, Utilities and sanitation in processing plant. By-product utilization from dairy industries.

Total: 52 hours

Textbooks

1. Outlines of Dairy Technology. Sukumar De
2. Dairy Plant System and Layout. Tufail Ahmed
3. Engineering for Dairy and Food Products. A W Farrall. John Wiley and Sons
4. Indian Dairy Products. K S Rangappa
5. Milk and Milk Products. Clarence Henry Eckles

Reference Books

1. Cheese and Butter by V. Cheke and A. Sheeprd
2. Dairy Chemistry and Biochemistry. P. F. Fox
3. Dairy Technology: Principles of Milk Properties and Processes. P. Walstra.

PFB222E: Automation & Robotics in Food Processing
4 Credits (4-0-0)

UNIT 1

Process control **12 Hours**

Introduction to process control, variables, strategies, laws Block and physical diagram of control systems, open and closed loop, feedback and forward controls pneumatic and electronic controllers. Measuring element controller and final control elements; P, PI, PID controls. Mode of control actions. PLC system; ladder diagram

UNIT 2

Automation and robotics **14 Hours**

Automatic process control in food industry. Process control methods in food industry, current, future trends. Robotics in food industry, specification of food sector robot.Data acquisition: Instrumentation in food processing, sensors for automation, measurement methods, applications, machine vision, optical sensors and spectroscopic techniques. SCADA; standards, application and implementation

UNIT-3

Modeling systems **12 Hours**

Modeling strategy, ANN, null hypothesis, Intelligent control system using fuzzy logic, design of PID controller, real time optimization Food Contaminants from Industrial Wastes. Pesticide Residues in Foods. Food Additives. Toxicants Formed during Food Processing.

UNIT 4

Automation **14 Hours**

Automation in fruit, vegetables process. Automation in sorting, thermal processing, fresh produce: Automation in bulk sorting; principles, requirements. Automation in food chilling and freezing; in storage, transport, retail systems. Automation in fruit vegetable processing; cleaning, grading, canning etc.

Total: 52 hours

Text books

1. Robotics and Automation in the Food Industry by D Caldwell, Elsevier Science, Woodhead Publishing.
2. Eackman DP. 1972. Automatic Process Control. Wiley Eastern.

Reference Books

1. George Stephanopolous, "Chemical Process Control", Prentice Hall of India, 1990.
2. Luyben, W. L, Process Modeling, Simulation and Control for Chemical Engineers, McGraw hill, 1973.
3. Considine DM. 1974. Process Instruments and Controls. Mc-Graw-Hill.
4. Thermal Processing of Foods: Control and Automation by K. P. Sandeep March 2011, Wiley-Blackwell.

PFB223E: Genomics, Proteomics & Bioinformatics
4 Credits (4-0-0)

UNIT-1

Biological databases **12 hours**

Introduction, Primary & Secondary database, Sequence file formats, Introduction to structures, Protein Data Bank (PDb), Molecular Modelling Database (MMDb), Structure file formats, Visualizing structural information, Database of structure viewers, Collection of sequences, sequence annotation, sequence description. Sequence alignment and database searching: Evolutionary basis of sequence alignment, Optimal alignment methods, Substitution scores & gap penalties, Statistical significance of alignments,

UNIT 2

14 hours

Database similarity searching, FASTA, BLAST, Low complexity regions, Repetitive elements, Multiple Sequence Alignment: Progressive alignment methods, Motifs and patterns, Clustral, Muscle; Scoring matrices, Distance matrices. Phylogenetic analysis: Alignment, tree building and tree evaluation, Comparison and application of Unweighted Pair Group Method with Arithmetic Mean (UPGMA),Neighbour Joining (NJ), Maximum Parsimony (MP), Maximum Likelihood (ML) methods, Bootstrapping, Jackknife; Software for Phylogenetic analysis. DNA barcoding: Methods tools and databases for barcoding across all species, Applications and limitations of barcoding, Consortium for Barcode of Life (CBOL) recommendations, Barcode of Life Database (BOLD). Structural biology: 3-D structure visualization and simulation,

UNIT 3

Basic concepts in molecular modeling **12 hours**

Different types of computer representations of molecules; External coordinates and Internal Coordinates, Molecular Mechanics, Force fields etc. Secondary structure elucidation using Peptide bond, phi, psi and chi torsion angles, Ramachandran map, anatomy of proteins – Hierarchical organization of protein structure –like CATH (class, architecture, topology, homology), SCOP (Structural Classification of Proteins), FSSP (families of structurally similar proteins).

UNIT 4

14 hours

Classification and comparison of 3D structures DNA & RNA secondary and tertiary structures, t-RNA tertiary structure; Protein Secondary structure prediction: Algorithms viz. Chou Fasman, GOR methods, Tertiary Structure prediction: Fundamentals of the methods for 3D structure prediction (sequence similarity/identity of target proteins of known structure, fundamental principles of protein folding etc.) Homology/comparative modelling, fold recognition, threading approaches, and ab initio structure prediction methods; CASP (Critical Assessment of protein Structure Prediction); Computational design of promoters, proteins & enzymes.

Total: 52 hours

Text books

1. A. D. Baxevanis and B.F.F. Ouellette (Eds). (2002)
2. D. W. Mount

Reference Books

1. Jones & Peuzner, (2004); Introduction to Bioinformatics Algorithms; Ane Books, India.
2. Web-resources and suggested reviews/ research papers.

PFB224E: Secondary Processing in Food Biotechnology
4 Credits (4-0-0)

UNIT 1

Overview of fermentation **12 Hours**

Fermentation as an ancient art, modern era of fermentation technology. Biology of industrial micro-organisms- isolation, screening and genetic improvement of industrially important micro-organisms.

UNIT 2

Fermentation systems **12 hours**

Batch and continuous systems, fed-batch culture, feedback systems, fermenter design, solid substrate fermentation, Instrumentation and control. Fermentation raw materials- criteria used in media formulation influence of medium, raw materials for process control.

UNIT 3

Downstream processing **12 Hours**

Objectives, steps, problems, separation processes. Microbial production of various primary and secondary metabolites- alcohol, amino-acids, organic acids (citric acid and acetic acid), enzymes, antibiotics (penicillin, cephalosphorin). Principles of overproduction of metabolites.

UNIT 4

Biomass production **12 Hours**

Microbial production of single cell protein, Baker's yeast. Immobilized enzyme technology- methods of immobilization and applications.

Membrane technology- methods and applications in bioprocessing. Waste treatment- introduction, waste treatment systems, microbial inoculants and enzymes for waste treatments.

Text books

1. Crueger, W. & Crueger, A. (2000). Biotechnology: A Textbook of Industrial Microbiology (2nd ed.): Panima, New Delhi.
2. Rehm, H. J., Red, G. (1993). Biotechnology: A Multi Volume Comprehensive Treatise (2nd ed.): VCH, New York.
3. Stansbury, P. F., Whitakar, A. and Hall, S. J. (1997). Principles of Fermentation Technology (2nd ed.): Pergamen Press, Oxford.

Reference Books

1. Reed, G. (1987). Prescott & Dunn's Industrial Microbiology (4th ed.): CBS, New Delhi.
2. Mansi, E. M. T. E. L. & Bryce, C. F. A. (1999). Fermentation Microbiology and Biotechnology.

PFB231E: Nanotechnology in Food Industry
4 Credits (4-0-0)

UNIT-1

Introduction **12 Hours**

Definition of nanotechnology, development, application of nanoscale materials, AFM, natural food nano substances and nanostructure – carbohydrate, protein, emulsion.

Nanotechnology fo improving food quality, detection of contaminants

UNIT-2

Nano Ingredients and additives **12 Hours**

Nano materials for food applications- metal oxides, functionalized nanomaterials, nano additives, relation to digestion

UNIT-1Nanotechnology in Agriculture and Food Technology Nanotechnology in Agriculture - Precision farming, Smart delivery system Nanofertilizers: Nanourea and mixed fertilizers, Nanofertigation Nanopesticides, Nanoseed Science. Nanotechnology in Food industry Nanopackaging for enhanced shelf life - Smart/Intelligent packaging - Food processing and food safety and bio-security – Electrochemical sensors for food analysis and contaminant detection.

UNIT-3

Nano technology in packaging **12 Hours**

Nano technology in food packaging, nano composites, nano coatings. Role in active packaging, intelligent packaging. Nano sensor. Nano membrane Potential Benefits and hazards. Industrial benefits, consumer benefits, Detection and characterization of nanoparticles in food, exposure, potential hazards

UNIT-4

12 Hours

Risks associated ENP, health risks- toxins, metabolism action etc. Risk governance- principle Regulations. General regulations, safety aspects in different regions, Regulation aspects of nano scale food ingredients, additives, FCMS.

Total: 52 hours

Text books

1. P. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead publication, London, 2006.
2. J. Altmann, Routledge, Military Nanotechnology: Potential Applications and Preventive Arms Control, Taylor and Francis Group, 2006.
3. Introduction to nanotechnology - Charles P. Poole; Frank J. Owens – 2008 – Wiley.
4. Nanotechnologies in Food – Qasim Chaudhary, Laurence Castle, Richard Watkins - 2010- RSC Publishing
5. P. J. Brown and K. Stevens, Nanofibers and Nanotechnology in Textiles, Woodhead Publishing Limited, Cambridge, (2007).

Reference Books

1. Q. Huang -Nanotechnology in the Food, Beverage and Nutraceutical Industries. Woodhead Publishing
2. Limited - 2010
3. Lestie prey, “Nanotech in food products”, Wiley publications 2010.
4. Pandua W., “Nanotech research methods for foods and bioproducts”, Wiley publications 2012.

PFB232E: Biotechnology of Fermented Foods
4 Credits (4-0-0)

UNIT-1

12 Hours

Sources of enzymes, enzymes their advantages/ disadvantages, commercially important enzymes used in Food industry and their mode of action. Role of enzymes used in food industry baking, brewing, meat and meat processing; enzymatic approach to tailor made fats; catabolic processes and oxygen-dependent reactions in food. Objectives and applications of enzymes and Immobilized enzymes in food processing. Oxidoreductases- Phenolases, Glucose Oxidases, Catalases, Peroxidases, Lipoxygenases, Xanthine Oxidases,

UNIT-2

14 Hours

Fermentative production of enzymes used in food industry by SSF and SmF, Recovery and purification of enzymes , cheese making and whey processing, impact of enzyme technology (bioethanol, protein hydrolysates, bioactive peptides); Enzymatic processing of fruit juices; Role of enzymes in baking, meat and meat processing. Production of Baker's Yeast, Microbial Proteins and Fats, Food enzymes Food related enzymes and applications: Amylases, Pectic Enzymes, Proteases, Rennet; Application of enzymes in food processing

UNIT-3

14 Hours

Historical perspective, mechanism of fermentation, effect on nutritional value, Technology of fermented Dairy Products like Cheese, Curd and Yoghurt, Butter milk and fermented milks such as cheese, yoghurt, sweet curd, paneer, shreekhand, Fermented pickles.

Technology of fermented meat and fish products. Fermentative Production of Beer, Wines, and other alcoholic beverages ,Cider and Vinegar. Fermented Vegetables (Pickles). Oriental fermented foods. Fermentation of vegetables and fruits – lactic acid fermentation. Fermentation of meat and fish. enzymatic processing of fruit juices.

UNIT-4

12 Hours

Functional foods, Traditional applications of food biotechnology- Fermented foods: eg dairy products, oriental fermentations, alcoholic beverages, and food ingredients; the role of biotechnology in fermented food products (dairy, meat, vegetable); Starter culture development, process development. Newer Processing Technology, Pesticide Residues, Newer Sources of Ingredients,

Total: 52 hours

Text Books /Reference Books

1. Industrialization of indigenous fermented foods by Keith H. Steinkraus
2. Microbiology of fermented foods by Brian J.B.Wood
3. Advances in Biochemical engineering, Vol 3, 1974, Ghose T.K.

PFB233E: Food Additives and Preservatives
4 Credits (4-0-0)

UNIT-1

Overview: **14 Hours**

Introduction to food additives and ingredients, their use in food processing, food product development and in food preservation, their functions and safety; Safety and quality evaluation of food additives and ingredients.

UNIT-2

Food preservatives **14 Hours**

Preservatives, antioxidants- chemistry, mechanism of action, properties and food applications. Food colours, Food Additives (emulsifiers, stabilizers and sweeteners): Colours, flavours- chemistry, properties, food applications. Emulsifiers, stabilizers, sweeteners- chemistry, mechanism of action, properties, food applications.

UNIT-3

12 Hours

Sequestrants, humectants and acidulants Sequestrants, humectants, acidulants - chemistry, mechanism of action, properties, food applications.

UNIT-4

Food ingredients **12 Hours**

Ingredients- carbohydrate, protein, fat based and nutraceutical ingredients, their production, properties and food applications

Total: 52 hours

Text books

1. Branen AL, Davidson PM; Salminen S. (2001). Food Additives. 2nd Ed. Marcel Dekker.
2. Gerorge AB. (1996). Encyclopedia of Food and Color Additives. Vol. III. CRC Press.
3. Gerorge AB. (2004). Fenaroli’s Handbook of Flavor Ingredients. 5 th Ed. CRC Press.
4. Madhavi DL, Deshpande SS; Salunkhe DK. (1996). Food Antioxidants: Technological, Toxicological and Health Perspective. Marcel Dekker, New York.

Reference Books

1. Morton ID & Macleod AJ. (1990). Food Flavours. Part A, B, C. Elsevier.
2. Nakai S; Modler HW. (2000). Food Proteins: Processing Applications. Wiley VCH.
3. Stephen AM. (Ed.). (2006). Food Polysaccharides and their Applications. Marcel Dekker.
4. T. E. Furia, Handbook of Food Additives, CRC Press.

PFB234E: Crop Improvement and Molecular Breeding
4 Credits (4-0-0)

UNIT 1
Introduction and basic concepts of classical plant breeding **14 Hours**

The status of plant breeding in agriculture, the importance of breeding, history and development of plant breeding in the world. Genetic structure of the variety, variability of cultivated plants, important cultural properties and characteristics of flora.The main phases of the breeding process, genetic resources, centers of origin of cultivated plants, preservation and conservation of genetic resources. Implications for the propagation of breeding methods and selection procedures, techniques and procedures for crossing

UNIT 2
Conventional techniques, methods and practices of breeding **12 Hours**

The techniques and selection methods. Breeding methods for self, cross-pollinated, and in vegetatively propagated crops. Peculiarities of the biennial and perennial species. Nature and theory of heterosis, using heterózního effect in plant-breeding techniques for the breeding of F1 hybrids. Male sterility, genetic determination of male sterility, the use of male sterility in breeding of F1 hybrids.

UNIT 3
Alternative breeding techniques **12 Hours**

Mutation breeding, induced mutagenesis, mutagens used, methods of working. Remote hybridization causes problems with pollination of species and the possibility of overcoming, the properties of distant hybrids. Properties of polyploids, the use of polyploidy in plant breeding, methods of obtaining polyploid breeding, use of aneuploidy. Haploids in plant breeding. Breeding for resistance to pests and diseases, genetic nature of resistance.

UNIT4
Gene manipulation in plant breeding **14 Hours**

The basic strategy of gene manipulation in plants, gene cloning and cloning vectors, expression vectors. The use of Agrobacterium tumefaciens in transgenosis plants, other technologies can obtain genetically modified plants. Objectives for Transgenosis in plants, most frequently used genes, characteristics of the GMOs, placing GMOs in the market. Legislation governing the handling of GMOs.

Total: 52 hours

Reference Books:

1. Principles of Crop Improvement by N.W. Simmonds and J. Smart
2. Principles of Cultivar Development, Vol. 1 Theory and Technique by W. R. Fehr
3. Selection Methods in Plant Breeding. Bos I &Caligari P. 1995. Chapman & Hall.
4. Molecular Breeding for Sustainable Crop Improvement, Vijay Rani Rajpal, S. Rama Rao, S.N. Raina, Vol.2., 2016, Springer International Publishing Switzerland, 978-3-319-27090-6

PFB208L: Food Processing and Product Development Lab
1 Credit (0-0-2)

1. Dairy Processing-probiotic yoghurt, cheese, whey protein, ice cream
2. Bakery processing
3. Cereal processing- unpolished
4. Fruit Processing
5. Vegetable processing- sauce, pickling
6. Formulation of Pediatric foods
7. Formulation of geriatric foods
8. Formulation of foods for women's health
9. Formulation of sports foods- energy bars- nutritional evaluation
10. Designing of New Food Product
11. learning art of indigenous process food

M. Tech. FOOD BIOTECHNOLOGY III SEMESTER

Sl. N.	Subject Code	Subject Title	Hours/Week					Exam Marks		
			Credits	Lecture	Tutorial	Practical	Total	CIE	SEE	Total
1	PFB31XE	Professional Elective -4	4	4	0	0	4	50	50	100
2	PFB32XE	Professional Elective -5	4	4	0	0	4	50	50	100
3	PFB33XE	Professional Elective -6	4	4	0	0	4	50	50	100
4	PFB301P	Project phase -1	4	0	0	8	8	50	50	100
5	PFB302I	Internship	4	0	0	0		50	50	100
		Total	**20**	**12**	**0**	**8**	**20**	**250**	**250**	**500**

List of Professional Electives

Professional elective 4		**Professional elective 5**	
Course Code		**Course Code**	**Course title**
PFB311E	Meat & Poultry food processing	PFB321E	Food Production System and Post Harvest Technology
PFB312E	Food Product Development	PFB322E	Food Industry by Product and Waste Management
PFB313E	Agricultural Biotechnology & Sustainability	PFB323E	Nutrigenomics
PFB314E	Advanced Nutrition	PFB324E	Processing of Spices and Plantation Crops
Professional elective 6			
Course Code	**Course title**	**Course Code**	**Course title**
PFB331E	Quality Control in Food Biotechnology	PFB333E	Processing Technology of Beverages
PFB332E	Downstream Processing Technology	PFB334E	Processing Technology of Legumes and Oil Seeds

PFB311E: Meat and Poultry Food Processing
4 Credits (4-0-0)

UNIT 1

Meat **12 Hours**

Composition from different sources; Muscle structure and composition; Postmortem muscle chemistry; Meat colour and flavours; Meat microbiology and safety; Modern abattoirs, Stunning methods.

UNIT 2

Slaughtering and dressing **14 Hours**

Steps in slaughtering and dressing; Operational factors affecting meat quality; effects of processing on meat tenderization; Halal, jhatka and kosher meat processing.

Chilling and freezing of carcass and meat, Cold storage, freezing and preservation. Canning, cooking, drying, pickling, curing and smoking; Prepared meat products salami, kebabs, sausages, sliced, minced, corned.

UNIT 3

Poultry industry in India **12 Hours**

Microbiology of poultry meat; Spoilage factors; Layout, sanitation and processing operations of poultry processing. Byproducts: eggs, egg products; Whole egg powder and egg yolk products: manufacture, packaging and storage.

UNIT 4

14 Hours

Fish: structure and composition, post mortem changes, rigor mortis, autolytic changes, bacteriological changes, rancidity, physical changes. Meat plant hygiene: GAP and HACCP; Packaging of meat products, Packaging of poultry products, refrigerated storage of poultry meat. . Types of fish, composition, structure, post-mortem changes in fish. Handling of fresh water fish. Canning, smoking, freezing and dehydration of fish. Fish sausage and home making. MMPO, MFPO, radiation processing meat safety.

CASE STUDIES: Safety and sanitation in meat processing industry

Total: 52 hours

Text books

1. Forrest JC. Principles of Meat Science. Freeman.
2. Govindan TK. Fish Processing Technology. Oxford & IBH.
3. Hui YH. Meat Science and Applications. Marcel Dekker.
4. Kerry J. et al. Meat Processing. Wood head Publ. CRC Press.

Reference Books

1. Levie A. Meat Hand Book. 4th Ed. AVI Publ.
2. Mead M. Poultry Meat Processing and Quality. Wood head Publ.
3. Mead GC. Processing of Poultry. Elsevier.
4. Pearson AM & Gillett TA. Processed Meat. 3rd Ed. Chapman & Hall.
5. Stadelman WJ & Cotterill OJ. Egg Science and Technology. 4th Ed. CBS.

PFB312E: Food Product Development
4 Credits (4-0-0)

UNIT-1

14 Hours

Introduction: Need, importance and objectives of formulation for new product development. Ideas, business philosophy and strategy of new product.

Formulation and Standardization

Formulation based on sources availability and cost competitiveness for concept developments of new products. Standardization of various formulation and product design.

UNIT-2

12 Hours

Product Development: Adaptable technology and sustainable technology for standardized formulation for process development. Process control parameters and scale-up, production trials for new product development at lab and pilot scale.

UNIT-3

12 Hours

Quality and Market: Quality assessment of newly developed products- nutritional and sensory qualities, shelf-life and safety evaluation as per FSSAI guide lines. Market testing and marketing plan.

UNIT-4

14 Hours

Economical aspect: Costing and economic evaluation. Economics of food plant construction- estimation of economic plant size (breakeven analysis and optimization) & Estimation of volume of production for each product. Commercialization/ product launch.

Total: 52 hours

Text books:

1. Food Product Development: Maximizing Success. R. Earle and A. Anderson
2. New Food Product Development: From Concept to Marketplace

Reference books:

1. Food Product Development: From Concept to the Marketplace. E. Graf and I. Saguy
2. Nutraceuticals Food Processing Technology: Innovative Scientific Research. Ed.R.P. Shukla
3. Food Science. B. Shrilakshmi
4. Food processing technology - principles and practice. P.J. Fellows
5. Industrial Economics: An Introductory Textbook. R.R. Barthwal

PFB313E: Agricultural Biotechnology and Sustainability
4 Credits (4-0-0)

UNIT 1

Concepts and scope of Agricultural Biotechnology **14 Hours**

Tissue culture in crop improvement, Micropropagation. Meristem culture and production of virus-free plants. Haploids in plant breeding;

Anther, microspore, embryo and ovary culture. Somatic hybridization; Protoplast isolation and fusion, cybrids. Somaclonal variation. Synthetic seeds. Cryopreservation, Secondary metabolites: production and elicitation with various biotic and abiotic elicitors.

UNIT 2

Genetic Engineering for Crop Improvement **12Hours**

Manipulation of Photosynthesis, Nitrogen fixation, Nutrient uptake efficiency. Molecular mechanisms of biotic stress resistance (Insects, fungi, bacteria, viruses, weeds) and abiotic stress tolerance (drought and salt) plants. Genetic engineering for quality improvement of Protein, lipids, carbohydrates, vitamins & mineral nutrients, Concept of map-based cloning and their application in transgenics. Animal Biotechnology: Fundamentals of animal cell culture. Classical and Molecular breeding in animals, Marker assisted selection.

UNIT 3

Animal cloning **14 Hours**

Transgenic animals, cloning of animals, Overview of Embryo Transfer in Farm Animals; Somatic Cell Nuclear Transfer and Other Assisted Reproductive Technologies. Basic principles for the production of transgenic fish, poultry breeds. Biosafety: Introduction to Biological Safety cabinets. Biosafety guidelines and Regulatory frameworks in India, GMOs & LMOs; Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in agriculture.

UNIT 4

14 Hours

Biotechnology for Sustainable Agriculture: an overview, Biotechnological tools to enhance sustainable production, Sustainable agriculture and food security, Green food production, Green house technology and protected cultivation: Types of Green house, Various component of green house, Design, criteria and calculation. Green house irrigation system, Pytotrons: Hydroponics and aeroponics. Organic Farming: Concept of Integrated nutrient management and Integrated pest management, molecular farming in animals and plants. Nanotechnology and its implication in Agricultural Biotechnology.

Total: 54 hours

Reference Books

1. Agricultural Biotechnology, S SPurohit, Agribios India, 2nd ed. 2003, digitalized 2011, ISBN:81-7754-156-0.
2. Handbook on Agriculture, Biotechnology and Development, Stuart J. Smyth, Peter W.B. Phillips and David Castle, Edward Elgar Publications, 1st ed,2015 ISBN: 978178347 1355.
3. Plant Biotechnology-The genetic manipulation of plants, Adrian Slater, Nigel Scott and Mark Fowler, Oxford university press, 2nded, 2010, ISBN-13:9780199282616.
4. Plants, Genes, And Crop Biotechnology, Maarten J. Chrispeels and David E. Sadava , Jones and Bartlett Publishers, 2nd ed. 2003, ISBN-13: 978-0763715861.

PFB314E: Advanced Nutrition
4 Credits (4-0-0)

UNIT 1

12 Hours

Human Nutritional Requirements, methods determining human nutrient needs. Description of basic terms and concepts in relation to human nutritional requirements, guidelines and recommendation. Development of International and National Nutritional RequirementsTranslation of nutritional requirements into Dietary Guidelines. Body Composition .Significance of body composition and changes through the life cycle. Methods for assessing body composition (both classical and recent) and their applications.

UNIT 2

12 Hours

Components of energy requirements: BMR, RMR, thermic effect of feeding, physical activity. Factors affecting energy requirements, methods of measuring energy expenditure. Estimating energy requirements of individuals and groups. Regulation of energy metabolism and body weight: Control of food intake – role of leptin and other hormones. Dietary fibre Types, sources, role and mechanism of action. Resistant starch, fructo-oligosaccharides, other oligosaccharides: Chemical composition and physiological, Significance. Glycemic Index and glycemic load.

UNIT 3

14 Hours

Carbohydrates and gene expression. Nutritional significance of fatty acids – SFA, MUFA,PUFA functions and deficiency. Role of n-3 and n-6 fatty acids and Prostaglandins. Trans Fatty Acids Conjugated linoleic acid, Nutritional Requirements and dietary guidelines (International and National) for visible and invisible fats in diets.

UNIT 4

14 Hours

Lipids and Macro minerals: (Calcium and Phosphorus)-History, structure, sources, absorption, transport, utilization, storage, excretion, functions, bioavailability, requirements and RDA, deficiency, toxicity, assessment of status and alteration in requirements in various clinical and metabolic disorders. gene expression. Vitamin A, Vitamin E, Vitamin K, Vitamin D.

Total 52 Hours

PFB321E: Food Production System and Post Harvest Technology
4 Credits (4-0-0)

UNIT 1

Introduction **12 Hours**

Basic post harvest physiology, definition, respiration and gas exchange, hormonal changes during post harvest, physical and chemical changes, transpiration, water stress. Factors affecting post-harvest physiology:

UNIT 2

12 Hours

Pre-harvest nutritional factors, harvesting and handling injuries, storage conditions; temperature, RH, composition and its modification, ethylene biosynthesis and action Changes during handling and storage:. Changes during ripening, hormones, enzymes associated, change in colour, texture, flavour during storage, role of vitamins and carbohydrates.

UNIT 3

12 Hours

Maturity and maturity indices, storage types, post- harvest treatments, bio regulators Factors involved with spoilage: Biotic, abiotic factors; temperature, insects, microbes; fungi, bacteria etc. quality and safety factors,

UNIT 4

12 Hours

Quality Improvement techniques: Improve quality; harvesting, handling techniques, coatings and treatments, insect control and microbial control, quality control measures, GAP, GMP, HACCP.
Storage characteristics: Storage characteristics of different fruits and vegetables, measurement of product quality methods; destructive and non- destructive tests; physical chemical, biological, visual methods.

Total: 52 hours

Text books

1. Post harvest physiology and pathology of vegetables by Jerry A Bartz.
2. Post Harvest Technology of Horticulture crops

Reference Books:

1. R.H.H. Wills et.al. An introduction to the Post-harvest physiology and handling of fruits and vegetables
2. Kadar AA.1992. Post-harvest Technology of Horticultural Crops. 2nd Ed. University of California.
3. Lal G, Siddapa GS & Landon GL.1986. Preservation of Fruits and Vegetables. ICAR.
4. Pantastico B. 1975. Post Harvest Physiology, Handling and Utilization of Tropical and Subtropical Fruits and Vegetables. AVI Publ.
5. Salunkhe DK, Bolia HR & Reddy NR. 1991. Storage, Processing and Nutritional Quality of Fruits and Vegetables. Vol. I. Fruits and Vegetables. CRC.
6. Thompson AK. 1995. Post Harvest Technology of Fruits and Vegetables. Blackwell Sci.
7. Verma LR. & Joshi VK. 2000. Post Harvest Technology of Fruits and Vegetables. Indus Publ.

PFB322E: Food Industry Byproducts & Waste Management
4 Credits (4-0-0)

UNIT-1

Byproducts I **14 Hours**

Various byproducts from Food Processing Industry: By products of cereals, legumes, oil seeds, dairy, fruit and vegetables processing industries and their uses.

UNIT-2

Byproducts II **12 hours**

By products of meat and fish processing units and their uses. Uses of byproducts of agro based industries in various sectors.

UNIT-3

14 hours

Various laws and regulations for waste management in food processing industries. Food industry wastes, Waste treatment methods for Cereals, Fruits, vegetables, Meat, Fish, Dairy processing and Brewery Industries.

UNIT-4

12 hours

Waste water treatment-Preliminary treatment, primary, secondary, advanced and final treatment; zero-discharge and zero-emission system.

Total: 52 hours

Text books

1. Handbook of Waste Management and Co-Product Recovery in Food Processing. K. Waldron
2. Waste Management for the Food Industries. I.S. Arvanitoyannis

Reference Books

1. Utilization of By-Products and Treatment of Waste in the Food Industry. Vasso Oreopoulou and Winfried Russ
2. Food Science. Norman N. Potter and Joseph H. Hotchkiss
3. Food Processing By-Products and their Utilization
4. Waste Management for the Food Industries. Ed. Ioannis S. Arvanitoyannis
5. Handbook of waste management and co-product recovery in food processing. Ed. Keith Waldron

PFB323E: Nutrigenomics
4 Credits (4-0-0)

UNIT-I

Introduction to gene-diet interactions **12 Hours**

Nutrigenomics: Scope and Importance to Human Health and Industry Transporter gene polymorphisms - interaction with effects of micronutrients in humans. Polymorphisms in genes affecting the uptake and transport of omega-6 and omega-3 polyunsaturated fatty acids: interactions with dietary lipids and hronic disease risk. Nutrigenomics approaches to unraveling physiological effects of complex foods. The intestinal microbiota - role in nutrigenomics.

UNIT-II

Modifying disease risk through nutrigenomics **12 Hours**

Modulating the risk of cardiovascular disease through nutrigenomics; Modulating the risk of diabetes through nutrigenomics; Modulating the risk of inflammatory bowel diseases through nutrigenomics; Modulating the risk of obesity through nutrigenomics; Modulating the risk of cancer through nutrigenomics; Modulating the malnutrition through nutrigenomics

UNIT-III

Technologies in nutrigenomics **14 Hours**

Different sequencing approaches, Microarray, Massarray, SNP genotyping, PCR and RT-PCR techniques

Proteomics techniques

1-D, 2-D gel electrophoresis, DIGE, novel peptide identification, peptide sequencing methods

Metabolomics techniques

Chromatography and mass spectrometry techniques, Discovery and validation of biomarkers for important diseases and disorders

Computational approaches

Introduction to different types of public domain databases, data mining strategies, primer designing.

UNIT-IV

Bringing nutrigenomics to industry, health professionals and the public **14 Hours**

Bringing nutrigenomics to the food industry: Industry-Academia partnerships as an important challenge; Bringing nutrigenomics to the public: Is direct-to-consumer testing the future of nutritional genomics? Interaction with health professionals in bringing nutrigenomics to the public; Is contemporary society ready for nutrigenomic science?Public health significance of nutrigenomics and nutrigenetics.

Total- 52 hours

PFB324E: Processing of Spices and Plantation Crops

4 Credits (4-0-0)

UNIT 1

12 Hours

Production and processing scenario of spice, flavour & plantation crops and its scope, Major Spices: (1) Post Harvest Technology composition, processed products of following spices – ginger, chilli, turmeric, onion, garlic, pepper, cardamom, cashew nut and coconut.

UNIT 2

14 Hours

Minor spices - herbs and leafy vegetables: processing and utilization, all spice, annie seed, sweet Basil, caraway seed, cassia, cinnamon, clove, coriander, cumin, dill seed, fern seed, nutmeg, mint, marjoram, rose merry, saffron, sage, savory, thyme, ajowan, curry leaves, asafoctida,Tea, coffee, cocoa:

UNIT 3

14 Hours

Processing and quality control, Vanilla and annatto; Processing spice oil and oleoresins; Chemistry and physiology of taste, flavouring compounds in foods separation, purification and identification of natural flavouring materials; Synthetic flavouring agents and their stability; flavours of soft drinks, baking and confectionery industry.

UNIT 4

12 Hours

Standards specification of spices and flavours; Packaging of spices and spice products; Processing of arecanut and its quality control; Processing of cashewnut and its quality control; Flavours of major and minor spices; By products from plantation crops and spices

Total- 52 hours

PFB331E: Quality Control in Food Biotechnology
4 Credits (4-0-0)

UNIT 1

14 Hours

Concept and evolution of quality control and quality assurance. Total Quality Management, Philosophy of GMP and cGMP. Preparation of audit, Conducting audit, Audit Analysis, Audit Report and Audit follow up Quality control laboratory responsibilities: GLP protocols on nonclinical testing control on animal house, data generation, integration and storage, standard test procedure, retention of sample records. CPCSEA guidelines.

UNIT 2

12 Hours

Quality review and batch release document of finished products, annual product quality review and parametric release, Audits, quality audits of manufacturing processes and facilities, audits of quality control.

UNIT 3

12 Hours

Good documentation practices, route cause analysis, corrective action preventive action (CAPA), out of specifications (OOS) and out of trend (OOT), Clinical studies- ICH GCP (E6) guidelines, post marketing surveillance, Pharmacovigilance.

UNIT 4

14 Hours

BABE (bioavailability and bioequivalence) studies, Concepts and management of contract manufacturing guidelines, Statistical Tools for Quality Control and Precision, Tools of Problem Solving and Continuous Improvement.
Introduction, scope and importance of IPR, Concept of trade mark, copyright and patents Product registration guidelines – CDSCO, USFDA, Concept of ISO 9001:2008, 14000, OSHAS guidelines, Quality Strategy for Indian Industry, Brief concept of IND, NDA, ANDA, SNDA and PAT.

Total: 52 hours

Text Books/ Reference Books

1. Sharp J. Good Pharmaceutical Manufacturing Practice: Rationale and Compliance. CRC Press; 2005.
1. Gad SC. Pharmaceutical Manufacturing Handbook: Production and Processes. John Wiley & Sons; 2008.
2. Steinborn L. GMP/ISO Quality Audit Manual for Healthcare Manufacturers and Their
3. Suppliers, Sixth Edition, (Volume 1 - With Checklists and Software Package). Taylor & Francis; 2003.
5. Kolman J, Meng P, Scott G. Good Clinical Practice: Standard Operating Procedures for Clinical Researchers. Wiley;1998.
6. Waller P. An Introduction to Pharmacovigilance. John Wiley & Sons; 2011.

PFB332E: Downstream Processing Technology
4 Credits (4-0-0)

UNIT 1

Introduction: **12 Hours**

Role and importance of downstream processing in biotechnological processes. Range and characteristics of bioproducts. Purification process of bio-product. Cell disruption methods for intracellular products; physical, chemical and mechanical methods. Basic principles of distillation,crystallization, centrifugation, ultracentrifugation (preparative and analytical).Types of centrifuges and rotors,centrifugation-differential,density gradient (zonal and isopycnic).

UNIT 2

Primary Recovery Operations **14 Hours**

Process involved in liquid-liquid extraction, solid-liquid extraction, ammonium sulphate precipitation, Precipitation of proteins and nucleic acids by solvents and polyethylene glycol, dialysis, electrodialysis, ultrafiltration (Removal of insolubles by filtration), reverse osmosis, drying and lyophilization. Membrane based separations theory, design and configuration of membrane separation equipment.

UNIT 3

Chromatography **14 Hours**

Principles of chromatographic seperations, Classification of chromatography- plain and column chromatography, Paper chromatography - Single dimensional (Ascending and Descending, radial and two dimensional) chromatography, partition coefficient, retention factor, Thin layer chromatography, Gas liquid Chromatography, Adsorption Chromatography: Adsorption column chromatography, Ion Exchange Chromatography: cation Exchange and anion Exchange chromatography. Gel Filtration Chromatography, Affinity Chromatography, High Performance liquid chromatography, NP-HPLC and RP-HPLC.

UNIT 4

Electrophoresis **12 Hours**

Electrophoresis principles, factors affecting electrophoresis mobility, Moving boundary electrophoresis, Zone Electrophoresis, Gel Electrophoresis, Continuous Gel electrophoresis, Disc Gel electrophoresis, Agarose Gel Electrophoresis, Capillary Electrophoresis, Cellulose Acetate, Starch Gel , Native and SDS-PAGE, High voltage electrophoresis, Isoelectric focusing, Immunoelectrophoresis, ELISA, Flow cytometry

Downstream Processes:

Case studies (production)-DSP flow sheets for penicillin, insulin, amino acid, monoclonal antibody.

Total: 52 hours

PFB333E: Processing Technology of Beverages
4 Credits (4-0-0)

UNIT 1

Introduction and History of growth **12 Hours**

Type of beverages: fruit & vegetable juices, fermented and non-fermented beverages, synthetic beverages, carbonated and non-carbonated beverages.

Tea, Coffee and Cocoa: Production, composition, processing and preparation.

UNIT 2

Fruit and Vegetable Beverages **14 Hours**

Juice extraction, clarification, preservation, packaging, concentration and drying. Various beverages from fruit juices, their preparation and preservation.

UNIT 3

Non carbonated and carbonated synthetic beverages **12 Hours**

Ingredients, source of carbon dioxide, chemical and physical properties of carbon dioxide, carbonating process, packaging of carbonating beverages. Alcoholic Beverages:Non-Distilled Beverages : Beer and WineDistilled Beverages :Vodka, Rum, Gin, Whisky, Arack, Toddy, Brandy

UNIT 4

Water for beverages: **14 Hours**

Types of water required for beverages, treatment of water. Additives for beverages: Natural and synthetic sweeteners and colours, acids, emulsifiers, preservatives, flavours and flavour enhancers. Quality control of beverage: Quality standards for beverages, chemical, microbial and sensory evaluation, product shelf life.

Total: 52 hours

PFB334E: Processing Technology of Legumes and Oil Seeds
4 Credits (4-0-0)

UNIT 1

12 Hours

Present status and future prospects of legumes and oilseeds; Morphology of legumes and oilseeds; Classification and types of legumes and oilseeds, Anti-nutritional compounds in legumes and oilseeds;

UNIT 2

14 Hours

Methods of removal of anti-nutritional compounds, Milling of legumes: home scale, cottage scale and modern milling methods, milling quality, efficiency and factors affecting milling.

UNIT 3

14 Hours

Problems in dhal milling industry, Soaking and germination of pulses, Cooking quality of legumes – factors affecting cooking quality, Oilseeds: composition, methods of extraction, Desolventization and refining of oils: degumming, neutralization bleaching, filtration, deodorization, etc.

UNIT 4

12 Hours

New technologies in oilseed processing, Utilization of oil seed meals for food uses i.e. high protein products like concentrate, isolates Byproduct of pulses and oil milling and their value addition.

Total: 52 hours

M. Tech (Digital Communication Engineering)

I Semester

Sl. No.	Subject Code	Subject	L-T-P	Credits
1	PEC131C	Probability and Random Process	3-2-0	4.0
2	PEC132C	Advanced Digital Communication	3-2-0	4.0
3	PEC133C	Antenna Theory and Design	3-2-0	4.0
4	Elective – I			4.0
	PEC131E	Multimedia Communication	4-0-0	
	PEC132E	Cloud Computing	4-0-0	
	PEC133E	Wireless Communication	4-0-0	
5	Elective – II			4.0
	PEC134E	Digital System Design using Verilog	4-0-0	
	PEC135E	Advanced Computer Networks	4-0-0	
	PEC136E	Multi-rate Systems and Filter Banks	4-0-0	
6	Elective – III			4.0
	PEC137E	Optical Networks	4-0-0	
	PEC138E	Image Processing	4-0-0	
	PEC139E	Artificial Intelligence	4-0-0	
		Total		24.0

L=Lecture Hours
T=Tutorial Hours
P=Practical Hours

Course Title: Probability and Random Process		Course Code: PEC131C
Credits: 4	Teaching Hours: 40 Hrs (10 Hrs/Unit)	(L-T-P: 3-2-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1) To provide the knowledge of probability and probabilistic models.
2) To equip the students with basic tools required to build and analyze models both in discrete and continuous context.
3) To make students understand and use the concepts of random processes in system design.
4) To provide the knowledge of processes to solve random problems/experiments such as transportation, traffic problems and queuing.

Course Outcomes:
A student who successfully completes this course should be able to
1) Solve various probability and discrete distribution problems.
2) Comprehend and use the concepts of special distributions in system design.
3) Apply the concepts of multiple random variables to address various random experiments.
4) Apply the concepts of random processes in the system design.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to Probability Theory: Experiments, sample space, Events, Axioms, Assigning probabilities, Joint and conditional probabilities, Baye's Theorem, Concept of independence & orthogonality, related problems.
Discrete Random Variables: Random Variables, Distributions and Density Functions: PMF, CDF, PDF, related problems & Engg Example.

Unit II (13 hours)

Operations on a Single Random Variable: Expected value (EV), EV of Random variables, EV of functions of Random variables, Conditional expected values, Central Moments. Characteristic functions, Probability generating functions, Moment generating functions.
Distribution functions: Gaussian random variable, Uniform Exponential, Laplace, Gamma, Erlang, Chi-Square, Rayleigh, Rician and Cauchy types of random variables.

Unit III (13 hours)

Pairs of Random variables: Joint PMF, Joint CDF, Joint PDF, Conditional Distribution, density and mass functions, EV involving pairs of Random variables, Independent Random variables.

Multiple Random Variables: Joint and conditional PMF, CDF, PDF, EV involving multiple Random variables, Gaussian Random variable in multiple dimension, Engg. application, linear prediction.

Unit IV (13 hours)

Random Process: Definition and characterization, Mathematical tools for studying Random Processes, Stationary and Ergodic Random processes, Properties of ACF.

Example Processes: Markov processes, Gaussian Processes, Poisson Processes, Engineering applications: Computer networks, Telephone networks.

Reference Books

1) S L Miller and D C Childers, Probability and random processes: application to Signal processing and communication, Academic Press / Elsevier 2004.
2) Papoulis and S U Pillai, Probability, Random variables and stochastic processes, McGraw Hill 2002.
3) Peyton Z Peebles, Probability, Random variables and Random signal principles, TMH 4th Edition 2007.
4) H Stark and Woods, Probability, random processes and applications, PHI 2001.

Course Title: Advanced Digital Communication		Course Code: PEC132C
Credits: 4	Teaching Hours: 40 Hrs (10 Hrs/Unit)	(L-T-P: 3-2-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1) To acquire knowledge of mathematical tools required for understanding digital communication systems.
2) To get insight of different digital modulation and demodulation techniques.
3) To understand the real time problems associated with digital communication systems.
4) To understand spread spectrum communication and its applications.

Course Outcomes:

A student who successfully completes this course should be able to

1) Decide the required digital modulation / demodulation technique for a given communication problem.
2) Design efficient digital communication systems to meet given SNR, bandwidth, bit error rate, security standards and etc.
3) Model and simulate a real time digital communication system.
4) Implement a real time digital communication system to meet given specifications.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Digital band-pass modulation techniques, Phase Shift Keying, Frequency Shift Keying, Amplitude Shift Keying, Detection of signals in Gaussian noise: Decision region, correlative receiver and binary decision threshold, Coherent detection of Binary Phase Shift Keying, signal space representation and computation of error probability, Coherent detection of Frequency Shift Keying, signal space diagram and computation of error probability, Non-coherent detection of binary Differential Shift Keying (DPSK), Non-coherent detection of Frequency Shift Keying, Quadrature Phase Shift Keying (QPSK).

Unit II (13 hours)

Communication through band-limited linear filter channels, optimum receiver for channels with Inter Symbol Interference (ISI) and white Gaussian Noise, optimum maximum- likelihood receiver, discrete-time model for channel with ISI, Linear equalization: peak distortion criterion and Mean Square Error criterion.

Unit III (13 hours)

Adaptive Equalization: Adaptive linear equalizer, adaptive decision feedback equalizer, adaptive equalization of Trellis- coded signals, Recursive least squares algorithms for adaptive equalization, self recovering (blind) equalization. Spread Spectrum Signals for Digital Communication: Model of Spread Spectrum Digital Communication System, Direct Sequence Spread Spectrum Signals, Frequency-Hopped Spread Spectrum Signals, CDMA, time-hopping SS, Synchronization of SS systems.

Unit IV (13 hours)

Digital Communication Through Fading Multi-Path Channels: Characterization of fading multi- path channels, the effect of signal characteristics on the choice of a channel model, frequency- non-selective slowly fading channel, diversity techniques for fading multi- path channels, Digital signal over a frequency-selective slowly fading channel, coded waveforms for fading channels, multiple antenna systems.

Reference Books

1) John G. Proakis, Digital Communications, McGraw-Hill publications, IV Edition, 2000.
2) B. Sklar, Digital Communications, McGraw-Hill publications, II Edition, 1996.
3) Simon Haykin, Communication Systems, Wiley Eastern Publication, III Edition, 2001.

Course Title: Antenna Theory and Design		Course Code: PEC133C
Credits: 4	Teaching Hours: 40 Hrs (10 Hrs/Unit)	(L-T-P: 3-2-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1) To introduce and discuss different types of antennas, various terminologies and excitations.
2) To study basic concepts of antenna arrays and array factor including complex arrays like binomial and chebyshev arrays.
3) To introduce basic principles and concepts of practical antennas viz., broadband antennas, frequency independent antennas, parabolic reflector antennas and general feed models.
4) To introduce various antenna synthesis methods and also methods of moments.

Course Outcomes:

A student who successfully completes this course should be able to

1) Comprehend antenna basics and parameters.
2) Design and analyze different antenna arrays
3) Comprehend various practical antennas and their principles and terminologies
4) Synthesize antennas using various synthesis methods

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Antenna Fundamentals and Definitions: Radiation mechanism - overview, Electromagnetic Fundamentals, Solution of Maxwell's Equations for Radiation Problems, Ideal Dipole, Radiation Patterns, Directivity and Gain, Antenna Impedance, Radiation Efficiency. Antenna Polarization. Resonant Antennas: Wires and Patches, Dipole antennas, Yagi - Uda Antennas, Micro strip Antenna.

Unit II (13 hours)

Arrays: Array factor for linear arrays, uniformly excited, equally spaced Linear arrays, pattern multiplication, directivity of linear arrays, non- uniformly excited-equally spaced linear arrays, Mutual coupling, multidimensional arrays, phased arrays, feeding techniques, perspective on arrays.

Unit III (13 hours)

Aperture Antennas: Techniques for evaluating Gain, reflector antennas - Parabolic reflector antenna principles, Axi -symmetric parabolic reflector antenna, offset parabolic reflectors, dual reflector antennas, Gain calculations for reflector antennas, feed antennas for reflectors, field representations, feed antennas used in practice. Broad band Antennas: Traveling - wave antennas, Helical antennas, Biconical antennas, sleave antennas, and Principles of frequency - independent Antennas, spiral antennas, and Log - Periodic Antennas.

Unit IV (13 hours)

Antenna Synthesis: Formulation of the synthesis problem, synthesis principles, line sources shaped beam synthesis, linear array shaped beam synthesis — Fourier Series, Woodward — Lawson sampling method, comparison of shaped beam synthesis methods, low side lobe narrow main beam synthesis methods Dolph Chebyshev linear array, Taylor line source method. Method of Moments: Introduction to method of Moments, Pocklington's integral equation, integral equations and Kirchoff's Networking Equations

Reference Books

1) Stutzman and Thiele, Antenna Theory and Design, 2nd Ed., John Wiley and Sons Inc.
2) C. A. Balanis, Antenna Theory Analysis and Design, John Wiley, 2nd Edition, 1997
3) Kraus, Antennas, McGraw Hill, TMH, 3rd Edition, 2003
4) Kraus and R.J. Marhefka, Antennas, McGraw Hil1, 2nd Edition, 1998
5) K. D. Prasad, Antenna & Wave Propagation, Satya Prakshan New Delhi, 1995.

Course Title: Multimedia Communication		Course Code: PEC131E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To introduce the basic concepts of multimedia data, its representation, storage and communication.
2) To introduce the need of data compression and different data compression techniques.
3) To introduce the concepts of basic video and audio compression techniques and standards.
4) To introduce different modes of multimedia communication across the networks.

Course Outcomes:

A student who successfully completes this course should be able to

1) Explain the main principles underlying the field of multimedia networking, and recognize the wider context of networked multimedia.
2) Explain the different coding techniques and significance of compression in multimedia networks.
3) Estimate the movement of objects in video frames
4) Compare and evaluate the performance of various issues in multimedia networking

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Multimedia Communications: Introduction, multimedia information representation, multimedia networks, multimedia applications, applications and networking terminology. Multimedia Information Representation: Digitization principles, text, images, audio, and video.

Unit II (13 hours)

Text and Image Compression techniques: Introduction, compression principles, text compression, image compression.

Unit III (13 hours)

Audio and Video Compression: Introduction, audio compression, video compression. Standards of Multimedia Communication: Introduction, reference models, standard relating to interpersonal communications, standards relating to interactive applications over Internet.

Unit IV (13 hours)

Multimedia Network Communications and Applications: Quality of Multimedia data transmission, Multimedia over IP, Multimedia over ATM networks. Information Network Design and Simulation: Introduction, design procedure, business needs and requirements, design aids, modeling and simulating networks, simulation, simulation languages and packages.

Reference Books

1) Fred Halsall, Multimedia Communications: Applications, Networks, Pearson Education Edition, 2001.
2) Ze-Nian Li, Mark S Drew, Fundamentals of Multimedia, Prentice Hall, 2004.
3) Nelin K Sharda, Multimedia Information Networking, Prentice Hall, 1999

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Course Title: Cloud Computing		Course Code: PEC132E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To introduce the broad perceptive of cloud computing concepts, models and enabling technology.
2) To familiarize with cloud computing mechanisms with respect to infrastructure, management and security.
3) To understand various cloud computing architectures, service quality metrics and SLAs.
4) To understand the basics of Internet of Things (IoT) and application areas.

Course Outcomes:

A student who successfully completes this course should be able to

1) Explain the strengths and limitations of cloud computing.
2) Identify the architectures, infrastructure and delivery models of cloud computing.
3) Explain the concepts of network virtualization, cloud management and security.
4) Demonstrate the IoT applications.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Fundamentals of Cloud Computing: Understanding cloud computing, fundamentals concepts and models, cloud-enabling technology, fundamental cloud security.

Unit II (13 hours)

Cloud Computing Mechanisms: Cloud infrastructure mechanisms, specialized cloud mechanisms, cloud management mechanisms, cloud security mechanisms.

Unit III (13 hours)

Cloud Computing Architectures: Fundamental cloud architectures, advanced cloud architectures, specialized cloud architectures.

Unit IV (13 hours)

Working with Clouds: Cloud delivery model considerations, cost metrics and pricing models, service quality metrics and SLAs. Internet of Things (IoT): Introduction, characteristics, architecture, applications.

Reference Books

1) Thomas Erl, Zaigham Mahmood, Ricardo Puttini, "Cloud Computing: Concepts, Technology and Architecture", Pearson education limited, 2013.
2) Olivier Hersent, David Boswarthick, Omar Elloumi , "The Internet of Things – Key applications and Protocols", Wiley, 2012.
3) Kai Hwang, Jack Dongarra & Geoffrey C. Fox, "Distributed and Cloud Computing: Clusters,

Grids, Clouds, and the Future Internet”.
4) Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, “Mastering Cloud Computing”, TMGH, 2013.
5) Kai Hwang, Geoffrey C Fox, Jack G Dongarra, “Distributed and Cloud Computing, From Parallel Processing to the Internet of Things”, Morgan Kaufmann Publishers, 2012.
6) Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building Automation”, Wiley, 2012.

Course Title: Wireless Communication		Course Code: PEC133E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100
Department : Electronics and Communication Engg. Designation : Elective		

Course Objectives:
1) To understand examples of wireless communication systems, different generations of mobile networks, WAN and PAN.
2) To understand the concepts of basic cellular system, frequency reuse, channel assignment strategies, handoff strategies, interference and concepts of outdoor propagation model.
3) To analyze and understand various modulation and demodulation techniques used in wireless communication.
4) To understand equalization, diversity, channel coding fundamentals, and channel accessing techniques.

Course Outcomes:
A student who successfully completes this course should be able to
1) Explain the evolution of wireless communication system with examples for analog and digital communication.
2) Design and analyze the frequency reuse mechanism for enhancing capacity of the cellular system.
3) Identify modulation and demodulation technique that is used for specific wireless communication standards.
4) Explain the significance of equalization, diversity, channel coding and different channel access techniques.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to wireless communication systems: Evolution of mobile radio communications, Mobile radio standards, examples: Cordless telephone systems, cellular telephone systems, comparison of common wireless communication systems, Modern Wireless Communication Systems: Second generation (2G) cellular networks, Third generation (3G) wireless networks, Wireless Local Loop (WLL) and LMDS, Wireless Local Area Networks (WLANs), Bluetooth and Personal Area Networks (PANs)

Unit II (13 hours)

The Cellular System Design Introduction, frequency reuse, channel assignment, Hand off mechanism, interface and system capacity, trunking and grade of service, cell splitting, sectoring, repeaters, A microcell zone concept. Mobile Radio Propagation: Large - scale path loss: Outdoor propagation model: Okumura model, Hata Model

Unit III (13 hours)

Modulation Techniques for Mobile Radio QPSK, Constant envelope modulation, MFSK, OFDM, DS and FH spread spectrum techniques. Frequency Management and channel Assignment Frequency management, set up channels, channel assignment and algorithms, traffic and channel assignment. Speech Coding: Introduction, characteristics of speech signals, quantization techniques, Adaptive Differential Pulse Code Modulation (ADPCM), Frequency Domain coding speech, Vocoders, Linear predictive coders, choosing speech codec for mobile communications

Unit IV (13 hours)

Equalization, Diversity and Channel Coding Fundamentals of equalization, training, linear and non linear equalizers, IMS and Zero forcing algorithms, diversity techniques, RAKE receivers, fundamental of channel coding, Reed-Solomon codes, Turbo and Trellis codes. Multiple Access Techniques FDMA, TDMA, FHMA, CDMA and SDMA, capacity of CDMA and SDMA.

Reference Books

1) T. S. Rapport, Wireless Communication: Principle and Practice, 2nd Edition, Pearson Education, 2002.
2) William C. Y. Lee, Mobile Cellular Telecommunications, 2nd Edition, McGraw Hill International Editions, 1995.
3) V. K. Garg and J. E. Wilkes, Wireless and Personal Communication systems, Prentice Hall, 1996.

Course Title: Digital System Design using Verilog		Course Code: PEC134E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To learn and appreciate basics of Verilog programming.
2) To learn programming using Verilog to describe digital circuits and systems.
3) To design digital circuits by writing Verilog code using different design styles.
4) To write test benches using Verilog to automate simulation and verification of design.

Course Outcomes:

A student who successfully completes this course should be able to write

1) Verilog code for combinational and sequential circuits.
2) Verilog code for simple digital system for given specifications using different design styles.
3) Verilog code using advanced verilog concepts.
4) Test benches to automate simulation and verification of design.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to Verilog: Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays, Loops in Verilog, Testing a Verilog Model

Unit II (13 hours)

Design Examples: Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and De-bouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.

SM Charts and Microprogramming: Introduction, State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Implementation of the Dice Game, Microprogramming, Linked State Machines

Unit III (13 hours) Additional Topics in Verilog: Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks. Hardware Testing and Design for Testability: Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.
Unit IV (13 hours) Component Test and Verification: Test-bench, Combinational circuit testing, Sequential circuit testing, Test-bench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive test-bench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates, Text Based Test-benches.
Reference Books 1) Charles Roth, Lizy Kurian John, and Byeong Kil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016 2) Zainalabedin Navabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed, 2008 3) Palnitkar, Samir. “Verilog HDL: a guide to digital design and synthesis” Vol. 1. Prentice Hall Professional, 2003. 4) Sagdeo, Vivek. “The complete Verilog book”. Springer Science & Business Media, 2007. 5) Smith, Douglas J., and Alex Foreword By-Zamfirescu. “HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog” Doone Publications, 1998. 6) Bhasker, Jayaram. “A Verilog HDL Primer”. Star Galaxy Publishing, 1999.

Course Title: Advanced Computer Networks		Course Code: PEC135E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100
Department : Electronics and Communication Engg. Designation : Elective		
Course Objectives: 1) To familiarize with the Networking Protocols and LAN 2) To understand the concept of Routing Protocols 3) To gain the knowledge of Transport and Congestion Control concepts 4) To get familiar with the Ad hoc networks		
Course Outcomes: A student who successfully completes this course should be able to 1) Classify network services, protocols and architectures, understand the concepts of link layer and		

LANs
2) Identify different addressing schemes, IPv4 and IPv6
3) Distinguish the services of TCP and UDP and understand the mechanism to avoid congestion
4) Differentiate the infrastructure and infrastructure-less wireless networks and Mobile IP

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Foundation of Networking Protocols: 5-layer TCP/IP Model, 7-Layer OSI Model, Internet Protocols and Addressing, Equal-Sized Packets Model: ATM - Networking Devices: Multiplexers, Modems and Internet Access Devices, Switching and Routing Devices, Router Structure. The Link Layer and Local Area Networks: Link Layer: Introduction and Services, Error-Detection and Error-Correction techniques, Multiple Access Protocols, Link Layer Addressing, Ethernet, Interconnections: Hubs and Switches, PPP: The Point-to-Point Protocol, Link Virtualization.

Unit II (13 hours)

Routing and Internetworking: Network–Layer Routing, Least-Cost-Path algorithms, Non-Least-Cost-Path algorithms, Intra-domain Routing Protocols, Inter-domain Routing Protocols, Congestion Control at Network Layer Logical Addressing: IPv4 Addresses, IPv6 Addresses-Internet Protocol: Internetworking,IPv4, IPv6, Transition from IPv4 to IPv6 – Multicasting Techniques and Protocols: Basic Definitions and Techniques, Intra-domain Multicast Protocols, Inter-domain Multicast Protocols, Node-Level Multicast algorithms.

Unit III (13 hours)

Transport and End-to-End Protocols: Transport Layer, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Mobile Transport Protocols, TCP Congestion Control – Application Layer: Principles of Network Applications, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, Domain Name System(DNS), P2P File Sharing, Socket Programming with TCP and UDP.
Congestion Control and Resource Allocation: Congestion-Avoidance Mechanisms, DEC bit, Random Early Detection (RED), Source-Based Congestion Avoidance.

Unit IV (13 hours)

Wireless Networks and Mobile IP: Infrastructure of Wireless Networks, Wireless LAN Technologies, IEEE 802.11 Wireless Standards, Cellular Networks, Mobile IP, Wireless Mesh Networks (WMNs), Mobile Ad-Hoc Networks: Overview of Wireless Ad-Hoc Networks, Routing in Ad-Hoc Networks, Routing Protocols for Ad-Hoc Networks

Reference Books

1) Nader F. Mir, Computer and Communication Networks, 2nd Edition, Prentice Hall, 2015
2) James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, Third Edition, Pearson Education, 2007
3) Larry Peterson and Bruce S Davis, Computer Networks :A System Approach, 5th Edition, Elsevier -2014

4) C. Siva Ram Murthy & B. S. Manoj, Ad hoc Wireless Networks, 2nd Edition, Pearson Education, 2011
5) Ian F Akyildiz and Xudong Wang, Wireless Mesh Networks, first edition, Wiley Publications, 2009.

Course Title: Multirate Systems and Filter Banks		Course Code: PEC136E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To get insight about multi-rate signal operations and systems.
2) To understand design methods of different multi-rate filter banks.
3) To know distortion (magnitude and phase) minimization techniques used in filter banks.
4) To understand implementation techniques of multi-rate filter banks.

Course Outcomes:

A student who successfully completes this course should be able to

1) Design a system to sample a given signal at different rates.
2) Design efficient filter banks to meet given specifications.
3) Solve multi-rate filtering problems using matrices.
4) Implement filter banks using different efficient structures.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Fundamentals of multi-rate systems: Basic multi-rate operations, Interconnection of building blocks, Poly-phase representation, Multistage implementations, Noble identities and their proof.

Unit II (13 hours)

Multi-rate filter banks: Maximally decimated filter banks, QMF bank, Errors created in QMF bank, Alias free QMF systems, Power symmetric QMF banks.

Unit III (13 hours)

Para-unitary perfect reconstruction filter banks: Lossless transfer matrices filter bank properties induced by para-unitariness, Two channel FIR paraunitary QMF banks and Two channel paraunitary QMF lattice.

Unit IV (13 hours)

Linear phase perfect reconstruction QMF banks: Necessary conditions, Lattice structures for linear phase FIR–PR QMF banks, Formal synthesis of linear phase FIR–PR QMF lattice. Cosine modulated filter banks: Pseudo QMF bank.

Reference Books

1) P. P. Vaidyanathan, "Multi-rate systems and filter banks", Pearson Education (Asia) Pvt, Ltd, 2004.
2) Gilbert Strang and Truong Ngujen, "Wavelets and filter banks", Wellesley Cambridge Press,

1996.
3) N. J. Fliege, “Multi-rate Digital Signal Processing”, John Wiley & Sons, USA, 2000.

Course Title: Optical Networks		Course Code: PEC137E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To study various optical system components.
2) To get familiar with the different client layers of optical layer and WDM network elements.
3) To learn different wavelength routing network design problems and manage the network
4) To understand the various protection schemes implemented in different layers of network.

Course Outcomes:

A student who successfully completes this course should be able to

1) Identify and describe different optical components to build an optical network
2) Realize different client layers of optical layer, WDM network elements, and able to select WDM networks.
3) Design the control and management aspects of optical network, including connection management, fault management and safety management
4) Identify various issues associated with deploying the optical protection schemes in different layers of network and how these functions in optical layers of the network work together.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Propagation of Signals in optical fiber: Light propagation in optical fibers, Loss & bandwidth, System limitations, nonlinear effects, Solutions. Optical Network Components: Couplers, Isolators & Circulators, Multiplexers & Filters, Optical Amplifiers, Switches, Wavelength Converters.

Unit II (13 hours)

Client layers of the optical layer: SONET/SDH, ATM, IP, Storage area networks, Gigabit and 10-Gigabit Ethernet. WDM Network Elements: Optical line terminals, Optical line amplifiers, optical add/drop multiplexers, optical cross connects.

Unit III (13hours)

WDM Network Design: Cost Trade-OFFS: A Detailed Ring Network Example, LTD and RWA Problems, Light path Topology Design, Routing and Wavelength Assignment, Wavelength Conversion. Control and Management: Network management functions, optical layer services and interfacing, Layers within the optical layer, Multivendor interoperability, Performance and fault management, Configuration management, optical safety.

Unit IV (13 hours)

Network survivability: Basic concepts, Protection in SONET/SDH, Protection in IP networks, Why optical layer Protection, Optical layer protection schemes, Interworking between Layers.

Reference Books

1) Rajiv Ramaswami, N Sivarajan, Optical Networks, M. Kauffman Publishers, 2nd edition, 2002.
2) John M. Senior, Optical fiber Communications, Pearson, 2nd edition 2006.
3) Gerd Keiser, Optical Fiber Communications, MGH, 4th edition, 2008.

Course Title: Image Processing		Course Code: PEC138E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To understand the fundamentals of digital image processing.
2) To understand image transforms and enhancement techniques used in digital image processing.
3) To know various image restoration techniques.
4) To know image compression and segmentation techniques.

Course Outcomes:
A student who successfully completes this course should be able to
1) Describe principles of different digital imaging systems and elements of image processing system.
2) Explain the various image enhancement techniques and decide the type of enhancement technique used for different application.
3) Differentiate between the monochrome and color image processing techniques.
4) Implement different coding techniques that are used in image compression.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Digital Image Fundamentals Image perception - light, luminance, brightness, and contrast; color representation, matching and reproduction; elements of a digital image processing system; two dimensional signal and systems- image sampling and quantization; some basic relationships between pixels; point spread function; imaging geometry - camera model, calibration and perspective transformation.

Unit II (13 hours)

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Homomorphic filtering, Color image enhancement, Image restoration; degradation model; inverse filtering; the Wiener filter.

Unit III (13hours)

Color Image Processing: Color fundamentals, color models; pseudo-color and full-color image processing; color transformations; color image smoothing and sharpening; color image segmentation and matching; noise reduction in color images.

Unit IV (13 hours)

Need for data compression, Huffman, Run Length Encoding, Shift codes, Dictionary coding, Arithmetic coding, Vector Quantization, Transform coding, Lossless and Lossy compression techniques, JPEG standard, JPEG 2000, MPEG.

Reference Books

1) Gonzalez R. C. and Woods R.E., Digital Image Processing, 3rd Edition, Prentice Hall, 2008
2) Anil K. Jain, Fundamentals of Digital Image Processing, Pearson 2002.

Course Title: Artificial Intelligence		Course Code: PEC139E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To gain knowledge about artificial intelligence, its characteristics, problem spaces and heuristic search techniques.
2) To know knowledge representation, its issues, and structured representation approaches.
3) To understand reasoning under uncertainty, non-monotonic reasoning, issues in implementation and game playing.
4) To know learning in problem solving, planning, natural language processing and understanding.

Course Outcomes:

A student who successfully completes this course should be able to

1) Define artificial intelligence, problem as a state space approach and solve the examples of heuristic search techniques.
2) Represent the knowledge and its different structures such as networks, frames, scripts, etc.
3) Define reasoning under uncertainty and solve different examples of games using artificial intelligence.
4) Quantify the learning in problem solving, need of planning and represent natural language processing and understanding

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction-Concepts and definition of AI, AI Problems, The Underlying assumption, What is an AI technique? AI characteristics, AI versus Natural Intelligence, Applications of AI, etc. Problems, Problem Spaces, and Search- Defining the Problem as State Space Search, Production Systems, Problem Characteristics, Production Systems Characteristics, Issues in the Design of Search Programs, Advantages and Disadvantages of DFS & BFS Technique. Heuristic Search Techniques- What is heuristic?, Heuristic Function, Importance of Heuristic Function, Examples, Search Techniques: Generate – and – Test, Hill Climbing, Best-First Search, Problem reduction, Constraint – Satisfaction, Means-Ends Analysis.

Unit II (13 hours)

Knowledge Representation- Representations and Mappings, Approaches to Knowledge Representation, Issues in Knowledge Representation. Procedural versus Declarative Knowledge, Logic Programming, Forward versus Backward reasoning, Matching. Approaches: Propositional Logic, Predicate Logic, Representing Simple Facts in Logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution, Natural Deduction. Structured Representation Approaches: Semantic Networks, Frames, Conceptual Dependency, Scripts, Etc.

Unit III (13 hours)

Reasoning under Uncertainty- Introduction to Non-monotonic Reasoning, Logics for Non-monotonic Reasoning, Implementation Issues, Augmenting a Problem Solver, Statistical Reasoning, Probability and Bay's Theorem, Certainty Factors and Rule-based Systems, Bayesian Networks, Dempster-Shafer Theory. Game Playing- Overview, The Minima Search Procedure, Adding Alpha-Beta Cutoffs, Additional Refinements, Examples.

Unit IV (13 hours)

Learning- What is Learning?, Rote Learning, Learning by taking Advice, Learning in Problem Solving, Learning from Examples: Induction, Explanation-based Learning, Discovery Analogy, Formal Learning Theory, Neural Net Learning and Genetic Learning. Planning- Overview, An Example Domain: The Blocks world, Components of a Planning System, Goal Stack Planning, Nonlinear Planning using Constraint Posting, Hierarchical Planning, Other Planning Techniques. Natural Languages Processing & Understanding- What is Understanding?, What makes Understanding Hard?, Understanding as Constraint satisfaction, Introduction to NLP, Syntactic Processing, Semantic Analysis, Discourse and Pragmatic Processing.

Reference Books

1) Elaine Rich, Kevin Knight, "Artificial Intelligence", Second Edition, Tata McGraw Hill.
2) Efraim Turban and Jay E. Aronson, "Decision Support Systems and Intelligent Systems", Sixth Edition 2002, Pearson Education Asia

M. Tech (Digital Communication Engineering)

II Semester

Sl. No.	Subject Code	Subject	L-T-P	Credits
1	PEC231C	Statistical Signal Processing	3-2-0	4.0
2	PEC232C	RF and Microwave Circuit Design	3-2-0	4.0
3	Elective – IV			4.0
	PEC231E	Machine Learning	4-0-0	
	PEC232E	DSP Processor and Architecture	4-0-0	
	PEC233E	Wireless Sensor Network	4-0-0	
4	Elective – V			4.0
	PEC234E	Error Control Codes	4-0-0	
	PEC235E	Network Security	4-0-0	
	PEC236E	Wireless Mobile Network Architecture	4-0-0	
5	Elective – VI			4.0
	PEC237E	Digital Verification	4-0-0	
	PEC238E	Speech Processing	4-0-0	
	PEC239E	MEMS in Communication	4-0-0	
6	PEC231FT	Field Work	0-0-4	2.0
7	PEC231L	Communication Engineering Laboratory	0-0-4	2.0
		Total		24.0

<table>
<tr><td colspan="2">Course Title: Statistical Signal Processing</td><td>Course Code: PEC231C</td></tr>
<tr><td>Credits: 4</td><td>Teaching Hours: 40 Hrs
(10 Hrs/Unit)</td><td>(L-T-P: 3-2-0)</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department : Electronics and Communication Engg.
Designation : Core</td></tr>
<tr><td colspan="3">Course Objectives:
1) To understand the statistical signal parameters and their interrelationship.
2) To know different techniques of discrete-time signal modeling.
3) To know different techniques of signal estimation, random process filtering and power spectrum estimation.
4) To know different algorithms necessary for efficient implementation of statistical signal problems.</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1) Characterize statistical signals necessary for their processing.
2) Model statistical signals with possible minimum model error.
3) Design efficient adaptive/non-adaptive systems necessary for given statistical signal processing problem.
4) Implement Levinson-Durbin algorithms to solve signal processing problems.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below:</td></tr>
<tr><td colspan="3">Unit I (13 hours)
Discrete time random process: Introduction, Random variables, Definitions, Jointly distributed random variables, Joint moments, Independent, Uncorrelated, Orthogonal random variables, Gaussian random variables, Random processes, Filtering, Spectral factorization.</td></tr>
<tr><td colspan="3">Unit II (13 hours)
Signal modeling: Introduction, Least squares method, Pade approximation, Prony’s method, Pole-Zero modeling, Finite data records, Autocorrelation method, Covariance method, Stochastic models, Autoregressive, Moving average models.</td></tr>
</table>

Unit III (13 hours) Levinson recursion and Winer filtering: Introduction, Levinson Durbin recursion development, Lattice filters, Step-up-down recursions, Levinson recursion, Winer filtering: Introduction, Winer filtering, Linear prediction, IIR filter, Discrete Kalman filter.
Unit IV (13 hours) Spectrum estimation and adaptive filtering: Introduction, Non-parametric methods, Adaptive periodogram, Parametric methods, Adaptive filtering: Introduction, FIR filter, Steepest descent adaptive filter, LMS algorithm, Applications: Channel equalization, Recursive least squares, Exponentially weighted RLS, Sliding window RLS algorithm.
Reference Books 1) Monson Hayes, Statistical Digital Signal Processing, John Wiley and sons, II Edition, 1996. 2) M. D. Srinath, Rajesh Karan, Statistical Signal Processing with Applications, Information System Science Series, II Edition, 1995. 3) Steven Kay, Fundamentals of Statistical Signal Processing, Prentice Hall, II Edition, 1993.

Course Title: RF and Microwave Circuit Design		Course Code: PEC232C
Credits: 4	Teaching Hours: 40 Hrs (10 Hrs/Unit)	(L-T-P: 3-2-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Core

Course Objectives:

1) To understand RF behavior of passive components and distributed components.
2) To use Smith chart for various applications.
3) To understand filter design concepts those are ubiquitous in many RF/MW circuits.
4) To understand different active RF solid state devices.

Course Outcomes:

A student who successfully completes this course should be able to

1) Analyze distributed circuit components of transmission line for radio frequencies.
2) Use Smith chart to display the behavior of transmission line as a function of frequency.
3) Design RF filters.
4) Analyze functionality and limitations of most widely employed active RF solid state devices.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction: Importance of radiofrequency design, Dimensions and units, Frequency spectrum, RF behavior of passive components: High frequency resistors, capacitors & inductors. Chip components and Circuit board considerations: Chip resistors, chip capacitors, surface mounted inductors. Transmission Line Analysis: Two-wire lines, Coaxial lines and Microstrip lines, Equivalent circuit representation, Basic laws, Circuit parameters for a parallel plate transmission line. General Transmission Line Equation: Kirchhoff voltage and current law representations, Traveling voltage and current waves, General impedance definition, Lossless transmission line model. Microstrip Transmission Lines. Terminated lossless transmission line: Voltage reflection coefficient, propagation constant and phase velocity, standing waves. Special terminated conditions: Input impedance of terminated lossless line, Short circuit transmission line, Open circuit transmission line, Quarter wave transmission line. Sourced and Loaded Transmission Line: Phasor representation of source, Power considerations for a transmission line, input impedance matching, return loss and insertion loss.

Unit II (13 hours)

The Smith Chart: Reflection coefficient in phasor form, Normalized Impedance equation, parametric reflection coefficient equation, graphical representation, Impedance transformation for general load, Standing wave ratio, Special transformation conditions. Admittance Transformations: Parametric admittance equation, Additional graphical displays. Parallel and series Connections: Parallel connections of R and L elements, Parallel connections of R and C elements, Series connections of R and L elements, Series connections of R and C elements, Example of a T Network.

Unit III (13 hours)

RF Filter Design: Filter types and parameters, Low pass filter, High pass filter, Band-pass and Band-stop filter, Insertion Loss. Special Filter Realizations: Butterworth type filter, Chebyshev type filters, De-normalization of standard low pass design. Filter Implementation: Unit Elements, Kuroda's Identities and Examples of Microstrip Filter Design. Coupled Filters: Odd and Even Mode Excitation, Band-pass Filter, Cascading band-pass filter elements, Design examples.

Unit IV (13 hours)

Active RF Components: Semiconductor Basics: Physical properties of semiconductors, PN-Junction, Schottky contact. RF Diodes: Schottky diode, PIN diode, Varactor diode, IMPATT diode, Tunnel diode, TRAPATT, BARRITT, and Gunn Diodes, Bipolar-Junction Transistors: Construction, Functionality, Temperature behavior, Limiting values. RF Field Effect Transistors: Construction, Functionality, Frequency response, Limiting values. High Electron Mobility Transistors: Construction, Functionality, Frequency response.

Reference Books

1) Reinhold Ludwig, Pavel Bretchko, "RF Circuit Design: Theory and Applications", Pearson Education Asia, 2005.
2) Mathew M. Radmanesh, "Radio Frequency and Microwave Electronics Illustrated", Pearson Education, Asia, 2006.
3) Qizheng Gu,"RF System Design of Transceivers for Wireless Communications", Springer International Edition, 2008.
4) Joseph J. Carr, "Secrets of RF Circuit Design", Tata McGraw-Hill, 3rd Edition, 2004.

Course Title: Machine Learning		Course Code: PEC231E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100
Department : Electronics and Communication Engg. Designation : Elective		

Course Objectives:

1) To study self-learning computer algorithms.
2) To conceptualize the machine learning techniques.
3) To understand machine learning and computational approaches.
4) To be familiar with Artificial Neural Networks.

Course Outcomes:

A student who successfully completes this course should be able to

1) Analyze machine learning techniques and computing environments that are suitable for the applications under consideration.
2) Solve problems associated with machine learning approaches.
3) To recognize various ways of selecting suitable model parameters for different machine learning techniques.
4) Integrate machine learning techniques into Artificial Neural Networks.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction: Definition of learning systems. Goals and applications of machine learning. Aspects of developing a learning system: training data, concept representation, function approximation.
Inductive Classification: The concept learning task. Concept learning as search through a hypothesis space. General-to-specific ordering of hypotheses. Finding maximally specific hypotheses. Version spaces and the candidate elimination algorithm. Learning conjunctive concepts. The importance of inductive bias.

Unit II (13 hours)

Decision Tree Learning: Representing concepts as decision trees. Recursive induction of decision trees. Picking the best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity. Occam's razor. Over-fitting, noisy data, and pruning.
Experimental Evaluation of Learning Algorithms: Measuring the accuracy of learned hypotheses. Comparing learning algorithms: cross-validation, learning curves, and statistical hypothesis testing.

Unit III (13 hours)

Computational Learning Theory: Models of learnability: learning in the limit; probably approximately correct (PAC) learning. Sample complexity: quantifying the number of examples needed to PAC learn. Computational complexity of training. Sample complexity for finite hypothesis spaces. PAC results for learning conjunctions, kDNF, and kCNF. Sample complexity for infinite hypothesis spaces, Vapnik-Chervonenkis dimension.

Rule Learning: Propositional and First-Order: Translating decision trees into rules. Heuristic rule induction using separate and conquer and information gain. First-order Horn-clause induction (Inductive Logic Programming) and Foil. Learning recursive rules. Inverse resolution, Golem, and Progol.

Unit IV (13 hours)

Artificial Neural Networks: Neurons and biological motivation. Linear threshold units. Perceptrons: representational limitation and gradient descent training. Multilayer networks and back propagation. Hidden layers and constructing intermediate, distributed representations. Over fitting, learning network structure, recurrent networks.

Reference Books

1) Tom Mitchell, Machine Learning, McGraw Hill, 1997
2) Christopher Bishop, Pattern Recognition and Machine Learning, Springer 2006

Course Title: DSP Processor and Architecture		Course Code: PEC232E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To get insight into building blocks of DSP processor.
2) To understand different addressing modes of DSP processor.
3) To know different instructions of DSP processor.
4) To learn programming of DSP processor.

Course Outcomes:

A student who successfully completes this course should be able to

1) Select a general purpose processor or a DSP processor for a given application.
2) Write efficient DSP processor assembly level programs.
3) Design and implement FIR and IIR filters on DSP processor.
4) Design DSP processor based system for a given application.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to Programmable DSPs: Multiplier and multiplier accumulator (MAC), Modified bus structures and memory access schemes in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes in P-DSPs. On-chip peripherals.
Computational Accuracy in DSP Implementations: Introduction, Number formats for signals and coefficients in DSP systems, Dynamic range and precision, Sources of error in DSP implementations.

Unit II (13 hours)

Architecture of DSP Processor-TMS320C5X: Bus structure, Central arithmetic and logic unit (CALU), Auxiliary register ALU, Index register, Auxiliary register compare register, Block move address register, Block repeat registers, Parallel logic unit, Memory mapped registers, Program controller, Flags in the status registers.
TMS320C5X Assembly Language Instructions: Assembly language syntax, Addressing modes, Load/Store instructions, Addition/Subtraction instructions, Move instructions, Multiplication instructions, The NORM instruction.

Unit III (13 hours) Instruction Pipelining in TMS320C5X and Programming: Program control instructions, Peripheral control, Pipeline structure, Pipeline operation, Normal pipeline operation, C50-based starter kit (DSK), Programs for familiarization of addressing modes, Programs for familiarization of arithmetic instructions.
Unit IV (13 hours) Real Time Signal Processing Using TMS320C5X: On chip timer in C5X and programming its mode, C5X serial port block diagram and its operation, Analog interfacing circuit (AIC), Terminal functions, Analog input and output, A/D and D/A filters, Internal timing configuration, AIC serial port modes and its registers, AIC serial port operation and reset function, Interfacing the DSP and AIC, FIR filter implementation.
Reference Books 1) B Venkataramani and M Bhaskar, Digital Signal Processors, TMH Education Private Limited, Second edition, 2010. 2) Avatar Singh and S Srinivasan, Digital signal processing, Implementations using DSP microprocessors, Cengage learning India private limited, Eighth edition, 2009.

Course Title: Wireless Sensor Network		Course Code: PEC233E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To obtain a broad understanding about networked wireless sensor devices, applications and network deployment.
2) To understand the concepts and issues of sensor node localization and synchronization.
3) To obtain a broad understanding about wireless characteristics and MAC protocols.
4) To know the principles of data transmission, clustering algorithm, different routing protocols and reliability.

Course Outcomes:

A student who successfully completes this course should be able to

1) Use principles of sensor nodes, network deployment and architectures.
2) Identify the issues of wireless sensor networks and propose the solution for conservation of sensor node energy.
3) Analyze or compare the performance of different routing and MAC protocols.
4) Compare the performance of various routing protocols of WSN.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction: the vision, networked wireless sensor devices, applications, key design challenges. Network deployment: Structured versus randomized deployment, network topology, connectivity, connectivity using power control, coverage metrics, and mobile deployment.

Unit II (13 hours)

Localization: issues & approaches, coarse-grained & fine-grained node localization, network-wide localization, theoretical analysis of localization techniques. Synchronization: Issues & traditional approaches, fine-grained clock synchronization, and coarse-grained data synchronization.

Unit III (13 hours)

Wireless characteristics: Basics, wireless link quality, radio energy considerations, SINR capture model for interference. Medium-access and sleep scheduling: Traditional MAC protocols, energy efficiency in MAC protocols, asynchronous sleep techniques, sleep-scheduled techniques, and contention-free protocols. Sleep-based topology control: constructing topologies for connectivity, constructing topologies for coverage, Set K-cover algorithms

Unit IV (13 hours)

Routing: Metric-based approaches, routing with diversity, multi-path routing, lifetime-maximizing energy-aware routing techniques, geographic routing, routing to mobile sinks. Data-centric networking: Data-centric routing, data-gathering with compression, querying, data-centric storage and retrieval, the database perspective on sensor networks. Reliability and congestion control: Basic mechanisms and tunable parameters, reliability guarantees, congestion control, real-time scheduling.

Reference Books

1) Kazem Sohraby, Daniel Minoli, Taieb Znati , “Wireless Sensor Networks: Technology, Protocols, and Applications”, Wiley Inter Science.
2) Edgar H. Callaway, Jr, “Wireless Sensor Networks: Architectures and Protocols”,
3) Auerbach Publications, CRC Press.
4) C.S Raghavendra, Krishna M, Sivalingam, Taieb Znati, “Wireless Sensor Networks”, Springer.
5) Bhaskar Krismachari, “Networking Wireless Sensors”, Cambridge University Press

Course Title: Error Control Codes		Course Code: PEC234E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To study in detail the fundamentals of linear block codes and several important class of linear block codes.
2) To study encoding and decoding of cyclic codes, BCH and RS codes.
3) To study encoding and decoding of convolutional codes.
4) To provide important concepts of concatenated codes, turbo codes and the methods for correcting the burst errors and combination of burst and random errors.

Course Outcomes:

A student who successfully completes this course should be able to

1) Explain groups, fields and coding concepts built upon them and also use LBCs for error detection and correction
2) Detect and correct single and double errors using cyclic and BCH codes in digital transmission systems.
3) Encode and apply Viterbi and stack algorithm in decoding convolutional codes.
4) Compare the error correction capability of different error control codes

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to Algebra: Groups, Fields, Binary Field Arithmetic, Construction of Galois Field GF(2m) and its Basic Properties, Computation using Galois Field GF(2m),Vector spaces and Matrices.Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block Code, Error Detecting and Correcting Capabilities of Block Code, Standard Array and Syndrome Decoding, Single Parity Check Codes, Repetition codes and Self Dual Codes.

Important Linear Block Codes: Hamming Codes, Reed-Muller Codes, The (24,12) Golay Code, Products Codes and Interleaved Codes (Qualitative treatment).

Unit II (13 hours)

Cyclic Codes: Description of Cyclic Codes, Generator and Parity Check Matrices, Encoding and Decoding of Cyclic Codes, Syndrome Computation and Error Detection, Meggitt Decoder Shortened Cyclic Codes. BCH Codes: Binary Primitive BCH Codes, Decoding of BCH Codes using Gorenstein-Zierler algorithm, Implementation of Galois Field Arithmetic, Implementation of Error Correction. Non Binary BCH codes: q- ary Linear Block Codes, Primitive BCH Codes over GF (q), Encoding of Reed-Soloman code.

Unit III (13 hours)

Convolutional Codes: Connection Pictorial Representation, Convolutional Encoding-Time Domain Approach, Transform Domain Approach, Structural and Distance Properties, Optimum Decoding of Convolutional Codes: The Viterbi Algorithm, Suboptimum Decoding of Convolutional Codes: The ZJ (Stack) Sequential Decoding Algorithm.

Unit IV (13 hours)

Concatenated Codes: Single-Level Concatenated Codes, Multi Level Concatenated Codes, Soft- Decision Multi Stage Decoding, and Turbo Codes: Introduction to Turbo Coding. Burst Error Correcting Codes: Introduction, Decoding of Single Burst Error correcting Cyclic Codes and Single Burst Error Correcting Codes, Burst and Random Error Correcting Codes.

Reference Books

1) Shulin, Daniel J.Costello, Error Control Coding, Pearson, Second Edition 2012.
2) Ranjan Bose, Information Theory, Coding and Cryptography, Tata McGraw Hill Publication, Second Edition 2008
3) Man Young Ree, Error correcting coding Theory, McGraw Hill Edition, 1989.

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Course Title: Network Security		Course Code: PEC235E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To understand the fundamentals of Cryptography.
2) To acquire knowledge of standard algorithms used to provide confidentiality, integrity and authenticity.
3) To understand the various key distribution and management schemes of network security.
4) To study encryption techniques for securing data in communication networks.

Course Outcomes:

A student who successfully completes this course should be able to

1) Analyze the vulnerabilities in any computing system.
2) Identify the security issues in the network.
3) Evaluate the security mechanisms using rigorous approaches.
4) Compare and contrast different IEEE standards, electronic mail and IP security.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Overview: Security trends, OSI security architecture, Security attacks, Security services, Security mechanism, Model for network security. Classical Encryption Techniques: Symmetric cipher model, Substitution techniques, Transposition techniques, Rotor machine, Steganography, Problems. Block Ciphers and DES (Data Encryption Standards): Block cipher principles, DES, Strength of DES, Block cipher design principles, Problems.

Unit II (13 hours)

Public Key Cryptography and RSA: Principles of public key cryptosystems, RSA algorithm, Problems. Key Management and Other Public Key Crypto Systems: Key management, Diffie-Hellman key exchange, Elliptic curve arithmetic, Elliptic curve cryptography, Problems. Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC's, Problems.

Unit III (13 hours)

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols, Digital signature standard. Authentication Applications: Kerberos, X.509 authentication service, Problems.

Unit IV (13 hours)

Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64 conversion, PGP random number generation. IP Security: Overview, IP security architecture, Authentication header, ESP (Encapsulating Security Pay-Load), Security associations, Key management, Problems.) Firewalls: Firewall design principles; trusted systems, Problems

Reference Books

1) William Stallings, Cryptography and network security: principles and practice, Fourth Edition, Pearson Education Inc. 2006.
2) Chris Brenton, Cameron Hunt, Mastering network security, Second Edition, Sybex inc. publishing, 2003.
3) Eric Cole, Ronald Krutz, James W. Conley, Network Security Bible, Wiley India,2000.
4) Roberta Bragg, Mark Rhodes-Ousley, Keith Strassberg, Network security: The complete reference, McGraw-Hill, 2004.

Course Title: Wireless and Mobile Network Architectures		Course Code: PEC236E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Course Objectives

1) To provide an overview of wireless communication networks and its applications in communication engineering and to study architecture, technologies of WBAN.
2) To study architecture, design issues and technologies of WPAN and WLAN.
3) To study architecture, protocols and applications of WMAN and WWAN.
4) To study different wireless ad-hoc networks and research issues.

Course Outcomes

A student who successfully completes this course should be able to

1) Know the basics of wireless communication networks.
2) Work on architectural components of wireless networks.
3) Analyze different protocols of wireless networks.
4) Identify research issues in wireless networking.

Unit I

Fundamentals of Wireless Communication and Wireless Networks: Wireless communication channel specifications, Wireless communication systems, Wireless networks, Switching technology, Communication problems, Wireless network issues and standards.
Wireless Body Area Networks: Properties, Network architecture, Components, Design issues, Network protocols, Technologies and applications.

Unit II

Wireless Personal Area Networks: Architecture, Components, Technologies and protocols, Bluetooth and Zigbee.
Wireless Local Area Networks: Network components, Design requirements, Architecture, WLAN standards, WLAN protocols, IEEE 802.11p and applications.

Unit III

Wireless Metropolitan Area Networks: IEEE-802.16, Architecture, Components, WiMax mobility support, Protocols, Broadband wireless networks and applications.
Wireless Wide Area Networks: Cellular networks, Satellite networks, WLAN versus WWAN, Internetworking and Applications.

Unit IV

Wireless Ad-hoc Networks: Mobile ad-hoc networks, Sensor networks, Mesh networks, VANETs, Research Issues in Wireless Networks: Modulation, Resource management, Channel allocation, Error control coding, Routing, Addressing, Flow and mobility control, Security and privacy, QoS and power management.

Reference Books

1) Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, “Wireless and Mobile Networks: Concepts and Protocols”, Wiley-India, 2010.
2) C. Siva Ram Murthy & B. S. Manoj “Ad hoc Wireless Networks”, Pearson Education, 2nd edition, reprint, 2005.
3) KavehPahlavan, P. Krishnamurthy, “Principles of Wireless Networks”, Pearson Education, 2002.
4) Yi-Bing Lin, ImrichChlamtac, “Wireless and Mobile Network Architectures”, John Wiley, 2001.
5) MarlynMallick, “Mobile and Wireless Design Essentials”, Wiley, 2003.
6) William C. Y. Lee, “Mobile Cellular Telecommunication – Analog and Digital Systems”, McGraw Hill, 2nd edition.

Course Title: Digital Verification		Course Code: PEC237E
Credits: 4	Teaching Hours:52 Hrs (10 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1. To learn and appreciate basics of Verilog programming.
2. To learn programming using Verilog to describe digital circuits and systems.
3. To design digital circuits by writing Verilog code using different design styles.
4. To write test benches using Verilog to automate simulation and verification of design.

Course Outcomes:

A student who successfully completes this course should be able to write

1. Verilog code for combinational and sequential circuits.
2. Verilog code for simple digital system for given specifications using different design styles.
3. Verilog code using advanced verilog concepts.
4. Test-bench to automate simulation and verification of design.

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 hours)

Introduction to Verilog: Introduction, Computer-Aided Design, Hardware Description Languages, Verilog Description of Combinational Circuits, Verilog Modules, Verilog Assignments, Procedural Assignments, Modeling Flip-Flops Using Always Block, Always Blocks Using Event Control Statements, Delays in Verilog, Compilation, Simulation, and Synthesis of Verilog Code, Verilog Data Types and Operators, Simple Synthesis Examples, Verilog Models for Multiplexers, Modeling Registers and Counters Using Verilog Always Statements, Behavioral and Structural Verilog, Constants, Arrays, Loops in Verilog, Testing a Verilog Model

Unit II (10 hours)

Design Examples: Introduction, BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller, State Graphs for Control Circuits, Scoreboard and Controller, Synchronization and Debouncing, A Shift-and-Add Multiplier, Array Multiplier, A Signed Integer/Fraction Multiplier, Keypad Scanner, Binary Dividers.

SM Charts and Microprogramming: Introduction, State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Implementation of the Dice Game, Microprogramming, Linked State Machines

Unit III (10 hours)

Additional Topics in Verilog: Introduction, Verilog Functions, Verilog Tasks, Multivalued Logic and Signal Resolution, Built-in Primitives, User-Defined Primitives, SRAM model, Model for SRAM Read/Write System, Rise and Fall Delays of Gates, Named Association, Generate Statements, System Functions, Compiler Directives, File I/O Functions, Timing Checks.

Hardware Testing and Design for Testability: Introduction, Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Built-In Self-Test.

Unit IV (10 hours)

Component Test and Verification: Testbench, Combinational circuit testing, Sequential circuit testing, Testbench Techniques, Simulation control, Limiting data sets, Applying synchronized data, Synchronized display of results, An interactive testbench, Random time intervals, Buffered data application, Design Verification, Assertion Verification, Assertion verification benefits, Open verification library, Using assertion monitors, Assertion templates, Text Based Testbenches.

Reference Books

1) Charles Roth, Lizy Kurian John, and Byeong Kil Lee "Digital Systems Design Using Verilog" Cengage Learning, 2016
2) Zainalabedin Navabi "Verilog Digital System Design" Second Edition, Mcgraw Higher Ed, 2008
3) Palnitkar, Samir. “Verilog HDL: a guide to digital design and synthesis” Vol. 1. Prentice Hall Professional, 2003.
4) Sagdeo, Vivek. “The complete Verilog book”. Springer Science & Business Media, 2007.
5) Smith, Douglas J., and Alex Foreword By-Zamfirescu. “HDL Chip Design: A practical guide for designing, synthesizing and simulating ASICs and FPGAs using VHDL or Verilog” Doone Publications, 1998.
6) Bhasker, Jayaram. “A Verilog HDL Primer”. Star Galaxy Publishing, 1999.

<table>
<tr><td colspan="2">Course Title: Speech Processing</td><td>Course Code: PEC238E</td></tr>
<tr><td>Credits: 4</td><td>Teaching Hours: 52 Hrs
(13 Hrs/Unit)</td><td>(L-T-P: 4-0-0)</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department : Electronics and Communication Engg.
Designation : Elective</td></tr>
<tr><td colspan="3">Course Objectives:
1) To understand speech production and perception mechanism along with basic knowledge of phonetics.
2) To provide knowledge of time-domain representation and analysis tools for speech analysis.
3) To know the frequency-domain representation and analysis concepts using short-time Fourier analysis tools.
4) To impart the concept of homomorphic analysis of speech signal along with elementary knowledge of LPC</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1) Explain the speech production and perception mechanism.
2) Characterize and analyze speech signals in Time domain.
3) Characterize and analyze speech signals in Frequency domain.
4) Analyze speech signal using homomorphic transformation and LPC.</td></tr>
<tr><td colspan="3">The topics that enable to meet the above objectives and course outcomes are given below:</td></tr>
<tr><td colspan="3">Unit I (13 hours)
Introduction: Speech signal, digital speech processing – Introduction, the process of speech production and classification and basics of phonetics, the acoustic theory of speech production, mechanism of hearing, digital models for speech – vocal tract, radiation, excitation the complete model.</td></tr>
<tr><td colspan="3">Unit II (13 hours)
Time domain models for speech processing: Introduction, time dependent processing of speech, short time energy and average magnitude, short time average zero crossing detectors, speech Vs silence discrimination, pitch period estimation, short time autocorrelation function, short time average magnitude difference function.</td></tr>
</table>

Unit III (13 hours) Short time Fourier analysis: Introduction, definitions and properties, spectrographic displays, analysis-by-synthesis – pitch synchronous spectrum estimation, pole zero analysis, analysis – synthesis systems – phase vocoder and channel vocoder.
Unit IV (13 hours) Homomorphic speech processing: Introduction, homomorphic systems for convolution, the complex cepstrum of speech, pitch detection, formant estimation. Linear predictive coding of speech: Introduction, basic principle of linear predictive coding, autocorrelation method, covariance method. Solution of LPC.
Reference Books 1) L. R. Rabiner and R. W. Schafer, Digital Processing of Speech Signals, Pearson Education (Asia) Pte. Ltd., 2004. 2) D. O'Shaughnessy, Speech Communications: Human and Machine, Universities Press, 2001. 3) B. Gold and N. Morgan, Speech and Audio Signal Processing: processing and perception of speech and music, Pearson Education 2003

Course Title: MEMS in Communication		Course Code: PEC239E
Credits: 4	Teaching Hours: 52 Hrs (13 Hrs/Unit)	(L-T-P: 4-0-0)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Elective

Course Objectives:

1) To know the fundamentals of MEMS, basic scaling laws as applied to micro domain & the design and working principle of various micro sensors & actuators.
2) To understand modeling of various types of micro-systems, simulation and micro fabrication of MEMS.
3) To get insight of RF MEMS components, their design and fabrication.
4) To understand optical devices like lenses, mirrors and DMDs.

Course Outcomes:
A student who successfully completes this course should be able to
1) Understand the fundamentals of MEMS, basic scaling laws as applied to micro domain and working principals of various micro sensing and actuating devices.
2) Acquire the knowledge of modeling, simulation and fabrication of MEMS devices.
3) Design and fabricate various RF MEMS components/devices.
4) Design and fabricate optical devices like lenses and mirrors.

The topics that enable to meet the above objectives and course outcomes are given below:

Unit I (13 hours)

Introduction to MEMS technology: Definition, Features of MEMS, Microsensor, microactuator, microsystems. Commercial MEMS Products: Medical pressure sensor, inkjet printer head, accelerometer. Scaling in Microdomain: Scaling laws in geometry, rigid body dynamics, electrostatic, electromagnetic, electricity, fluid mechanics & heat transfer.
MEMS Design & working principle: Transduction principles in microdomain- Biomedical sensor & biosensor, chemical sensor, optical sensor, pressure sensor, thermal sensor. Actuation using thermal force, shape-memory alloy, piezoelectric and electrostatic forces.

Unit II (13 hours)

MEMS modeling: modeling elements in electrical, mechanical, thermal and fluid systems. Modeling electrostatic systems.
Microfabrication/Micromachining: Overview of micro fabrication, review of microelectronics fabrication processes like photolithography, deposition, doping, etching, structural and sacrificial materials, and other lithography methods, MEMS fabrication methods like surface, bulk, LIGA and wafer bonding methods.

Unit III (13hours)

Simulation of MEMS: Need for simulation, FEM, MEMS design and realization tools such as ANSYS/Multiphysics, CoventorWare, COMSOL.

Radio Frequency (RF) MEMS: Introduction, Review of RF-based communication systems, RF – MEMS like switches and relays, MEMS inductors and Capacitors, RF filters, resonators, phase shifters, transmission lines, micromachined antenna (Qualitative treatment only).

Unit IV (13 hours)

Optical MEMS: Preview, passive optical components like lenses and mirrors, actuators for active optical MEMS. Basic optical communication networks using MOEMS devices.

Case Studies: Case studies of Microsystems including micro-cantilever-based sensors and actuators with appropriate selection of material properties: thermal, mechanical properties. Static and dynamic mechanical response with different force mechanisms: electrostatic, electromagnetic, thermal.

Reference Books

1) Tai, Ran Hsu, "MEMS and Microsystems Design and Manufacture", Tata McGraw-Hill, 2002.
2) Nitaigour Premchand Mahalik, "MEMS", Tata McGraw-Hill, 2007.
3) Chang Liu, "Foundations of MEMS", Pearson International Edition, 2006.
4) Vijay K. Vardhan, K. J. Vinoy, K. A. Jose, "RF MEMS and Their Applications", John Wiley & Sons, 2003.
5) P. Rai-Choudhury, "MEMS and MOEMS Technology and Applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
6) G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat, V. K. Aatre , "Micro and Smart Systems", Wiley India, 2010.

<table>
<tr><td colspan="2">Course Title: Field Work</td><td>Course Code: PEC231F</td></tr>
<tr><td>Credits: 2</td><td>Teaching Hours: 04 Hrs/Week</td><td>(L-T-P: 0-0-4)</td></tr>
<tr><td>CIE Marks: 50</td><td>SEE Marks: 50</td><td>Total Marks: 100</td></tr>
<tr><td colspan="3">Department : Electronics and Communication Engg.
Designation : Field Work</td></tr>
<tr><td colspan="3">Course Objectives:
1) To expose the students to the state of art technologies.
2) To provide hands on experience with latest industry oriented projects.
3) To know the issues/challenges in communication engineering.
4) To provide the technical documentation skills.</td></tr>
<tr><td colspan="3">Course Outcomes:
A student who successfully completes this course should be able to
1) Use the latest technologies related to the telecommunication industry.
2) Handle industry oriented projects.
3) Resolve the issues/challenges in communication engineering.
4) Write effective technical documentation.</td></tr>
<tr><td colspan="3">The field work experience provides the student with the opportunity to make analytical observations and gain personal competence in a supervised physical activity setting.</td></tr>
</table>

Course Title: Communication Engineering Laboratory		Course Code: PEC231L
Credits: 2.0	Teaching Hours: 04 hrs/Week	(L-T-P: 0-0-4)
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engg.
Designation : Laboratory

Course Objectives:

1) To know the different modeling techniques of discrete time signals.
2) To know different error control coding techniques.
3) To characterize different transmission lines and their performance evaluation.
4) To learn different image processing techniques.

Course Outcomes:

After completion of this laboratory the students are able to

1) Visualize the importance of signal modeling in different fields like communication, signal processing, signal compression, etc.
2) Understand the design principles of digital communication systems with minimum error.
3) Understand the limitations of modulation techniques and the communication channels.
4) Process image and multimedia signals.

The Experiments that enable to meet the above objectives and course outcomes are given below:

Sl. No	LIST OF EXPERIMENTS
1	Modeling of a given discrete time signal using least squares method and computation of modeling error.
2	Modeling of a given discrete time signal using Pade approximation method. Computation of modeling error and its comparison with least squares method.
3	Estimation of spectrum of a given finite duration discrete time signal and computation of bias and variance of estimation.
4	Write a MATLAB code to encode and decode the all possible data words for a systematic linear block code.
5	Write a MATLAB code to encode and decode the all possible data words for a cyclic code.
6	Experiment to find the distributed components (R, L, G and C) of a transmission line for the following lengths: (a) 25mts Transmission Line. (b) 50mts Transmission Line. (c) 75mts Transmission Line. (d) 100mts Transmission Line.
7	Experiment to find the characteristics of a micro-strip low pass filter.
8	Experiment to find the characteristics of a micro-strip band-pass filter.
19	Experiment to estimate the spectrum of a given signal using Bartlett's method.
10	Develop a code to write image matrix in to a file using imwrite( )function of MATLAB.
11	Develop a code to enhance image using histogram equalization technique.
12	HTML program for inserting (a) image (b) table.

BASAVESHWAR ENGINEERING COLLEGE, BAGALKOT
DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M. Tech.) MACHINE DESIGN

2020-21 Batch Summary of Credits Allocation

Sl. No	Sem.	Core/lab	Elective	Project	Industry /seminar	Total credit per term
1	I	10	14	-		24
2	II	12	12	-		24
3	III	-	4	10	6	20
4	IV	-	-	20	-	20
Total Cr.		**22**	**30**	**30**	**6**	**88**

Semester – II

Sl. No	Subject Code	Subject Title	Marks		Cont. Hrs.			Total cr.
			CIE	SEE	L	T	P	
1	PMD 201 C	Advanced Machine Design	50	50	3	2	0	4
2	PMD 202 C	Dynamics & Mechanism Design	50	50	3	2	0	4
3	PMD 213 C	Theory of Plasticity	50	50	3	2	0	4
4	PMD 020 E	Design for Manufacture	50	50	3	2	0	4
5	PMD 015 E	Mechanics of Composite Materials and Structures	50	50	3	2	0	4
6	PMD 006 E	Fracture Mechanics	50	50	3	2	0	4
		Total credits			**24**			

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)

SEMESTER – II

ADVANCED MACHINE DESIGN

Course Code	PMD 201 C	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	(4 – 0 – 0)	SEE MARKS	: 100
Credits	4	SEE Exam Hours	: 3 Hrs

UNIT –I

Introduction: **06 Hours**

Role of failure prevention analysis in mechanical design ,Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr's theory and modified Mohr's theory, Numerical examples.

Fatigue of Materials: **06 Hours**

Introductory concepts, High cycle and low cycle fatigue, Fatigue design models ,Fatigue design methods ,Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features.

UNIT – II

Stess-Life (S-N) Approach: **06 Hours**

S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behaviour, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach.

Strain-Life(ε-N)approach: **06 Hours**

Monotonic stress-strain behavior ,Strain controlled test methods ,Cyclic stress-strain behavior ,Strain based approach to life estimation, Determination of strain life fatigue properties, Mean stress effects, Effect of surface finish, Life estimation by ε-N approach.

UNIT – III

LEFM Approach: **06 Hours**

LEFM concepts, Crack tip plastic zone, Fracture toughness, Fatigue crack growth, Mean stress effects, Crack growth life estimation

Statistical Aspects of Fatigue: **07 Hours**

Definitions and quantification of data scatter, Probability distributions, Tolerance limits, Regression analysis of fatigue data, Reliability analysis, Problems using the Weibull distribution.

UNIT – IV

Fatigue from Variable Amplitude Loading: **07 Hours**

Spectrum loads and cumulative damage, Damage quantification and the concepts of damage fraction and accumulation, Cumulative damage theories, Load interaction and sequence effects, Cycle counting methods, Life estimation using stress life approach.

Surface Failure: **08 Hours**

Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General contact, Dynamic contact stresses, Surface fatigue strength.

Assignment : It depends on the course instructor

Course outcomes :

- To study the role of failure in mechanical design
- To Study and review Mohr's theory and modified Mohr's theory for failure of ductile and brittle materials.
- To study and understand LEFM concepts.
- To study and understand the definitions and quantification of data scatter, Probability distributions, Tolerance limits.
- To study and understand the regression analysis of fatigue data, Reliability analysis.
- To study and understand the spectrum loads and cumulative damage.
- To study and understand surface fatigue spherical contact, cylindrical contact, General contact.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	Edition/Year of Publication
1.	"Metal Fatigue in engineering"	Ralph I. Stephens,	John Wiley New York, Second edition.	2001
2.	"Failure of Materials in Mechanical Design"	Jack. A. Collins,	John Wiley, New York	1992
3.	"Machine Design"	Robert L. Norton,	Pearson.	
Reference Books:				
1.	Fatigue of Materials	S.Suresh,	Cambridge university press, Cambridge, U.K.	
2.	Fundamentals of Metal Fatigue Analysis	Julie.A.	Benantine Prentice Hall,1	1990
3.	Fatigue and Fracture	ASM Hand Book, Vol 19		2002

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)

SEMESTER – II

DYNAMICS & MECHANISM DESIGN

Course Code	PMD 202 C	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	4:0:0	SEE MARKS	: 100
Credits	4	SEE Exam Hours	: 3 Hrs

UNIT – I

Geometry of motion: **04 Hours**

Introduction, Analysis and Synthesis, Mechanism terminology, Planar, spherical and spatial mechanisms, mobility, kinematic inversion, Grashof's law, Mechanical advantage, Coupler curves, five bar, six bar chains, Equivalent mechanisms, Unique mechanisms.

Generalised principles of dynamics: **10 Hours**

Fundamental laws of motion, Generalised coordinates, Configuration space constraints, Virtual work, Principle of virtual work, Energy and momentum, Work and kinetic energy, Equillibrium and stability, Kinetic energy of a system, Angular momentum, Generalised momentum.

UNIT – II

Lagrange's Equation: **16 Hours**

Lagrange's equation from D'Alembert's principles, Hamilton principles, Lagrange's equation from Hamilton principle, Application of Lagrange's equations for conservative and non conservative, autonomous systems with holonomic and non holonomic constraints, Application to systems with very small displacements and to impulsive motion.

Introduction to Synthesis:

Type, Number, and Dimensional synthesis, Function generation, Path generation and Body guidance, Precision Point, Chebychev spacing, Position synthesis of general slider crank mechanism, crank mechanism with optimum transmission angle.

UNIT – III

Synthesis Using Relative pole method: **14 Hours**

Poles and Relative poles of four bar and slider crank mechanism.

Dimensional Synthesis :

Three position synthesis, Point position reduction, Four precision point, The overlay method, Coupler curve synthesis using complex algebra, Two position synthesis of slider crank chain mechanism and crank rocker mechanism, crank mechanism with optimum transmission angle. Cognate linkages.

Analytical Method : Freudenstein's Equation for four bar mechanism and slider crank mechanism, Blochs method of synthesis.

UNIT – IV

Synthesis of Spatial Linkage: **08 Hours**

Introduction to spatial linkage, spatial mechanisms, the position problem, Position analysis of the RGGR mechanism, The Eulerian angles, a theorem on angular velocities and acceleration, The Hooke's universal joint.

Assignment : It depends on the course instructor

Course outcomes :

- To study and understand analysis and synthesis,Mechanism terminology, Planar, spherical and spatial mechanisms, mobility, kinematic inversion, Grashof’s law.
- To analyze Coupler curves, five bar, six bar chains, Equivalent mechanisms, Unique mechanisms.
- To analyze Virtual work, Principle of virtual work, Energy and momentum, Work and kinetic energy in mechanism design.
- To study the Lagrange's equation from D'Alembert's principles, Hamilton principles for mechanism design.
- To study the Type, Number, and Dimensional synthesis, Function generation, Path generation and Body guidance.
- To study and understand Poles and Relative poles of four bar and slider crank mechanism.
- To study and understand the Eulerian angles, a theorem on angular velocities and acceleration, The Hooke's universal joint.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	Edition/Year of Publication
4.	“Theory of Machines and Mechanism”	E.Shigley & J.J.Uicker	McGraw Hill,	
2.	“Principles of Dynamics”	Greenwood	Prentice Hall of India	1988
3.	“Theory of Mechanism and machines”	Ghosh and Mallick	East West press	
Reference Books:				
4.	“Advanced Mechanism Design”	Erdman Sandor	Prentice Hall	
5.	“Mechanism synthesis and analysis”	Soni A.H	McGraw Hill	

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)
SEMESTER – II

THEORY OF PLASTICITY

Course Code	PMD 213 C	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	(4 – 0 – 0)	SEE MARKS	: 100
Credits	4	SEE Exam Hours	: 3 Hrs

UNIT –I

Fundamentals of elasticity: **10L+6T Hours**

Concept of stress, strain, stress strain transformation laws. Spherical and deviatoric stress, and strain tensor. Octahedral stress strain. Engineering and natural strains, cubical dilation, strain rate and the strain rate tensor. Numericals

UNIT – II

Plastic Stress – Strain Relations: **10L+6T Hours**

Types materials, Empirical relations, Theories of plastic flow: Saint-Venant's theory, Prandtl Reuss theory. Experimental verification of Saint Venant's theory of plastic flow. The concept of plastic potential.

UNIT – III

Yield Criteria For Ductile Metal: **10L+7T Hours**

Introduction, Yield or plasticity conditions. Experimental evidence for yield criteria. The Haigh_Westergaard stress space. Geometrical representation of Yield criteria, Numerical.

UNIT – IV

Plastic bending of beams and Torsion of bars. **10L+7T Hours**

Analysis of stress in bending: Idealized stress strain curve, Non-linear stress strain curve, Shear stress distribution, Residual stresses in plastic bending. Plastic bending of unsymmetrical bending.

Torsion of bars: Plastic torsion of a circular bar. Residual stress: Elastic-perfectly plastic material, Nonlinear material. Soap film analogy for plastic torsion.

Assignment : It depends on the course instructor

Course outcomes :

- Be able to **apply** theory of elasticity to **formulate** and **solve** elasticity problems
- **Elucidate** the concepts of plastic stress strain relation.
- Be able to **identify** and **analyze** the yield criteria for ductile material.
- Be able to **formulate**, **solve** and **analyze** plastic bending of beams and torsion of bars.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	Edition/Year of Publication
5.	"Theory of Plasticity and Metal forming Process"	Sadhu Singh	Khanna Publishers, Delhi	
6.	"Engineering Plasticity – Theory and Application to Metal Forming Process"	R.A.C. Slater	McMillan Press Ltd.	
Reference Books:				
6.	"Plasticity for Mechanical Engineers"	Johnson and Mellor		
7.	"Theory of Plasticity"	Haffman and Sachs		
8.	"Theory of plasticity"	Chakraborty	Mc Graw Hill	

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)
SEMESTER – II

DESIGN FOR MANUFACTURE

Course Code :	**PMD 020E**	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	3:0:0	SEE MARKS	: 100
Credits	04	SEE Exam Hours	: 3 Hrs

UNIT –I

Effect of Materials And Manufacturing Process on Design — **10L+2T Hours**

Major phases of design. Effect of material properties on design Effect of manufacturing processes on design. Material selection process-c per unit property, Weighted properties and limits on properties methods.

Tolerance Analysis

Process capability, mean, variance, skewness,kurtosis, Process capability metrics, Cp, Cpk, Cost aspects, Feature tolerances, Geometr tolerances, Geometric tolerances, Surface finish, Review of relationship between attainable tolerance grades and different machining proce Cumulative effect of tolerance-Sure fit law and truncated normal law.

UNIT – II

Datum Features, Selective Assembly,10L+4T Hours

Functional datum, Datum for manufacturing, Changing the datum. Examples.

Interchangeable part manufacture and selective assembly, Group tolerance of mating parts equal, Control of axial play-Introducing seco machining operations, Laminated shims, examples

Design of Gauges

Design of gauges for checking components in assemble with emphasis on various types of limit gauges for both hole and shaft

UNIT III

Design of components with casting consideration — **10L+10T Hours**

Design of components with casting consideration. Pattern, Mould, and Parting line. Cored holes and Machined holes. Identifying the possible and probable parting line. Casting requiring special sand cores. Designing to obviate sand cores

UNIT IV

Component design with machining considerations10L+10T Hours

Component design with machining considerations link design for turning components-milling, Drilling and other related processes including f machining operations.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	
1.	Design for manufacture	harry Peck,	Pitman publications	
2.	Metrology	R K Jain	Khanna Publication	

Reference Books:

1.	Product design for manufacture and assembly	– Geoffrey Boothroyd, Perter Dewhurst Winston Knight – Marcel	.	
2.	ASM Hand Book. Vol 20			

Scheme of Examination:
Student has to solve any five full questions choosing at least one from each Unit.

Course assessment method : continuous and semester end assessment

Course designed by: Dr. M S Hebbal

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)
SEMESTER – II

MECHANICS OF COMPOSITE MATERIALS AND STRUCTURES

Course Code	PMD 015 E	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	4:0:0	SEE MARKS	: 100
Credits	4	SEE Exam Hours	: 3 Hrs

UNIT – I

Introduction to Composite Materials: 06 Hours

Introduction, Natural and man-made composites, Classification and Characteristics of Composite Materials, Mechanical Behavior of Composite Materials, Basic Terminology of Laminated Fiber-Reinforced Composite Materials, Properties of Composite material, applications.

Macro Mechanics of Lamina: 08 Hours

Hooke's law for different types of material, Number of Elastic Constants, Derivation of Nine Independent Constants for Orthotropic Material, Two- dimensional relationship of compliance and stiffness matrix. Hooke's law for two dimensional angle lamina, Engineering constants- Numerical problems, Invariant properties, Stress-Strain relation for lamina of arbitrary orientation, Numerical Problems.

UNIT – II

Micro Mechanica Analysis of a Lamina: 06 Hours

Introduction, Evaluation of the four elastic moduli, Rule of mixture, Numerical Examples.
Macro

Mechanical Analysis of a Laminate: 08 Hours

Introduction, Code, Kirchoff Hypothesis, CLT, A, B, and D matrices (Detailed Derivation), Engineering constants, Special cases of laminates, Numerical examples.

UNIT – III

Hygrothermal Effects on Composites: 06 Hours

Effect of hygrothermal forces on mechanical behavoiur, Micromechanics of hygrothermal properties, Residual stresses, Warpage, Numerical examples.

Failure Criteria and Strength of Laminates: 08 Hours

Failure criteria for an elementary composite layer or Ply, Maximum Stress and Strain Criteria, Approximate strength criteria, Inter-laminar Strength, Tsai-Hill theory, Tsai, Wu tensor theory, Numerical problem, practical recommendations. Numerical examples.

UNIT – IV

Analysis of laminated composite plates: **06 Hours**
Equilibrium equations, Bending of symmetric and Antisymmetric cross ply and angle ply plates.

Manufacturing of FRC and Applications: **06 Hours**
Manufacturing: Contact and Compression Moulding, Pultrusion, Filament welding, Curling.Applications of composites: Aircraft, Missiles, Space Hardware, Automobile, Marine, Electrical and Electronics, Recreational and Sports equipment-future potential of composites..

Assignment : It depends on the course instructor

Course outcomes :

- Understand the terminologies and preliminary concepts related to Composite Materials.
- Apply the mechanics of composites and apply them in the product design process.
- Analyze the Behaviour of Composites under different loading conditions (Mechanical, thermal, hygral, and combined effects) and their practical applications method.
- Analyze the Knowlwdge on Applications of FRC and their manufacturing and apply the knowledge obtained from this course in practice

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

S.No.	**Title of the book**	**Name of the Author/s**	**Name of the publishers**	**Edition/Year of Publication**
7.	Mechanics of Composite Materials	Rober M. Jones	Taylor & Francis, 2nd Ed.	
8.	Mechanics of Laminated Composite Plates and Shells,	Reddy J. N.,	CRC Press	
9.	, Mechanics of Composite Materials & Structures	Madhujit Mukhopadyay	University Press	
Reference Books:				
9.	Mechanics of Composite Materials	Autar K. Kaw	CRC Press, New York	
10	Advanced Mechanics of	Valery V. Vasiliev,	Second edition,	2007

	composite Materials,.	Evgeny V. Morozov,	Elsevier Ltd, U.K	
11	Composite Materials and Structures,	P. K. Sinha	E-Book, http://www.ae.iitkgp.ernet.in/ebooks/index.html	

DEPARTMENT OF MECHANICAL ENGINEERING
MASTER OF TECHNOLOGY (M.Tech.)
MACHINE DESIGN (PMD)

SEMESTER – II

FRACTURE MECHANICS

Course Code	PMD 006 E	CIE MARKS	: 50
Teaching Hours/Week (L:T:P)	4:0:0	SEE MARKS	: 100
Credits	4	SEE Exam Hours	: 3 Hrs

UNIT – I

Fracture Mechanics Principles: **07 Hours**
Introduction sources of micro and macro cracks fracture criterion based on stress concentration and theoretical strength Griffith's energy, Balance approach, subsequent modifications, stress intensity factor approach.

Stress Analysis for Members with Cracks: **06 Hours** Linear elastic fracture mechanics crack tip stresses and deformations, relation between stress intensity factor and fracture toughness stress intensity based solutions, 3-D cracks.

UNIT – II

Crack tip Plastic Zone: **03 Hours**
Plastic zone estimation, plane stress plane strain, yielding fracture mechanics. Irwin's model, Dugdale's model.

Experimental determination of Fracture: **05 Hours**
Toughness, Specimen size requirements and various stress procedures, effects of temperature, loading rate and plate thickness on fracture toughness.

Elastic–Plastic Fracture Mechanics: **06 Hours**
Introduction, Elastic–Plastic fracture criteria, crack resistance curve(R), Path-independent integrals, J-integral , J- integral fracture criterion, crack opening displacement(COD), experimental determination of J-integral and COD.

UNIT – III

Fatigue and Fatigue crack growth rate: **06 Hours**
Fatigue loading and deign concepts, various stages of fatigue crack propagation, fatigue crack growth laws, design applications, ariable amplitude loading.

Linear static fracture Mechanics Design Concepts: **06 Hours**
General fracture mechanics design procedure for terminal failure, design selection materials design, application examples including fatigue loading.

UNIT – IV

Mixed mode fracture: **04 Hours**
Introduction, the stress criterion, strain energy density, 2_D linear elastic crack problems.

Dynamic Fracture: **05 Hours**
Introduction, Mohr's model, strain energy release rates, crack branching, practical applications of crack arresting techniques. Experimental determination of dynamic SIF.

NDT and Fracture Mechanics: **02 Hours**
Introduction, various NDT methods used in Fracture mechanics.

Assignment : It depends on the course instructor

Course outcomes :

- Learn different fracture mechanics principles & understand the propagation of cracks in material.To analyze Coupler curves, five bar, six bar chains, Equivalent mechanisms, Unique mechanisms.
- Understand fracture analysis which includes the usage of linear elastic fracture mechanics (LEFM), crack opening displacement (COD) and j-integral.
- Understand the mathematical and physical principles of fracture mechanics and their applications to engineering design.
- Compute the stress intensity factor, energy release rate, and the stress and strain fields around a crack tip for linear materials.
- Determine experimentally the fracture toughness and understanding design principle of materials and structures using fracture mechanics approaches.
- Predict the likelihood of failure of a structure containing a defect and Design materials and structures using fracture mechanics approaches.

Question paper pattern:

- Total of eight questions with two from each unit to be set uniformly covering the entire syllabus.
- Each question carries 20 Marks and should not have more than 4 sub divisions.
- Any five full questions are to be answer choosing at least one from each unit.

S.No.	Title of the book	Name of the Author/s	Name of the publishers	Edition/Year of Publication
10	"Fracture of Engineering Brittle Materials"	Jayatilake	"Applied Science"London	
2.	"Fracture Mechanics-Fundamental and Applications"	Anderson,T.L	CRC press	1998

Reference Books:				
12	" Engineering fracture mechanics"	S.A. Meguid	Elsevier.	
13	"Elementary Engineering Fracture Mechanics"	David Broek	Noordhoff.	
14	"Fracture and Fatigue Control in Structures",	Rolfe and Barsom	Prentice hall.	
15	"Introduction to Fracture Mechanics"	Karen Hellan	McGraw Hill.	
16	"Fundamentals of Fracture Mechanisms"	Knott	Butterworths.	