Basaveshwar Engineering College, Bagalkote
Department of Artificial Intelligence and Machine Learning Engineering
Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

III Semester

Sl. No.	Category	Subject Code	Subject Title	Credits	Hours/Week			Examination Marks		
					L	T	P	CIE	SEE	Total
1	BSC	22UMA301C	Partial Differential Equations and Integral Transforms	03	03	-	-	50	50	100
2	PCC	22UAI302C	Data Structures and Applications	04	04	-	-	50	50	100
3	PCC	22UAI303C	Computer Organization	03	03	-	-	50	50	100
4	PCC	22UAI304C	AI and its Applications	03	03	-	-	50	50	100
5	IPCC	22UAI305C	Python for Data Science (I)	03	02	-	02	50	50	100
6	PCC	22UAI306C	Data Structures Lab	01	-	-	02	50	50	100
7	AEC	22UAI307C	Robotics Lab	01	-	-	02	50	-	50
8	AEC	22UAI308C	Biology for Engineers	02	02			50		50
9	BSC	22UMA300M	Bridge Course Mathematics I	-	03	-	-	50	50	100
10	MC	NS	NSS	-	-	-	02	100	-	100
		PE	P. ED.							
		YO	Yoga							
			Total	20	20	-	08	550	350	900

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4th Semester

Sl. No.	Category	Subject Code	Subject Title	Credits	Hours/Week			Examination Marks		
					L	T	P	CIE	SEE	Total
1	BSC	22UMA401C	Statistics and Probability Distributions	03	03	-	-	50	50	100
2	IPCC	22UAI402C	Analysis & Design of Algorithms (I)	04	03	-	02	50	50	100
3	PCC	22UAI403C	Operating Systems	04	03	-	-	50	50	100
4	PCC	22UAI404C	Data Science for AI	03	03	-	-	50	50	100
5	IPCC	22UAI405C	Embedded System (I)	03	02	-	02	50	50	100
6	PCC	22UAI406C	Data Science Lab	01	-	-	02	50	50	100
8	PCC	22UAI407C	Agile Methodologies	01	02	-	-	50	-	50
9	HSSM	22UAI408C	UHV-II	01	01	-	-	50	50	100
10	BSC	22UMA400M	Bridge Course Mathematics I	-	03	-	-	50	50	100
11	MC	NS	NSS	-	-	-	02	100	-	100
		PE	P. ED.							
		YO	Yoga							
			Total	20	22	-	08	550	400	950

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22UMA301C	**Partial Differential Equations and Integral Transforms**	**03 - Credits (3 : 0 : 0)**
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hrs.**

Partial Differential Equations_I : Introduction to PDE, Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE.

UNIT – II	**10 Hrs.**

Partial Differential Equations_II : Solutions of PDE by the method of separation of variable. Derivation of one-dimensional heat and wave equations and their solutions by explicit method, solution of Laplace equation by using five point formulas.

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. Inverse Z-transforms.

References:

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:

After completion of the course the students shall be able to

CO1: Identify different types of PDEs including linear vs nonlinear, first order vs higher-order, and partial derivatives of different variables.
CO2: Learn various analytical techniques to solve to specific types of PDEs, such as variable separable and explicit method.
CO3: Grasp the concept of representing periodic functions as an infinite sum sinusoidal (sine and cosine) with different frequencies.
CO4:/Grasp the concept of the Fourier transform as a mathematical tool that converts a function from the time domain into the frequency domain.

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22UAI302C	**Data Structures and Applications**	**04-Credits**
Hrs/Week:04	**L:T:P:4:0:0**	CIE Marks:50
Total Hours:52		SEE Marks:50

UNIT - I	**13 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	**13 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	**13 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	**13 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.	

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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:

After completion of the course the students shall be able to

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.

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22UAI303C	**Computer Organization**	**03-Credits**
Hrs/Week: 03	**L:T:P:3:0:0**	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", 5th 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.

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Course Outcomes:

After completion of the course the students shall be able to

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

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22UAI304C	**AI and Its Applications**	**03-Credits**
Hrs/Week:03	**L:T:P:3:0:0**	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,

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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:	

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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 to solve problems, Bernard Marr, Wiley Publications,2019.

Course Outcomes:

After completion of the course the students shall be able to

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.

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22UAI305C	**Python for Data Science(I)** L:T:P:2:0:2	**03-Credits**
Hrs/Week: 02+02		**CIE Marks:50**
Total Hours: 40 (30 L+20 P)		**SEE Marks:50**

UNIT - I	**07 Hrs**
Introduction to Data Science: Definition of Data Science, working process of Data Science works, Data Science uses, Tools for data science **Introduction to NumPy:** Understanding Data Types in Python: A Python Integer Is More Than Just an Integer, A Python List Is More Than Just a List, Fixed-Type Arrays in Python, Creating Arrays from Python Lists, Creating Arrays from Scratch, NumPy Standard Data Types, The Basics of NumPy Arrays: NumPy Array Attributes, Array Indexing: Accessing Single Elements, Array Slicing: Accessing Subarrays, Reshaping of Arrays, Array Concatenation and Splitting. Computation on NumPy Arrays: Universal Functions, The Slowness of Loops, Introducing UFuncs, Exploring NumPy's UFuncs, Advanced Ufunc Features. Aggregations: Min, Max, and Everything in Between. Sorting Arrays: Fast Sorting in NumPy: np.sort and np.argsort.	
UNIT – II	**08 Hrs**
Data Manipulation with Pandas: Installing and Using Pandas, Introducing Pandas Objects, The Pandas Series Object, The Pandas Data Frame Object, The Pandas Index Object. Data Indexing and Selection : Data Selection in Series, Data Selection in Data Frame. Handling Missing Data, Trade-Offs in Missing Data Conventions, Missing Data in Pandas, Operating on Null Values. Hierarchical Indexing: A Multiply Indexed Series, Methods of Multi Index Creation, Indexing and Slicing a Multi Index. Rearranging Multi-Indices, Data Aggregations on Multi-Indices. Combining Datasets: Concat and Append, Recall: Concatenation of Num Py Arrays, Simple Concatenation with pd.concat. Combining Datasets: Merge and Join, Relational Algebra, Categories of Joins, Specification of the Merge Key, Specifying Set Arithmetic for Joins, Overlapping Column Names: The suffixes Keyword Example: US States Data. Aggregation and Grouping: Planets Data, Simple Aggregation in Pandas, GroupBy: Split, Apply, Combine. Pivot Tables: Motivating Pivot Tables, Pivot Tables by Hand, Pivot Table Syntax Example: Birthrate Data. High-Performance Pandas: eval() and query(), Motivating query() and eval(): Compound Expressions, pandas.eval() for	

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Efficient Operations, DataFrame.eval() for Column-Wise Operations, DataFrame.query() Method.	
UNIT - III	**07 Hrs**
Visualization with Matplotlib: General Matplotlib Tips, Importing matplotlib, Setting Styles, show() or No show()? How to Display Your Plots, Saving Figures to File. Simple Line Plots: Adjusting the Plot: Line Colors and Styles, Adjusting the Plot: Axes Limits, Labeling Plots. Simple Scatter Plots: Scatter Plots with plt.plot , Scatter Plots with plt.scatter, plot Versus scatter: A Note on Efficiency. Visualizing Errors: Basic Error bars, Continuous Errors. Density and Contour Plots: Visualizing a Three-Dimensional Function, Histograms, Binnings, and Density, Two-Dimensional Histograms and Binnings: Customizing Plot Legends: Choosing Elements for the Legend, Legend for Size of Points, Multiple Legends. Customizing Colorbars: Customizing Colorbars Example: Handwritten Digits. Multiple Subplots: plt.axes: Subplots by Hand, plt.subplot: Simple Grids of Subplots,plt.subplots: The Whole Grid in One Go, plt.GridSpec: More Complicated Arrangements. Customizing Ticks: Major and Minor Ticks, Hiding Ticks or Labels, Reducing or Increasing the Number of Ticks. Customizing Matplotlib: Configurations and Stylesheets , Plot Customization by Hand, Changing the Defaults: rcParams, Stylesheets. Three-Dimensional Plotting in Matplotlib: Three-Dimensional Points and Lines, Three-Dimensional Contour Plots, Wireframes and Surface Plots, Surface Triangulations. Geographic Data with Basemap: Map Projections, Drawing a Map Background, Plotting Data on Maps Example: California Cities Example: Surface Temperature Data. Visualization with Seaborn: Seaborn Versus Matplotlib, Exploring Seaborn Plots, Example: Exploring Marathon Finishing Times.	
UNIT - IV	**08 Hrs**
Version Control System: Why Do We Need a Version Control System? Fundamentals of Git Git installation and setup basic local Git operations creating a repository, cloning a repository, making and recording changes, staging and committing changes, viewing the history of all the changes, undoing changes, Git Branching and merging Basic Creating and switching to new branches, Switching between branches, Merging local branches together, GitHub - Basics of distributed git - Account creation and configuration - Create and push to repositories - versioning - Collaboration – Migration,Create repository – named mini project-1 Push the same to GitHub. **Containers:** Why containers? What is a docker? How docker works? Components of docker -	

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Docker container - Docker client - Docker daemon - Docker image - Docker registry Install docker on desktop and start the docker tool. Publish the container in Registry, Docker file Docker image Commands to create docker file. Build docker image with docker file create docker container from docker image Run the docker container.

Text Books:

1. Jake VanderPlas ,"Python Data Science Handbook", 2017. O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472. ISBN: 978-1-4919-1205-8
2. Giuseppe Bonaccorso, "Machine Learning Algorithms", Second Edition, ISBN: 978-1-78934-799-9, Packet Publishing Ltd., Birmingham,UK.
3. Peter Norvig and Stuart J. Russell, "Artificial Intelligence: A Modern Approach", third edition, ISBN:978-93-325-4351-5, pearson , 2021.(Chapter 12 and Chapter 13)
4. Marco Peixeiro, Time Series Forecasting in Python, October 2022, Manning Publications, ISBN: 9781617299889

Reference books:

1. Tom Mitchel, "Machine Learning ", International Edition 1997, McGraw Hill Education.

e-Resources and other Digital Material:

1. https://www.tutorialspoint.com/numpy/index.htm
2. https://www.tutorialspoint.com/python_pandas/index.htm
3. https://www.w3schools.com/python/numpy/default.asp
4. https://www.geeksforgeeks.org/what-is-exploratory-data-analysis/
5. https://www.ibm.com/topics/exploratory-data-analysis
6. https://towardsdatascience.com/an-extensive-guide-to-exploratory-data-analysis-ddd99a03199e
7. https://www.docker.com/resources/what-container/
8. https://www.simplilearn.com/tutorials/docker-tutorial/what-is-docker-container
9. https://git-scm.com/book/en/v2/Getting-Started-About-Version-Control
10. https://www.simplilearn.com/tutorials/git-tutorial/git-installation-on-windows
11. https://www.tutorialspoint.com/git/index.htm
12. https://www.w3schools.com/datascience/ds_introduction.asp
13. https://www.simplilearn.com/tutorials/data-science-tutorial/introduction-to-data-science

Course Outcomes:

After completion of the course the students shall be able to

CO1: To ***understand*** data types in python and to apply array concepts using NumPy.
CO2: ***Understand*** and ***Apply*** Structuring data using NumPy and manipulating the data using

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Pandas. CO3: Using Pandas to ***analyze*** and work with data sets. CO4: ***Apply*** and ***Analyze*** Graphical visualization of data using Matplotlib CO5: ***Analyze*** and ***Apply*** Version Control System and Docker in the development data science projects.

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21UMA401C	**Statistics and Probability Distributions**	**03-Credits(3:0:0)**
Hours /Week: 03		CIEMarks:50
Total Hours: 40		SEE Marks : 50

UNIT–I	**10 Hrs.**

Statistics:

Curve fitting by the method of leastsquares: $y = a + bx$, $y = ab^x$, $y = a + bx + cx^2$. Correlation, expression for the rank correlation coefficient and regression.

UNIT–II	**10 Hrs.**

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	**10 Hrs.**

Probability distributions:

Binomial distributions, Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.

UNIT–IV	**10 Hrs.**

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.

References:

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.
5. Probability and stochastic processes by Roy D.Yates and David J.Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Theory and problems of probability by Seymour Lipschutz(Schaum'sSeries).

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Course Outcomes: After completion of the course the students shall be able to 1. Apply the least square sense method to construct the specific relation for the given group of data. 2. Solve problems on correlation and regression 3. Apply the concepts of probability 4. Apply the concepts of probability distributions 5. Apply the concept of Markov Chain for commercial and industry purpose.

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22UAI402C	Analysis & Design of Algorithms (I)	Credits:04
L:T:P:3:0:2		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT-I	10 + 6 Hrs

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 Hrs

Divide and Conquer: Merge sort, Quick sort, 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 Hrs

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 Hrs

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.

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

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

Course Outcomes :

After completion of the course student will be able to

CO1: Understand the notion of an algorithm, asymptotic notations and different problem types.
CO2: Analyze the recursive and non-recursive algorithms.
CO3: Understand the algorithm design techniques using divide and conquer approach.
CO4: Understand the algorithm design techniques using dynamic programming and greedy approaches.
CO5: Explain the algorithm design techniques using backtracking, branch & bound, NP-complete and NP-hard problems.

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22UAI403C	**Operating Systems** L:T:P:4:0:0	**04-Credits**
Hrs/Week: 04		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**13 Hrs**

Introduction to operating systems, types and services.
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; 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, Inter-process communication (Intd.), Threads: concepts, Multi-Threaded Programming: Overview; Multithreading models;
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.

UNIT - IV	**13 Hrs**

Virtual Memory Management: Background; Demand paging; Page replacement; Allocation of frames.

File system: concepts and implementation, secondary storage structures. File System: File concept; Access methods; Directory structure; File system mounting; File sharing; Implementing File System: File system structure; File system implementation; Directory implementation; Allocation methods; Free space management.

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.

Course Outcomes :

After completion of the course student will be able to

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CO 1: Understand the notion of an algorithm, asymptotic notations and different problem types.
CO 2: Analyze the recursive and non-recursive algorithms.
CO 3: Understand the algorithm design techniques using divide and conquer approach.
CO 4: Understand the algorithm design techniques using dynamic programming and greedy approaches.
CO 5: Explain the algorithm design techniques using backtracking, branch & bound, NP-complete and NP-hard problems.

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22UAI404C	Data Science for AI	Credit: 03
Hrs/Week: 03Hrs	L: T: P: 3: 0: 0	CIE Marks: 50
Total Hours: 40Hrs		SEE Marks: 50

UNIT-I	10 Hrs.
Significance of data in AI , AI Software Development life cycle , Compare traditional software development with AI Software Development, Example – Game rules (Chess). Machining Learning , Machine learning types , Machine learning workflow , Machine learning applications , Challenges in ML , Building a model-steps involved . Pipelines: Data engineering , Machine learning , Deployment. Introduction to Data Science, Data Science uses, Data Science tools and technique. Big Data : Vs of Big Data - Sources of data, Role of Big Data in AI&ML. Data: Introduction, Data types: Structured Data, Unstructured Data, Challenges with Unstructured Data. Data Collection: Open Data, Social Media Data, Multimodal Data, Data Storage and Presentation. Data Preprocessing: Importance of data preprocessing, Data cleaning , Assess Data quality , Data anomalies , Detect missing values with pandas data frame functions: info() and .isna() , Diagnose type of missing values with visual and statistical methods (eg. chi-squared test of independence). Approaches to deal with missing values: Keep the missing value as is , Remove data objects with missing values „Remove the attributes with missing values , Estimate and impute missing values. Detecting outliers :univariate outlier detection, bivariate outlier detection, Time series outlier detection. Dealing with outliers : Do nothing, Replace with the upper cap or lower cap, Perform a log transformation, Remove data objects with outliers . Data Integration :Overview, data integration challenges. Approaches: Adding attributes , Adding data objects. Data reduction : Distinction between data reduction and data redundancy. Objectives: Methods with numerosity data reduction with dimensionality data reduction. Data transformation: Need for data transformation, Normalization, Standardization Data transformation with - binary coding, ranking transformation and discretization. Data transformation with ranking transformation and discretization.	
UNIT–II	10 Hrs.

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Exploratory data analysis : overview , EDA goals and benefits. Univariate data analysis: Characterizing data with descriptive statistics , Univariate distribution, Univariate comparison plots , Univariate composition plots .

Univariate analysis tests : Hypothesis testing Error, Test statistic, type, interpreting test statistics. Understanding p-value.

Multivariate analysis: Finding relationship in data using Covariance and Correlation.
Multivariate distribution plot ,Multivariate comparison plot, Multivariate relationship plot ,Multivariate composition plot.

Feature Engineering, Data Splitting Importance of data splitting - Training set - Validation set - Testing set, Underfitting and Overfitting

UNIT–III	10 Hrs.

Machine Learning pipeline, Supervised Learning: Regression, Types of regression, Regularization in ML, Real-Life Applications. Linear regression Overview: Types, Simple linear regression, Multiple linear regression, Polynomial linear regression, Applications of Linear Regression .

Understanding Simple linear regression, Regression equation, Assumptions, Gradient descent, Setting up the regression problem. Implementation: Student score based on study hours Problem statement, Create a model to analyses the relation between CIE and SEE result using sklearn. Create a model to analyze the relation between crop yield and rain fall rate, Build linear regression model using Stats model. Model Evaluation & testing: Evaluate regression model, Evaluation Metric, Coefficient of Determination or R-Squared (R2) , Root Mean Squared Error (RSME) . Optimize regression model, Gradient descent.

Cross-validation: Why do we need Cross-Validation? Techniques - Hold out method - Leave One Out Cross-Validation - K-Fold Cross-Validation.

Multiple Linear Regression: Overview, Assumptions , Normal Equation , Applications. Identification and collection of regression dataset, Perform data exploration, preprocessing and splitting on datasets , build regression model , evaluate the model , minimize the cost function using Boston housing price dataset from sci-kit learn datasets . Overfitting vs underfitting in Linear regression.

Supervised learning – classification, Types: Binary classification, Multi-Label Classification, Multi-Class Classification, Imbalanced Classification, Classification models , Applications

KNN Classification: Overview, KNN classification and regression , Choosing best K using validation method, Perform classification on Breast cancer data set using sklearn. Evaluation Metrics for Classification - confusion matrix, Accuracy, Precision and Recall ,Specificity , F1-score , AUC-ROC.

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UNIT–IV	**10 Hrs.**
Decision tree, Understanding Entropy, information gain, Issues in decision tree, Overfitting in decision tree classifier and Pruning, Decision Tree Classifier Applications. Build decision tree-based model in python for like Play Tennis dataset from sci-kit learn Or any classification dataset from UCI , Kaggle. Evaluation of decision tree model with different metrics. Hyper parameter tuning for Decision Tree Classifier. Logistic regression: Introduction to logistic regression. Difference between linear and logistic regression. Applications of logistic regression. The Logistic Function. The Logistic Regression Model. Gradient Descent and Optimization. Model Evaluation. Model Validation. Implementing Logistic Regression in Python (sklearn) for real world problems. Un supervised Learning: Definition and differences from supervised learning, Applications of unsupervised learning. Types of Unsupervised Learning, Overview of Clustering: Definition and types of clustering, Applications of clustering in different fields. Introduction to K-Means Clustering :Concept of K-Means Clustering. History and development of the K-Means algorithm, Real-world applications. Understanding the K-Means Algorithm: The objective function of K-Means, Steps involved in the K-Means algorithm. Distance Metrics: Euclidean distance and its importance in K-Means, Other distance metrics (Manhattan, Cosine), Choosing the right distance metric. Practical Implementation in Python (sklearn). Evaluating and Validating Clusters.	
Reference Books/ Journals/ Technical Reports	
1. "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, 2. "Python for Data Analysis" by Wes McKinney. 3. Online Courses: Coursera (Andrew Ng's Machine Learning), edX, Udacity. 4. Tutorials and Blogs: Towards Data Science, Kaggle kernels.	
Course Outcomes : After completion of the course student will be able to **CO 1:** Comprehensive Understanding of Data and AI Development Lifecycle **CO 2:** Mastering Exploratory Data Analysis and Data Preparation **CO 3:** Developing and Evaluating Machine Learning Models **CO 4:** Implementing and Evaluating Advanced Machine Learning Algorithms	

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22UAI405C	Embedded Systems (I)	Credits: 03
L:T:P:2:0:2		CIE Marks:50
Total Hours/Week: 40 (28 T+12 P)		SEE Marks:50

UNIT-I	08 Hrs
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.	
UNIT–II	**06 Hrs**
Addressing modes: Immediate, register, direct and indirect addressing modes. **Instruction Set and Programming:** Data transfer, Arithmetic, Logic and compare instructions, and assembly programs	
UNIT- III	**06 Hrs**
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.	
UNIT- IV	**08 Hrs**
Interfacing Peripherals with 8051 Microcontroller: LED interfacing, Seven segment LED interfacing, LCD interfacing, Stepper motor interfacing, DC motor interfacing (programs for interfacing peripherals in assembly)	

Reference books

1. Kenneth J. Ayala, "8051 Microcontroller: Architecture, Programming and Applications", 3rd Edition, Thomson publication , 2005.
2. Muhammad Ali Mazidi, Janice Gillespie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems: using Assembly & C", 2nd Edition, Pearson, 2006.

Course Outcomes:

After completion of the course student 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.

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22UAI407C	**Agile Methodologies** **L:T:P:1:0:0**	**01-Credits**
Hrs/Week: 01		CIE Marks:50
Total Hours:15		SEE Marks:50

UNIT-I	**04 Hrs.**

Introduction: Software Development Life Cycle (SDLC), Different types of software development models, Need of Agile software development, agile context– Manifesto, Principles, Methods, Values, Roles, Artifacts, Stakeholders, and challenges. Business benefits of software agility.

UNIT–II	**04 Hrs.**

Project Planning: Recognizing the structure of an agile team– Programmers, Managers, Customers. User stories– Definition, Characteristics and content. Estimation– Planning poker, Prioritizing, and selecting user stories with the customer, projecting team velocity for releases and iterations

UNIT–III	**03 Hrs.**

Project Design: Fundamentals, Design principles–Single responsibility, Open-closed, Liskov substitution, Dependency-inversion, Interface-segregation

UNIT–IV	**04 Hrs.**

Design Methodologies: Need of scrum, Scrum practices –Working of scrum, Project velocity, Burn down chart, Sprint backlog, Sprint planning and retrospective, Daily scrum, Scrum roles– Product Owner, Scrum Master, Scrum Team.

Reference Books

Text Books

1. Ken Schawber, Mike Beedle, "Agile Software Development with Scrum", International Edition, Pearson.
2. Robert C. Martin, "Agile Software Development, Principles, Patterns and Practices", First International Edition, Prentice Hall.
3. Pedro M. Santos, Marco Consolaro, and Alessandro Di Gioia, "Agile Technical Practices Distilled: A learning journey in technical practices and principles of software design", First edition, Packt Publisher.

Reference Books

1. Lisa Crispin, Janet Gregory, "Agile Testing: A Practical Guide for Testers and Agile Teams", International edition, Addison Wesley.
2. Alistair Cockburn, "Agile Software Development: The Cooperative Game", 2nd Edition, Addison-Wesley

E-Books and Online learning material

1. "The Complete Guide to Agile Software Development" https://clearbridgemobile.com/complete-guideagile-

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software-development/
2. "Agile Fundamentals Ebook: A Complete Guide for Beginners", https://agileken.com/agilefundamentals-ebook/

Online Courses and Video lectures

1. "Agile Software Development", https://www.edx.org/course/agile-software-development Accessed on August 27, 2021.
2. "Agile Software Development", https://www.coursera.org/learn/agile-software-development Accessed on August 27, 2021.

Course Outcomes:

On completion of the course, the student will have the ability to:

CO1: **Interpret** the concept of agile software engineering and its advantages in software development.
CO2: **Determine** the role of design principles in agile Project Planning.
CO3: Students should be able to **apply** key design principles, including Single Responsibility Principle (SRP), Open-closed Principle (OCP), Liskov Substitution Principle (LSP), Dependency Inversion Principle (DIP), and Interface Segregation Principle (ISP), to develop software solutions that are flexible, extensible, and easy to maintain
CO4: **Make use** of various tools available to agile teams to facilitate the project.

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5th Semester

Sl. No	SUBJECT CODE	SUBJECT TITLE	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1.	21UAI501E	Computer Networks	03	03	-	-	50	50	100
2.	21UAI502C	Principles of AI	03	03	-	-	50	50	100
3.	21UAI503C	Machine Learning Algorithms (I)	04	03	-	02	50	50	100
4.	21UAI504C	Database Management System	03	03	-	-	50	50	100
5.	21UAI505N	Professional Open Elective -I	03	03	-	-	50	50	100
6.	21UAI509L	Database Management System lab	01	-	-	02	50	50	100
7.	21UHS507I	Summer Internship - II	03	-	-	-	50	50	100
8.	21UHS508C	Environmental Studies	01	01	-	-	50	50	100
9.	21UHS001N	Soft Skills	02	01	-	-	50	50	100
		Total	**23**	**17**	**00**	**04**	**450**	**450**	**900**

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6th Semester

Sl. No	SUBJECT CODE	SUBJECT TITLE	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1.	21UAI601C	Optimization Techniques for Machine Learning	03	03	-	-	50	50	100
2.	21UAI602C	Advanced AI and ML	03	03	-	-	50	50	100
3.	21UAI604E	Professional Elective Course – II	03	03	-	-	50	50	100
4.	21UAI605N	Professional Open Elective – II	03	03	-	-	50	50	100
5.	21UAI605N	Professional Open Elective – III	03	03	-	-	50	50	100
6.	21UAI606L	Web Programming Lab	02	-	02	02	50	50	100
7.	21UAI607L	Advanced AI and ML lab	01	-		02	50	50	100
8.	21UHS608P	Mini Project	02	-	-	03	50	50	100
9.	21UHS600C	Indian Knowledge System	01	01	-	-	50	50	100
		Total	**21**	**16**	**02**	**07**	**450**	**450**	**900**

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21UAI501E	**Computer Networks** 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 Network and Communication: Definition, **Network topology:** Mesh (advantages and disadvantages), Star (advantages and disadvantages), Ring (advantages and disadvantages). **Types of Networks based on size:** LAN, WAN, MAN. **Classes of transmission media:** Guided (wired)-Twisted pair cable, Coaxial cable, Fiber-optic cable. Unguided (wireless)-Free space. **Propagation modes:** *Switching (switched networks)-* Circuit switched networks, Packed switched network-datagram circuit network, virtual circuit network, message switched network. **OSI (Open System Interconnection):** Seven layers, how data is referred to in the OSI model? Interaction between layers in the OSI model, advantages of OSI model, differences between OSI and TCP/IP models. Port number, port range groups. **IP address:** Types of IP addresses- IPv4, IPv6, IP address format, classes of IP address. **Protocols and Standards:** The key elements of a protocol, Standard Creation committees.	

e-Resources:

- https://datacommandnet.blogspot.com/p/protocols-and-standards.html
- https://www.javatpoint.com/ip-address-format-and-table
- https://data-flair.training/blogs/osi-model-in-computer-network/
- https://www.geeksforgeeks.org/how-communication-happens-using-osi-model/
- https://www.geeksforgeeks.org/difference-between-ip-address-and-port-number/
- https://www.studytonight.com/computer-networks/protocols-and-standards
- https://www.geeksforgeeks.org/difference-between-ip-address-and-port-number/
- https://www.javatpoint.com/ip-address-format-and-table

UNIT – II	**10 Hrs**
Data link layer: Data link layer services and flow control techniques. Design issues. *Framing:* Character count, Flag bytes with byte stuffing, Starting and ending flags, with bit stuffing. *Elementary data link protocols:* Utopian simplex protocol-, a simplex stop and wait protocol for an error-free channel. *Noisy channel*: *Sliding Window protocols:* Stop-and-Wait Automatic Repeat Request, Go-Back-N Automatic Repeat Request. *Controlled Access Protocols:*	

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Reservation, Polling, And Token Passing. *Error Detection:* Simple Parity check, Two-dimensional Parity check, Checksum, Cyclic redundancy check. Multiple Access Protocols - ALOHA, CSMA,CSMA/CD, CSMA/CA, Collision free protocols.

e-Resources:

- https://www.tutorialspoint.com/what-is-byte-stuffing-in-computer-networks
- https://www.geeksforgeeks.org/stop-and-wait-arq/
- https://www.javatpoint.com/go-back-n-arq

UNIT - III	10 Hrs

Network Layer: Services, *Routing algorithms*- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms. **Transport layer:** Services, advantage and disadvantages, responsibility of transport layer, Elements of Transport Protocols, Congestion control. The Internet Transport Protocols (TCP) and User Datagram Protocol (UDP), differences between TCP and UDP and features of network layer. CIDR, Subnetting, SuperNetting, ARP, RARP.

e-Resources:

- https://citizenchoice.in/course/computer-networks-theory/Chapter%204/2-process-to-process-delivery
- https://www.geeksforgeeks.org/transport-layer-responsibilities/
- https://www.tutorialspoint.com/what-are-the-elements-of-transport-protocol
- https://www.geeksforgeeks.org/differences-between-tcp-and-udp/
- https://www.mobiprep.com/post/class-notes-cn-transport-layer-and-congestion-control

UNIT - IV	10 Hrs

The application Layer: Functions of application layer, Application layer services, protocols. *DNS (Domain Name System):* Domain Name Space, Distribution of Name Space, DNS in the internet, resolution, applications of DNS. *Electronic mail:* Components of Email System. E-Mail Protocol-SMTP (Simple Mail Transfer Protocol), POP (Post Office Protocol), IMAP (Internet Mail Access Protocol). Architecture of WWW, *Web Documents:* static, dynamic, and active Static. **Network Security:** Goals of Network Security, Security Services, Types of Network Security and classification of Security Attacks.

e-Resources:

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- https://www.geeksforgeeks.org/computer-security-and-its-challenges/
- https://www.tutorialspoint.com/internet_technologies/e_mail_protocols.htm
- https://www.javatpoint.com/computer-network-application-layer
- https://www.infosectrain.com/blog/types-of-network-security-attacks/

Text Books:

1. Andrew S Tanenbaum, David. J. Wetherall, "Computer Networks", Pearson Education, 5th Edition.

Reference books:

1. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill, Fourth Edition 2. Kurose and Ross, Computer Networking- A Top-Down approach, Pearson, 5th edition

e-Resources and other Digital Material:

1. https://www.digimat.in/nptel/courses/video/106105183/L01.html
2. https://mrcet.com/downloads/digital_notes/CSE/III%20Year/COMPUTER%20NETWORKS%20NOTES.pdf
3. https://www.netacad.com/courses/networking/networking-essentials
4. https://www.coursera.org/learn/computer-networking
5. https://nptel.ac.in/courses/106/105/106105081
6. https://www.edx.org/course/introduction-to-networkin

Course Outcomes:

1. ***Understand*** and ***Contrast*** the concept of computer network concepts with it types, topologies, transmission media, layered protocols and standards, port and IP address, network models and ***discuss*** the functionalities of each layer in these models.
2. **Discuss** and **Analyze** flow control and error control mechanisms and apply them using standard data link layer protocols.
3. ***Analyze*** and ***apply*** various routing algorithms to find shortest paths for packet delivery. ***Explain*** the details of Transport Layer Protocols (UDP, TCP) and suggest appropriate reliable/unreliable communication.
4. ***Analyze*** the features and operations of various application layer protocols such as HTTP, DNS, SMTP and need of network security.

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21UAI502C	**Principles of AI**	**Credits:03**
L:T:P:3:0:0		CIE Marks:50
Total Hours/Week: 40/03		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.

UNIT – IV	**10 Hrs**

First Order Logic: Representation Revisited, Syntax and Semantics of First Order logic, Using First Order logic.
Inference in First Order Logic: Propositional Versus First Order Inference, Unification, Forward Chaining, Backward Chaining, Resolution.
Introduction to Uncertain Knowledge and Reasoning: Quantifying Uncertainty: Acting under Uncertainty.

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.

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

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21UAI503C	**Machine Learning Algorithms(I)**	**03-Credits**
L:T:P:2:0:2	**L:T:P:3:0:0**	CIE Marks: 50
Total Hours/Week: 40 (28 T+12 P)		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,

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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.

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21UAI504C	**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.

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CO3: Demonstrate the use of concurrency and transactions in database. CO4: Design and build database applications for real world problems.

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21UAI601C	**Optimization Techniques for Machine Learning**	**03-Credits**
Hrs/Week: 03	**L:T:P:3:0:0**	CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I — **10 Hrs**

Foundation:
Function Optimization, Candidate solutions, Objective functions, Evaluation costs.
Optimization and Machine Learning: Introduction to ML and Optimization, Learning as optimization, Optimization in ML project.
How to Choose an Optimization Algorithm: Optimizing algorithms, Differentiable objective function, Non differentiable objective function.
Background:
No Free Lunch Theorem for Machine Learning, Implications for optimization and Machine learning.
Local Optimization vs. Global Optimization: Local Optimization, Global Optimization, Local Optimization vs. Global Optimization.
Premature Convergence: Convergence in ML, Premature convergence, Addressing premature convergence.
Creating Visualization for Function Optimization: Visualization for function optimization, Visualize 1D function optimization, **Visualize 2D function optimization**,
Stochastic Optimization Algorithms: Stochastic optimization and algorithms, Practical considerations for Stochastic Optimization.
Random Search and Grid Search: Naïve function optimization algorithms, Random search for function optimization, Grid search for function optimization.

UNIT – II — **10 Hrs**

Local Optimization:
Gradient in Machine Learning, Derivative and gradient, Worked examples of calculating derivatives, Interpreting derivatives, Calculating derivative of a function.
Univariate Function Optimization: Univariate function optimization, Convex univariate function optimization, Non convex univariate function optimization.
Pattern Search: Nelder-Mead Optimization Algorithm, Nelder-Mead example in Python, Nelder-Mead on challenging functions.
Second Order optimization algorithms: The BFGS and L-BFGS-B Optimization Algorithms, Worked examples of BFGS.
Stochastic Hill Climbing algorithms: Stochastic Hill Climbing algorithm and its implementation, Examples of applying Stochastic Hill Climbing algorithms.
Iterated Local Search: Introduction to iterative local search, Ackley objective function, Stochastic Hill Climbing algorithm with random restarts, Iterated local search algorithms.

UNIT - III — **10 Hrs**

Global Optimization:
Simple Genetic Algorithm: Genetic algorithm from scratch, genetic algorithm for Onemax, Genetic algorithm for function optimization.

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Evolution Strategies: Develop a (μ,λ)-ES, develop (μ+λ)-ES.
Differential Evolution: Differential evolution algorithm from scratch, Differential evolution algorithm on the sphere function.
Simulated Annealing : Implement simulated annealing and worked Example.

UNIT - IV	10 Hrs

Gradient Descent:
Gradient Descent Optimization: Gradient descent and worked example. Gradient descent optimization, Gradient descent with momentum and its visualization. Gradient Descent with AdaGrad,Gradient Descent with RMSProp,Gradient Descent with Adadelta, Adam Optimization Algorithm
Projects:
Use Optimization Algorithms to Manually Fit Regression Models: Optimize linear and logistic regression models,
Optimize Neural Network Models: Optimize a perceptron and a multi layer perceptron.
Feature Selection using Stochastic Optimization: Optimization for feature selection, Enumerate all feature subsets.
Manually Optimize Machine Learning Model: Mannual hyper parameter optimization, Perceptron hyper parameter optimization, XGBOOST hyper parameter optimization.

Text Books:

1. Optimization Techniques for Machine Learning, Jayson Brownlee, Machine learning mastery,2021.

Reference Books:

1. Linear Algebra and Learning from Data, Gilbert Strang
2. Convex Optimization by Stephen Boyd
3. Optimization for Machine Learning by Suvrit Sra, MIT Press.

Course Outcomes:
CO1: Grasp essential concepts in function optimization and Connect Optimization with Machine Learning
CO2:Develop the skill to pick the right optimization algorithm based on the problem
CO3:Create visualizations for function optimization
CO4 :Apply optimization techniques to ML based real-world problems

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21UAI602C	Advanced AI and ML L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs
Support Vector Machine (SVM): Basic terms, how does SVM works? Types of SVM, mathematical intuition behind support vector machine, SVM kernel functions, applications of SVM, advantages and disadvantages of SVMs, differences between logistic regression and SVM, v-SVM. **Advanced clustering techniques:** Introduction to clustering, applications of clustering, density based clustering algorithms, density reachability and density connectivity. *DBSCAN clustering:* types of points after the DBSCAN clustering is completed, algorithmic steps for DBSCAN clustering, the complexity of DBSCAN. *BIRCH algorithm:* stages of BIRCH algorithm, algorithm and cluster features, parameters of BIRCH, advantages of BIRCH. Differences between: DBSCAN and K-means, BIRTH and K-means. **Implementation of:** SVM, DBSCAN, BIRCH algorithms using python.	

e-Resources:

- https://www.analyticsvidhya.com/blog/2021/10/support-vector-machinessvm-a-complete-guide-for-beginners/
- https://stackabuse.com/implementing-svm-and-kernel-svm-with-pythons-scikit-learn/
- Radial Basis Function (RBF) Kernel: The Go-To Kernel | by Sushanth Sreenivasa | Towards Data Science
- https://www.kdnuggets.com/2020/04/dbscan-clustering-algorithm-machine-learning.html#:~:text=low%20point%20density.-,Density%2DBased%20Spatial%20Clustering%20of%20Applications%20with%20Noise%20(DBSCAN),is%20containing%20noise%20and%20outliers.
- https://www.freecodecamp.org/news/8-clustering-algorithms-in-machine-learning-that-all-data-scientists-should-know/
- https://www.javatpoint.com/birch-in-data-mining

UNIT – II	10 Hrs
Ensemble techniques: Definition, ensemble learning approaches. *Bagging techniques:* Random forest, differences between decision tree and random forest, example for random forest, features of random forest. *Boosting techniques:* Working processes of boosting, Gradient boosting-elements, algorithm. AdaBoosting, XGBoost, differences between bagging and boosting techniques.	

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Recommendation system: *Content based technique:* working processes, advantages and disadvantages. *Collaborative based technique:* working process, advantages and disadvantages. *Hybrid based techniques:* working process and advantages and disadvantages. Applications of recommendation system. **Implementation of:** Random Forest, Content based and Collaborative based techniques using python.

e-Resources:

- https://www.pluralsight.com/guides/ensemble-methods:-bagging-versus-boosting
- https://www.wallstreetmojo.com/gradient-boosting/
- https://www.mygreatlearning.com/blog/random-forest-algorithm/
- Ensemble Learning Methods: Bagging, Boosting and Stacking (analyticsvidhya.com)
- https://www.geeksforgeeks.org/recommendation-system-in-python/
- https://www.nvidia.com/en-us/glossary/data-science/recommendation-system/#:~:text=A%20recommendation%20system%20is%20an,demographic%20information%2C%20and%20other%20factors.
- https://towardsdatascience.com/introduction-to-recommender-systems-6c66cf15ada
- https://www.analyticsvidhya.com/blog/2021/07/recommendation-system-understanding-the-basic-concepts/
- https://www.iteratorshq.com/blog/an-introduction-recommender-systems-9-easy-examples/

UNIT - III	10 Hrs

Introducing Neural Networks: Deep Learning at a glance: How deep learning works, differences between Machine Learning (ML) and Deep Learning (DL), Convolution Neural Network (CNN) architecture, illustration of different operations in CNN model(convolution, padding, flattening),advantages and disadvantage of CNN model, building an CNN, types of pre-defined CNN models:- VGG, AlexNet, LeNet, ResNet and GoogleNet. **A brief introduction to TensorFlow and Keras:** Differences between Keras and TensorFlow, advantages and disadvantage of Keras and TensorFlow. **Implementation of CNN**: using keras and TensorFlow.

e-Resources:

- https://www.tensorflow.org/tutorials/images/cnn
- https://medium.com/analytics-vidhya/cnns-architectures-lenet-alexnet-vgg-googlenet-resnet-and-more-666091488df5
- https://www.javatpoint.com/machine-learning-vs-deep-learning
- https://www.geeksforgeeks.org/cnn-introduction-to-pooling-layer/

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- https://www.ibm.com/in-en/topics/convolutional-neural-networks#:~:text=The%20convolutional%20layer%20is%20the%20core%20building%20block%20of%20a,matrix%20of%20pixels%20in%203D.
- https://www.analyticsvidhya.com/blog/2021/06/building-a-convolutional-neural-network-using-tensorflow-keras/

UNIT - IV	10 Hrs

Knowledge Representation: Techniques of knowledge representation, Ontological Engineering, Categories and Objects, Events, Mental Events and Mental Objects, Reasoning systems for categories, the internet shopping world. Quantifying Uncertainty: Probabilistic reasoning in Artificial intelligence, Bayes' theorem in Artificial intelligence, Application of Bayes' theorem in Artificial intelligence, Bayesian Belief Network in artificial intelligence

e-Resources:

- https://www.javatpoint.com/ai-techniques-of-knowledge-representation
- https://mitu.co.in/wp-content/uploads/2022/01/5.-Knowledge-Representation-in-AI.pdf
- https://www.uio.no/studier/emner/matnat/ifi/nedlagte-emner/INF5390/v14/forelesninger/inf5390-07-knowledge-representation.pdf
- https://pages.mtu.edu/~nilufer/classes/cs5811/2016-fall/lecture-slides/cs5811-ch13-quantifying-uncertainty.pdf
- Valen, J., Balki, I., Mendez, M. et al. Quantifying uncertainty in machine learning classifiers for medical imaging. Int J CARS 17, 711–718 (2022). https://doi.org/10.1007/s11548-022-02578-3

Text Books:

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Second Edition, ISBN: 978-1-78934-799-9, Packet Publishing Ltd., Birmingham,UK.
2. Peter Norvig and Stuart J. Russell, "Artificial Intelligence: A Modern Approach", third edition, ISBN:978-93-325-4351-5, pearson , 2021.(Chapter 12 and Chapter 13)

Reference books:

1. Tom Mitchel, "Machine Learning ", International Edition 1997, McGraw Hill Education.

e-Resources and other Digital Material:

1. https://onlinecourses.nptel.ac.in/noc21_cs24/preview
2. https://onlinecourses.nptel.ac.in/noc20_cs62/preview

Course Outcomes:

1. ***Apply*** and ***Analyze*** various algorithms for SVM, and Clustering techniques.
2. ***Analyze*** and ***Apply*** basic concepts of ensemble, and recommendation systems.
3. ***Understand*** and ***Apply*** the basic concepts of CNN using TensorFlow and Keras
4. ***Understand*** and ***Contrast*** the concept of Knowledge Representation and Quantifying Uncertainty.
5. ***Apply*** and ***Analyze*** machine learning algorithms on given data and interpret the results obtained.

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21UAI604E	**Cloud Computing L:T:P:3:0:0**	**03-Credits**
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	**10 Hrs**

System Models and Enabling Technologies: 10 Hrs

Scalable Computing towards Massive Parallelism; System Models for Distributed and Cloud Computing - Clusters of Cooperative Computers, Grid Computing Infrastructures, Peer-to-Peer Network Families, Cloud Computing over the Internet; Parallel and Distributed Programming Models.

Computer Clusters:

Clustering for massive parallelism – Trend, Design objectives, Issues; Clusters and MPP architectures; Design Principles – SSI features.

UNIT – II	**10 Hrs**

Cloud platform architecture over virtualized data centers:

Cloud computing and service models; data center design and interconnection networks; architecture design of compute and storage clouds;

Public cloud platforms (GAE, AWS and Azure); inter cloud resource management.

UNIT - III	**10 Hrs**

Cloud security and trust management;

Cloud Programming and Software Environments: Features of Cloud and Grid Platforms; Parallel and Distributed Programming Paradigms - Parallel Computing and Programming Paradigms., MapReduce, Twister, and Iterative MapReduce, Hadoop Library from Apache.

UNIT - IV	**10 Hrs**

Programming Support of Google App Engine, Programming Amazon AWS and Microsoft Azure:

Emerging cloud software environments, Enabling technologies for Internet of Things

Text Books:

1)Kai Hwang, Geoffrey C. Fox, Jack J. Dongarra, Distributed & Cloud Computing, Morgan Kaufmann / ELSEVIER Publishers, 2012

2)Dinakar Sitaram, Geeta Manjunath, Moving to the cloud, SYNGRESS/ ELSEVIER 2012

Course Outcomes:

CO1:To explain various computing paradigms and system models for massive computing.

CO2:To describe service models, design of data centres and various cloud platforms.

CO3To analyze data flow in parallel and distributed programming models and apply them to solve problems on distributed systems.

CO4:To describe public cloud platforms, emerging cloud software environments & enabling technologies for internet of things.

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7th Semester

Sl. No	SUBJECT CODE	SUBJECT TITLE	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1.	UAI701C	Big Data Analytics	03	03	-	-	50	50	100
2.	UAI702C	Internet of Things	03	03	-	-	50	50	100
3.	UAI703E	Professional Elective – IV	03	03	-	-	50	50	100
4.	UAI704E	Professional Elective – V	03	03	-	-	50	50	100
5.	UAI705E	Professional Elective – VI	03	03	-	-	50	50	100
6.	UAI706X	Open Elective –C	03	03	-	-	50	50	100
7.	UAI707L	Robotic Process Automation Laboratory	01	-	-	02	50	50	50
8.	UAI709O	Moocs / Swayam (Online Course) *	03	-	-	-	50	50	100
9.	UAI708I	Internship	02	-	-	-	70	30	30
		Total	**24**	**19**		**02**	**470**	**430**	**780**

*The student has to qualify in MOOCs (NPTEL) recommended courses of total 03 credits (3 courses of 1 credit each or 2 courses of 1 credit and 2 credits or 1 course of 3 credits) during III/ IV/V/VI semesters and to be evaluated in VII semester

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8th Semester

Sl. No	SUBJECT CODE	SUBJECT TITLE	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1.	UAI801H	Innovation, Business Models and Entrepreneurship	03	03	-	-	50	50	100
2.	UAI802H	IPR in Artificial Intelligence	03	03	-	-	50	50	100
3.	UAI803P	Project Work	17	-	-	06	50	50	100
4.	UAI804S	Seminar	01	-	-	02	50	50	100
		Total	**24**	**06**	**00**	**08**	**200**	**200**	**400**

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UAI701C	Big Data Analytics L:T:P:4:0:0	04-Credits
Hrs/Week: 04		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	13 Hrs
Types of Digital Data: Classification of Digital Data – Structured Data, SemiStructured Data, and Unstructured Data. Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data,What is 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 Data Warehouse Environment, A Typical Hadoop Environment, What is New Today? 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, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Why is Big Data Analytics Important? What Kind of Technologies are we looking Toward to Help 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	**13 Hrs**
Big Data Technology Landscape - NoSQL (Not Only SQL) and Hadoop.**NoSQL (Not Only SQL)** - 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. Introducing Hadoop, Why Hadoop? Why not RDBMS?, 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	**13 Hrs**
Introduction to MongoDB: What is MongoDB? Why MongoDB?, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.- Insert, Save, Update, Remove, find methods, Dealing with NULL values, Count, Limit, Sort and Skip Methods. **Introduction to Cassandra:** An Introduction, Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections.	
UNIT - IV	**13 Hrs**
Hive: What is Hive?, Hive Architecture, Hive Data Types, Hive File Formats, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function (UDF). Introduction to Pig: What is Pig?, 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, Relational Operators, Eval Function, Complex Data Types.	

Text Books:

1. Seema. Acharya and Subhashini. C, "Big Data and Analytics", 1st Edition, Wiley India, 2015 (Chapters 1,2,3,4,5,6,7,9,10).

Reference books:

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1. Bart. Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", 1 st Edition, Wiley, 2014.
2. DT Editorial Services, "Big Data: Black Book, Comprehensive Problem Solver", 1 st Edition, Dreamtech Press, 2016.
3. Tom. White, "Hadoop – The Definitive Guide", 3rd Edition, O'Reilly, 2012.
4. Alex Holmes, "Hadoop in Practice", 2nd Edition, Dreamtech Press India Pvt. Ltd, 2014.
5. Dayong. Du, "Apache Hive Essentials", 2 nd Edition, Packt Publishing Limited, 2018.
6. Alan. Gates, "Programming Pig", 2nd Edition, Shroff/O'Reilly, 2016.
7. Alan. Gates, "Programming Pig: Dataflow Scripting with Hadoop", 2 nd Edition, Shroff/O'Reilly, 2016.

Online Resources:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.guru99.com/machine-learning-tutorial.htm
3. https://www.geeksforgeeks.org/machine-learning/
4. http://archive.ics.uci.edu/ml/index.php (Popular dataset resource for ML beginners)

Course Outcomes:

After completing the course, the student will be able to:

CO1: Analyze the characteristics of digital data and its challenges in big data environment.
CO2: Analyze the challenges of big data analytics and its terminologies that prevent businesses from capitalizing.
CO3: Build meaningful conversations on Big Data and analytics using Hadoop.
CO4: Identify suitable types of NoSQL databases to solve complex engineering problems.
CO5: Apply Hive and Pig tools on structured data for processing and analyzing

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UAI702C	**INTERNET OF THINGS**	**03-Credits**
Hrs/Week: 03	L: T:P:S **(3:0:0:0)**	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	**10 Hrs**
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.	
UNIT – II	**10 Hrs**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies: Salient features of protocol stacks utilizing IEEE 802.15.4 (Intd.). IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT	
UNIT - III	**10 Hrs**
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. Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR.	
UNIT - IV	**10 Hrs**
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. Operating Systems on RaspberryPi, Configuring RaspberryPi. Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.	

Textbooks

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 Arshdeep Bahga, "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)

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Course Outcomes:
CO1: To recall IT, OT, IoT and Digitization concepts. CO2: To describe various IoT network architectures and designs. CO3: To describe IoT network engineering. CO4: To explain data and analytics for IoT. CO5: To describe IoT Physical Devices and Endpoints. CO6: To explain various IoT strategies/applications.

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UAI7O3E	**Block Chain Management**	**03-Credits**
Hrs/Week: L:T:P:S	**L: T :P: 3:0:0**	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	**10 Hrs**
Introduction to Blockchain: Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.	
UNIT – II	**10 Hrs**
Blockchain: Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.	
UNIT - III	**10 Hrs**
Concept of Double Spending: Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Creation of Blocks. **Introduction to Bitcoin:** Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet.	
UNIT - IV	**10 Hrs**
Introduction to Ethereum: Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.	

Textbooks
1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep Bikramaditya Signal, Gautam Dhameja .
2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti
3. Blockchain by Melanie Swan, OReilly Publications

References
1. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton
2. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

Course Outcomes:
CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies.
CO2: Analyze the role of block chain applications in different domains including cybersecurity.
CO3: Evaluate the usage of Block chain implementation/features for the given problem.
CO4: Exemplify the usage of bitcoins and its impact on the economy.
CO5: Analyze the application of specific block chain architecture for a given problem

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UAI703E	Deep Learning L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs

Fundamentals of deep learning: What is Deep Learning, Applications, Weights and Activation functions, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss, Data Preprocessing, Image augmentation in OpenCV. What are convolutional neural network and tensorflow, Convolutional layer, Pooling layer, How to create the layers in Python. **ConvNets:** Basic concepts of Convolutional Neural Networks starting from filetering. Convolution and pooling operation and arithmatics of these.
Revisiting ConvNet Architectures: Discussions on famous convnet architectures - AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet, MobileNet-v1, MobileNet-v2, EfficientNet, GhostNet.

e-Resources:

- ✓ https://www.geeksforgeeks.org/introduction-deep-learning/
- ✓ https://www.jeremyjordan.me/convnet-architectures/
- ✓ https://towardsdatascience.com/convolutional-neural-networks-explained-9cc5188c4939
- ✓ https://www.analyticsvidhya.com/blog/2020/10/what-is-the-convolutional-neural-network-architecture/

UNIT – II	10 Hrs

Transfer learning, RCNN (Fast RCNN, Faster RCNN, Mask RCNN), Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN.
Representation and Generative Learning: Autoencoder Architecture-Implementing an Autoencoder in TensorFlow –DenoisingSparsity in Autoencoders Models for Sequence Analysis, Generative adversarial Networks, Simple example with MNIST dataset, Limitation of GAN and Deep Convolutional GANs.

e-Resources:

- ✓ https://ai.unist.ac.kr/~chiu/ml_resource/slides/Chapter17_Autoencoders.pdf
- ✓ https://towardsdatascience.com/r-cnn-fast-r-cnn-faster-r-cnn-yolo-object-detection-algorithms-36d53571365e
- ✓ https://www.geeksforgeeks.org/r-cnn-vs-fast-r-cnn-vs-faster-r-cnn-ml/
- ✓ https://www.analyticsvidhya.com/blog/2018/10/a-step-by-step-introduction-to-the-basic-object-detection-a

UNIT - III	10 Hrs

Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.
Recurrent Architectures, Transformers, Vision Transformers: Introduction to Recurrent Neural Networks (RNNs), The Architecture of a Traditional RNN, How does Recurrent Neural Networks work? Backpropagation Through Time (BPTT), issues of Standard RNNs,RNNApplications,Basic Python Implementation (RNN with Keras), Recurrent Neural

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Networks- Vanishing Gradients, Long Short-Term Memory (LSTM) Units- TensorFlow Primitives for RNN Models-Augmenting Recurrent Networks with Attention,Applications of LSTM.

e-Resources:

- ✓ https://www.analyticsvidhya.com/blog/2022/03/a-brief-overview-of-recurrent-neural-networks-rnn/
- ✓ https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/lstm

UNIT - IV	10 Hrs

Deep Learning applications of Reinforcement Learning and NLP: Key elements of Reinforcement Learning, What are the types of deep reinforcement learning in NLP?, OpenAI Gym Toolkit, How is Deep Learning applied to RL, Robotic Manipulation using Deep RL, Application of Deep learning to Natural Language Processing, Automatic Language Translation, Automatic Text Classification, RCNN and YOLO architectures, fully convolutional segmentations, Mask-RCNNs.

e-Resources:

- ✓ https://neptune.ai/blog/reinforcement-learning-applications
- ✓ https://spotintelligence.com/2022/12/23/nlp-reinforcement-learning/
- ✓ https://link.springer.com/article/10.1007/s10462-022-10205-5

Text Books:

8. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.
9. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016.
10. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press

Reference books:

1. AurélienGéron, "Hands-On Machine Learning with Scikit- Learn and TensorFlow", O'Reilly, 2017.
2. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", Apress, 2017.

Online Resources:

- ✓ https://cse.iitkgp.ac.in/~adas/courses/dl_spr2022/syllabus.html
- ✓ https://onlinecourses.nptel.ac.in/noc22_cs22/preview

Course Outcomes:

After completing the course the student will be able to:

CO1: Recognize the characteristics of deep learning models that are useful to solve real-world problems.

CO2:Remember architectures and optimization methods for deep neural network training

CO3: Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems

CO4: Design the test procedures to assess the efficacy of the developed model.

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UAI704E	**Social Network Analysis**	**03-Credits**
Hrs/Week: 03	**L: T: P: 3:0:0**	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	**10 Hrs**
Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.	
UNIT – II	**10 Hrs**
Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality **Network communities and Affiliation networks:** Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs	
UNIT - III	**10 Hrs**
Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections	
UNIT - IV	**10 Hrs**
Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.	

Textbooks

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. Statistical Analysis of Network Data with R (Use R!). Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Course Outcomes:
CO1: Define notation and terminology used in network science.
CO2: Demonstrate, summarize and compare networks.
CO3: Explain basic principles behind network analysis algorithms.
CO4: Analyze real world network.

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UAI704E	Optimization Techniques for Machine Learning	03-Credits
Hrs/Week: 03	L:T:P:3:0:0	CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I	10 Hrs

Foundation:
Function Optimization, Candidate solutions, Objective functions, Evaluation costs.
Optimization and Machine Learning: Introduction to ML and Optimization, Learning as optimization, Optimization in ML project.
How to Choose an Optimization Algorithm: Optimizing algorithms, Differentiable objective function, Non differentiable objective function.
Background:
No Free Lunch Theorem for Machine Learning, Implications for optimization and Machine learning.
Local Optimization vs. Global Optimization: Local Optimization, Global Optimization, Local Optimization vs. Global Optimization.
Premature Convergence: Convergence in ML, Premature convergence, Addressing premature convergence.
Creating Visualization for Function Optimization: Visualization for function optimization, Visualize 1D function optimization, **Visualize 2D function optimization**,
Stochastic Optimization Algorithms: Stochastic optimization and algorithms, Practical considerations for Stochastic Optimization.
Random Search and Grid Search: Naïve function optimization algorithms, Random search for function optimization, Grid search for function optimization.

UNIT – II	10 Hrs

Local Optimization:
Gradient in Machine Learning, Derivative and gradient, Worked examples of calculating derivatives, Interpreting derivatives, Calculating derivative of a function.
Univariate Function Optimization: Univariate function optimization, Convex univariate function optimization, Non convex univariate function optimization.
Pattern Search: Nelder-Mead Optimization Algorithm, Nelder-Mead example in Python, Nelder-Mead on challenging functions.
Second Order optimization algorithms: The BFGS and L-BFGS-B Optimization Algorithms, Worked examples of BFGS.
Stochastic Hill Climbing algorithms: Stochastic Hill Climbing algorithm and its implementation, Examples of applying Stochastic Hill Climbing algorithms.
Iterated Local Search: Introduction to iterative local search, Ackley objective function, Stochastic Hill Climbing algorithm with random restarts, Iterated local search algorithms.

UNIT - III	10 Hrs

Global Optimization:
Simple Genetic Algorithm: Genetic algorithm from scratch, genetic algorithm for Onemax, Genetic algorithm for function optimization.
Evolution Strategies: Develop a (μ,λ)-ES, develop $(\mu+\lambda)$-ES.
Differential Evolution: Differential evolution algorithm from scratch, Differential evolution algorithm on the

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sphere function.
Simulated Annealing : Implement simulated annealing and worked wxample.

UNIT - IV	**10 Hrs**

Gradient Descent:
Gradient Descent Optimization: Gradient descent and worked example. Gradient descent optimization, Gradient descent with momentum and its visualization. Gradient Descent with AdaGrad,Gradient Descent with RMSProp,Gradient Descent with Adadelta, Adam Optimization Algorithm

Projects:
Use Optimization Algorithms to Manually Fit Regression Models: Optimize linear and logistic regression models,
Optimize Neural Network Models: Optimize a perceptron and a multi layer perceptron.
Feature Selection using Stochastic Optimization: Optimization for feature selection, Enumerate all feature subsets.
Manually Optimize Machine Learning Model: Mannual hyper parameter optimization, Perceptron hyper parameter optimization, XGBOOST hyper parameter optimization.

Text Books:

1. Optimization Techniques for Machine Learning, Jayson Brownlee,Machine learning mastery,2021.

Reference Books:

1. Linear Algebra and Learning from Data, Gilbert Strang
2. Convex Optimisation by Stephen Boyd
3. Optimisation for Machine Learning by Suvrit Sra, MIT Press.

Course Outcomes:
CO1: Grasp essential concepts in function optimization and Connect Optimization with Machine Learning
CO2:Develop the skill to pick the right optimization algorithm based on the problem
CO3:Create visualizations for function optimization
CO4 :Apply optimization techniques to ML based real-world problems

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UAI705E	**Reinforcement Learning**	**03-Credits**
Hrs/Week: 03	**L:T:P:3:0:0**	CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I	**10 Hrs**
Introduction to RL, Markov Decision Process (MDP): Markov Process, Markov Reward Process, Markov Decision Process and Bellman Equations, Partially Observable MDPs.**Planning by Dynamic Programming (DP):**Policy Evaluation, Value Iteration, Policy Iteration, DP Extensions and Convergence using Contraction Mapping.**Model-free Prediction:** Monte-Carlo (MC) Learning, Temporal-Difference (TD) Learning, TD-Lambda and Eligibility Traces.	
UNIT – II	**10 Hrs**
Model-free Control: On-Policy MC Control, On-Policy TD Learning and Off-Policy Learning. **Value Function Approximation:** Incremental Methods and Batch Methods, Deep Q-Learning, Deep Q-Networks and Experience Replay.**Policy Gradient Methods** Finite-Difference, Monte-Carlo and Actor-Critic Methods.	
UNIT - III	**10 Hrs**
Integrating Planning with Learning: Model-based RL, Integrated Architecture and Simulation-based Search.**Exploration and Exploitation (Bandits):** Multi-arm Bandits, Contextual Bandits and MDP Extensions.**Integrating AI Search and Learning**: Classical Games: Combining Minimax Search and RL.	
UNIT - IV	**10 Hrs**
Hierarchical RL: Semi-Markov Decision Process, Learning with Options, Abstract Machines and MAXQ Decomposition**Deep RL:** PPO, DDPG, Double Q-Learning, Advanced Policy Gradients etc.**Multi-Agent RL:** Cooperative vs. Competitive Settings, Mixed Setting, Games, MARL Algorithms.	

Text Books:

1. Richard S. **Sutton** and Andrew G. **Barto**; Reinforcement Learning: An Introduction; 2nd Edition, MIT Press, 2020.

Reference Books:

1. Csaba **Szepesvári**; Algorithms of Reinforcement Learning; Synthesis Lectures on Artificial Intelligence and Machine Learning, vol. 4, no. 1, 2010.
2. Dimitri P. **Bertsekas**; Reinforcement Learning and Optimal Control; 1st Edition, Athena Scientific, 2019.
3. Dimitri P. **Bertsekas**; Dynamic Programming and Optimal Control (Vol. I and Vol. II); 4th Edition, Athena Scientific, 2017.

Course Outcomes:

CO1: Define RL tasks and the core principles behind the RL, including policies, value functions, deriving Bellman equations.
CO2: Implement in code common algorithms following code standards and libraries used in RL.
CO3: Understand and work with tabular methods to solve classical control problems.
CO4: Understand and work with approximate solutions (deep Q network-basedalgorithms).
CO5: Learn the policy gradient methods from vanilla to more complex cases.

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UAI701C	Big Data Analytics L:T:P:4:0:0	04-Credits
Hrs/Week: 04		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	13 Hrs
Types of Digital Data: Classification of Digital Data – Structured Data, SemiStructured Data, and Unstructured Data. Introduction to Big Data: Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data,What is 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 Data Warehouse Environment, A Typical Hadoop Environment, What is New Today? 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, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Why is Big Data Analytics Important? What Kind of Technologies are we looking Toward to Help 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	**13 Hrs**
Big Data Technology Landscape - NoSQL (Not Only SQL) and Hadoop.**NoSQL (Not Only SQL)** - 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. Introducing Hadoop, Why Hadoop? Why not RDBMS?, 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	**13 Hrs**
Introduction to MongoDB: What is MongoDB? Why MongoDB?, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.- Insert, Save, Update, Remove, find methods, Dealing with NULL values, Count, Limit, Sort and Skip Methods. **Introduction to Cassandra:** An Introduction, Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections.	
UNIT - IV	**13 Hrs**
Hive: What is Hive?, Hive Architecture, Hive Data Types, Hive File Formats, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function (UDF). Introduction to Pig: What is Pig?, 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, Relational Operators, Eval Function, Complex Data Types.	

Text Books:

1. Seema. Acharya and Subhashini. C, "Big Data and Analytics", 1st Edition, Wiley India, 2015 (Chapters 1,2,3,4,5,6,7,9,10).

Reference books:

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1. Bart. Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", 1 st Edition, Wiley, 2014.
2. DT Editorial Services, "Big Data: Black Book, Comprehensive Problem Solver", 1 st Edition, Dreamtech Press, 2016.
3. Tom. White, "Hadoop – The Definitive Guide", 3rd Edition, O'Reilly, 2012.
4. Alex Holmes, "Hadoop in Practice", 2nd Edition, Dreamtech Press India Pvt. Ltd, 2014.
5. Dayong. Du, "Apache Hive Essentials", 2 nd Edition, Packt Publishing Limited, 2018.
6. Alan. Gates, "Programming Pig", 2nd Edition, Shroff/O'Reilly, 2016.
7. Alan. Gates, "Programming Pig: Dataflow Scripting with Hadoop", 2 nd Edition, Shroff/O'Reilly, 2016.

Online Resources:

1. https://www.tutorialspoint.com/machine_learning_with_python/index.htm
2. https://www.guru99.com/machine-learning-tutorial.htm
3. https://www.geeksforgeeks.org/machine-learning/
4. http://archive.ics.uci.edu/ml/index.php (Popular dataset resource for ML beginners)

Course Outcomes:

After completing the course, the student will be able to:

CO1: Analyze the characteristics of digital data and its challenges in big data environment.

CO2: Analyze the challenges of big data analytics and its terminologies that prevent businesses from capitalizing.

CO3: Build meaningful conversations on Big Data and analytics using Hadoop.

CO4: Identify suitable types of NoSQL databases to solve complex engineering problems.

CO5: Apply Hive and Pig tools on structured data for processing and analyzing

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UAI702C	**INTERNET OF THINGS**	**03-Credits**
Hrs/Week: 03	L: T:P:S **(3:0:0:0)**	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	**10 Hrs**
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.	
UNIT – II	**10 Hrs**
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies: Salient features of protocol stacks utilizing IEEE 802.15.4 (Intd.). IP as the IoT Network Layer, The Business Case for IP, the need for Optimization, Optimizing IP for IoT	
UNIT - III	**10 Hrs**
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. Securing IoT, A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR.	
UNIT - IV	**10 Hrs**
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. Operating Systems on RaspberryPi, Configuring RaspberryPi. Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture.	

Textbooks

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 Arshdeep Bahga, "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)

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Course Outcomes:

CO1: To recall IT, OT, IoT and Digitization concepts.
CO2: To describe various IoT network architectures and designs.
CO3: To describe IoT network engineering.
CO4: To explain data and analytics for IoT.
CO5: To describe IoT Physical Devices and Endpoints.
CO6: To explain various IoT strategies/applications.

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UAI703E	**Block Chain Management**	**03-Credits**
Hrs/Week: L:T:P:S	**L: T :P: 3:0:0**	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	**10 Hrs**
Introduction to Blockchain: Introduction to Blockchain, How Blockchain works, Blockchain vs Bitcoin, Practical applications, public and private key basics, pros and cons of Blockchain, Myths about Bitcoin.	
UNIT – II	**10 Hrs**
Blockchain: Architecture, versions, variants, use cases, Life use cases of blockchain, Blockchain vs shared Database, Introduction to cryptocurrencies, Types, Applications.	
UNIT - III	**10 Hrs**
Concept of Double Spending: Concept of Double Spending, Hashing, Mining, Proof of work. Introduction to Merkel tree, Privacy, payment verification, Creation of Blocks. **Introduction to Bitcoin:** Introduction to Bitcoin, key concepts of Bitcoin, Merits and De Merits Fork and Segwits, Sending and Receiving bitcoins, choosing bitcoin wallet.	
UNIT - IV	**10 Hrs**
Introduction to Ethereum: Introduction to Ethereum, Advantages and Disadvantages, Ethereum vs Bitcoin, Introduction to Smart contracts, usage, application, working principle, Law and Regulations. Case Study.	

Textbooks

1. Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions by Arshdeep Bikramaditya Signal, Gautam Dhameja .
2. Blockchain Applications: A Hands-On Approach by Bahga, Vijay Madisetti
3. Blockchain by Melanie Swan, OReilly Publications

References

1. Bitcoin and Cryptocurrency Technologies by Aravind Narayan. Joseph Bonneau, princton
2. Bitcoin and Blockchain Basics: A non-technical introduction for beginners by Arthu.T Books.

Course Outcomes:

CO1: Demonstrate the basics of Block chain concepts using modern tools/technologies.
CO2: Analyze the role of block chain applications in different domains including cybersecurity.
CO3: Evaluate the usage of Block chain implementation/features for the given problem.
CO4: Exemplify the usage of bitcoins and its impact on the economy.
CO5: Analyze the application of specific block chain architecture for a given problem

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UAI703E	Deep Learning L:T:P:3:0:0	03-Credits
Hrs/Week: 03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs

Fundamentals of deep learning: What is Deep Learning, Applications, Weights and Activation functions, Decision Surfaces, Linear Classifiers, Linear Machines with Hinge Loss, Data Preprocessing, Image augmentation in OpenCV. What are convolutional neural network and tensorflow, Convolutional layer, Pooling layer, How to create the layers in Python. **ConvNets:** Basic concepts of Convolutional Neural Networks starting from filetering. Convolution and pooling operation and arithmatics of these.
Revisiting ConvNet Architectures: Discussions on famous convnet architectures - AlexNet, ZFNet, VGG, C3D, GoogLeNet, ResNet, MobileNet-v1, MobileNet-v2, EfficientNet, GhostNet.

e-Resources:

- ✓ https://www.geeksforgeeks.org/introduction-deep-learning/
- ✓ https://www.jeremyjordan.me/convnet-architectures/
- ✓ https://towardsdatascience.com/convolutional-neural-networks-explained-9cc5188c4939
- ✓ https://www.analyticsvidhya.com/blog/2020/10/what-is-the-convolutional-neural-network-architecture/

UNIT – II	10 Hrs

Transfer learning, RCNN (Fast RCNN, Faster RCNN, Mask RCNN), Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam, Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization, Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN.
Representation and Generative Learning: Autoencoder Architecture-Implementing an Autoencoder in TensorFlow –DenoisingSparsity in Autoencoders Models for Sequence Analysis, Generative adversarial Networks, Simple example with MNIST dataset, Limitation of GAN and Deep Convolutional GANs.

e-Resources:

- ✓ https://ai.unist.ac.kr/~chiu/ml_resource/slides/Chapter17_Autoencoders.pdf
- ✓ https://towardsdatascience.com/r-cnn-fast-r-cnn-faster-r-cnn-yolo-object-detection-algorithms-36d53571365e
- ✓ https://www.geeksforgeeks.org/r-cnn-vs-fast-r-cnn-vs-faster-r-cnn-ml/
- ✓ https://www.analyticsvidhya.com/blog/2018/10/a-step-by-step-introduction-to-the-basic-object-detection-a

UNIT - III	10 Hrs

Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.
Recurrent Architectures, Transformers, Vision Transformers: Introduction to Recurrent Neural Networks (RNNs), The Architecture of a Traditional RNN, How does Recurrent Neural Networks work? Backpropagation Through Time (BPTT), issues of Standard RNNs,RNNApplications,Basic Python Implementation (RNN with Keras), Recurrent Neural

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Networks- Vanishing Gradients, Long Short-Term Memory (LSTM) Units- TensorFlow Primitives for RNN Models-Augmenting Recurrent Networks with Attention,Applications of LSTM.

e-Resources:

- ✓ https://www.analyticsvidhya.com/blog/2022/03/a-brief-overview-of-recurrent-neural-networks-rnn/
- ✓ https://www.simplilearn.com/tutorials/artificial-intelligence-tutorial/lstm

UNIT - IV	10 Hrs

Deep Learning applications of Reinforcement Learning and NLP: Key elements of Reinforcement Learning, What are the types of deep reinforcement learning in NLP?, OpenAI Gym Toolkit, How is Deep Learning applied to RL, Robotic Manipulation using Deep RL, Application of Deep learning to Natural Language Processing, Automatic Language Translation, Automatic Text Classification, RCNN and YOLO architectures, fully convolutional segmentations, Mask-RCNNs.

e-Resources:

- ✓ https://neptune.ai/blog/reinforcement-learning-applications
- ✓ https://spotintelligence.com/2022/12/23/nlp-reinforcement-learning/
- ✓ https://link.springer.com/article/10.1007/s10462-022-10205-5

Text Books:

8. Nikhil Buduma, "Fundamentals of Deep Learning: Designing Next-Generation Machine Intelligence Algorithm", O'Reilly, 2017.
9. Ian Goodfellow, YoshuaBengio and Aaron Courville, "Deep Learning", MIT Press, 2016.
10. Deep Learning- Ian Goodfelllow, Yoshua Benjio, Aaron Courville, The MIT Press

Reference books:

1. AurélienGéron, "Hands-On Machine Learning with Scikit- Learn and TensorFlow", O'Reilly, 2017.
2. Nikhil Ketkar, "Deep Learning with Python: A Hands-on Introduction", Apress, 2017.

Online Resources:

- ✓ https://cse.iitkgp.ac.in/~adas/courses/dl_spr2022/syllabus.html
- ✓ https://onlinecourses.nptel.ac.in/noc22_cs22/preview

Course Outcomes:

After completing the course the student will be able to:

CO1: Recognize the characteristics of deep learning models that are useful to solve real-world problems.

CO2:Remember architectures and optimization methods for deep neural network training

CO3: Able to design and deploy simple TensorFlow-based deep learning solutions to classification problems

CO4: Design the test procedures to assess the efficacy of the developed model.

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UAI704E	Social Network Analysis	03-Credits
Hrs/Week: 03	L: T: P: 3:0:0	**CIE Marks:**50
Total Hours: 40 Hrs		**SEE Marks:**50

UNIT - I	10 Hrs

Introduction to social network analysis and Descriptive network analysis: Introduction to new science of networks. Networks examples. Graph theory basics. Statistical network properties. Degree distribution, clustering coefficient. Frequent patterns. Network motifs. Cliques and k-cores.

UNIT – II	10 Hrs

Network structure, Node centralities and ranking on network: Nodes and edges, network diameter and average path length. Node centrality metrics: degree, closeness and betweenness centrality **Network communities and Affiliation networks:** Networks communities. Graph partitioning and cut metrics. Edge betweenness. Modularity clustering. Affiliation network and bipartite graphs

UNIT - III	10 Hrs

Information and influence propagation on networks and Network visualization: Social Diffusion. Basic cascade model. Influence maximization. Most influential nodes in network. Network visualization and graph layouts. Graph sampling. Low -dimensional projections

UNIT - IV	10 Hrs

Social media mining and SNA in real world: FB/VK and Twitter analysis: Natural language processing and sentiment mining. Properties of large social networks: friends, connections, likes, re-tweets.

Textbooks

1. David Easley and John Kleinberg. "Networks, Crowds, and Markets: Reasoning About a Highly Connected World." Cambridge University Press 2010.
2. Eric Kolaczyk, Gabor Csardi. Statistical Analysis of Network Data with R (Use R!). Springer, 2014.
3. Stanley Wasserman and Katherine Faust. "Social Network Analysis. Methods and Applications." Cambridge University Press, 1994.

Course Outcomes:

After completing the course the student will be able to:

CO1: Define notation and terminology used in network science.
CO2: Demonstrate, summarize and compare networks.
CO3: Explain basic principles behind network analysis algorithms.
CO4: Analyze real world network.

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UAI704E	**Optimization Techniques for Machine Learning**	**03-Credits**
Hrs/Week: 03	**L:T:P:3:0:0**	CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I	**10 Hrs**

Foundation:
Function Optimization, Candidate solutions, Objective functions, Evaluation costs.
Optimization and Machine Learning: Introduction to ML and Optimization, Learning as optimization, Optimization in ML project.
How to Choose an Optimization Algorithm: Optimizing algorithms, Differentiable objective function, Non differentiable objective function.
Background:
No Free Lunch Theorem for Machine Learning, Implications for optimization and Machine learning.
Local Optimization vs. Global Optimization: Local Optimization, Global Optimization, Local Optimization vs. Global Optimization.
Premature Convergence: Convergence in ML, Premature convergence, Addressing premature convergence.
Creating Visualization for Function Optimization: Visualization for function optimization, Visualize 1D function optimization, **Visualize 2D function optimization,**
Stochastic Optimization Algorithms: Stochastic optimization and algorithms, Practical considerations for Stochastic Optimization.
Random Search and Grid Search: Naïve function optimization algorithms, Random search for function optimization, Grid search for function optimization.

UNIT – II	**10 Hrs**

Local Optimization:
Gradient in Machine Learning, Derivative and gradient, Worked examples of calculating derivatives, Interpreting derivatives, Calculating derivative of a function.
Univariate Function Optimization: Univariate function optimization, Convex univariate function optimization, Non convex univariate function optimization.
Pattern Search: Nelder-Mead Optimization Algorithm, Nelder-Mead example in Python, Nelder-Mead on challenging functions.
Second Order optimization algorithms: The BFGS and L-BFGS-B Optimization Algorithms, Worked examples of BFGS.
Stochastic Hill Climbing algorithms: Stochastic Hill Climbing algorithm and its implementation, Examples of applying Stochastic Hill Climbing algorithms.
Iterated Local Search: Introduction to iterative local search, Ackley objective function, Stochastic Hill Climbing algorithm with random restarts, Iterated local search algorithms.

UNIT - III	**10 Hrs**

Global Optimization:
Simple Genetic Algorithm: Genetic algorithm from scratch, genetic algorithm for Onemax, Genetic algorithm for function optimization.
Evolution Strategies: Develop a (μ,λ)-ES, develop $(\mu+\lambda)$-ES.
Differential Evolution: Differential evolution algorithm from scratch, Differential evolution algorithm on the

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sphere function.

Simulated Annealing : Implement simulated annealing and worked wxample.

UNIT - IV	**10 Hrs**

Gradient Descent:

Gradient Descent Optimization: Gradient descent and worked example. Gradient descent optimization, Gradient descent with momentum and its visualization. Gradient Descent with AdaGrad,Gradient Descent with RMSProp,Gradient Descent with Adadelta, Adam Optimization Algorithm

Projects:

Use Optimization Algorithms to Manually Fit Regression Models: Optimize linear and logistic regression models,

Optimize Neural Network Models: Optimize a perceptron and a multi layer perceptron.

Feature Selection using Stochastic Optimization: Optimization for feature selection, Enumerate all feature subsets.

Manually Optimize Machine Learning Model: Mannual hyper parameter optimization, Perceptron hyper parameter optimization, XGBOOST hyper parameter optimization.

Text Books:

1. Optimization Techniques for Machine Learning, Jayson Brownlee,Machine learning mastery,2021.

Reference Books:

1. Linear Algebra and Learning from Data, Gilbert Strang
2. Convex Optimisation by Stephen Boyd
3. Optimisation for Machine Learning by Suvrit Sra, MIT Press.

Course Outcomes:

After completing the course the student will be able to:

CO1: Grasp essential concepts in function optimization and Connect Optimization with Machine Learning
CO2:Develop the skill to pick the right optimization algorithm based on the problem
CO3:Create visualizations for function optimization
CO4 :Apply optimization techniques to ML based real-world problems

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UAI705E	**Reinforcement Learning**	**03-Credits**
Hrs/Week: 03	**L:T:P:3:0:0**	CIE Marks: 50
Total Hours: 40		SEE Marks: 50

UNIT - I	**10 Hrs**
Introduction to RL, Markov Decision Process (MDP): Markov Process, Markov Reward Process, Markov Decision Process and Bellman Equations, Partially Observable MDPs.**Planning by Dynamic Programming (DP):**Policy Evaluation, Value Iteration, Policy Iteration, DP Extensions and Convergence using Contraction Mapping.**Model-free Prediction:** Monte-Carlo (MC) Learning, Temporal-Difference (TD) Learning, TD-Lambda and Eligibility Traces.	
UNIT – II	**10 Hrs**
Model-free Control: On-Policy MC Control, On-Policy TD Learning and Off-Policy Learning. **Value Function Approximation:** Incremental Methods and Batch Methods, Deep Q-Learning, Deep Q-Networks and Experience Replay.**Policy Gradient Methods** Finite-Difference, Monte-Carlo and Actor-Critic Methods.	
UNIT - III	**10 Hrs**
Integrating Planning with Learning: Model-based RL, Integrated Architecture and Simulation-based Search.**Exploration and Exploitation (Bandits):** Multi-arm Bandits, Contextual Bandits and MDP Extensions.**Integrating AI Search and Learning**: Classical Games: Combining Minimax Search and RL.	
UNIT - IV	**10 Hrs**
Hierarchical RL: Semi-Markov Decision Process, Learning with Options, Abstract Machines and MAXQ Decomposition**Deep RL:** PPO, DDPG, Double Q-Learning, Advanced Policy Gradients etc.**Multi-Agent RL:** Cooperative vs. Competitive Settings, Mixed Setting, Games, MARL Algorithms.	

Text Books:

1. Richard S. **Sutton** and Andrew G. **Barto**; Reinforcement Learning: An Introduction; 2nd Edition, MIT Press, 2020.

Reference Books:

1. Csaba **Szepesvári**; Algorithms of Reinforcement Learning; Synthesis Lectures on Artificial Intelligence and Machine Learning, vol. 4, no. 1, 2010.
2. Dimitri P. **Bertsekas**; Reinforcement Learning and Optimal Control; 1st Edition, Athena Scientific, 2019.
3. Dimitri P. **Bertsekas**; Dynamic Programming and Optimal Control (Vol. I and Vol. II); 4th Edition, Athena Scientific, 2017.

Course Outcomes:
After completing the course the student will be able to:

CO1: Define RL tasks and the core principles behind the RL, including policies, value functions, deriving Bellman equations.
CO2: Implement in code common algorithms following code standards and libraries used in RL.
CO3: Understand and work with tabular methods to solve classical control problems.
CO4: Understand and work with approximate solutions (deep Q network-basedalgorithms).
CO5: Learn the policy gradient methods from vanilla to more complex cases.

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE

DEPARTMENT OF BIOTECHNOLOGY

SCHEME OF TEACHING AND EXAMINATION

B. E. III SEMESTER

2023-24

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	BSC	22UMA301C	Partial differential equations and integral transforms	03	3	0	0	50	50	100
2.	IPCC	22UBT302C	Microbiology + Lab	04	3	0	2	50	50	100
3.	IPCC	22UBT303C	Unit Operations + Lab	04	3	0	2	50	50	100
4.	PCC	22UBT304C	Biochemistry	03	3	0	0	50	50	100
5.	PCC	22UBT305C	Bioprocess Principles and Calculations	03	2	2	0	50	50	100
6.	BSC	22UBT340C	Biology for Engineers	02	2	0	0	50	50	100
7.	PCCL	22UBT306L	Biochemistry Lab	01	0	0	2	50	50	100
8.	MC	22UHS001M 22UHS002M 22UHS003M	Yoga NSS PE	00	0	0	2	25	-	-
			Total	**20**	**16**	**2**	**8**	**375**	**350**	**700**

22UMA301C	PARTIAL DIFFERENTIAL EQUATIONS AND INTEGRAL TRANSFORMS	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
Partial Differential Equations_I : Introduction to PDE, Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivatives with respect to one independent variable only. Solution of Lagrange's linear PDE. **(RBT Levels: L1, L2 and L3)**	
UNIT – II	**10 Hrs.**
Partial Differential Equations_II : Solutions of PDE by the method of separation of variable. Derivation of one-dimensional heat and wave equations and their solutions by explicit method, solution of Laplace equation by using five point formulas. **(RBT Levels: L1, L2 and L3)**	
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. **(RBT Levels: L1, L2 and L3)**	
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. Inverse Z-transforms. **(RBT Levels: L1, L2 and L3)**	

References:

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 Objectives:
1. PDE’s provides a powerful tool for quantifying rates of change optimizing functions, and modeling complex systems. 2. To provide a way, to represent periodic functions in terms of simple trigonometric functions. 3. To transform a function from the time domain to the frequency domain. 4. Provides a powerful mathematical tool for analyzing, designing, and manipulating discrete time signals and systems.
Course Outcomes: After completion of the course the students shall be able to, 1. Identify different types of PDEs including linear vs nonlinear, first order vs higher-order, and partial derivatives of different variables. 2. Learn various analytical techniques to solve to specific types of PDEs, such as variable separable and explicit method. 3. Grasp the concept of representing periodic functions as an infinite sum sinusoidal (sine and cosine) with different frequencies. 4. Grasp the concept of the Fourier transform as a mathematical tool that converts a function from the time domain into the frequency domain.

Evaluation Scheme:

Assessment	Marks	Weightage
CIE-I	40	20
CIE-II	40	20
Assignments/ Quizzes/Case Study/ Course Project/Term Paper/Field Work	10	10
SEE	100	50
Total	**190**	**100**

Question paper pattern for CIE-I and CIE-II:

Question paper consists Part-A and Part-B. Part A is compulsory, it consists of short answer questions of 1 or 2 marks, covering Unit-I and Unit-II (no multiple choice questions and No true or false questions).

1. In Part-B, four questions are to be set as per the following table.

CIE	Number of questions / Maximum marks	Sub divisions	Covering entire unit

I	Two questions of 15 marks (Solve any one)	Sub divisions shall not be mixed within the unit	Unit-I
	Two questions of 15 marks (Solve any one)	Sub divisions shall not be mixed within the unit	Unit-II
II	Two questions of 15 marks (Solve any one)	Sub divisions shall not be mixed within the unit	Unit-III
	Two questions of 15 marks (Solve any one)	Sub divisions shall not be mixed within the unit	Unit-IV

Question paper pattern for SEE:

1. Question paper consists Part-A and Part-B. Question number 1 is compulsory, it consists of short answer questions of 1 or 2 marks, covering entire syllabus (no multiple choice questions and No true or false questions, 50% of questions must be L3 and L4 level).
2. In Part-B total of eight questions with two from each unit; with internal choice to be set uniformly covering the entire syllabus.
3. Each question carries 20 marks and should not have more than four subdivisions.
4. In Part-B, any FOUR full questions are to be answered choosing at least one from each unit.
5. Sketches, figures and tables if any should be clearly drawn, as the same is scanned for printing.
6. The question paper should contain all the data / figures / marks allocated, with clarity.

22UBT302C	MICROBIOLOGY	Credits: 04
L: T: P - 3: 0: 2		CIE Marks: 50
Total Hours/Week: 5		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction: 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–II	**10Hrs.**
Microorganisms: Bacteria- Morphology and ultra structure of Bacteria, Culturing of bacteria, reproduction and growth pattern (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–III	**10 Hrs.**
Control of Microorganisms: Control of microorganisms by Physical methods and chemical methods, antibiotics, chemotherapeutic agents and Phage biotics. Medical Microbiology: Normal microflora, common diseases caused by microbes-pathogenesis, symptoms, diagnosis, treatment, prevention.	
UNIT–IV	**10 Hrs.**
Agricultural and Environmental Microbiology: Microbiology of soil, Air and Aquatic Microbiology, Bio-fertilizer, Plant endophytes, Microbes in bioremediation and bio-control 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).	

REFERENCE BOOKS *

1. Pelczar, Chan and Noel Kreig, “Microbiology”- 5th Edition Tata Macgraw Hill, 2010.
2. Tortora, Funke and Case, “Microbiology an Introduction” -8th Edition, Pearson Education, 2006.
3. Stainer R.Y., Ingraham J.L., “General Microbiology”- 5th Edition Mc.Millan Press, 2010.
4. Madigan, Martinko, Parker, Brock’s, “Biology of Microorganisms” - 10th Edition, Prentice Hall, Pearson Education, 2003.
5. Prescot and Dunn, “Industrial Microbiology”-Agribios India, 2002.
6. J. Salle, “Fundamental Principles of Bacteriology” – 7th Edition, Tata Macgraw Hill, 2007.

7. E Alcamo I “Fundamentals of Microbiology”6th Ed, Jones &Bartlet, Pub. 2001.
8. Prescott, Harley & Klein, “Microbiology” -7th Edition, WCB/McGraw Hill, Int. Edition, 2008.

COURSE OUTCOMES**

- Ability to know the basic concepts of Microbiology, scope ,organization and understand the techniques to study microorganisms through microscopy
- Ability to analyze the structure of different microbes and interpret the techniques used to grow and identify the microbes
- Ability to discuss the causative organisms of the disease and their effect on society
- Ability to analyse the applied techniques in the environment and create awareness to society

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.

COURSE OUTCOMES**

1. Ability to know the basic concepts of Microbiology, scope ,organization and understand the techniques to study microorganisms through microscopy
2. Ability to analyze the structure of different microbes and interpret the techniques used to grow and identify the microbes
3. Ability to discuss the causative organisms of the disease and their effect on society
4. Ability to analyse the applied techniques in the environment and create awareness to society

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	2			2		2					1	1	1
CO 2	2	2	2		2	3		1					2	1	2
CO 3	3	3	2		2	2		1				1	1	1	2
CO 4	3	3	3		2	3		2				1	2	1	3

22UBT303C	UNIT OPERATIONS	Credits: 04
L:T:P – 3:0:2		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	10 Hrs.

Fundamentals of Fluid Mechanics:

Units and Dimensions- Basic and Derived units, Dimensional homogeneity, Dimensional Analysis, Fluid definition and classification of fluids, Properties and Rheological behaviour of fluids, Newton's Law of viscosity, Newtonian and Non-Newtonian types of Fluids, Hydrostatic equilibrium, Barometric equation and Pressure measurement using manometers, Conceptual numericals, Types of Fluid flow- Laminar and Turbulent, Reynolds number and its Importance.

UNIT–II	10 Hrs.

Fluid Flow and Measurement:

Basic equations of fluid flow - Continuity equation and Bernoulli theorem and equation; Derivation of Bernoulli's equation, Correction for Bernoulli's equation, Flow through circular and non-circular conduits, Flow Measurement, Different types of flow measuring devices (Orifice meter, Venturimeter, Rotameter), Pumps- Classification of Pumps (Centrifugal & Reciprocating pumps), Construction and working of Centrifugal pump, characteristics of pumps and Characteristic Curves.

UNIT–III	10 Hrs.

Filtration and Sedimentation:

Theory of Filtration, Types of Filtration, Distribution of overall pressure drop (Resistances), Filter medium, Characteristics of filter medium, Filter aids, Factors Affecting Rate of Filtration, Filtration equipment's - Plate and Frame Filter Press, Rotary Drum Filter. Theory of Settling and Sedimentation, Types of Settling - Free and Hindered, Stoke's law, Newton's law, Terminal settling velocity, Batch sedimentation, Equipment (cyclones, thickeners), Conceptual numericals

UNIT–IV	10 Hrs.

Size Separation and Mixing:

Size Separation: Concept and Importance of screening operation, Type of Screen Analysis, Effectiveness of a Screen, Factors affecting performance of screens. Concept Of Mixing, Homogeneous and Heterogeneous Mixtures, Importance of Mixing and Agitation, Mixing liquids with liquids, Construction and Flow Patterns of Impellers, Mixing Of Gases With Liquids

List of Experiments in Unit Operations Laboratory

1. **Verification of Bernoulli's theorem**
2. **Study of packed bed characteristics**
3. **Orifice meter**

4. **Venturimeter**
5. **Rotameter**
6. **Batch sedimentation test**
7. **Screen effectiveness and Sieve analysis**
8. **Filtration**
9. **Settling**
10. **Mixing**

Text Books and Reference Books *

1. McCabe W. L, Smith J. C and Harriott (2005) Unit operations of Chemical Engineering, 7th Edn., McGraw-Hill Publications, USA.
2. Gavhane K. A (2014) Unit Operations I, Fluid Flow and Mechanical operations, 24nd Edition. Nirali Prakashan, India.
3. Alan S Foust, Wenzel LA, Clump CW, Maus L, and Anderson LB (2008) Principles of Unit Operations. 3rd Edn. John Wiley & Sons, USA.
4. Coulson and Richardson's Chemical Engineering Volume 1A: Fluid Flow: Fundamentals and Applications. 7th Edition, Elsevier, USA. Edited by R. P. Chhabra V. Shankar (2017)

. Coulson and Richardson's Chemical Engineering Volume 2A: Particulate Systems and Particle Technology. 6th Edition, Elsevier, USA. Edited by R. P. Chhabra and Basavaraj Gurappa (2019)

Course Outcomes**

After completion of the course student will be able to

1. Understand the application of dimensional analysis and can state and describe the nature and properties of the fluids.
2. Apply the knowledge of fluid mechanics and determine the flow rate, discharge of transportation fluids
3. Apply the knowledge of filtration and sedimentation in Engineering applications
4. Apply the knowledge of Size Separation and Agitation techniques in Engineering applications

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	1	1	-	-	-	-	-	-	-	3		
CO2	3	2	3	2	1	-	-	-	-	-	-	-	3		
CO3	2	3	3	1	1	-	-	-	-	-	-	-	2		
CO4	2	3	3	1	1	-	-	-	-	-	-	-	2		

22UBT304C	BIOCHEMISTRY	Credits: 03
L: T: P - 3: 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT – 1	12 Hrs.
Carbohydrate Metabolism: Glycolysis, TCA cycle, Glyoxylate cycle, Gluconeogenesis and regulation of gluconeogenesis, pentose phosphate pathwayand Electron transport chain, oxidative phosphorylation, bioenergetics, Structure and properties of ATP. Disorders of carbohydrate metabolism.	
UNIT – 2	**10 Hrs.**
Lipid Metabolism: 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.	
UNIT – 3	**10 Hrs.**
Nucleic acid Metabolism: 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.	
UNIT – 4	**10 Hrs.**
Amino Acid Metabolism: 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.	

REFERENCES*

1. David L. Nelson and Michael Cox (2017). "Lehninger Principles of Biochemistry" **7th** edition W.H Freeman & Co., Pub.
2. Lubert Stryer (2010)., "Biochemistry" -5th edition Freeman & Co., Pub.
3. Voet&Voet (2011). "Biochemistry"- 4th edition, John Wiley,New York Pub.
4. Thomas M. Davlins (2010). " Biochemistry with clinical correlations" 7th edition Wiley-Liss;.
5. Mathews, Vanholde & Arhen (2010). "Biochemistry" -3rd edition, Pearson Education Pub
6. Elliot & William H (2011). "Biochemistry & Molecular Biology"3rd edition, John Wiley.
7. U. Sathyanarayana (2022). "Biochemistry" -5th edition, Books and Allied Pub.

COURSE OUTCOMES**

After completion of the course student will have the ability

1. To understand the metabolic pathways in the carbohydrates along with its energetic and interpret the metabolic disorders.
2. To understand lipid metabolism and comprehend the regulation of along with the in born errors of metabolism.
3. To understand the origin of atoms in purine and pyrimidine & also interpret the pathways in the nucleic acid metabolism and also its disorders
4. To understand pathways involved in amino acid metabolism and its disorders.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	1	2	3	2			3	3				3	2	3	
CO 2	2	3	3	3		3	2	3				3	2	1	2
CO 3	2	2	3	3		3	2	2				3	3	2	
CO 4	2	2	2	2		2	2	2				2	2	2	

22UBT305C	BIOPROCESS PRINCIPLES AND CALCULATIONS	03 - Credits (2 : 2 : 0)
Hours / Week : 04		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – 1	7 + 3 Hrs.

Introduction to Engineering Calculations

Dimensions and System of Units:

Introduction, Fundamental and Derived Units, Fundamental and Derived Quantities; System of Units (FPS, CGS, MKS, SI); Conversion of Units, Inter-conversion; Conceptual Numericals

Basic Chemical Engineering Calculations:

Atomic, Molecular and Equivalent weights, molar concept, Gram atom, Gram mole; Equivalent Weight; Concept of Normality, Molarity and Molality. Method of Expressing the Composition of Mixtures and solutions, weight fraction, mole fraction, Percentage by weight, mole percent and volume percent; Concept of PPM (Parts Per Million); Conceptual Numericals;

Gases, Ideal Gas Law, Dalton's Law, Partial Pressure, Amagat's Law, Gaseous Mixtures, Relationship between Partial Pressure and Mole Fraction of Component Gas; Average Molecular Weight of Gas Mixture; Density of Gas Mixture; Conceptual Numericals

UNIT – 2	7 + 3 Hrs.

Introduction to Bioprocesses:

Bioprocess Engineering, Role of a bioprocess engineer in the biotechnology industry, unit operations involved in bioprocesses

Material Balance without Chemical Reactions

General material balance equation for steady and unsteady states.

Generalized Block Diagram of process showing input and output; Material balance equations for Unit Operations like Distillation, Evaporation, Crystallization, Mixing, Drying, Extraction; Material balances and calculations on Distillation, Evaporation, Crystallization and Mixing Unit Operations- Conceptual Numericals

UNIT – 3	7 + 3 Hrs.

Material Balance Involving Chemical Reactions

Generalized material balance equations, stoichiometry, Principles of stoichiometry, stoichiometric ratio, proportion, Definitions of limiting and excess reactants, fractions and percentage conversion, yield and percentage yield, selectivity, Material Balance and Conceptual Numericals on different Unit processes

UNIT – 4	7 + 3 Hrs.

Stoichiometry of Microbial growth and Product formation

Stoichiometry of cell Growth and Product Formation- elemental balances, degrees of reduction of substrate and biomass; available-electron balances; yield coefficients of biomass and product formation

REFERENCES
Chemical Process Calculations by D. C. Sikdar, PHI Learning Private Limited, Delhi, 2013 Introduction to Process Calculation by K A Gavane, Nirali Publications,2016 Stoichiometry by B. I. Bhatt and S. M. Vora, Tata McGraw Hill Publishing, 4th Edition, 2004 Basic Principles and Calculations in Chemical Engineering by David Himmelblau, PHI Learning Private Limited, 2005 Bioprocess Engineering Principles by Pauline M. Doran, Academic Press, 2012 Biochemical Engineering Fundamentals: by J. E. Bailey & D. F. Ollis, McGraw Hill, 2005 Bioprocess Engineering by Shule and Kargi, Prentice Hall, 2010
COURSE OUTCOMES
After completion of the course student will be able to 1. Describe and Perform Basic Biochemical Calculations involving compositions of Mixtures and solutions 2. Apply the knowledge of Material Balances and Solve the Bioprocess Engineering Problems involving Unit Operations 3. Apply the knowledge of Material Balances and Solve the Bioprocess Engineering Problems involving Unit Processes 4. Solve the Bioprocess Engineering problems applying Stoichiometry knowledge of Microbial cells

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	3	3									2	2	1	
CO 2	2	3	3									2	2	1	
CO 3	3	3	3									1	2	1	
CO 4	3	3	3									1	2	1	

22UBT340C/22UBT440C	BIOLOGY FOR ENGINEERS	02 - Credits (2: 0 : 0)
Hours / Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

UNIT-I	06 Hrs.

Bio Inspiration Models Used In Engineering:

Bio inspiration - Introduction, Alliance between Engineering and Biology, Biomimicry - Science mimicking nature.

Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Gecko Feet, Plant burrs (Velcro), Shark skin (Friction reducing swimsuits), Kingfisher beak (Bullet train), Fire fly LED.

UNIT–II	06 Hrs.

Nature Bioinspired Materials And Mechanisms

BioEcholocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Respiration (MFCs)
Human Blood substitutes-hemoglobin based oxygen carriers (HBOCs) and perflourocarbons (PFCs). Artificial Intelligence for disease diagnosis. Bioichips & their applications.

Biosensors & their applications. Nanobiomolecules in medical science. Biofilms in dental treatment

UNIT–III	07 Hrs.

Human Organ Systems And Bio Designs

Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).

Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators).

Lungs as purification system gas exchange mechanisms, spirometry, Ventilators, Heart-lung machine).

Eye as a Camera system, bionic eye. **Kidney** as a filtration system - dialysis systems. **Muscular and Skeletal Systems** as scaffolds, bioengineering solutions for muscular dystrophy and osteoporosis.

UNIT–IV	07 Hrs.

Trends In Bioengineering

Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods, electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Self-healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic). Bio-bleaching.

Reference Books *

1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022
2. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012
3. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
4. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011
5. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2020.
6. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, CRC Press, 2012
7. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C. Mattiussi, MIT Press, 2008
8. Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C Udayashankar Lambert Academic Publishing, 2019
9. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016
10. Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016

Web links and Video Lectures (e-Resources)

- VTU EDUSAT / SWAYAM / NPTEL / MOOCS / Coursera / MIT-open learning resource
- https://nptel.ac.in/courses/121106008
- https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
- https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
- https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
- https://www.coursera.org/courses?query=biology
- https://onlinecourses.nptel.ac.in/noc19_ge31/preview
- https://www.classcentral.com/subject/biology
- https://www.futurelearn.com/courses/biology-basic-concepts

Course Outcomes**

After completion of the course student will be able to

1. Corroborate the concepts of biomimetics for specific requirements.

2. Understand the concept of bioinspired materials and mechanisms.
3. Evaluate the principles of design and development of biodesigns based on human organ systems.
4. Explore innovative biobased solutions for ecofriendly and socially relevant problems.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3		1									1			
CO 2	3		1									1			
CO 3	3		1									1			
CO 4	3		1		3	1	1					1			

22UBT306L	BIOCHEMISTRY LAB	Credits: 01
L: T: P - 0: 0:2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

LIST OF EXPERIMENTS 12 Hrs.
1. pH measurements, concentration of solutions and units, conversion factors, accuracy. 2. Preparation of buffers of constant strength. 3. Qualitative tests for carbohydrate and lipids. 4. Qualitative tests for amino acids and proteins. 5. Estimation of sugar by Folin Wu and O-toluene method. 6. Estimation of amino acid by ninhydrin method 7. Estimation of protein by Lowry's method. 8. Estimation of nitrogen by Kjeldahl method. 9. Estimation of urea by diacetylmonooxime method. 10. Determination of Saponification value of lipids. 11. Determination of Iodine value of lipid. 12. Determination of acid value of a lipid.
REFERENCE BOOKS*
1. Plummer D. T (2017)"Practical Biochemistry" – 3rd edition McGraw Hill Education pub. 2. T N. Pattabhiraman, (2017) "Laboratory Manual & Practical Biochemistry" 4th Edition, All India Publishers & Distributors 3. Sadasivam, S. and Manickam (2017) A Biochemical Method. 3rd Edition, New Age International Publishers, New Delhi. 4. Rodney Boyer, "Modern Experimental Biochemistry" 3rd edition, Pearson Education Pub, (2000). 5. Keith Wilson(2003). "Practical Biochemistry" 3rd edition Cambridge University Pub. 6. Beedu SashidharRao and Vijay Deshpande (2005) "Experimental Biochemistry"I.K International Pvt. Ltd.
COURSE OUTCOMES**
After completion of the course student will have the ability 1. To understand the importance of pH & learn the different strength of solution & buffer preparations. 2. To identify various biomolecules by means of qualitative analysis. 3. To quantify the concentrations of the biomolecules in the given sample. 4. To apply knowledge of acid & iodine value to determine the quality of lipids.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course	Programme Outcomes	Programme Specific

Outcomes													Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	1	2	3	2			3	3				1	2	3	
CO 2	2	3	2	2			2	3					1	3	
CO 3	2	3	3	3		3	2	2					2	1	
CO 4	2	3	3	2		2	2	2					3	1	

B. E. IV SEMESTER

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	BSC	22UBT401C	Biostatistics & Biomodeling	03	2	2	0	50	50	100
2.	IPCC	22UBT402C	Immunotechnology + Lab	04	3	0	2	50	50	100
3.	IPCC	22UBT403C	Heat & Mass Transfer + Lab	04	3	0	2	50	50	100
4.	PCC	22UBT404C	Molecular Biology	03	3	0	0	50	50	100
5.	PCC	22UBT405C	Cell culture techniques	02	2	0	0	50	50	100
6.	PCCL	22UBT406L	Cell culture & Molecular Biology Lab	01	0	0	2	50	50	100
7.	HSMC	22UHS424C	UHV-II	01	1	0	0	50	50	100
8.	PCCL	22UBT407L	Biostatistics lab	01	0	0	2	50	50	100
9.	MC	22UHS001M 22UHS002M 22UHS003M	Yoga NSS PE	00	0	0	2	25	-	-
			Total	**19**	**14**	**2**	**10**	**425**	**400**	**800**

22UBT401C	BIOSTATISTICS & BIO-MODELING	Credits: 03
L: T: P - 2: 2: 0		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction and Descriptive Statistics: 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 fitting straight line).	
UNIT–II	**10Hrs.**
Probability and Probability Distributions: 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, F and $\chi2$ (Chi square -goodness of fit test) distributions and their applications in Biology.	
UNIT–III	**10 Hrs.**
Statistical Inference , ANOVA and Design of Experiments: 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–IV	**10 Hrs.**
Bio-modeling: 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.	

REFERENCE BOOKS *

1. Khan and Khanum, (2008),Fundamentals of Biostatistics(3rd edition), Ukaaz Publication
2. Kapur J.N. (2001),Mathematical Models in Biology and Medicine(1st edition), New age international Pvt. Ltd.

3. Agarwal B.L. (2009), Basic statistics(5^{th} edition), New age international Publishers
4. Rastogi V. B.(2006), Fundamentals of Biostatistics, Ane Books

COURSE OUTCOMES**

After completion of the course student will be able to

1. Interpretation of the data using different statistical methods.
2. Investigate the probability distributions of the data.
3. Design and analyze the experimentation using statistical tools.
4. Apply the biomodelling concepts in various biological studies.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	-	3	2	-	-	-	-	3	-	2	3	2	-
CO2	2	2	-	3	1	-	-	-	-	2	-	-	3	1	-
CO3	1	3	3		3	-	-	-	-	2	-	2	3	-	-
CO4	3	2	-	2	2	-	-	-	-	1	-	2	2	2	-

22UBT402C	IMMUNOTECHNOLOGY	Credits: 04
L: T: P - 3 : 0: 2		CIE Marks: 50
Total Hours/Week: 5		SEE Marks: 50

UNIT-I	10Hrs.
The immune system: Introduction, Cells and Organs of the immune system: Lymphoid cells and myeloid cells. Primary (thymus, bone marrow and lymphatic system) and secondary Lymphoid organs (lymph nodes, spleen, MALT). Innate and adaptive immunity. Antigens: Chemical and biological Factors affecting antigenicity/Immunogenicity and molecular nature, Haptens, adjuvants. Antibodies: their structure and function, Immunoglobulin classes (IgG, IgA, IgE, IgD and IgM) and subclasses (isotypic, allotypes, idiotypes and anti-idiotytopic antibodies). Cytokines and their role in immune response.	
UNIT–II	**10 Hrs.**
Humoral and cell mediated immunity: Introduction to humoral and cell mediated immunity. B-lymphocytes maturation and mechanism of activation. Thymus derived lymphocytes (T cells) and types, T-cell maturation and mechanism of activation. Major Histocompatibility Complex: MHC I and MHC II structure and functions. Antigen processing and presentation process. Complement system and its pathways (classical, alternative and lectin pathway) regulation and biological consequences of compliment activation.	
UNIT–III	**10 Hrs.**
Immunological disorders: Hypersensitivity reactions and its types. Autoimmune disorders- Organ specific, Systemic Autoimmune disorders, types 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–IV	**10Hrs.**

Immunodiagnosis:

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, chemiluminescence assay, flow cytometry, fluorescence activated cell sorting (FACS) analysis. Production of monoclonal antibodies.

Laboratories:

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. Countercurrent immunoelectrophoresis (CCIEP)
6. Rocket immunoelectrophoresis (RIEP)
7. Western blot (IGg Purification)
8. ELISA/ DOT Blot.

REFERENCE BOOKS *

1. Roitts, (2017), Essential Immunology (13th edition), Wiley Blackwell
2. Kuby, J.(2019), Immunology(8th edition), W H Freeman publishers
3. Chakravarthy, A.K.(2006),Immunology & Immunotechnology, Oxford University Press
4. Rastogi, S. C. (2005), Immunodiagnostics (1st Edition), New Age International

COURSE OUTCOMES**

After completion of the course student will be able to

1. Interpret the properties and functions of immune system.
2. Asses the functions of humoral and cell mediated immune system.
3. Develop the vaccines by analyzing the immunological disorders
4. Identify the diseases using different immunodiagnostic tools.

Course Outcomes	Programme Outcomes (POs)											Programme Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	-	3	1	2	-	-	-	-	-	-	-	1	-	2	-
CO 2	-	2	-	3	-	-	-	-	-	1	-	1	-	3	-
CO 3	-	-	3	-	3	2	-	-	-	-	2	2	-	3	1
CO 4	-	2	-	2	3	-	-	-	-	2	-	2	2	3	-

22UBT403C	HEAT AND MASS TRANSFER	04- Credits (3 : 0 : 2)
Hours / Week : 05		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT-I	10 Hrs.

Fundamentals of Heat Transfer:

Modes of heat transfer; Conduction – steady state heat conduction through uni-layer and multilayer plane wall, sphere and cylinder, Conceptual numericals on conduction; Forced and Natural convection, Conceptual Numericals on convection; Significance of Dimensionless numbers (Nu, Gr, Pr, Re, Pe numbers only); Heat transfer to fluids without phase change; heat transfer in laminar and turbulent flow inside closed conducts.

UNIT–II	10 Hrs.

Heat Transfer concept in Heat Exchangers:

Heat transfer with phase change - Condensation – film wise and drop wise; Boiling – types of boiling; Flow arrangements in Heat transfer equipment's - co current and counter current flow; LMTD, Elementary design of double pipe heat exchanger and shell and tube heat exchanger; Concepts of Heat transfer coefficients- Individual and overall; Fouling factor and Resistance for heat transfer; Conceptual numericals

UNIT–III	10 Hrs.

Mass transfer concepts

Diffusion - Fick's law of diffusion; Measurement of diffusivity, Two film theory of mass transfer, Mass transfer coefficients and their correlations. Liquid-Liquid, Solid-Liquid, Liquid-Gas, Solid-Liquid-Gas mass transfer. Principles, mass transfer considerations in unit operations like Extraction, Absorption, Adsorption, Crystallization and Evaporation

UNIT–IV	10 Hrs.

Mass transfer Operations

Methods of distillation –Simple, Flash, and Fractional distillation of binary mixtures, Continuous Distillation with reflux, relative volatility, fractionation of binary mixtures -McCabe Thiele method, Extractive and Azeotropic distillation, Drying, Principle of Drying, Drying rate, drying curve.

LIST OF EXPERIMENTS (ANY 10)

1. **Thermal conductivity of material (solid or liquid)**
2. **Heat transfer in a composite wall by conduction**
3. **Heat transfer by Natural Convection**
4. **Heat transfer by Forced convection**
5. **LMTD and Effectiveness in Heat Exchanger – Co-current**
6. **LMTD and Effectiveness in Heat Exchanger – Counter-current**
7. **Distillation**
8. **Extraction**

9. **Drying**
10. **Leaching**

Reference Books *

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 (2017) Coulson and Richardson's Chemical Engineering Volume 1A: Fluid Flow: Fundamentals and Applications. 7th Edition, Elsevier, USA.
4. Heat and Mass Transfer: Fundamentals and Applications, 7th Edition, Butterworth-Heinemann
5. Pauline Doran (2012) Bioprocess Engineering Principles, 2nd Edition, Academic Press
6. Alan S Foust, Wenzel LA, Clump CW, Maus L and Anderson LB (2008). Principles of Unit Operations, 2nd Edn. John Wiley & Sons, USA.
7. Kern (2001). Process Heat Transfer, 2nd Edn. McGraw-Hill Publications, USA.
8. Perry RH and Green DW (2008). Perry's Chemical Engineering Hand Book, 8th Edn. McGraw- Hill Publications.

Course Outcomes**

After completion of the course student will be able to

1. State the different modes of heat transfer and solve basic heat transfer problems
2. Apply the knowledge of Heat Exchangers in Biochemical Engineering applications
3. Apply the knowledge of Mass Transfer in Unit Operations to solve Biochemical Engineering problems
4. Apply the knowledge of Distillation and Drying Unit Operations in Bioprocess Industries

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	1							1	2		
CO 2	3	2	3	3	2							2	2		
CO 3	2	3	2	2	1							1	2		
CO 4	3	2	1	1	1							1	2		

22UBT404C	MOLECULAR BIOLOGY	Credits-3
L: T: P - 3 : 0: 0		CIE Marks : 50
Total Hours/week : 03		SEE Marks : 50

UNIT – 1	12 Hrs.
Introduction 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. **Replication:** Replication-basic concepts, structure and function of DNA polymerases, ligases, helicase. mechanism of DNA replication in prokaryotes and eukaryotes, End replication problem in eukaryotes, telomerase and its role, DNA damage & Repair (Photo reactivation, excision repair, recombinational repair, SOS repair).	
UNIT – 2	**10 Hrs.**
Transcription Mechanism of transcription in prokaryotes and eukaryotes, Bacterial RNA polymerase, structure and function of RNA polymerases (prokaryotes & eukaryotes), general transcription factors, post transcriptional processing, 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	**10 Hrs.**
Gene Expression in Prokaryotes 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	**10 Hrs.**
Transposons and Oncogenes 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, Tumour suppressor genes, retroviruses and its life cycle. **Genetic Recombination and Molecular markers:** Genetic recombination in bacteria- transformation, transduction and recombination, Mechanism of recombination-homologous (Holliday model), site specific recombination.	

REFERENCES*
1. David Nelson and Michael Cox, (2017), Lehninger Principles of Biochemistry (6th Edition), W.H. Freeman 2. James Watson (2008), Molecular Biology of the Gene (5th Edition) Pearson Education 3. David Freifelder, (2008), Essentials of Molecular Biology (2nd Edition), Narosa Publishing House
COURSE OUTCOMES**
1. Apply the knowledge of the basic aspects of molecular biology and classify the mechanism of DNA repair processes along with replication. 2. Acquire working knowledge on the mechanism of transcription, translation and post translational processes along with their applications in research. 3. Use research-based knowledge of gene regulation mechanism in prokaryotes and eukaryotes in the field of Biotechnology. **4.** Select and apply the steps of transposition, Proto-oncogenes conversion and molecular mechanism of genetic recombination in treating diseases.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	-	2	1	3	2	1	-	-	-	-	-	2	1	1
CO2	1	-	1	3	3	2	2	-	-	-	-	-	2	2	1
CO3	1	-	1	3	2s	1	1	-	-	-	-	-	1	1	1
CO4	1	-	3	3	3	2	3	-	-	-	-	-	2	2	1

22UBT405C	CELL CULTURE TECHNIQUES	Credits: 02
L: T: P - 2: 0: 0		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

UNIT – 1	8 Hrs.
Plant cell culture: 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, somatic embryogenesis. Plant growth hormones - auxins, gibberlins, cytokinins. Stoichometry of cell growth and product formation.	
UNIT – 2	**6 Hrs.**
Culture techniques and applications: Protoplast culture, somatic hybridization, haploid production, micro propagation,somaclonal variation, crop improvement, hairy root culture, synthetic seeds. Regeneration of plantlets-shooting, rooting and hardening.	
UNIT – 3	**6 Hrs.**
Animal cell culture Techniques History and development of mammalian cell culture. lab layout and equipments, cell culture media (Natural and Artificial) - components of the medium, functions of media components. Role of antibiotics in media. Types of primary culture, establishment of primary culture, cell lines – mechanical and enzymatic mode of desegregation. Subculture - passage number, split ratio, seeding efficiency, criteria for subculture.	
UNIT – 4	**6 Hrs.**
Cell line Characterization and Maintenance Measurement of Cell viability and Cytotoxicity assay –MTT, LDH dehydrogenase, . Dye exclusion and inclusion tests, clonogenic assay. Characterization. Cell line contaminations, detection and control. Stem cells & their applications	
REFERENCES BOOKS*	
1. Culture of Animal cells-3rd Edition-R.IanFreshney.Wiley Less, 2010 2. Introduction to Plant biotechnology by H. S. Chawla, 2nd Edition, Oxford and IBH Publishers, 2010 3. Biotech Expanding Horizons-B. D. Singh, Kalyani Publishers,2010. 4. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter Molecular biology of The Cell, GS publishers,2002	
COURSE OUTCOMES**	
1. To use the plant cells to produce in vitro cultures 2. To comprehend the applications of plant tissue culture techniques in various fields 3. To acquire working knowledge of culture of animal cells in *in vitro* conditions. 4. To identify, and classify the cell culture techniques	

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3												1	1	1
CO 2	1				3									2	2
CO 3	1				3			1			1		3	3	
CO 4	3				3									3	

22UHS424C	UNIVERSAL HUMAN VALUES-II	Credit: 01
L:T:P - 1 : 0: 0		CIE Marks: 50
Total Hours/Week:01		SEE Marks: 50

UNIT-I	04 Hrs.
Introduction to Value Education: Right Understanding; Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT–II	**04 Hrs.**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	
UNIT–III	**04Hrs.**
Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' **–** as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature.	
UNIT–IV	**03 Hrs.**
Implications of the Holistic Understanding – a Look at Professional Ethics Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics; Holistic Technologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession	

Reference Books

1. R R Gaur, R Sangal, G P Bagaria, ‘Human Values and Professional Ethics’, , Excel Books, New Delhi, 2010
2. A. Nagaraj, Jeevan VidyaEkParichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4. Annie Leonard,The Story of Stuff (Book), Simon & Schuster, 2011.
5. Mohandas Karamchand Gandhi,The Story of My Experiments with Truth, Public Affairs Press of Washington, DC. 1948
6. E. F Schumacher, Small is Beautiful,. Blond & Briggs, 1973

7. Cecile Andrews, Slow is Beautiful, New Society Publishers, 2006.
8. J C Kumarappa, Economy of Permanence, Akhil Bharat Sarva-Seva-Sangh, Rajghat, Kashi, 1958.
9. Pandit Sunderlal, Bharat Mein Angreji Raj,Publications Division, M/O Information & Broadcasting, Govt. of India, 2016
10. Dharampal,Rediscovering India, Society for Integrated Development of Himalayas, 2003
11. Gandhi, Mohandas K. Hind Swaraj or Indian Home Rule Ahmedabad, Nava jivan Pub. House, 1946.
12. India Wins Freedom, Maulana Abdul Kalam Azad, Orient Black Swan, 1988.
13. Romain Rolland, Gandhi, Romain Rolland (English), Srishti, 2000.

Course Outcomes

Upon successful completion of the course, students will be able to:

CO1: Explore holistic vision of life - themselves and their surroundings.

CO2: Develop competence and capabilities for maintaining Health and Hygiene.

CO3: Analyse various problems in life, family,Society and in handling problems with Sustainable Solutions.

CO4: Apply values to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions.

CO5: Adopt the value of appreciation and aspiration for excellence and gratitude for all.

		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
No	Programme Outcomes Course Outcomes															
Upon successful completion of course the Students will																

be able to:																
1	Explore holistic vision of life - themselves and their surroundings.							3	2	3			1			
2	Develop competence and capabilities for maintaining Health and Hygiene.						3	3	1	1			1			
3	Analyse various problems in life, family,Society and in handling problems with Sustainable Solutions.						3	3	2	1			1			
4	Apply values to their own self in different day-to-day settings in real life and in handling						2	2	3	2			1			

	problems with sustainable solutions.															
5	Adopt the value of appreciation and aspiration for excellence and gratitude for all.								3				1			

22UBT406L	CELL CULTURE AND MOLECULAR BIOLOGY LAB	Credits: 01
0:0:2 - N_L : N_T: N_P		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

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. Study of absorption spectra of nucleic acids.
6. UV Vis survival curve of bacteria.
7. Agarose gel electrophoresis.
8. Isolation of genomic DNA from plant sources.
9. Isolation of plasmid DNA from E. coli.
10. Estimation of DNA by diphenyl method.
11. Estimation of RNA by orcinol method.
12. Purity of nucleic acids by UV-Vis Spectrophotometer.
13. Standard Operating Procedure for Centrifuge and Gel Documentation Unit.

Reference Books *

1. Sadashiva and Manickam, (2017), Biochemical Methods, (2nd Edition), W.H. Freeman
2. R.A. Dixon & Gonzales, (1995), Plant Cell Culture: A Practical Approach by IRL Press. (2nd Edition),
3. Sambrook& Russell, (2002), Molecular Cloning, (3rd Edition), Cold Spring Harbor Lab.

Course Outcomes**

After completion of the course student will be able to

1. Conduct and analyze the growth of plant and animal cells by plant and animal tissue culture techniques.
2. Apply absorption spectra and analyze SOP for various lab equipments.
3. Conduct and analyze the concentration and purity of DNA.
4. Conduct observations and experiments including Genomic DNA/plasmid DNA /RNA/protein.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	1	3	1	-	-	-	-	-	1	1	3	1
CO2	1	2	2	1	3	2	-	-	-	-	-	1	1	3	1
CO3	1	2	2	1	3	1	-	-	-	-	-	1	1	3	1
CO4	2	2	3	2	3	2	-	-	-	-	-	1	1	3	1

22UBT407L	BIOSTATISTICS LAB	Credits: 1
L: T: P - 0:0:2		CIEMarks:50
Total Hours/Week: 02		SEEMarks:50

LIST OF EXPERIMENTSIN BIOSTATISTICS LABORATORY

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 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 Design- Analysis.
10. Placket-Burman Design for media optimization.
11. Response Surface Methodology for media optimization.

REFERENCE BOOKS *

1. Khan and Khanum, (2008),Fundamentals of Biostatistics(3rd edition), Ukaaz Publication
2. Kapur J.N.(2001),Mathematical Models in Biology and Medicine(1st edition), New age international Pvt. Ltd.
3. Agarwal B.L. (2009), Basic statistics(5th edition), New age international Publishers
4. Rastogi V. B.(2006), Fundamentals of Biostatistics, Ane Books

COURSE OUTCOMES**

After completion of the course student will be able to

1. Create data file, draw graphs, charts using statistical software tools.
2. Calculate measures of dispersion and central tendency.
3. Analyse the data using ANOVA.
4. Design experimental set up using statistical software tools.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	1	3	-	-	-	-	-	-	1	2	2	1	1
CO 2	3	3	2	3	3	-	-	-	-	-	2	2	2	1	-
CO 3	2	3	3	2	2	2	-	-	-	-	-	3	2	1	-
CO 4	3	3	1	3	3	2	-	-	-	-	-	3	2	1	2

B. E. V SEMESTER

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	PCC	21UBT501C	Bioinformatics	03	3	0	0	50	50	100
2.	IPCC	21UBT502C	Genetic Engineering & Applications + lab	04	3	0	2	50	50	100
3.	PEC	21UBT5XXE	Elective –I	03	3	0	0	50	50	100
4.	OEC	21UXX5XXN	Open Elective-I	03	3	0	0	50	50	100
5.	PCCL	21UBT503L	Bioinformatics Lab	01	0	0	2	50	50	100
6.	AEC	21UHS521C	Quantitative Aptitude and Professional Skills	02	2	0	0	50	50	100
7.	INT	21UBT504I	Summer Internship – II	03	0	0	4	100	-	100
8.	HSMC	21UBT523C	Environmental Studies	01	1	0	0	50	50	100
			Total	**20**	**15**	**0**	**08**	**450**	**350**	**800**

Elective-I

21UBT511E: Environmental BT
21UBT512E: Nutraceuticals
21UBT513E: Computational Biology
21UBT514E: Protein Engineering and Drug Design
21UBT515E: Environmental BT

Open Elective-I

21UBT532N: Biofuels Technology

21UBT501C	BIOINFORMATICS	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	12 Hrs.

Introduction to Bioinformatics and Biological Database

Introduction to bioinformatics, Components of bioinformatics and 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 primary and secondary databases

UNIT–II	10 Hrs.

Sequence alignment and database searches:

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–III	10 Hrs.

Phylogenetic analysis and predictive methods using sequences

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–IV	10 Hrs.

Plasmid mapping and primer designing &molecular modelling techniques

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

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**

After completion of the course student will be able to

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

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	2	-	-	2	1	2	2				3	2	2	3
CO 2	3	2	2	2	2	1	2	-				3	2	2	3
CO 3	3	2	-	1	-	-	2	-				3	2	2	3
CO 4	2	2	-	1	-	2	-	-				3	1	-	2
CO 5	2	2	2	1	-	2	-	2				1	2	-	2
CO 6	2	1	2	2	2	2	1	1				1	1	1	1

21UBT502C	GENETIC ENGINEERING & APPLICATIONS	Credits: (4: 0: 0)
L: T: P – 3-0-2		CIE Marks: 50
Total Hours/Week: 5		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction

Tools of genetic engineering- vectors in recombinant DNA technology, biology and salient features of vectors, Types of vectors - plasmids, cosmids, bacteriophage lambda 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–II	10Hrs.

Nucleic acid hybridization and amplification

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 cDNA libraries:

Construction of Complementary DNA (cDNA), genomic DNA libraries and cDNA libraries.

UNIT–III	10 Hrs.

Gene transfer techniques

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 (Flavr savr tomatoes). Application of plant transformation for productivity and performance – Herbicide resistance - glyphosate. insect resistance - Bt genes(*Bacillus thuringiensis* and its mode of action), Cry proteins – mechanism of action.

UNIT–IV	10 Hrs.

Gene therapy

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.

REFERENCE BOOKS

1. Molecular Biotechnology, Principles and applications of Recombinant DNA by Bernard R Glick and Jack J Pasternak, second edition, CBS Publishers, 2012.
2. Recombinant DNA by Watson, et al., second edition, Freeman Publishers 2010.
3. Principles of gene manipulation, Primrose S.B., Blackwell Scientific Publications, 2010.
4. From Genetics to Gene Therapy – the molecular pathology of human disease by David S Latchman, BIOS scientific publishers, 2010.
5. Biotechnology Expanding Horizon, B.D.Singh, 3rd revised edition, Kalyani Publishers,2010

6. https://onlinecourses.swayam2.ac.in/cec19_bt02/preview

LAB

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. Lyophilization of biologic samples (fluids, microbial samples)
9. SOP for UV-Spectrophotometer
10. SOP for PCR
    PCR (Amplification with specific primers)

COURSE OUTCOMES

1. Apply the knowledge of various tools used in genetic engineering experiments.
2. Select and apply the knowledge of methods of nucleic acid detection, hybridization and amplification and library construction in research.
3. Identify different methods of various gene transfer techniques in plants, animals and microbes
4. Use knowledge of various strategies of Gene therapy in therapeutics and engineer microbes for the production of biopharmaceuticals

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	-	1	-	2	3	-	2	-	-	-	-	2	1	3	1
CO 2	-	1	-	-	3	-	1	-	-	-	-	2	2	3	1
CO 3	-	1	-	2	3	1	1	-	-	-	-	2	3	3	1
CO 4	-	1	-	2	3	2	1	-	-	-	-	2	3	3	1

22UBT511E	ENVIRONMENTAL BT	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Microorganisms

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–II	12Hrs.

Biological Treatment of Wastewater

Waste water characteristics BOD, COD, Primary & Secondary treatment, nano-filtration, ulta-filration 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–III	10 Hrs.

Bioleaching & Biomining

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–IV	10 Hrs.

Biotechnology in Biodiversity Conservation

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.

REFERENCE BOOKS*

1. Environmental Biotechnology by Pradipta Kumar Mahopatra.
2. Text book of microbiology by R C Dubey and D K Maheshwari
3. Environmental Biotechnology by Foster C.F., John ware D.A., Ellis Horwood Limited,1987.
4. Bioprocess Technology- fundamentals and applications, S O Enfors & L Hagstrom (1992),

RIT,.

5. Comprehensive Biotechnology Vol. 1- 4 : M.Y. Young (Eds.), Pergamon Press.
6. Industrial Microbiology : L.E. Casida, Willey Eastern Ltd., 1989.
7. Industrial Microbiology : Prescott & Dunn, CBS Publishers, 1987.
8. Biotechnology, Economic & Social Aspects : E.J. Dasilva, C Ratledge & A Sasson, Cambridge Univ. Press, Cambridge.

COURSE OUTCOMES**

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.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	3	2	2				2		3		1	2	3	1
CO 2	2	3	2	1				1	2				3	3	1
CO 3	2	3	2	1				1	2				3	3	1
CO 4	1	3	2	3				2	2	3			2	3	
CO 5								2		3		3			
CO 6	1	3	2	2					2	2			1	3	

22UBT512E	NUTRACEUTICALS	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to Nutraceutical and dietetics 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–II	**10Hrs.**
Nutrition related diseases and disorders 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–III	**10 Hrs.**
Nutraceuticals of microbial, plant and animal origin 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–IV	**10 Hrs.**
Biotechnology in Phytonutraceuticals 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	

REFERENCE 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.
3. M. Maffei ,Dietary Supplements of Plant Origin, Taylor & Francis,1 st Edition,2003.
4. Shahidi and Weerasinghe, Nutraceutical beverages Chemistry, Nutrition and health Effects,

American Chemical Society,1 st Edition, 2004.
5. Richard Neeser& J. Bruce German (2004) Bioprocesses and Biotechnology for Functional Foods and Nutraceuticals, Jean, Marcel Dekker, Inc.
6. TimothtS. 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

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	2	-	-	2	1	2	2				3	2	2	3
CO 2	3	2	2	2	2	1	2	-				3	2	2	3
CO 3	3	2	-	1	-	-	2	-				3	2	2	3
CO 4	2	2	-	1	-	2	-	-				3	1	-	2
CO 5	2	2	2	1	-	2	-	2				1	2	-	2
CO 6	2	1	2	2	2	2	1	1				1	1	1	1

21UBT513E	COMPUTATIONAL BIOLOGY	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – 1	12 Hrs
Nature and scope of Computational Biology: Basic algorithms in Computational Biology, Biological and Computer algorithm, Fibonacci problem, Dynamic Programming, Time and space complexity of algorithms, Laplace's Rule. Search Algorithms: Random walk, Hill climbing, simulated annealing. Combinatorial Pattern Matching: Hash Tables, Repeat Finding, Exact Pattern Matching; Genetic Algorithm: Basic Concepts, Reproduction, Cross over, Mutation, Fitness Value, Optimization using GAs; Applications of GA in bioinformatics.	
UNIT – 2	**8 Hrs**
Combinatorial Pattern Matching: Hash Tables, Repeat Finding, Exact Pattern Matching; Genetic Algorithm: Basic Concepts, Reproduction, Cross over, Mutation, Fitness Value, Optimization using GAs; Applications of GA in bioinformatics.	
UNIT – 3	**10 Hrs**
Hidden Markov Model: Markov processes and Markov Models, Hidden Markov Models. Forward and Backward Algorithms, Most probable state path: Viterbi algorithm, Parameter Estimation for HMMs:-Baum-Welch Algorithm, Applications of profile HMMs for multiple alignment of proteins and for finding genes in the DNA.	
UNIT – 4	**10 Hrs**
Insilico Drug Design and Biopython applications in Computational Biology Insilico Drug Design: Basic Concepts, importance and application, Molecular force fields and energy minimization, Molecular Dynamics Simulation methods, Methods of Insilico Drug Design: structure and ligand based drug design approach, structure based drug design: Molecular docking. Biopython: Introduction, important features and application of biopython in computational biology, Create a simple sequence in Biopython for DNA, RNA and Protein Alphabets, Sequence Alignment Tools in Biopython, PDB Module of Biopython,	
REFERENCE BOOKS	

- Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith,1999,Pearson Education.
- Arthur M.Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
- Higgins and W.Taylor (Eds), Bioinformatics-Sequence, Structure and databanks, Oxford University Press, New Delhi, 2000
- An introduction to bioinformatics algorithms by Neil C. Jones, Pavel Pevzner. MIT Press.2004 2.
- Biological sequence analysis: Probabilistic models of proteins and nucleic acids by Richard Durbin, Eddy, Anders Krogh, 1998

Algorithms for Molecular Biology by Ron Shamir Lecture, Fall Semester, 20014.

1. Bioinformatics- a practical guide to the analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., 1998, John Wiley & Sons, UK.
2. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith, 1999,Pearson Education.
3. Arthur M.Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
4. D.Higgins and W.Taylor (Eds), Bioinformatics-Sequence, Structure and databanks, Oxford University Press, New Delhi, 2000.
5. Bioinformatics: the machine learning approach by Pierre Baldi, Søren Brunak. MIT Press.2001 2.
6. Bioinformatics: Sequence and Genome Analysis: by David Mount, University of Arizona,Tucson

COURSE OUTCOMES

After completion of the course student will be able to

1) Understand the nature, scope of computational biology and biological and computer algorithms.
2) Know about the Combinatorial Pattern Matching, Genetic algorithms and their applications.
3) Analyze various Markov processes and Markov Models.
4) **Learn about the Insilico Drug Design and Biopython applications in Computational Biology**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	3	3									2	2	1	
CO 2	2	3	3									2	2	1	
CO 3	3	3	3									1	2	1	
CO 4	3	3	3									1	2	1	

21UBT514E	PROTEIN ENGINEERING AND DRUG DESIGN	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours

Structure of proteins

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–II	10 Hrs.

Molecular modeling

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–III	10 Hrs.

Insilico drug design

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–IV	10 Hrs.

Docking methods

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.

REFERENCE BOOKS *

1. Bioinformatics Methods & Applications: Genomics, Proteomics & Drug Discovery, S C Rastogi, Mendiratta & P Rastogi, PHI,4th Edition, 2013
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 methods and computer - assisted drug discovery

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	2	-	1	1	2	2	-	-	-	1	2	1	1
CO2	1	-	2	-	-	2	2	3	-	-	-	1	2	1	2
CO3	-	-	1	1	2	-	2	2	-	-	-	1	2	1	-
CO4	2	-	2	-	-	1	2	2	-	-	-	1	2	1	-

21UBT532N	BIOFUELS TECHNOLOGY	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Biochemistry of biofuels and energy resources

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–II	12Hrs.

Biofuel feed stocks

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–III	10 Hrs.

Technologies for biofuels

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–IV	10 Hrs.

Biofuels in perspective

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.

REFERENCE BOOKS*

1. Foster C. F., John ware D.A.Environmental Biotechnology by, Ellis Horwood Limited, 1987.
2. Larry Anderson and David A Fuels from Waste by Tillman. Academic Press, 1977.
3. Biotechnology, Economic & Social Aspects: E.J. Dasilva, C Ratledge & A Sasson, Cambridge Univ. Press, Cambridge, 2000
4. Environmental Biotechnology by Pradipta Kumar Mahopatra, 2007.

COURSE OUTCOMES**

After completion of the course student will be able to

1. Ability to understand the basic principle involved in bioconversion process in energy and to differentiate the conventional fuels with biofuels .
2. Able to diagnose the types of feed stocks used for biofuels.
3. Able to produce the biofuels (biodiesel, bioalcohol biogas and biohydrogen) using current technologies and innovations involved
4. Able to understand and recall current issues related with production and use of biofuels, Research opportunities, economic feasibility of the biofuels

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	2	-	-	2		1	-	-	-	-	1	3	2	-
CO 2	3	3	-	3			2	-	-	-	-	1	2	-	-
CO 3	3	3	-	3	3		2	-	-	-	-	3	-	2	-
CO 4	3	3	-	3			2	-	-	-	-	3	-	1	-

21UBT503L	BIOINFORMATICS LAB	Credits: 1
L: T: P – 0-0- 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

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, and Xenologs
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.

REFEENCE BOOKS*

1. Bioinformatics – Andreas D Boxevanis. Wiley Interscience, 1998.
2. Bioinformatics – David W Mount, cold spring harbor, 2001.
3. Bioinformatics – A biologists guide to biocomputing and the internet. Stuart M brown,
4. Fundamental Concepts of Bioinformatics – D E Krane & M L Raymer, Pearson, 2006.
5. Computational methods in Molecular Biology – S.L.Salzberg, D B Searls, S Kasif, Elsevier, 1998.
6. Bioinformatics – methods and applications: Genomics, proteomics and drug Discovery – s c Rastogi, N. mendiratta & prastogi, phi, 2006.

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

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	3	3	-	3	1	-	3				3	3	3	1
CO 2	3	3	3	-	3	1	-	-				3	2	3	1
CO 3	3	3	2	2	3	1	1	-				3	3	3	1
CO 4	3	3	2	-	3	-	1	-				3	2	3	2
CO 5	3	3	2	1	3	1	-	2				3	3	3	2
CO 6	3	3	3	2	3	1	-	1				3	2	3	1

21UBT523C/21UBT623C	ENVIRONMENTAL STUDIES	01 - Credits (1: 0 : 0)
Hours / Week : 01		CIE Marks : 50
Total Hours : 15		SEE Marks : 50

UNIT – 1	04 Hrs.

Natural Resources:

Human activities and their impacts. EIA, **Renewable Energy**: Solar energy, Wind energy, Hydropower, Tidal energy, Ocean thermal energy, Geo thermal energy, Biomass energy, Biogas, Biodiesel, Bioethanol, Hydrogen as fuel.
Non renewable Energy: Coal, Petroleum, Natural gas, Nuclear energy.

UNIT – 2	04 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, strategies for sustainable development. Environment economics – concept of green building, Circular Economy.

UNIT – 3	03 Hrs.

Current Environmental Issues of concern:

Greenhouse Effect- Greenhouse gases and Global Warming, Climate change, ozone layer depletion, Acid rain, Eutrophication
Environmental policy legislation rules & regulations

UNIT – 4	04Hrs.

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, plastic, chemical, E–waste, food & construction industry waste management).

REFERENCES

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
4. Meenakshi “Environmental Science & Engineering” Pranticce Hall of India, 2006

COURSE OUTCOMES

After completion of the course the students shall be able to,

- Ability to recognize natural resources and its uses.
- Able to understand pollution and its effects on environment and to implement sustainable future in the work place.
- Ability to understand current environmental issues.
- Able to apply the waste management techniques in various fields

Course Outcomes	Program Outcomes												Program Specified Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	**-**	**1**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO 2	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO 3	**-**	**2**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**-**	**-**	**3**	**1**	**-**	**-**
CO 4	**-**	**-**	**-**	**1**	**-**	**2**	**2**	**1**	**-**		**-**	**3**	**1**	**-**	**1**

Question Paper Pattern for SEE:

Question is of Objective type

Duration of exam is 1 hour 30 mins

50 questions covering all the four units. Each question carries one mark

B. E. VI SEMESTER

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	BSC	21UBT601C	Bioprocess and Bioreaction Engineering	03	3	0	0	50	50	100
2.	PCC	21UBT602C	Upstream Processing Technology	03	3	0	0	50	50	100
3.	PCC	21UBT603C	Biotransformation and Enzyme Technology	03	3	0	0	50	50	100
4.	PEC	21UBT6XXE	Elective-II	03	3	0	0	50	50	100
5.	OEC	21UXX6XXN	Open Elective –II	03	3	0	0	50	50	100
6.	OEC	21UXX6XXN	Open Elective –III	03	3	0	0	50	50	100
7.	AEC	21UHS600C	Indian Knowledge systems	01	1	0	0	50	50	100
8.	PCCL	21UBT604L	Biokinetics & Enzyme Technology Lab	01	0	0	2	50	50	100
9.	MP	21UBT605P	Mini Project	02	0	0	4	50	50	100
10.	MC	21UHS001M 21UHS002M 21UHS003M	Yoga NSS PE	00	0	0	2	10	-	-
Total				**22**	**19**	**0**	**8**	**460**	**450**	**900**

Elective-II

21UBT621E: Biofuels Technology
21UBT622E: Food Biotechnology
21UBT623E: Biopython
21UBT624E: Genomics & Proteomics
21UBT625E: Bioreactor Design

Open Electives –II

21UBT632N: Environmental Technology

Open Electives –III

21UBT633N: Industrial Safety

21UBT601C	BIOPROCESS AND BIOREACTION ENGINEERING	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Kinetics of Homogeneous reactions:

Basic Concepts of Bioreaction 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–II	10 Hrs.

Interpretation of Batch Bioreactor Data:

Constant volume batch reactor, Integral method of analysis of data -first order, second order, zero order reactions, fractional life, homogenous catalysed reactions, irreversible reaction in series, irreversible reactions in parallel, reactions of shifting order, autocatalytic reactions, reversible reactions, differential method of analysis of data.

UNIT–III	10 Hrs.

Ideal Bioreactor and bioprocess models:

Ideal Batch Reactor, General features of reactors, Basic design equation, relation between Concentration and conversion, Batch cycle time, Space-Time and Space-Velocity, Mixed flow reactor, Plug flow Reactor, Holding time and space time for flow reactors

Design for Single Reactions: Size comparison of single reactors. Growth kinetics quantification Unstructured models for microbial growth- Substrate limited growth-models with growth inhibitors, product formation kinetics. Monod kinetics

UNIT–IV	10 Hrs.

Analysis of Bioreactors:

Various types of reactors for immobilised cell and enzyme systems, Multiple reactors like CSTR in series /CSTR in Parallel; MFR in series/ MFR in Parallel, PFR in series/ PFR in parallel, Reactors of different types in series, Challenges and issues in bioprocess industries- mixing, interphase mass and heat transfer, Bioreactor instrumentation and control, bioreactor considerations for animal cell cultures and plant cell cultures.

Reference 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.
4. Bailey J E and Ollis DF (2010) Biochemical Engineering Fundamentals, 2nd edn. Mc Graw- Hill.
5. Charles D. Holland (1990) Fundamentals of Chemical Reaction Engineering, John Wiley and Sons.
6. Pauline M Doran., Bioprocess Engineering Principles, 2nd Edition, Academic Press, USA, 2013.
7. Tapobrata Panda., Bioreactors: Analysis and Design, 1st Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2011.
8. Indian Standards Institution, Code for Unfired Pressure Vessels, IS – 2825.
9. Bhattacharya, B.C, Introduction to Chemical Equipment Design, CBS Publications, 1985.
10. Perry’s Chemical Engineers Handbook. 7th Edition Mc Graw Hill Publications

Course Outcomes**

After completion of the course student will be able to

5. Understand the basic concept of reaction engineering to solve bioprocess problems
6. Predict the order and rate of the different reactions.
7. Analyze the batch bioreactor data for different reactions.
8. Apply the suitable bioreactor for different biochemical reactions.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	3	3	2	2							2	2		
CO2	2	3	2	3	1							2	2		
CO3	2	3	3	2	2							2	2		
CO4	2	3	3	3	1							2	2		

21UBT602C	UPSTREAM PROCESSING TECHNOLOGY	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Fermentation process
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. Classification of Fermentation Systems: Batch, fed batch and continuous process and their applications, Types of Fermentors.
Scale Up: Process engineering concepts, engineering considerations, mechanical considerations, energy considerations. Process GMP considerations of scale up, operations and quality.

UNIT–II	10Hrs.

Raw materials and media
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) of industrial media, microbio

UNIT–III	10 Hrs.

Microbial system
Isolation of industrially important microorganisms, Strain development methods, Preservation of industrially important microorganisms. Development of inoculum from 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–IV	10 Hrs.

Plant Cell system
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).
Animal Cell system :
Scale up in suspension (stirred and static), monolayer (roller bottles, nunc cell factory microcarriers culture) and Perfusion culture (fixed and fluidized bed reactors).
Factors affecting cell 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).

REFERENCE BOOKS

1. Principles of fermentation Technology by P.F. Stanbury and A. Whitaker, Aditya books (P) Ltd. New Delhi 1997.
2. Bioprocess Engineering by Michael L. Shuler, 2nd Edition Shuler & Kargi, Fikret Kargi, Academic Internet Publishers, 2006
3. Introduction to plant Biotechnology by H.S. Chawla, Second edition, Oxford & IBH Publisher
4. Plant tissue Culture : Theory and Practice by S.S. Bhojwani and M.K. Razdan (1996). Elsevier
5. Culture of animal cells by Ian Freshney IVth Edition. John Willey & Sons Publ.
6. Animal Biotechnology by Murray Moo-Young (1989), Pergamon Press, Oxford

COURSE OUTCOMES

1. Understand and identify the component parts of fermentor and fermentation system
2. Select the raw material , prepare and sterilize the media and also to optimize the industrial media using Design of experiments
3. Develop/design the industrially important microbes for industrial scale processes
4. Operate the reactors for Plant, Animal and GMOs

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	3	1											1	3	
CO 2	-	3												3	3
CO 3	2	2	3	1	1					2		1	3	3	
CO 4	2									3		1		3	

21UBT603C	BIOTRANSFORMATION AND ENZYME TECHNOLOGY	Credits: 3
L:T:P - **3-0-0**		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Enzyme action: 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	
UNIT–II	**10 Hrs.**
Enzymatic Techniques: 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–III	**10 Hrs.**
Enzymes of biological importance: Enzyme pattern in diseases like in Myocardial infarctions (SGOT, SGPT, & LDH) Acetylcholinesterase, angiotensin converting enzyme (ACE), 5'- nucleotidase (5NT), glucose-6-phosphate dehydrogenase (GPD). Use of isozymes as markers in cancer.	
UNIT–IV	**10 Hrs.**
Industrial uses of enzymes: 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.	

Reference Books *

1. Trevor Palmer (2008). Enzymes: Biochemistry , Biotechnology, Clinical Chemistry. Horwood Publishing Ltd, East-West Press,5th Edition.
2. David L. Nelson and Michael Cox (2017). "Lehninger Principles of Biochemistry" **–**7th Edition.
3. Nicholas C. Price and Lewis Stevens (2009).Fundamentals of Enzymology, Oxford university Press, 3rd edition.
4. James R Hanson (2017). "An Introduction to Biotransformation in Organic Chemistry" 5th edition , Oxford university Press,
5. Daniel L. Purich, Melvin I. Simon, John N. Abelson (2009). Contemporary Enzyme Kinetics and Mechanism" Academic press, 3rd edition.
6. K. Faber (2018). Biotransformations in Organic: Springer- Verlag.4th Edition,.
7. Bailey and Ollis (2017). "Biochemical Engineering Fundamentals", Mcgraw Hill 2nd Ed.

Course Outcomes**
After completion of the course student will have the ability 1. To understand mechanism of enzyme and its reactions. 2. To know enzymatic techniques to characterize the enzymes and apply the techniques of immobilization of enzymes. 3. To understand the importance of enzymes in diagnostics. 4. To apply knowledge of using enzymes in detergent, wool, leather and food industries.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	3	1	-	2		-	-	-	-	1	3	2	-
CO2	3	3	2	2	-	3	2	-	-	-	-	-	3	1	-
CO3	3	2	-	2	-	2	-	-	-	-	-	-	3	3	-
CO4	2	3	1	1	-	2	4	-	-	-	-	-	3	1	-

21UBT621E	BIOFUELS TECHNOLOGY	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Biochemistry of biofuels and energy resources

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–II	12Hrs.

Biofuel feed stocks

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–III	10 Hrs.

Technologies for biofuels

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–IV	10 Hrs.

Biofuels in perspective

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.

REFERENCE BOOKS*
1. Foster C. F., John ware D.A.Environmental Biotechnology by, Ellis Horwood Limited, 1987. 2. Larry Anderson and David A Fuels from Waste by Tillman. Academic Press, 1977. 3. Biotechnology, Economic & Social Aspects: E.J. Dasilva, C Ratledge & A Sasson, Cambridge Univ. Press, Cambridge, 2000 4. Environmental Biotechnology by Pradipta Kumar Mahopatra, 2007.
COURSE OUTCOMES**
After completion of the course student will be able to 1. Ability to understand the basic principle involved in bioconversion process in energy and to differentiate the conventional fuels with biofuels . 2. Able to diagnose the types of feed stocks used for biofuels. 3. Able to produce the biofuels (biodiesel, bioalcohol biogas and biohydrogen) using current technologies and innovations involved 4. Able to understand and recall current issues related with production and use of biofuels, Research opportunities, economic feasibility of the biofuels

Course Outcomes	**Programme Outcomes**												**Programme Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	2	-	-	2		1	-	-	-	-	1	3	2	-
CO 2	3	3	-	3			2	-	-	-	-	1	2	-	-
CO 3	3	3	-	3	3		2	-	-	-	-	3	-	2	-
CO 4	3	3	-	3			2	-	-	-	-	3	-	1	-

21UBT622E	FOOD BIOTECHNOLOGY	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours
Introduction 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–II	**10 Hrs.**
Microbial biotechnology of food 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–III	**10 Hrs.**
Plant food applications 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–IV	**10 Hrs.**
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.	
REFERENCE BOOKS *	

1. Kalidas s, Gopinadhan P, Anthony P and Robert E.Levin- " Food Biotechnology"- second edition, CRC press, 2006
2. Gustavo F.G and Gustavo V.B,-" Food Science and Food Biotechnology"- CRC press, 2003
3. Mahesh S.-" Plant Molecular Biotechnology"- first edition, New age international publishers, , 2008
4. 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

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2	-	2	1	-	-	-	-	-	1	2	1	1
CO2	2	-	2	-	3	2	-	-	-	-	-	1	2	1	1
CO3	1	1	1	-	2	2	-	-	-	-	-	1	2	1	2
CO4	2	-	2	-	2	1	-	-	-	-	-	1	2	1	1
CO5	2	1	1	-	3	1	-	-	-	-	-	1	2	1	2
CO6	1	-	1	-	2	2	-	-	-	-	-	2	2	1	1

21UBT623E	Biopython	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	16 Hrs.
Introduction and brief history of Biopython, Biopython modules, Tools and GNU/Linux, Nucleic Acid Bioinformatics, Sequences, Strings, and the Genetic Code, Sequences File Formats, Introduction to Biological Sequence Database, Sequence Motifs, Introduction to Motifs, String Matching, Consensus Sequences, Motif Finding, Promoters, De novo Motif Finding.	
UNIT–II	**12 Hrs.**
Sequence Alignments, Alignment Algorithms and Dynamic Programming, Alignment Software, Alignment Statistics, Short Read Mapping Multiple Sequence Alignments, Molecular Evolution, and Phylogenetics, Multiple Sequence Alignment, Phylogenetic Trees, Models of mutations, Practices Lab 4: Using BLAST on the command line, Lab 5: Phylogenetics	
UNIT–III	**12 Hrs.**
Genomics, The Three Fundamental "Gotchas" of Genomics, Genomic Data and File Formats, Genome Browsers, Transcriptomics, High-throughout Sequencing (HTS), RNA Deep Sequencing, Small RNA sequencing, Long RNA sequencing, Single-Cell Transcriptomics, Transcription Initiation, Transcription, Elongation, RNA Seq, Noncoding RNAs, Small Noncoding RNAs (srcRNAs), Long Noncoding RNAs, RNA Structure Prediction, Destabilizing energies. Practices: Lab 6: Genome Annotation Data, Lab 7: RNA-seq, Lab 8: RNA Structure, Lab 9: Proteins.	
UNIT–IV	**12 Hrs.**
Protein Alignment, Functional Annotation of Proteins, Secondary Structure prediction, Gene Ontology, Gene Regulation, Transcription Factors and ChIP-seq, MicroRNA regulation and Small RNA-seq, Regulatory Networks. Practices: Lab 8: RNA Structure, Lab 9: Proteins, Lab 10: ChIP-seq	
Reference Books *	
Reference Books: 1) Prof. David A. Hendrix 2) Deep Learning with Python, Francois Chollet Reference Books/Protocols: Tutorials Point (Simply easy learning).	
Course Outcomes**	

After completion of the course student will be able to

1,Obtain knowledge on the biopython-GNU/Linux, modules, tools, commands and Motifs.

2.Acquire the skills of Sequence Alignments using the Softwares, Statistics, Short Read Mapping, Multiple Sequence Alignments, Molecular Evolution,

3.Understand and Analyze the Phylogenetics, Phylogenetic Trees, and Models of mutations.

4.Utilize the biopython in analysis of the Genomic and transcriptomics data.

5. Conduct the Protein Alignment, Functional Annotation, Secondary Structure prediction, Gene Ontology, Gene Regulation.

21UBT624E	GENOMICS AND PROTEOMICS	Credits: 3
L:T:P – 3-0-0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction

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. c) prediction of new genes and their function by databases, d) potential revenue in the area diagnostic and biomedical applications, e) biosimilars market and implications.

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–II	10 Hrs.

Functional Genomics

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	10 Hrs.

Structure of Proteins

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–IV	10 Hrs.

Proteomics

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.

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.
4. Sabesan, Genomics & Proteomics –Ane Books, 2007. 5. Pennington S. R. and M J Dunn Proteomics.

COURSE OUTCOMES**

After completion of the course student will be able to

1. To know about genes, brief history, polymorphism, prediction methods, Biosimilars, business opportunities in diagnostic and medicine
2. Understand about the Human genome project, tools in DNA sequencing methods and other advanced techniques, Comparative genomics using model organisms, functional genomics of different organisms and molecular markers, gene and physical mapping techniques
3. To know about Protein structure analysis and molecular interactions
4. Analysis of proteins, quantification, sequencing, identification, protein predictive methods and proteomics in medicine

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	**3**	**3**	**2**	**-**	**-**	**2**	**2**	**-**				**1**	-	**2**	**3**
CO 2	**3**	**3**	**1**	**-**	**-**	**2**		**-**				**2**	1	-	3
CO 3	**3**	**2**	**2**	**1**	**2**	**-**		**-**				**1**	**1**	**2**	2
CO 4	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**				**1**	**1**	**2**	**2**

21UBT625E	BIOREACTOR DESIGN	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT-I	10 Hrs.

BASICS OF BIOREACTORS

Overview of bioreactions, Elements in bioreactor design, Rate expression in biological systems, Basic concept of material and energy balances, Development and significance of bioreactors, Bioreactor configurations, Classification of bioreactors, Bioreactors for solid-state fermentation, plant and animal cell cultures

UNIT–II	10 Hrs.

BIOREACTOR OPERATION

Common operations of bioreactor, Identification of common factors for smooth operation of bioreactors, Spectrum of basic bioreactor operations, Bioreactor operation for immobilized systems, plant and animal cell cultures

UNIT–III	10 Hrs.

BATCH, SEMICONTINUOUS AND CONTINUOUS BIOREACTORS DESIGN

Overview of bioreactor design, Batch and semi continuous bioreactors for submerged fermentation of microbes, Continuous flow stirred tank and plug flow tubular bioreactors for submerged fermentation of microbes, Recycle bioreactors, Multistage bioreactors, Bioreactors for enzyme reactions and immobilized systems

UNIT–IV	10 Hrs.

CASE STUDIES AND SCALE-UP

Design of packed bed, fluidized bed, airlift, hollow fibre, plant cell, mammalian cell bioreactors for various applications, Scale=up – Criteria, Similarity criteria, Methods, Generalized approaches.

Reference Books *

1. Levenspiel, O., Chemical Reaction Engineering, Wiley Eastern Ltd.
2. Atkinson, B., Biological Reactors, pion Ltd., London,1974.
3. Coulson, Richardson, Sinnott, An introduction to chemical engineering design, Pergamon
4. Alba S., Humphrey E and Milli N.R., “Bio Chemical Engineering” Academic Press, 1973.
5. Scragg. A.H “Bioreactors in Biotechnology”- A Practical approach
6. Tapobrata Panda. “Bioreactors: Analysis and Design”, Latest Edition, New Delhi: Tata McGraw Hill Education Private Limited. 2011
7. Moser, Anton. “Bioprocess Technology: Kinetics and Reactors”, Latest Edition, New York: Springer Verlag. 1988
8. Lydersen, D’ Elia, Nelson, Bioprocess engineering: Systems and equipment.

9. Rawlings, J. B. and Ekerdt, J. G. “Chemical Reactor Analysis and Design Fundamentals”, Latest Edition, San Francisco: Nob Hill Publisher. 2002

Course Outcomes**

After completion of the course student will be able to

5. State and Describe basic concepts of bioreactors
6. Apply the knowledge and Execute bioreactor operations for various applications
7. Design bioreactors for various biochemical applications
8. Apply the knowledge of scale up process to design bioreactors from Research to Industrial level

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	2	2	1							1	2		
CO 2	3	2	3	3	2							2	2		
CO 3	2	3	2	2	1							1	2		
CO 4	3	2	1	1	1							1	2		

21UBT632N	ENVIRONMENTAL TECHNOLOGY	Credits: 3
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours

Introduction:

Current Environmental Issues and scope of Environmental science and technology biogeochemical role of soil microorganisms, Bioconcrete, Environment Impact Assessment

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

Sustainable future: Green building concept, Carbon foot print, crediting, trading and its calculation, Water foot print Rain water harvesting .

UNIT–II	10 Hrs.

Waste water treatment:

Waste water characteristics BOD, COD, Primary & Secondary treatment, nanofiltration. ultrafiltration and microfiltration Microbial removal of phosphorous and Nitrogen Wastewater treatment of industries like sugar factories, food industries, beverages industries, and distilleries.

Solid waste management

Basic aspects, general composition of municipal solid wastes, aerobic treatment, anaerobic treatment biogas generation Solid waste management. Hazardous wastes, Biomedical Wastes E waste management, MoEF rules.

UNIT–III	10 Hrs.

Bioleaching & Biomining:

Microbes in Bioleaching- types, methods of bioleaching, Microbial recovery of 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–IV	10Hrs.

Biofuels:

Definition, Renewable and nonrenewable resources Advantages and disadvantages of biofuels
Biofuel feed stocks-sugar starch, cellulose, lipid Types of biofuel- first, second and third generation
Technologies for bio-fuel production-transesterification, gasification 2G technology, Biomethanation, Issues of biofuel production and its use. Microbial fuel cells.

Biodiversity: Value of biodiversity, threats to biodiversity approaches of biodiversity conservation.

REFERENCE BOOKS *

1. Pradipta Kum Mahopatra, 2006, Text Book of Environmental Biotechnology, I K Publishers.
2. R C Dubey and D K Maheshwari,2013 Text book of Microbiology,
3. M Y Young ,2004 ,Comprehensive Biotechnology Vol 1-4 (Eds). Pergamon Press

4. EJ Dasilva, C Ratledge & A Sasson, 2003, Biotechnology, Economic & Social Aspects Cambridge Univ Press.
5. Indu Shekhar Thakur,2012,Environmental Biotechnology Basic concepts and applications, Second Edition, I K international Publishing House, Pvt, Ltd.

COURSE OUTCOMES**

1. Able to analyse the current environmental issues, scope of environmental Technology and understand the various sustainable future concepts.
2. Able to analyse the methods used in treatment of waste water and solid waste.
3. Able to understand the concept of bioleaching process and biomining activity
4. Able to analyse the types and methods used in cleaning of the environment by bioremediation.
5. Able to define the sources of biofuels and produce various biofuels
6. Able to analyse the need of conservation of biodiversity

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2				2	1								1	1
CO2	2	3	1		1								2	2	2
CO3	3	2			1								2	3	2
CO4	2	2	1				1						2	3	1
CO5	2	1					3					2	2	2	2
CO6	2		1		2		1					2	2	3	2

21UBT633N	INDUSTRIAL SAFETY	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Industrial safety
Need for safety, importance of occupational health and safety, Health and safety programs, unsafe conditions, factors contributing to unsafe conditions, Good Lab Practices (GLP).
Accidents: Accident preventive measure, Measurement and control of safety performance, 5E'sfor accident prevention- Engineering, Education, Enthusiasm, Enforcement and Evaluation. Hierarchy of Controls, Safety policy.
Chemical Hazards- Types of hazards, Classification of chemicals based on their nature, routes to exposure of chemicals, Health effects of harmful chemicals in the work environment, Control of chemical hazards.

UNIT–II	10Hrs.

Electrical Hazards and Control measures
Electrical hazards, protection against voltage fluctuations, effects of shock on human body.Fire- Fire formation, Classification of fire, Methods of fire extinction, Fire extinguishing agents. Evacuation procedures for workers duringemergency conditions.
Physical Hazards and Control measures
Noise in Industry, Effect of noise on humans, Noise exposure regulation, Workers exposure to electromagnetic field, effects of radiations, Conflict resolution techniques, Classification of dangerous materials with pictorial symbols, Safety in transportation of dangerous materials by road, rail, ships andpipelines.

UNIT–III	10 Hrs.

Biological and Construction Hazards and their control measures
Biosafety levels for microorganism (BL1,BL2,BL3,BL4), Risk groups and their classification. Bioterrorism. HAACP system, Lab associated infections, Cartagena Protocol on Biosafety. Biohazard control program,
Construction Hazards
Hazards in construction and safety measures, site safety, scope of safety in construction, Good Manufacturing Practices (GMP).

UNIT–IV	10 Hrs.

Occupational Health and Toxicology
Classification of Occupational hazards, occupational related diseases- silicosis, asbestosis, pneumoconiosis. Industrial toxicology, local, systemic and chronic effects .Industrial Hygiene- principles of industrial hygiene, Various types of Company policies. Ergonomic hazards, work-related musculoskeletal disorders, physical workplace risk factors.

REFERENCE BOOKS

1. Bioethics and Biosafety by Sateesh M.K.,I.K.International pub,Kindle edition,2012
2. Biotechnology Expanding Horizon, B.D.Singh, 3rdrevised edition, Kalyani Publishers, 2015
3. Safety Management in Industry N.V Krishnan, 3rdrevised edition JAICO Publishing House
4. Fundamentals of Occupational Health and safety, Benjamin O Alli, 2nd edition, Geneva Publications, 2008
5. Bioethics and Biosafety in Biotechnology V.Krishna, New Age International,1st

edition,2007

6. Handbook of Human Factors and Ergonomic Hazards, M Neville Stanton Alan Hedge , 2nd edition, CRC Press, 2015

COURSE OUTCOMES

1. Apply the knowledge of the basic aspects of Industrial hazards (Accidents and Chemical Hazards) and safety in Industries.
2. Identify physical hazards electrical hazards and apply control measures in workplace.
3. Identify various types of biological hazards and apply control measures.
4. Acquire the knowledge of Occupational related diseases and Identify control measures and apply industrial toxicology and hygiene the same in work place.

21UBT604L	BIOKINETICS & ENZYME TECHNOLOGY LAB	Credits: 01
L: T: P - 0: 0:2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

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
11. Prediction of % error, standard deviation need to be calculated from expt. no 5 and 6)

12 Hrs.

REFERENCE BOOKS*

1. Pattabiraman 2017. Laboratory manual of Biochemistry, 4th Edition, International Book Publishers, India,.
2. Sadasivam and Manickam, 2017, Biochemical methods, 2nd Edition, New age International Publishers.

COURSE OUTCOMES**

After completion of the course student will have the ability

1. To to isolate enzymes and plot calibration curves for estimation the enzyme activity and specific activity.
2. To evaluate the optimum pH and temperature required for enzyme activity and analyze the effect of inhibitors for enzyme activity.
3. To apply knowledge of Km & Vmax for enzyme activity.
4. To immobilize enzymes and find the activity of enzymes.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
CO 1	1	2	3	2			3	3				3	2	3	1

CO 2	2	3	3	2			2	3				3	2	3	1
CO 3	2	3	3	3		3	2	2				2	2	1	2
CO 4	3	3	3	2		2	2	2				2	3	1	1

B. E. VII SEMESTER

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	PCC	UBT704C	Economics and Plant Design	3	3	0	0	50	50	100
2.	PCC	UBT715C	Downstream Processing Technology	3	2	2	0	50	50	100
3.	PEC	UBT7XXE	Elective-4	3	3	0	0	50	50	100
4.	PEC	UBT7XXE	Elective-5	3	3	0	0	50	50	100
5.	HSMS	UBT716H	Industrial Management and Entrepreneurship	3	3	0	0	50	50	100
6.	OEC	UBT733N	Industrial Safety (Open Elective)	3	3	0	0	50	50	100
7.	INT	UBT711I	Industrial Internship	2	0	0	4	50	50	100
8.	PCCL	UBT710L	Bioseparation Techniques Lab	1	0	0	2	50	50	100
Total				**21**	**18**	**0**	**06**	**400**	**400**	**800**

Elective-4 & Elective-5

UBT722E: Biopython
UBT723E: Industrial BT
UBT724E: Food Processing Technology
UBT725E: Protein Engineering and Drug Design
UBT731E: Nanobiotechnology & Biomaterials
UBT732E: Computational Biology
UBT733E: Bioconjugative Technology
UBT734E: Food Biotechnology

UBT704C	ECONOMICS & PLANT DESIGN	Credits: 3:
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week:03		SEE Marks: 50

UNIT-I	10 Hrs.

Process design development

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–II	12Hrs.

Capital investments

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–III	10 Hrs.

Cost analysis

Cost Analysis: Factors involved in project cost estimation, methods employed for the estimation of the capital investment. Estimation of working capital

Depreciation: different type of depreciation methods of and calculations, Conceptual numerical.

UNIT–IV	10 Hrs.

Profitability analysis

Methods for the evaluation of profitability. Return on original investment, interest rate of return, Cash flow diagrams. Break-even analysis. Conceptual numericals.

REFERENCE BOOKS*

- Peters and Timmerhaus (1989) Plant Design and Economics for Chemical Engineers, 4th edn.McGraw Hill.
- Rudd and Watson (1987) Strategy of Process Engineering, Wiley.
- Poornima M C (2006) Entrepreneurship Development and Small Business Enterprises”, Pearson education.
- Vasanth Desai (2007) Dynamics of Entrepreneurial Development & Management”,H imalaya Publishing House.
- Khanka SS (2004) Entrepreneurship Development, S Chand & Co.

Thomas W. Zimmer, Norman M. Scarborough.(2007), Essentials of Entrepreneurship and small Business Management

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.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	1	1			1	1	1		2		2		
CO 2	2	1	2	1			1	1	1		3		2		
CO 3	1	2	1	2			1	1	1		2		1		
CO 4	2	1	2	2			1	1	1		3		2		
CO 5	1	1	2	1			1	1	1		2		1		
CO 6	2	2	2	1			1	1	1		2		2		

UBT715C	DOWNSTREAM PROCESSING TECHNOLOGY	Credits: 3
L: T: P – 2-2-0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction 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–II	**12Hrs.**
Primary Recovery Operations 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–III	**10 Hrs.**
Chromatography 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–IV	**10 Hrs.**
Electrophoresis 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.	

REFERENCE BOOKS*

1. BioseparationsPrinciples and techniques, by B.Sivasankar, Kindle edition,PHI Publishers, 2010
2. Biophysical chemistry principles and Techniques by Upadhay and Nath,Himalaya Publishing House, 3rd edition, 2010
3. NPTEL Source material.
4. Bioseparations - Downstream processing for biotechnology by Belter P.A., Cussier E. and Wei Shan Hu., Wiley Interscience Pub, 1988
5. Separation Processes in Biotechnology by Asenjo J. and Dekker M, 1993.
6. Product Recovery in Bioprocess Technology – BIOTOL Series, VCH, 1990
7. Rate controlled separations by Wankat P.c., Elsevier, 1990
8. Fermentation & Enzyme Technology by D.I.C. Wang, Wiley Eastern 1979

COURSE OUTCOMES**

1. Identify the basic separation unit operation in DSP like membrane separation, enrichment operation, product recovery and various resolutions and fractionation techniques.
2. Interpret and analyze the industrial fermentation processes.
3. Apply the knowledge in identifying various pharma and R&D sections.
4. Analyse the details of experimentation pertaining to chromatography and electrophoresis.
5. Understand analyse and apply the techniques in various tests involved in finding out purity of biological components.
6. Apply the knowledge in identifying various biochemicals using advanced purifications like HPLC and to demonstrate DSP flowsheets.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1			2			3	2	2				1	2	1	1
CO 2			2			3	2	3				1	2	1	1
CO 3			1			3	2	2				1	2	1	1
CO 4			2			3	2	2				1	2	1	1
CO 5			1			3	3	3				1	2	1	1
CO 6			1			3	2	2				2	2	1	1

UBT716H	INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	12 Hrs.
Development of management thoughts and its functions 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–II	**10 Hrs.**
Quantitative techniques in managerial decisions 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–III	**10 Hrs.**
Production And Material Management 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–IV	**10 Hrs.**
Entrepreneurship& personnel management 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.	

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. C.B.Mamoria and S.V.Gankar- Personnel Management, Himalaya Pub, 21 st edn,2010
4. Veerabhadra Havinal -Management and Entrepreneurship- New Age International, 2009
5. Ramesh Burbure – Management &Entrepreneurship- Rohan Pub. 2008
6. Poornima M. Charanthimath – Entrepreneurship Development, Pearson Education-2005

COURSE OUTCOMES**

After completion of the course student will be able to

1. Recall and recollect the history theories and definition of management and its importance in society
2. Analyze and apply the basic concepts of Quantitative techniques of management
3. Know the difference between production and productivity, measurement and cost analysis
4. Explore the knowledge of production costs, planning and material management
5. Make basic economic analysis of project
6. Understand the role and importance of entrepreneurship in economic development

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	-	-	-	-	-	1	-	-	-	3	1	-	-	2
CO2	-	1	-	-	-	-	-	-	-	-	3	1	-	-	2
CO3	-	1	-	-	-	-	-	-	-	-	3	1	-	-	2
CO4	-	1	-	-	-	-	-	-	-	-	3	1	-	-	2
CO5	-	1	-	-	-	-	-	-	-	-	3	1	-	-	2
CO6	-	1	-	-	-	-	-	-	2	-	3	1	-	-	2

UBT710L	BIOSEPARATION TECHNIQUES LAB	Credits: 1
L: T: P – 0-0-2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

LIST OF EXPERIMENTS

1. Cell disruption techniques.
2. Solid-liquid separation methods: Filtration (Cross flow)
3. Solid-liquid separation methods: Sedimentation.
4. Solid-liquid separation methods: Centrifugation.
5. Membrane dialysis
6. Product enrichment operations: Precipitation – (NH4)2 SO4 fractionation of a protein.
7. Product enrichment operations: Two – phase aqueous extraction.
8. Product drying techniques.
9. Estimation of Amino acids / Carbohydrates by TLC.
10. Separation of ethanol from fermented broth.
11. Separation of Citric acid from fermented broth.
12. Separation of proteins by molecular sieving.
13. Analysis of biomolecules by HPLC / GC (using standard spectra).

REFERENCE BOOKS**

1. Protein Purification by Scopes R.K., IRL Press,1993.
2. Rate controlled separations by Wankat P.C., Elsevier, 1990
3. Bioseparations by Belter P.A. and Cussier E., Wiley, 1985.
4. Bio-separations Science & Engineering By Roger G Harrison, Paul Todd, Scott R Rudge, Demetri.
5. Product Recovery in Bioprocess Technology - BIOTOL Series, VCH, 1990
6. Separation processes in Biotechnology by Asenjo J. and Dekker M. 1993

COURSE OUTCOMES**

1. Able to prepare/reproduce the protocols for the experiments.
2. Able to extract the intracellular product using different cell disruption techniques.
3. Able to concentrate, purify the desired product using different chromatography/ filtration techniques.
4. Able to analyze the product both quantitative/qualitatively.
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.

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3												3		1
CO 2		2												3	1
CO 3			3										2	2	1
CO 4				3	3								2	2	1
CO 5		3										2	2	3	1
CO 6		3										2	3	2	1

UBT722E	Biopython	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	16 Hrs.
Introduction and brief history of Biopython, Biopython modules, Tools and GNU/Linux, Nucleic Acid Bioinformatics, Sequences, Strings, and the Genetic Code, Sequences File Formats, Introduction to Biological Sequence Database, Sequence Motifs, Introduction to Motifs, String Matching, Consensus Sequences, Motif Finding, Promoters, De novo Motif Finding.	
UNIT–II	**12 Hrs.**
Sequence Alignments, Alignment Algorithms and Dynamic Programming, Alignment Software, Alignment Statistics, Short Read Mapping Multiple Sequence Alignments, Molecular Evolution, and Phylogenetics, Multiple Sequence Alignment, Phylogenetic Trees, Models of mutations, Practices Lab 4: Using BLAST on the command line, Lab 5: Phylogenetics	
UNIT–III	**12 Hrs.**
Genomics, The Three Fundamental "Gotchas" of Genomics, Genomic Data and File Formats, Genome Browsers, Transcriptomics, High-throughout Sequencing (HTS), RNA Deep Sequencing, Small RNA sequencing, Long RNA sequencing, Single-Cell Transcriptomics, Transcription Initiation, Transcription, Elongation, RNA Seq, Noncoding RNAs, Small Noncoding RNAs (srcRNAs), Long Noncoding RNAs, RNA Structure Prediction, Destabilizing energies. Practices: Lab 6: Genome Annotation Data, Lab 7: RNA-seq, Lab 8: RNA Structure, Lab 9: Proteins.	
UNIT–IV	**12 Hrs.**
Protein Alignment, Functional Annotation of Proteins, Secondary Structure prediction, Gene Ontology, Gene Regulation, Transcription Factors and ChIP-seq, MicroRNA regulation and Small RNA-seq, Regulatory Networks. Practices: Lab 8: RNA Structure, Lab 9: Proteins, Lab 10: ChIP-seq	

Reference Books *

Reference Books:

3) Prof. David A. Hendrix
4) Deep Learning with Python, Francois Chollet

Reference Books/Protocols: Tutorials Point (Simply easy learning).

Course Outcomes**
After completion of the course student will be able to 1,Obtain knowledge on the biopython-GNU/Linux, modules, tools, commands and Motifs. 2.Acquire the skills of Sequence Alignments using the Softwares, Statistics, Short Read Mapping, Multiple Sequence Alignments, Molecular Evolution, 3.Understand and Analyze the Phylogenetics, Phylogenetic Trees, and Models of mutations. 4.Utilize the biopython in analysis of the Genomic and transcriptomics data. 5. Conduct the Protein Alignment, Functional Annotation, Secondary Structure prediction, Gene Ontology, Gene Regulation.

UBT724E	FOOD PROCESSING TECHNOLOGY	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction 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–II	**12Hrs.**
Detection of Microorganisms 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–III	**10 Hrs.**
Food Spoilage & Preservation 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–IV	**10 Hrs.**
Food Engineering 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.	

REFERENCE BOOKS*

1. Food Science & Nutrition, by Sunetra Roady, Oxford University Press,2007.
2. Food microbiology by William Frazier and Westhoff D.C, 4^{th}Edn,TATA McGraw Hill Pub(2005)

3. Modern Food Micro-Biology by James M.Jay, CBS Publishers.2005.
4. Food Microbiology by K.Vijay RameshMJP Publishers, 2007.
5. Plant biotechnology In Agriculture by K. Lindsey and M.G.K. Jones, Prentice Hall, USA. 1990.
6. Food Science By Potter N.N. and Joseph Hotchkiss, 5thEdn, CBSPub,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

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1			2			3	2	2				1	2	1	
CO 2			2			3	2	3				1	2	1	
CO 3			1			3	2	2				1	2	1	
CO 4			2			3	2	2				1	2	1	
CO 5			1			3	3	3				1	2	1	
CO 6			1			3	2	2				2	2	1	

UBT725E	PROTEIN ENGINEERING AND DRUG DESIGN	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours

Structure of proteins
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–II	10 Hrs.

Molecular modeling
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–III	10 Hrs.

Insilico drug design
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–IV	10 Hrs.

Docking methods
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.

REFERENCE BOOKS *

6. Bioinformatics Methods & Applications: Genomics, Proteomics & Drug Discovery, S C Rastogi, Mendiratta & P Rastogi, PHI,4th Edition, 2013
7. Moody P.C.E. and A.J. Wilkinson Protein Engineering, IRL Press, Oxford, 3rd Edition,2010.
8. Creighton T.E. Proteins, Freeman W.H. Second Edn,1993.
9. Branden C. and Tooze R. Introduction of protein structure, Garland,1993.
10. The molecular modeling perspective in drug design by N Claude Cohen, 2008, Academic Press.

COURSE OUTCOMES**

5. Ability to study protein structure prediction and protein engineering and design
6. Able to understand molecular modeling
7. Able to know computer assisted new lead design
8. Able to study docking methods and computer - assisted drug discovery

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**1**	**-**	**2**	**-**	**1**	**1**	**2**	**2**	**-**	**-**	**-**	**1**	**2**	**1**	**1**
CO2	**1**	**-**	**2**	**-**	**-**	**2**	**2**	**3**	**-**	**-**	**-**	**1**	**2**	**1**	**2**
CO3	**-**	**-**	**1**	**1**	**2**	**-**	**2**	**2**	**-**	**-**	**-**	**1**	**2**	**1**	**-**
CO4	**2**	**-**	**2**	**-**	**-**	**1**	**2**	**2**	**-**	**-**	**-**	**1**	**2**	**1**	**-**

UBT731E	NANOBIOTECHNOLOGY AND BIOMATERIALS	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to nanotechnology: **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–II	**10 Hrs.**
Biopolymers: 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–III	**10 Hrs.**
Synthetic polymers: 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–IV	**10 Hrs.**
Biocompatibility: 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.	

REFERENCE BOOKS *

1. B.Vishwanath (2011). “ Nano Materials” Published by Narosa Publishing House Pvt. Ltd., New Delh.
2. Mark Ratner and Daniel Ratner (2003). “Nanotechnology:A Gentle Introduction to Next Gig Idea” Pearson Ecducation Ltd.
3. K Eric Drexler (1993). “Unbounding the future” Quill.
4. Stephen Lee and Lynn M Savage (2010). “Biological molecules in Nanotechnology”.

COURSE OUTCOMES**

After completion of the course student will have the

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.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	3	-	-	1	2	-	-	-	-	-	2	2	1
CO2	1	2	3	-	-	1	-	-	-	-	-	-	3	-	-
CO3	2	2	3	-	-	2	-	-	-	-	-	-	2	2	1
CO4	3	3	3	-	-	2	-	-	-	-	-	-	2	1	1
CO5	3	3	3	-	-	1	-	-	-	-	-	1	2	-	-
CO6	2	3	3	-		3	3	-	-	-		-	3	1	-

UBT732E	COMPUTATIONAL BIOLOGY	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – 1	12 Hrs
Nature and scope of Computational Biology: Basic algorithms in Computational Biology, Biological and Computer algorithm, Fibonacci problem, Dynamic Programming, Time and space complexity of algorithms, Laplace's Rule. Search Algorithms: Random walk, Hill climbing, simulated annealing. Combinatorial Pattern Matching: Hash Tables, Repeat Finding, Exact Pattern Matching; Genetic Algorithm: Basic Concepts, Reproduction, Cross over, Mutation, Fitness Value, Optimization using GAs; Applications of GA in bioinformatics.	
UNIT – 2	**8 Hrs**
Combinatorial Pattern Matching: Hash Tables, Repeat Finding, Exact Pattern Matching; Genetic Algorithm: Basic Concepts, Reproduction, Cross over, Mutation, Fitness Value, Optimization using GAs; Applications of GA in bioinformatics.	
UNIT – 3	**10 Hrs**
Hidden Markov Model: Markov processes and Markov Models, Hidden Markov Models. Forward and Backward Algorithms, Most probable state path: Viterbi algorithm, Parameter Estimation for HMMs:-Baum-Welch Algorithm, Applications of profile HMMs for multiple alignment of proteins and for finding genes in the DNA.	
UNIT – 4	**10 Hrs**
Insilico Drug Design and Biopython applications in Computational Biology Insilico Drug Design: Basic Concepts, importance and application, Molecular force fields and energy minimization, Molecular Dynamics Simulation methods, Methods of Insilico Drug Design: structure and ligand based drug design approach, structure based drug design: Molecular docking. Biopython: Introduction, important features and application of biopython in computational biology, Create a simple sequence in Biopython for DNA, RNA and Protein Alphabets, Sequence Alignment Tools in Biopython, PDB Module of Biopython,	
REFERENCE BOOKS	

- Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith,1999,Pearson Education.
- Arthur M.Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
- Higgins and W.Taylor (Eds), Bioinformatics-Sequence, Structure and databanks, Oxford University Press, New Delhi, 2000
- An introduction to bioinformatics algorithms by Neil C. Jones, Pavel Pevzner. MIT Press.2004 2.
- Biological sequence analysis: Probabilistic models of proteins and nucleic acids by Richard Durbin, Eddy, Anders Krogh, 1998

Algorithms for Molecular Biology by Ron Shamir Lecture, Fall Semester, 20014.

7. Bioinformatics- a practical guide to the analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., 1998, John Wiley & Sons, UK.
8. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith, 1999,Pearson Education.
9. Arthur M.Lesk, Introduction to Bioinformatics, Oxford University Press, New Delhi, 2003.
10. D.Higgins and W.Taylor (Eds), Bioinformatics-Sequence, Structure and databanks, Oxford University Press, New Delhi, 2000.
11. Bioinformatics: the machine learning approach by Pierre Baldi, Søren Brunak. MIT Press.2001 2.
12. Bioinformatics: Sequence and Genome Analysis: by David Mount, University of Arizona,Tucson

COURSE OUTCOMES

After completion of the course student will be able to

5) Understand the nature, scope of computational biology and biological and computer algorithms.
6) Know about the Combinatorial Pattern Matching, Genetic algorithms and their applications.
7) Analyze various Markov processes and Markov Models.
8) **Learn about the Insilico Drug Design and Biopython applications in Computational Biology**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	3	3									2	2	1	
CO 2	2	3	3									2	2	1	
CO 3	3	3	3									1	2	1	
CO 4	3	3	3									1	2	1	

UBT733E	BIOCONJUGATIVE TECHNOLOGY	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours:40		SEE Marks: 50

UNIT-I	10 Hours
Bioconjugative technology Modification of Amino Acids, Peptides and Proteins – Modification of sugars, polysaccharides and glycoconjugates – modification of nucleic acids and oligonucleotides.	
UNIT–II	**10 Hrs.**
Chemistry of active groups 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–III	**10 Hrs.**
Enzyme and nucleic acid modification and conjugation 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–IV	**10 Hrs.**
Bioconjugate applications 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.	

REFERENCE BOOKS *

1. Bioconjugate Techniques, G.T. Hermanson, Academic Press, 2 nd edition 2008
2. Bioconjugate techniques , Greg T Hermanson, academic Press ,Global store , 2016
3. A Text book of biophysics by Dr R.N. Roy,UBS publishers, 2001
4. Bioconjugative Chemistry by Vincent M Rotello, American Chemical society, 2016
5. Bioconjugate techniques , Greg T Hermanson, academic Press ,Global store , 2017

COURSE OUTCOMES**

1. Able to understand modification of nucleic acids and oligonucleotides.
2. Ability to know the chemistry of active groups.
3. To analyse the bioconjugate reactants.
4. To analyze bioconjugate applications .
5. Ability to know the conjugate derivatives.
6. Ability tostudy the conjugation process.

Course Outcomes	Programme Outcomes (POs)	Program Specific Outcomes (PSOs)

	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	-	2	-	1	1	2	1	-	-	-	1	2	1	1
CO2	1	-	2	-	-	2	2	-	-	-	-	1	2	1	2
CO3	-	-	1	1	2	-	2	-	-	-	-	1	2	1	-
CO4	2	-	2	-	-	1	2	1	-	-	-	1	2	1	-
CO5	-	-	1	2	2	-	3	1	-	-	-	1	2	1	1
CO6	1	-	1	-	-	2	2	2	-	-	-	2	2	1	-

UBT734E	FOOD BIOTECHNOLOGY	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours

Introduction

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–II	10 Hrs.

Microbial biotechnology of food

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–III	10 Hrs.

Plant food applications

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–IV	10 Hrs.

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.

REFERENCE BOOKS *

5. Kalidas s, Gopinadhan P, Anthony P and Robert E.Levin- " Food Biotechnology"- second edition, CRC press, 2006
6. Gustavo F.G and Gustavo V.B,-" Food Science and Food Biotechnology"- CRC press, 2003
7. Mahesh S.-" Plant Molecular Biotechnology"- first edition, New age international publishers, , 2008
8. Norman N.Potter and Joseph H. Hotchkiss- Food Science- fifth edition- CBS publishers and distributors, 2007

COURSE OUTCOMES**

7. Students will be able to know the importance and current status of food biotechnology
8. Students will acquire the knowledge on novel food bioprocessing, nutrigenomics in brief.
9. Explore the applications of microbes in food biotechnology, new sources of food from microbes etc
10. Will be able to learn about plant food biotechnology and transplastomic technology
11. Will get the knowledge on applications of Animal food biotechnology and food safety and its regulation
12. Able to have an overview recent trends in GMOs and food biotechnology

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1	2	-	2	1	-	-	-	-	-	1	2	1	1
CO2	2	-	2	-	3	2	-	-	-	-	-	1	2	1	1
CO3	1	1	1	-	2	2	-	-	-	-	-	1	2	1	2
CO4	2	-	2	-	2	1	-	-	-	-	-	1	2	1	1
CO5	2	1	1	-	3	1	-	-	-	-	-	1	2	1	2
CO6	1	-	1	-	2	2	-	-	-	-	-	2	2	1	1

UBT733N	INDUSTRIAL SAFETY	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	12 Hrs.
Industrial safety Need for safety, importance of occupational health and safety, Health and safety programs, unsafe conditions, factors contributing to unsafe conditions, Good Lab Practices (GLP). Accidents: Accident preventive measure, Measurement and control of safety performance, 5E's for accident prevention- Engineering, Education, Enthusiasm, Enforcement and Evaluation. Hierarchy of Controls, Safety policy. Chemical Hazards: Types of hazards, Classification of chemicals based on their nature, routes to exposure of chemicals, Health effects of harmful chemicals in the work environment, Control of chemical hazards.	
UNIT–II	10 Hrs.
Electrical Hazards and Control measures Electrical hazards, protection against voltage fluctuations, effects of shock on human body. Fire- Fire formation, Fire extinguishing agents. Evacuation procedures for workers during emergency conditions. Physical Hazards and Control measures: Noise, noise exposure regulation, properties of sound, Workers exposure to electromagnetic field, Ionizing radiation and non-ionizing radiations, effects of radiations, Classification of dangerous materials with pictorial symbols, Safety in transportation of dangerous materials by road, rail, ships and pipelines.	
UNIT–III	10 Hrs.
Biological and Construction Hazards and their control measures Classification of Bio hazardous agents –bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases –Hazardous material used in labs, Instructions followed for hazardous waste disposal, Biohazard control program, Biological safety cabinets. Construction Hazards: Hazards in construction and safety measures, Good Manufacturing Practices (GMP).	
UNIT–IV	10 Hrs.
Occupational Health and Toxicology Classification of Occupational hazards, occupational related diseases- silicosis, asbestosis, pneumoconiosis, etc. lead, nickel, chromium and manganese toxicity, effects and prevention Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects. Industrial Hygiene. Various types of Company policies.	

REFERENCE BOOKS *
1. Mark Friend and James Kohn, (2007), Fundamentals of Occupational Safety and Health The Scarecrow Press, Inc. 2. Phil Hughes and Ed Ferret, (2011), Introduction to Health and Safety at work, (5th edition), Elsevier Ltd.
COURSE OUTCOMES**
After completion of the course student will be able to 1. Analyze the effects of hazards in workplace and select appropriate measures of safety for preventing industrial accidents and chemical hazards. 2. Identify physical and electrical hazards and apply control measures in work place for the prevention of fires and explosions. 3. Identify various types of biological hazards and understand the methods of hazard identification and preventive measures. 4. Assess the risks in the occupation, identify control measures and apply hygiene in the work place.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	1	2	-	1	3	-	-	-	-	-	1	1	1	1
CO2	-	1	2	-	1	3	-	-	-	-	-	1	1	1	1
CO3	-	1	2	-	1	3	-	-	-	-	-	1	1	1	1
CO4	-	1	2	-	1	3	-	-	-	-	-	1	1	1	1

B. E. VIII SEMESTER

Sl. No	Category	Subject Code	Subject Title	Credits	Hours/ Week			Examination Marks		
					L	T	P	CIE	SEE	TOTAL
1.	PEC	UBT82XE	Elective-6	03	3	0	0	50	50	100
2.	PEC	UBT83XE	Elective-7	03	3	0	0	50	50	100
3.	PP	UBT805P	Project	15	0	0	30	50	50	100
Total				**21**	**6**	**0**	**30**	**150**	**150**	**300**

Elective-6
UBT823E: Biosimulations
UBT824E: Metabolic engineering
UBT825E: Bionanalytical techniques
UBT827E: Pharmaceutical BT

Elective-7
UBT830E: Clinical research
UBT832E: Health diagnostics
UBT833E: Validation & quality control
UBT834E: Product development
UBT835E: Validation & quality assurance

UBT823E	BIOSIMULATIONS	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	08 Hours
Modelling Principles: Basic modeling principles, uses of mathematical modeling classification of modeling techniques Fundamental laws, energy equations, continuity equation, equations of motion, transport equations, equations of state, equilibrium states and chemical kinetics-examples.	
UNIT–II	**08 Hrs.**
Mathematical Models for Biochemical Engineering Systems: Mathematical models for Biochemical engineering systems, Mathematical models in batch and continuous process, continuous flow tanks, reversible reaction.	
UNIT–III	**16 Hrs.**
Simulation Softwares in Bioprocess: Introduction to SuperPro Designer for Material balance, Software for mass and energy balance; Energy Balance with and without reaction. **Metabolic Flux** Balance Analysis: Introduction, Principle of steady state metabolic flux balance analysis, COPASI, COBRA.	
UNIT–IV	**08Hrs.**
Matlab and Simulink: MATLAB for data analysis Basics, Data analysis, curve fittings, Numerical integration, Euler and fourth order RungeKutta method, Simulation of gravity flow tank, SIMULINK for dynamic systems.	

REFERENCE BOOKS *

1. Luben W.L. “Process Modelling Simulation and Control for Chemical Engineers”, McGrawHill, International New York, 1990.
2. Franks RGE. “Mathematical Modeling in Chemical Engineering”, John Wiley and Sons, Inc., New York, 2004.
3. Biquette W.B. “Process Dynamics- Modeling analysis with simulation”, Prentice Hall; 1 edition January 15, 1998.
4. William J. Palm. “Introduction to Matlab 7 for Engineers”, III, McGraw Hill 2005.
5. Kenneth J. Beers. “Numerical Methods for Chemical Engineering Applications in MATLAB”, Massachusetts Institute of Technology, Cambridge University press 2007 edition.
6. http://www.mathworks.com

COURSE OUTCOMES**

Course Outcomes: After the completion of this course, students will be

1) Analyse the biological and bioprocess data and make suitable interpretation of them.

2) Handle mathematical models
3) Understand simulation software’s for bioprocess development.
4) Analyze using Matlab and Simulink

UBT824E	METABOLIC ENGINEERING	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours
Introduction 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, Anaplerotic Pathways, 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–II	**10 Hrs.**
Metabolic flux 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–III	**10 Hrs.**
Regulation of metabolic pathways 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–IV	**10 Hrs.**
Metabolic engineering in practice 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).	
REFERENCE BOOKS *	

1. P.F. Stanbury and A. Whitkar. 2008,Principle of Fermentation Technology pergaman press,
2. Wang D I C Cooney C I Demain, A L ,2008, “Fermentation and enzyme Technology” John Willey,
3. Roberts, 2007 “Metabolism of Agrochemicals in Plants” Willey Int,.
4. David L. Nelson and Michael Cox, 2016, “Lehninger Principles of Biochemistry” –6th Edition
5. Lubert Stryer, 2010 “Biochemistry” -Freeman & Co., Pub.

COURSE OUTCOMES**

1. Recall the concepts of cellular metabolism.
2. Explain the Basic concepts of metabolic engineering.
3. Explain Fundamentals of Metabolic flux analysis.
4. Apply the knowledge of metabolic flux analysis.
5. Apply the knowledge of regulatory mechanism for altering the metabolic pathways.
6. Design the metabolic pathways for desired product.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2	2			2							1	1	1
CO2	2	2	2		2	3							2	1	2
CO3	3	3	2		2	2						1	1	1	2
CO4	3	3	3		2	3						1	2	1	3
CO5	2	1		2		2		2					1	3	1
CO6	1	2	3	2		3		1					1	3	1

UBT825E	BIOANALYTICAL TECHNIQUES	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – 1	10 Hrs.

Centrifugation

Introduction: Basic, Types of centrifuges: Desktop, High Speed and Ultracentrifuge (Preparatory and Analytical), Design and their working principle, Types of Rotors, Wall-effect

Spectroscopy :

(i) Absorption Spectroscopy

Simple theory of absorption of light by molecules, Chromophore and terminologies associated with absorption of molecules

The Beer-Lambert Law and its deviations

Single and double beam spectrophotometers for measuring Visible and Ultraviolet light: Instrumentation and Parameters measured in absorption Spectroscopy **(UV-Vis spectrophotometer)**

Empirical rule for the absorption spectra of biological macromolecules

Chemical Analysis by absorption spectroscopy using Visible and Ultraviolet light

(ii) Fluorescence Spectroscopy

Simple theory of Fluorescence

Instrumentation and Technology of Fluorescence Spectroscopy **(Fluorescence spectrometer)**

Intrinsic Fluorescence measurements for information about the conformation and binding sites of proteins

Extrinsic fluorescence measurements for information about the conformation and binding sites of proteins

UNIT – 2	10 Hrs.

(iii) Infrared Spectroscopy

Infrared Spectroscopy: Basic Principle Instrumentation and Technology of Infrared Spectroscopy (Fourier-transform infrared spectroscopy (FTIR))

Information in Infrared Spectra and Applications of Infrared spectroscopy

(iv) Optical Rotatory Dispersion (ORD) & Circular Dichroism (CD)

Theory of Optical Rotatory Dispersion (ORD) & Circular Dichroism (CD)

Relative values of ORD and CD measurements, Advantages of CD over ORD

Instrumentation for measuring ORD and CD, Applications of ORD and CD

(v) Nuclear Magnetic Resonance (NMR) Spectroscopy

Nuclear Magnetic Resonance (NMR) Spectroscopy : Principle Basic Instrumentation of NMR Spectrometer

Applications of NMR Spectroscopy

(vi) Mass spectrometry

Mass spectrometry: Basic Principle Instrumentation and main components of mass spectrometers Ionization source, Mass analyzers, and Detectors **(LC-MS and GC-MS)**

Applications of Mass Spectrometry

UNIT – 3	10 Hrs.

Chromatography
Adsorption Chromatography: Simple Theory & Types
Operations of columns : Terminologies and concept
Elution : Types of elution methods
Supports : Concept of mesh size and mesh screen
Gas Chromatography: Principle, Basic set up of Gas chromatography system, Detectors and Uses of Gas chromatography
Gel Chromatography (molecular-sieve chromatography): Simple Theory, Materials (dextran, agarose and polyacrylamide gels), Advantages of gel chromatography, Estimation of molecular
weight and applications of gel chromatography
Ion-Exchange Chromatography: Principle, Properties of Ion Exchangers, Choice of Ion Exchangers, Technique and application of Ion Exchange chromatography.
High-Performance of Liquid Chromatography (HPLC): Principle, Application of pressure in HPLC, Advantages and uses of HPLC.
Affinity Chromatography: Principle, Methods of Ligand immobilization (Cyanogen-bromide-activated agarose, Aminoethyl- and hydrazide-activated polyacrylamide), uses of affinity chromatography

UNIT – 4	10 Hrs.

Electrophoresis
Iso-electric focusing (IEF): Principle, Technique and application, 2-D PAGE: Steps involved in 2-D PAGE, application in proteomics
Pulse-field gel electrophoresis: Principle, Technique and Application
Capillary electrophoresis: Principle, Technique and Application
X-ray crystallography
Interaction of X-ray with matter: Absorption, Scattering and diffraction (Bragg' s Law)
Preparation of crystals : Hanging and sitting drop vapor diffusion methods
X-ray diffraction methods
Application of X-ray Diffraction in Crystal structure

REFERENCES

1. Fundamentals of Bioanalytical Techniques And Instrumentation, Ghosal, Sabari, Avasthi, Anupama Sharma, Second Edition, Phi Learning Pvt. Ltd., 2018.
2. Bioanalytical Techniques, Abhilasha Shourie, Shilpa S. Chapadgaonkar, The Energy and Resources Institute, 2015
3. Biomolecular and Bioanalytical Techniques: Theory, Methodology and Applications, Vasudevan Ramesh, John Wiley & Sons Ltd, 2019
4. Handbook of Analytical Techniques, Helmut Günzler, Alex Williams, WILEY, 2001
5. Analytical Techniques in Biotechnology, Suzy Hill, Syrawood Publishing House, 2016
6. Analytical Techniques In Biotechnology, Goutam Bhowmik, Tata McGraw Hill Education Private Limited, 2010
7. Instrumental Methods of Chemical Analysis, G. R. Chatwal and A. K. Sham, 5th edition Himalaya Publishing House, 2005.
8. Instrumental Analysis, D. A. Skoog, F. J. Holler, S. R. Crouch, 11th edition, Brooks/Cole, a part of Cengage Learning, 2012.

COURSE OUTCOMES

After completion of the course student will be able to

9. Understand the basic concepts and principles of the major analytical techniques including instrumentation, sample preparation and standardization.
10. Evaluate the proper application of various analytical techniques for problem solving in biological sciences.
11. Demonstrate the ability to plan and execute experiments, and analyze and interpret the outcomes.
12. Design an analytical regimen to obtain data relevant to their research problem

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	3	3	3									2	2	1	
CO 2	2	3	3									2	2	1	
CO 3	3	3	3									1	2	1	
CO 4	3	3	3									1	2	1	

UBT827E	PHARMACEUTICAL BT	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

Introduction:
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–II	10 Hrs.

Toxicology:
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–III	10 Hrs.

Stem cells in health care:
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–IV	10 Hrs.

Analysis of biologicals & pharmaceuticals:
Vitamins Cold remedies Laxatives Analgesics, NSAIO, 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.

REFERENCE BOOKS *

4. Gary Walsh, (2013),Biopharmaceuticals Biochemistry and Biotechnology (2^{nd} Edition), Wiley Publishers.
5. Bartram Katzung, (2009),Basic & Clinical Pharmacology(9th Edition), McGrawHill.
6. Leon Lachman, Herbert. Lieberman & Joseph Kanig, Vergese, (1987) The Theory & Practice of Industrial Pharmacy, (3^{rd} Edition) Publishing House Bombay.

COURSE OUTCOMES**

After completion of the course student will be able to

1. Apply and classify various biological sources of pharmaceutical products to retrieve the basic concept of pharmacology, drug metabolism .and their importance in biotechnology
2. Select and apply the toxicological studies of pharmaceutical products
3. Use knowledge of the techniques used in the manufacture of pharmaceutical products and apply in the field of Biopharmaceuticals.
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. Select and apply appropriate techniques advanced techniques in drug delivery system.
6. Demonstrate an ability to apply principles various other applications to protect the global community from various dreadful diseases.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	-	2	2	2	3	3	1	-	-	-	-	-	3	2	1
CO2	-	3	3	3	3	2	3	-	-	-	-	-	2	2	1
CO3	-	2	3	2	3	1	-	-	-	-	-	-	3	2	-
CO4	-	2	3	2	3	1	-	-	-	-	-	-	2	2	-
CO5	-	3	3	2	3	1	-	-	-	-	-	-	2	3	-
CO6	-	3	3	3	3	2	2	-	-	-	-	-	2	2	3

UBT830E	CLINICAL RESEARCH	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours
Introduction 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–II	**10 Hrs.**
Therapeutics 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–III	**10 Hrs.**
Healthcare marketplace 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–IV	**10 Hrs.**
Clinical research 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.	

REFERENCE BOOKS *
1. Gary Walsh., Biochemistry and Biotechnology, 2002, John Wiley & Sons Ltd. 2. Gallin and . J. I. Ognibene F. P, 2007 Principles and Practice of Clinical Research by, 2nd Edition, Elsevier Publication. , 3. William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A. Lichtman,2005, Hematology, 4. John Wiley & Sons Ltd by Arunabha Ray & Kavitha Gulati, 2007,Current Trends in Pharmacology IK Intl.
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

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	3	-	2	-	2	1	-	-	-	2	2	2	1
CO2	1	2	3	-	1	-	2	1	-	-	-	3	3	1	1
CO3	1	2	3	-	2	-	2		-	-	-	3	2	2	1
CO4	1	3	3	-	1	-	1	1	-	-	-	2	2	1	1
CO5	1	3	3	-	-	-	-	-	-	-	-	1	2	3	
CO6	1	3	3	-	1	-	2	-	-	-	-	3	3	3	3

UBT832E	HEALTH DIAGNOSTICS	Credits: 03
L:T:P – 3:0:0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hours
INTRODUCTION: 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–II	**10 Hrs.**
Biochemical diagnostics 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–III	**10 Hrs.**
Immunodiagnostics 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–IV	**10 Hrs.**
Imaging diagnostics 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.	

REFERENCE BOOKS *
1. Lisa Anne Shimeld.,2000 Essentials of Diagnostic Microbiology 2. Balley & Scott’s. 1998 Diagnostic Microbiology, 2ND edition, 3. Burtis & Ashwood,.Tietz ,2005,Text book of Clinical Biochemistry.
COURSE OUTCOMES**
1. Ability to study Biochemical disorders, chromosomal disorders. 2. Able to study DNA based diagnostics. 3. Analyse Biochemical diagnostics. 4. Understand cell based diagnostics. 5. Analyse Immunodiagnostics 6. Understand imaging diagnostics

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	-		2	-	-	-	-	-	-	1	1	1
CO2	2	2	2	-	2	3	-	-	-	-	-	-	2	1	2
CO3	3	3	2	-	2	2	-	-	-	-	-	1	1	1	2
CO4	3	3	3	-	2	3	-	-	-	-	-	1	2	1	3
CO5	1	3	3	-	-	-	-	-	-	-	-	1	2	3	
CO6	1	3	3	-	1	-	2	-	-	-	-	3	3	3	3

UBT833E	VALIDATION & QUALITY CONTROL	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction 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–II	**10Hrs.**
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–III	**10 Hrs.**
Implementation 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–IV	**10 Hrs.**
Quality 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.

REFERENCE 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, 723 pp.,
3. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed., 1998.
4. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance
5. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. . Cloud,Interpharm Press, 1998.
6. 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. Ability to retrieve the regulations , fundamentals of validations and its procedures
4. Capable of understanding the ISO standards and environmental management systems
5. An ability to analyse the analytical methods of validation, issues and automated system and standards
6. Ability to interpret guidelines and discuss the case studies
7. Ability to discuss the quality control measures used in industries
8. Ability to analyse the Quality Management System

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	2					2	3	1						1	3
CO 2	2			2		3	3	3					2	2	3
CO 3	3					3	2	2				3	2	3	2
CO 4	2					3	1	3				3	2	3	3
CO 5	2					2	3	3				2	2	2	3
CO 6	2			2		2	1	2				2	2	3	2
CO 7	2			1		3	1	2				1	2	3	2
CO8	2			2		3	1	2				3	3	2	2

UBT834E	PRODUCT DEVELOPMENT	Credits: 3
L: T: P – 3-0-0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	12 Hrs.
Essentials of product development The product development process, privacy policies and *K*nowledge 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	**12Hrs.**
Interpersonal Skills 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	**10 Hrs.**
Reporting and formulations 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	**10 Hrs.**
Safety and Security at workplace 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.	
REFERENCE BOOKS*	
1. Endrenyi, L., Declerck, D. and Chow, S. (2017). Biosimilar Drug Product Development. Boca Raton: CRC Press. 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. 2. Ability to understand the various techniques in Pharma industries. 3. Demonstrate the different interpersonal skills. 4. Demonstrate the methodologies and applications of Project development and management.	

5. Ability to comprehend various techniques involved in Reporting.
6. Describe the different formulations of various energy drinks
7. Analyse and list the various health hazards in industry.
8. Ability to understand importance of safety and implement in various Industries.

Course Outcomes	**Programme Outcomes**												**Programme Specific Outcomes**		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1		2	2	3	1			3	1		2	2	2	1	1
CO 2		2	2	3	3		2					3	2	1	
CO 3					2	3		2	3	3	3	3	2	1	1
CO 4		3	3	3	3	3	2	3	3	3	3	3	2	1	2
CO 5			3	3	3		2			2	2	3	2	1	
CO 6					2							3	2	1	
CO 7				2	3	3		3					2	1	
CO 8					2	3	3	3				2			

UBT835E	VALIDATION & QUALITY ASSURANCE	Credits: 2
L: T: P – 2-0-0		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

UNIT-I	7 Hrs.
Introduction 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 & how it Differs from Qualification (IQ, OQ & PQ) Procedures, Validation life cycle, A Review of Prospective, Concurrent, Retrospective Validation & Revalidation . FDA and ICH guidelines.	
UNIT–II	**6 Hrs.**
Types of Validation Validation of Water & Thermal Systems, including HVAC Facilities & Cleaning Validation. Validation of Active Pharmaceutical Ingredients (APIs) 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, 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–III	**7 Hrs.**
Quality Assurance The Influence of Good Automated Manufacturing Practice (GAMP),Quality System, Contract Review, Design Document and Data Control, Purchasing, Control of Customer Supplied Product, Process Control, Corrective and Preventive Action, Handling, Storage, Packaging, Preservation and Delivery, Control of Quality Records, Internal Quality Audits, Quality Objectives, Quality Planning, Quality Control, Quality Assurance, Quality Improvement.	
UNIT–IV	**6 Hrs.**
Quality Control Efficiency; Relating to Process and Product, Process characteristics, Quality Characteristics, Documentation, Information, Specification, Quality Manual, Quality Plan, Record of Examination, Objective, Inspection.Quality Requirement, Customer Satisfaction, Capability; Management System, Quality Management System, Quality Policy, Continual Improvement.	

REFERENCE 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, 723 pp.
3. Validation of Pharmaceutical Processes: Sterile Products, Frederick J. Carlton (Ed.) and James Agalloco (Ed.), Marcel Dekker, 2nd Ed., 1998.
4. Validation Standard Operating Procedures: A Step by Step Guide for Achieving Compliance
5. Pharmaceutical Equipment Validation: The Ultimate Qualification Handbook, Phillip A. Cloud, Interpharm Press, 1998.
6. 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

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2				2	2								1	3
CO 2	2	3	1	2	3	3							2	2	3
CO 3	3	2			3	3						3	2	3	2
CO 4	2	2	1		3	3	1					3	2	3	3
CO 5	2	1			2	2	3					2	2	2	3
CO 6	2		1	2	2	2	1					2	2	3	2

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III- Semester **2022-23 Admitted Batch Scheme and Syllabus**

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture	Tutorial	Practical/ Drawing	CIE Marks	SEE Marks	Total Marks	Credits
					L	T	P				
1	BSC	22UMA301C	Numerical Techniques and Fourier Series	Mathematics	3	0	0	50	50	100	3
2	PCC	22UCV302C	Mechanics of Materials	Civil Engineering	3	0	0	50	50	100	3
3	PCC	22UCV303C	Fluid Mechanics & Hydraulics	Civil Engineering	3	0	0	50	50	100	3
4	PCC	22UCV304C	Concrete Technology	Civil Engineering	3	0	0	50	50	100	3
5	PCC	22UCV305C	Building Materials and Construction Technology	Civil Engineering	2	0	0	50	50	100	2
6	IPCC	22UCV306C	Engineering Geology	Civil Engineering	1	0	2	50	50	100	2
7	AEC	22UCV307C	Building Planning and drawing using Auto Cad	Civil Engineering	2	0	2	50	50	100	3
8	PCC	22UCV308L	Basic materials and concrete testing lab	Civil Engineering	0	0	2	50	50	100	1
9	BSC		Bridge Course Mathematics-I	Mathematics	3	0	0	50	50	100	0
10	MC	22UHS001M/ 22UHS002M 22UHS003M	NSS/Yoga/PE	Humanities	-	-	-				0
					20	**0**	**6**	**450**	**450**	**900**	**20**

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22UMA302C	COMPLEX ANALYSIS AND INTEGRAL TRANSFORMS	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I Complex Variables	10 Hrs.
Analytic function, Cauchy-Riemann equations in Cartesian and polar forms. Construction of analytic function (Cartesian and polar forms), Discussion of conformal transformations: z^2, e^z and $z + a^2/z$ *(z # 0)*, Bilinear transformations. **(RBT Levels: L1, L2 and L3)**	
UNIT – II Complex Integration	**10 Hrs.**
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. **(RBT Levels: L1, L2 and L3)**	
UNIT – III Fourier series	**10 Hrs.**
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. **(RBT Levels: L1, L2 and L3)**	
UNIT – IV Fourier transforms	**10 Hrs.**
Infinite Fourier transforms and inverse Fourier transforms- simple properties, Fourier sine and Fourier cosine transforms. Inverse Fourier sine and cosine transforms. **(RBT Levels: L1, L2 and L3)**	

References:

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.

Learning Objectives:

1. Exploring various applications of complex variables in engineering fields.
2. Learning Cauchy-Riemann equations and their role in determining the differentiability of complex functions.
3. Understanding contour integration and its applications in evaluating complex integrals, including, Cauchy's integral theorem, and Cauchy's integral formula.
4. To provide a way, to represent periodic functions in terms of simple trigonometric functions.
5. To transform a function from the time domain to the frequency domain.

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Course Outcomes:

After completion of the course the students shall be able to,

1. Learn about analytic functions and the concept of complex differentiability, including Cauchy–Riemann equations and be able to determine if a function is analytic.
2. Understand the principles of Contour integration and be able to evaluate complex integrals using various techniques such as the Cauchy's integral theorem and the residue theorem. .
3. Grasp the concept of representing periodic functions as an infinite sum sinusoidal (sine and cosine) with different frequencies.
4. Grasp the concept of the Fourier transform as a mathematical tool that converts a function from the time domain into the frequency domain.

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22UCV302C	MECHANICS OF MATERIALS	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	12 Hrs.
Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Principle of superposition, Elongation of uniform bars, stepped bars and composite bars and Numerical examples.	
UNIT–II	**10 Hrs.**
Relation amongst elastic constants and volumetric strain: Elastic constants. Relationship amongst E and G, Relation amongst E and K, Volumetric strain, expression for volumetric strain and Numerical examples. **Compound Stresses:** Introduction, state of stress at a point, General two dimensional stress system, principal planes and Principal stresses. Maximum Shear stresses and Maximum Principal stresses and Numerical examples.	
UNIT–III	**10 Hrs.**
Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combination **Columns and struts:** 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, Rankin's formula.	
UNIT–IV	**10 Hrs.**
Bending stresses and shear stresses in beams: Review of Internal forces in beams, SF, BM, SFD and BMD. Introduction to bending stress in beam. Assumptions in simple bending theory, Pure bending, and derivation of Eulers Bernoulli's beam equation. Section modulus, Flexural rigidity, Beam of uniform strength. Introduction to shear stress in beam. Expression for horizontal shear stress in beam. Shear stress diagrams for rectangular, symmetrical I and T sections. Numerical problems.	

Reference Books

1. B. C. Punmia, Ashok Jain, Aran Jain, Mechanics of Materials, Lakshmi Publications, New Delhi, Revised edition.2017.
2. Basavarajaiah and Mahadevappa, Strength of Materials, Publishers, University press, Hyderabad India 3rd Edition 2010.
3. S.S.Bhavikatti, Strength of Materials, 2nd Edition Vikas Publications, New Delhi 2006. 4. R. Subramanian, Strength of Materias, Oxford University Press 3rd edition 2016.
4. Beer and Johnson, Mechanics of Materials, McGraw hill Publications,
5. R. C. Hibbeler, Mechanics of Materials, Pearson Publications.

Course Outcomes (Students will be able to…)

1. Evaluate the basic concepts of the stresses and strains for different materials and strength of structural elements subjected to axial and temperature stresses.
2. Evaluate the development of internal forces and resistance mechanism for one dimensional and two-dimensional structural elements.
3. Draw bending and shear stress distribution diagrams for beams of various cross sections and for various loads.
4. Determine slope and deflection for statically determinate beams and buckling loads for columns.

COs	Programme Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1.0	2.0		2.0		1.0				1.0			2.0		
CO2		2.0		2.0		3.0							2.0		
CO3			3.0				3.0						2.0		
CO4			3.0	3.0	3.0			3.0					2.0		
Average	0.3	1.0	1.5	1.0	0.8	1.0	0.8	0.8		0.3			2.0		

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22UCV303C	FLUID MECHANICS AND HYDRAULICS	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Properties of fluids: Density, Specific volume, specific weight, Relative density, and viscosity. Surface tension and Capillarity, Newton's law of viscosity, **Types of fluids:** Newtonian & Non-Newtonian fluids, Ideal and Real fluids, Newton's law of viscosity. **Fluid pressure and its measurement:** Derivation of Pascal's law, and Hydrostatic law. Numericals. Types of pressure. Manometers and their classification, theory, derivation and numerical problems, Mechanical pressure gauges and Bourdon's pressure gauge.	
UNIT–II	**10 Hrs.**
Fluid statics: Definition of Total pressure, Centre of pressure, Derivation of total hydrostatic force and depth of center of pressure on a plane surface (horizontal, vertical, inclined, curved) and Numerical Problems. **Fluid kinematics:** Lagrangian and Eulenian approaches of fluid flow analysis, Classification of flows. Continuity equation, Derivation of Continuity equation in three dimensions, Numerical Problems. Velocity and Acceleration in 3D. Definition and properties of velocity potential function and stream functions, streamline & equipotential line, and relation between them. Numerical Problems.	
UNIT–III	**10Hrs.**
Fluid dynamics: Derivation of Euler's equation and Bernoulli's equation for ideal & real fluids with assumptions and limitations. Problems on Bernoulli's equation Application of Bernoulli's equation to pitot tube and venturi-meter and Numerical Problems. **Dimensional Analysis:** Raleigh's methods and Buckingham methods **Pipe flow:** Definition, Classification of flows, HGL and TEL, major and minor losses in pipe flows. Derivation of equation for head loss due to friction (Darcy-Weisbach equation). Problems on major and minor head losses and compound pipes. Water Hammer in Pipes: Derivation for pressure rise due to gradual and sudden closure of valve and numerical problems.	
UNIT–IV	**10 Hrs.**
Open channel flow: Definition and classification, Derivation of Chezy's and Manning's equations and Numerical Problems. Most economical rectangular, trapezoidal, and circular channel sections: Derivations and numerical problems. Specific energy: Specific energy curve, Derivation of critical depth, critical velocity, and minimum specific energy, Numerical problems. Froude's number and its significance. **Notches and Weirs:** Classification of notches and weirs, derivation of discharge equation through rectangular, triangular, trapezoidal section and numerical problems. Hydraulic Coefficients, Weirs: Ogee and Broad crested **Hydraulic Machines:** Impact of jet, Pumps and Turbines (Classification and working principle)	
Reference Books *	

1. James F Cruise, Vijay P. Singh, Elementary Hydraulics (1stEdition), Mohsan M. 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. Wylie Fluid 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.

Course Outcomes (Students will be able to**

1. Demonstrate a comprehensive understanding of fluid properties, including measuring density, viscosity, surface tension, and pressure. They will differentiate between Newtonian and non-Newtonian fluids and apply their knowledge to solve numerical problems utilizing manometers and pressure gauges.
2. Analyze fluid statics, including hydrostatic forces and center of pressure, and apply fluid kinematics principles, including continuity equations and velocity potential functions, to solve numerical problems in fluid mechanics.
3. Apply fluid dynamics, including Euler's and Bernoulli's equations, and apply them to solve problems in pipe flow, head losses, and water hammer phenomena.
4. Apply the concept of open channel flow, including Chezy's and Manning's equations, economical channel sections, specific energy, Froude's number, hydraulic jumps, and discharge equations for notches and weirs through derivations and numerical problem-solving.

COs	**Programme Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	2										2			2.0
CO2	2	2										2			2.0
CO3	2	2	2									2			2.0
CO4	2	2										2			2.0
Average	2.0	2.0	2.0									2.0			2

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22UCV304C	CONCRETE TECHNOLOGY	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.

Cement and Aggregates:

Cement

Cement, Chemical Composition, Hydration of Cement. Types of cement, Manufacture of cement, Testing of cement - Field testing. Fineness by Sieve test and Blaine's air permeability test, Normal consistency test, Setting time test and Soundness test.

Fine aggregates-Grading of aggregates, Specific gravity, Bulking, Moisture content and Deleterious materials.

Coarse aggregates - Importance of size, shape and texture. Grading of aggregates, Sieve analysis, and Specific gravity. Flakiness and Elongation index. Crushing, Impact and Abrasion tests.

UNIT–II	10 Hrs.

Fresh Concrete Properties

Workability - Factors affecting workability, Measurement of workability –Slump Test, Flow test, Compacting Factor Test and Vee-bee Consistometer Test. Segregation and Bleeding. Manufacturing process of concrete - Batching, mixing, transporting, placing, compaction and curing.

UNIT–III	10Hrs.

Admixtures- Chemical admixtures -plasticizers, accelerators, retarders and air entraining agents. Mineral admixtures- Fly ash, silica fume and rice husk ash. Water proofing compounds.

Hardened Concrete Properties: Testing of hardened concrete - Compressive strength, Split tensile strength and Flexural Strength test. Factors affecting strength. w/c ratio, aggregate properties. Relation between Compressive strength and Tensile strength, Bond strength, Modulus of rupture and Elasticity.

UNIT–IV	10 Hrs.

Durability - Definition, Factors affecting, environmental exposure conditions, Permeability – Definition, factors affecting permeability. Shrinkage, factors affecting shrinkage; Creep - factors affecting creep, effect of creep.

Concrete Mix Design

Concept of mix design, variables in proportioning, exposure conditions. Procedure of mix design as per latest IS 10262:2019.Numerical examples of mix design on mix design for OPC concrete mixes and Fly ash concrete mixes.

Reference 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 10262:2019 for concrete mix design.

5. A.R. SanthaKumar, "Concrete Technology", Oxford University Press, New Delhi (New Edition).
6. M.L. Gambhir, "Concrete Technology", McGraw Hill Education, 2014.
7. N.V. Nayak, A.K. Jain Handbook on advanced Concrete Technology, ISBN: 978-81-8487-186-9

Course Outcomes (Students will be able to…)**

1. Manufacture of Cement, types of cement, Chemical composition, Hydration of cement and tests on cement. Importance of size, shape and texture of aggregates. Grading of aggregates. Tests on aggregates.
2. Fresh Concrete:
   Workability, Measurement of workability Segregation and Bleeding. Manufacturing process of concrete.
3. Chemical and Mineral admixtures.
   Evaluate the testing procedure for hardened concrete to assess its hardened properties.
4. Durability of concrete
   Concrete Mix Design: Concept of mix design, Procedure of mix design as per IS 10262-2019, Numerical examples of mix design.

COs	Programme Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1					2						2	2.0		2.0
CO2	1					1						2	2.0		2.0
CO3	1											2	2.0		2.0
CO4	1					2		3				2	2.0		2.0
Average	1.0					1.7		3.0				2.0	2.0		

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22UCV305C	**BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY**	**Credits: 2**
L:T:P - 2 : 0: 0		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

UNIT-I	**05 Hrs.**
Building materials: Bricks: Classification of bricks, Tests on bricks. **Other Building Materials**: Reinforcing steel, Structural steel. **Foundations:** Safe bearing capacity of soil, Plate load test, Classification of foundations, introduction to spread, combined, strap, mat and pile foundation.	
UNIT–II	**06 Hrs.**
Masonry: Definition of terms used in masonry, Types of bonds in brickwork, Coursed and Uncoursed 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:** Different types of doors, Windows, and Ventilators.	
UNIT–III	**06 Hrs.**
Floors: Types of flooring (Materials and methods of laying): Granolithic, Ceramic, Marble, Polished Granite flooring **Roofs:** Flat Roof (R.C. Flat terraced roofing), Lean to roof, Wooden truss (King post and Queen post truss). **Miscellaneous**: Shoring, Scaffolding, Damp proof course, Plumbing, Form work	
UNIT–IV	**06 Hrs.**
Arch, Lintel, Chejja: Classification of arches and Lintels: Types and classifications, Chejja, Functions. **Plastering and painting:** Purpose of plastering, Materials used for plastering, Lime mortar, Cement Mortar, Methods of plastering, Purpose of Painting, Application of paints to new and old surfaces, Distemper, Plastic emulsion, Enamel Powder coated painting to walls and steel surfaces, Polishing of wood surface.	

Reference Books *

1. Punmia B.C Laxmi Building Construction Pubications Pvt Ltd New Delhi 2008
2. S.C Rangalwala, Building Construction, Character Publishing House, Anand India25th2007.
3. Sushil Kumar, Building Construction, Standard Publisher,NewDelhi2008
4. Rangawala P. C Engineering Materials, Chapter Publishing house, Anand India-2014
5. Sushil Kumar, Engineering Materials, Standard Publication and Distributors, New Delhi

Course Outcomes**

After completion of the course student will be able to:

1. Assess the quality of building materials, describe the method of finding SBC of soil and evaluate the suitability of different foundations for different soil conditions.
2. Classify and describe different types of masonry, design (geometric) doglegged staircase, assessing the suitability of a staircase and classify different doors and windows for buildings.
3. Classify different types of floors and roofs. Understand the miscellaneous engineering works like Shoring, Scaffolding, Damp proof course, Plumbing, Form work
4. Compare types of lintels, chajja and arches, describe method of construction and method of plastering and application of paints and finishes for different surfaces.

COs	Programme Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3.0	3.0											2.0		
CO2	3.0	3.0											2.0		
CO3	3.0	3.0	3.0	3.0									2.0		
CO4	3.0			2.0									2.0		
Average	3.0	3.0	3.0	2.5									2.5		

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22UCV306C	ENGINEERING GEOLOGY	**Credits: 2**
L:T:P - 1 : 0: 2		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**04 Hrs.**
Introduction: Geology- its branches; Engineering geology, scope of geology in civil engineering; Work activities of engineering geologist **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	**04 Hrs**
Petrology: 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. **Physical Geology:** 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. Landslides: Causes, effects and preventive measures.	
UNIT-III	**04 Hrs.**
Structural Geology: 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	**04 Hrs.**
Hydrogeology: 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	

ENGINEERING GEOLOGY LAB (Integrated)

LIST OF EXPERIMENTS

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. Parbin Singh, 2008,A **Text book of Engineering & General Geology**; S.K Kataria & Sons, 8th Revised Edn. New Delhi.
2. Santoshkumar Garg,1999, **Physical and Engineering Geology;** Khanna Publishers,3rd revised and enlarged Edn New Delhi.
3. P.KMukerjee, 1990,A **Text book of Geology;** The World Press, 11th reviser Edn .Pvt Ltd Calcutta.
4. K.M.Bangar**, 2004, Principles of Engineering Geology;** Standard Publishers and Distributors, New Delhi.
5. D. Venkat Reddy, 1997, **Engineering Geology for Civil Engineers;** Oxford& IBH Publishers, New Delhi.
6. N.Chennakesavalu,2009,**Text Book of Engineering Geology**; Macmillan Publishers2ndEdn India Ltd. New Delhi.
7. Vasudev Kanithi,2018,**Engineering Geology**; Universities Press (India) Pvt. Ltd. Hyderabad.
8. Subinoy Gangopadhyay,2013, **Engineering Geology**; Oxford Universities Press New Delhi.
9. F.G.H. Blyth, M.H. de Freitas,1988, **Geology for Engineers**; Elsevier publications7thEdn 1
10. KVGK Gokhale , **Principles of Engineering Geology**; B S Publications, Hyderabad.
11. H.H.Read,1984, **Rutley's, Elements of Mineralogy ;** CBS Publishers &Distributors,New Delhi.
12. G.W.Tyrrel,1987,**Principles of Petrology;** BI Publications PvtLtd,New Delhi.
13. S.K. Duggal, H.K.Pandey, N.Rawal, - **Engineering Geology**, Mc Graw Hill Education publications 2017

REFERENCE BOOKS for LAB:

1	B.S.Satyanarayanswamy,2003,EngineeringGeologylabManual,Eurasia Publication,NewDelhi.
2	M.T.MarutheshaReddy,2002,EngineeringGeologyPracticals,NewAge InternationalPvt Ltd ,1stEdn, New Delhi.
3	N.W.Gokhale,1987,Manual of Geological Maps, CBS Publishers & Distributors, 1stEdn, New Delhi.
4	N.W. Gokhale,1996, Exercises on geological Maps & Dip-Strike Problems,CBS Publishers &Distributors, 1stEdn, New Delhi.
5	N.W.Gokhale,2001,AGuide to Field Geology, CBS Publishers & Distributors, 1stEdn.New Delhi.

Course Outcomes**
After completion of the course student will develop competencies in:

1. Realize the importance of geological studies for safe, stable, and economic design of any Civil Engineering Structures.
2. Get the basic knowledge and effective usage of earth's materials (Mineral & Rocks) in different Civil Engineering Projects
3. 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.
4. Know about the importance of groundwater, its occurrence, exploration and artificial recharge methods.

COs	**Programme Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3.0	3.0	2.0	-	2.0	2.0	-	-	-	-	-	-		1.0	
CO2	3.0	2.0	3.0	-	2.0	1.0	-	-	-	-	-	-		1.0	
CO3	3.0	2.0	3.0	-	3.0	-	-	-	1.0	-	-	-		1.0	
CO4	2.0	1.0	1.0	-	2.0	1.0	-	-	1.0	-	-	1.0		1.0	
Average	2.8	2.0	2.3		2.3	1.3			1.0			1.0		1.0	

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22UCV307C	**BUILDING PLANNING AND DRAWING USING AUTO CAD**	Credits: 3
L:T:P - 2 : 0 : 2		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	6 Hrs.
Drawing Basics: Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962. Simple engineering drawings with CAD drawing tools : Lines, Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse, Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet, Using Text: Single line text, Multiline text, Spelling, Edit text, Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing toolbars, Working with multiple drawings.	
UNIT–II	**6 Hrs.**
Functional design of buildings: Principles of planning, planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC.	
UNIT–III	**14 Hrs.**
Working drawings for various components of building.: Following drawings are to be prepared for the data given using CAD Software 1. Cross section of stepped wall Foundation, masonry wall. 2. Cross section of masonry wall for one story and two stories. 3. Isolated RCC column footings. 4. Different types of staircases – Dog legged, Open well.	
UNIT–IV	**14 Hrs.**
Drawing of Plan, elevation and sectional elevation using CAD software for: 1. Single Storied Building with one bedroom 2. Single Storied Building with two bedroom. 3. Two Storied Building **Draw the line diagram using CAD software for:** 1. Primary health center. 2. Primary school building. 3. PWD EE office 4. Tahshildar Office 5. PWD Sub-division office	

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, 4thEdn. 1989.
3. Sushil Kumar, Building Construction, Standard Publications, New Delhi, 19th Edn. May 2018National Building Code, BIS, New Delhi, Dec 1986.

Course Outcomes**

1. To understand the basic concept on Auto Cad software tools.
2. Prepare, read and interpret the drawings in a professional set up.
3. To execute the Drawing of different Elements of the Building.
4. Prepare the Plan, Elevation, cross section and line diagram for residential and public buildings.

COs	**Programme Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1.0	2.0		2.0		1.0				1.0			2.0		
CO2		2.0		2.0		3.0							2.0		
CO3			3.0				3.0						2.0		
CO4			3.0	3.0	3.0			3.0					2.0		
Average	1.0	2.0	3.0		3.0	2.0							2.0		

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22UCV308L	**BASIC MATERIALS AND CONCRETE TESTING LAB**	Credits: 1
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

List of experiments

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 specimen two-point loading.
5. Tests on bricks.
6. Cement: Normal consistency, setting time, soundness by Le chateliers apparatus, Compression strength test and sieve method for fineness of cement and 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 KA, English, Experimental Strength of Materials, Universities Press Ltd. London 2010
4. Suryanarayana AK, 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 CB, Kishore K. Ravi Chawla, Material Testing Laboratory Manual, Standard Publishers & Distributors 1996.
7. M.L. Gambhir, Concrete Manual, Dhanpat Rai & Sons – New Delhi 2004.

Course Outcomes** (Students will be able to

1. Analyze the response of a solid material to different forces (such as Compressive, Tensile, Shear, Flexure, and Torque) and determine the resulting stresses and corresponding strain.
2. Investigate the effects of Torque and internal fluid pressure on a solid material and calculate the resulting stresses and corresponding strain.
3. Assess and analyze the mechanical properties of different materials under varying loading conditions.

COs	Programme Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1							2	2		2	2		
CO2	1	1							2	2		2	2		
CO3	1	1							2	2		2	2		
Average	1	1							2	2		2	2		

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IV- Semester 2022-23 Admitted Batch Scheme and Syllabus

Sl. No.	Course			Teaching Department	Teaching hours and Scheme of Evaluation						
	Category	Code	Title		Lecture L	Tutorial T	Practical/ Drawing P	CIE Marks	SEE Marks	Total Marks	Credits
1.	BSC	22UMA401C	Partial Deferential Equations & Statistics	Mathematics	3	0	0	50	50	100	3
2.	PCC	22UCV402C	Analysis of Statically Determinate Structures	Civil Engineering	3	0	0	50	50	100	3
3.	PCC	22UCV403C	Soil Mechanics	Civil Engineering	3	0	0	50	50	100	3
4.	PCC	22UCV404C	Transportation Engineering	Civil Engineering	4	0	0	50	50	100	4
5.	IPCC	22UCV405C	Surveying	Civil Engineering	3	0	2	50	50	100	4
6.	PCC	22UCV406L	Fluid Mechanics Lab	Civil Engineering	0	0	2	50	50	100	1
7.	PCC	22UCV407L	Geotechnical Engineering lab	Civil Engineering	0	0	2	50	50	100	1
8.	HSMC	22UHS424C	UHV - II	Humanities/Civil Engg.	1	0	0	50	50	100	1
9	BSC		Bridge Course Mathematics-I	Mathematics	3	0	0	50	50	100	0
10	MC	22UHS001M/ 22UHS002M 22UHS003M	NSS/Yoga/PE	Humanities	-	-	-				0
					20	**0**	**6**	**450**	**450**	**900**	**20**

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22UMA402C	Statistics and Probability Theory	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I Statistics and Probability	10 Hrs.
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. **(RBT Levels: L1, L2 and L3)**	
UNIT – II Probability distributions	**10 Hrs.**
Random variables, Problems on expectation and variance. Binomial distributions Poisson distributions and Normal distributions. **(RBT Levels: L1, L2 and L3)**	
UNIT – III Joint Probability distributions & Markov chains	**10 Hrs.**
Concept of joint probability, Joint distributions - discrete random variables. 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. **(RBT Levels: L1, L2 and L3)**	
UNIT – IV Calculus of Variations	**10 Hrs.**
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. **(RBT Levels: L1, L2 and L3)**	

References:

5. Higher Engineering Mathematics by Dr. B.S. Grewal, Khanna Publishers, New Delhi.
6. Advanced Engineering Mathematics By H. K. Das, S. Chand & company Ltd. Ram Nagar, New Delhi
7. Advanced Engineering Mathematics by E Kreyszig ,John Wiley & Sons.
8. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
9. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).

Learning Objectives:

1. To apply the knowledge of Statistics in various Engineering fields
2. To acquire knowledge about predictions preferably on the basis of mathematical equations.
3. To understand the principal concepts about probability.

Course Outcomes:

After completion of the course the students shall be able to,

5. Apply the least square sense method to construct the specific relation for the given group of data.
6. Solve problems on correlation and regression
7. Apply the concepts of probability and distributions
8. Apply the concept of Markov Chain for commercial and industry purpose.

22UCV402C	**ANALYSIS OF DETERMINATE STRUCTURES**	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
Introduction and Analysis of Plane Trusses: Structural forms, Conditions of equilibrium, Compatibility conditions, Degree of freedom, Linear and nonlinear analysis, Static and kinematic indeterminacies of structural systems. **Arches and Cable Structures:** Three hinged parabolic arches with supports at the same and different levels. Determination of normal thrust, radial shear and bending moment. **Analysis of cables** under point loads and UDL. Length of cables for supports at same and at different levels.	
UNIT–II	**10 Hrs.**
Deflection of Beams: Definition of slope, Deflection and curvature, Sign conventions, Review of moment-curvature equation. **Moment area method:** Derivation, Mohr's theorems, Sign conventions, Application of moment area method for determinate prismatic beams, Beams of varying section, Use of moment diagram by parts. **Conjugate beam method**: Real beam and conjugate beam, conjugate beam theorems, Application of conjugate beam method of determinate beams of variable cross sections.	
UNIT–III	**8 Hrs.**
Energy Principles and Energy Theorems: Principle of virtual displacements, Principle of virtual forces, Strain energy and complimentary energy, Strain energy due to axial force, bending, shear and torsion, Deflection of determinate beams and trusses using total strain energy, Deflection at the point of application of single load, Castiglione's first theorem and its application to estimate the deflections of trusses, Special applications- unit load method for beams and frames.	
UNIT–IV	**12 Hrs.**
Influence Lines and Moving Loads: Concepts of influence lines-ILD for reactions, SF and BM for determinate beams-ILD for axial forces in determinate trusses Reactions, BM and SF in determinate beams using rolling loads concepts.	
Reference Books *	

B C Punmia, Ashok Kumar Jain, Aran Kumar Jain Theory of structures Vol-I & II Laxmi Publications, New Delhi-2004

C S Reddy-Basic Structural Analysis, 2 Edition, Tata Mc Graw Hill, New Delhi-2003.

Ramamrutham, R Narayan-Theory of structures,Dhanpt Rai Publishing Company,8 Edition New Delhi-2008

Hibbeler R C, Structural Analysis, Prentice Hall, 9th edition, 2014

0. Devadoss Menon, Structural Analysis, Narosa Publishing House, New Delhi, 2008.

1. Prakash Rao D S, Structural Analysis, University Press Pvt. Ltd, 2007.

Course Outcomes**

1. Understand the basic concepts associated with structural systems. Determine the stress resultants in arches and cables.
2. Evaluate the slopes and deflections for statically determinate beams and trusses by moment–area and conjugate beam method.
3. Understand the energy principles and energy theorems and its applications to determine the deflections of beams, trusses and frames.
4. Understand the basic concepts associated with influence lines. Analysis of simply supported beams under rolling load.

COs	Programme Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1.0	2.0		2.0		1.0				1.0			2.0		
CO2		2.0		2.0		3.0							2.0		
CO3			3.0				3.0						2.0		
CO4			3.0	3.0	3.0			3.0					2.0		
Average	1.0	2.0	3.0	2.3	3.0	2.0	3.0	3.0					2.0		

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22UCV403C	SOIL MECHANICS	Credits: 3
L:T:P - 3:0:0		CIE Marks:50
Total Hours/Week: 3		SEE Marks:50

UNIT-I	10Hrs.

Introduction: Formation of soil, phase diagram, basic definitions and their interrelationships.
Index Properties-Definitions and their determination, 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).
Clay Mineralogy: Soil structure-single grained, honey combed, flocculent and dispersed structures, 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.

UNIT–II	10 Hrs.

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.
Seepage Analysis: Laplace equation, assumptions, limitations and 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.

UNIT–III	11 Hrs.

Compaction of Soil: Definition, ppriniciple 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.
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.

UNIT–IV	9 Hrs.

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, unconfined compression test, triaxial compression test and vane shear test, Test under different drainage conditions.

Reference Books *

1. G. Ranjan and A.S.R Rao, Basic and Applied Soil Mechanics- New Age International (P) Ltd., New Delhi, 4th Edition 2022.
2. B. C. Punmia, A. K. Jain and A. K. Jain, Soil Mechanics and Foundation Engg.- Laxmi Publications Co, New Delhi. 17th edition 2017.
3. J. Knappett and R. F. Craig, Craig's Soil Mechanics- CRC Press Ninth Edition 2019.
4. B. M. Das, Principles of Geotechnical Engineering with WebAssign - India, Cengage Learning, 10th Edition 2022.

5. V.N.S. Murthy, Text Book of Soil Mechanics and Foundation Engineering- CBS Publishers & Distributors New Delhi 2018.
6. C. Venkatrahmaiah, Geotechnical Engineering, New Age International (P) Ltd., New Delhi 5th Edition 2017.
7. D. P. Coduto, M. R. Yeung and W. A. Kitch, Geotechnical Engineering: Principles & Practices, Pearson, 2nd edition, 2011
8. H. Khan, Text Book of Geotechnical Engineering- PHI, India Second Edition 2005.
9. J. Bowles, Foundation Analysis and Design- McGraw Hill Pub. Co. New York Fifth Edition 2001.
10. A. Singh and G.R. Chowdhary, Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd., NewDelhi 1992.

Course Outcomes**

1. Analyse and interpret soil properties and clay mineralogy to effectively apply engineering principles in practical scenarios.
2. Apply Darcy's law, seepage phenomena, and utilize flow nets to solve practical engineering problems related to flow through soils and seepage analysis.
3. Apply the principles of compaction and consolidation to effectively control soil behaviour in engineering projects.
4. Determine settlement of soils and utilize testing methods to find shear strength parameters.

COs	**Programme Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1						1				2		3.0	
CO2	2	1										2		3.0	
CO3	3	2		1				1				2		3.0	
CO4	2	2		1				1				2		3.0	
Average	2.5	1.5		1.0				1.0						3.0	

22UCV404C	TRANSPORTATION ENGINEERING	**Credits: 4**
L:T:P - 4 : 0: 0		CIEMarks:50
Total Hours/Week: 4		SEEMarks:50

UNIT-I	13 Hrs.
Highway Development Plans: Historical Development; Functional classification of rural and urban roads; Planning Visions – 2021 (Rural Highways), 2025 (Rural roads), National Urban Transport Policy (NUTP), PMGSY; Components of Detailed Project Report (DPR) of roads; Public Private Partnership Models.	
UNIT–II	**13 Hrs.**
Geometric Design: Design factors; Cross-section elements, Sight distances; Road Alignment - Horizontal and Vertical profiles; Combination of profiles; Placement of utilities and services; Design considerations in hill areas; Design software	
UNIT–III	**13 Hrs.**
Highway Materials and Mix Design: Soil – Desirable properties, Tests – Atterburg limits, Proctor values, CBR, Modulus (k); Stone Aggregates – Desired properties, Tests; Asphalt – Classification, properties, routine tests and modifiers;– Desirable properties for pavements; Bituminous Mix design **Pavement Design:** Factors affecting design; Traffic volume and Axle load survey; Flexible pavements – Layers, design requirements and IRC-37 based design; Rigid pavements: Layers, design requirements, stresses in layers, Design based on IRC-58.	
UNIT–IV	**13 Hrs.**
Highway Construction: Design specification and construction steps of subgrade, embankments, granular layers (GSB, WBM, WMM), bituminous sub-bases, bases, binder and surface courses, concrete pavement (DLC and PQC), Joints in bituminous and rigid pavements; Guidelines for Externally funded Road Projects. **Highway Maintenance:** Types of surface and sub-surface failures, Evaluation and remedial measures; Drainage – surface and sub-surface, Filter design criteria; Design of overlays based on Benkelman Beam and Falling Weight Deflectometer (FWD)	

Reference Books *

1. Right, Paul H. and Dixon, Karen K., "Highway Engineering", John Wiley and Sons Inc. 2004
2. Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros. 2004
3. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros. 2004
4. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall. 2002
5. Jotin Khisty, C. and Kent Lall, B., "Transportation Engineering – An Introduction", Third edition, Pearson India 2016
6. Relevant Indian Roads Congress Codes – Geometric Aspects: IRC:38, 69, 73, 86, SP-23. Pavements: IRC:37, 58, 15, 44 Others: IRC:SP-42, SP-88, MORT&H Specifications

Course Outcomes**

After completion of the course student will be able to

1. Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
2. Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
3. Design road geometrics, structural components of pavement and drainage.
4. Apply basic knowledge of various highway construction and maintenance.

COs	**Programme Outcomes (POs)**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1.0					2.0								3.0	
CO2	2.0	2.0	2.0											3.0	
CO3	1.0	2.0	2.0	2.0										3.0	
CO4	1.0					2.0								3.0	
Average	1.3	2.0	2.0	2.0		2.0								3.0	

22UCV405C	**SURVEYING**	**Credits: 4**
L:T:P - 3 : 0: 2		CIEMarks:50
Total Hours/Week: 5		SEEMarks:50

UNIT-I	10 Hrs.

Introduction: Definition of surveying, Objectives and importance of surveying. Classification of surveying, Principles of surveying, Units of measurements, Chain and tape types, Surveying measurements and errors.

Measurement of Directions and Angles: Compass survey: Basic definitions, meridians, bearings, magnetic and True bearings. Prismatic and surveyor's compasses, temporary adjustments, declination. Quadrantal bearing system, whole circle bearing system, local attraction.

UNIT–II	10 Hrs.

Levelling: Basic terms and definitions, Methods of levelling-Spirit levelling , Types of levels-Dumpy level, auto level, digital and laser levels-Instrument setup, Booking and reduction of levels-HI method, Rise and fall method. Differential levelling, profile levelling, fly levelling, check levelling, reciprocal levelling, Numerical problems.

Contouring: Contours definition and characteristics, Methods of contouring, Interpolation of contours, contour gradient, and contours uses.

UNIT–III	10 Hrs.

Theodolite Survey: Theodolite and types, Fundamental axes and parts of Vernier Transit theodolite, uses of theodolite, Temporary adjustments, measurement of horizontal angles (Repetition and reiteration methods) and vertical angles

Trigonometric Levelling: Determination of Heights and Distances: of an accessible object, Inaccessible object by single plane and double plane methods, Numerical problems.

UNIT–IV	10 Hrs.

Tachometry: Basic principle, types of tachometry, Instruments and accessories used in tachometry, distance equation for horizontal and inclined line of sight in fixed stadia hair method, numerical problems.

Curves: Simple curves: Types, Elements, Designation of curves, Setting out of simple curves by linear methods (numerical problems on offsets from long chord & chord produced method), and Setting out curves by Rankine's deflection angle method, Numerical problems.

BVV Sangha's

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SURVEYING LABORATORY (INTEGRATED)
1. Demonstration of basic surveying instruments like (Chain, Tape ect…) 2. Setting out hexagon by compass 3. 3. Levelling Differential Levelling Fly levelling and Fly back leveling Reciprocal leveling, Profile and cross section levelling Contouring 4. Theodolite Measurement of Horizontal and vertical angles Determination of elevation of an object: Base accessible Determination of distance and elevation of an object: Base In-accessible- Single Plane. 5. Total Station Introduction → Taking Out Basic Measurements (SHV, REM, MLM) 6. Total Station –Station Orientation, Back sighting, Instrument Synchronization, Data Recording. 7. Works on Total Station Area Measurement Topographic survey Set out Parallel Lines Downloading an contour map compilation only

Reference Books *

1. B.C. Punmia, Surveying, Vol. 1 , 16th Edition, Laxmi Publications, New Delhi.2005
2. S. S. Bhavikatti, 'Surveying & Leveling Vol-I', I. K. International New Delhi, 2008
3. S.K. Duggal, "Surveying Vol. I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
5. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
6. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
7. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation, 5th edition, John Wiley and Sons India
8. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication
9. Kang-tsung Chang, Introduction to geographic information systems, McGraw Hill HigherEducation.

Course Outcomes**

After completion of the course student will be able to

1. Students will get the knowledge of basics of surveying and basic instruments used in civil engineering surveys and Application of compass surveying for measurement of areas, bearing and distance along with the direction.
2. Finding the elevation, elevation differences and heights of different objects under different conditions.
3. 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.
4. Setting of curves by different methods for different alignments.

COs	Programme Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	1	2	-	-	-	-	-	-	1	2	2	1
CO2	3	3	2	1	2	-	-	-	-	-	-	1	2	2	1
CO3	3	3	2	1	2	-	-	-	-	-	-	1	2	2	1
CO4	3	3	1	1	2	-	-	-	-	-	-	1	2	2	1
Average	3.0	3.0	1.8	1.0	2.0							1.0	2.0	2.0	1.0

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22UCV406L	FLUID MECHANICS LAB	Credits: 1
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

List of experiments

1. Calibration of Orifice.
2. Calibration of mouthpiece.
3. Calibration of triangular notches.
4. Calibration of rectangular notches.
5. Calibration of trapezoidal notches.
6. Calibration of ogee and broad creasted 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

Reference 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. Bireshwar Majumdar, Fluid mechanics lab manual by PHILearning, 2nd edition 2015.
4. K. L. Kumar. "Engineering Fluid Mechanics Experiments" Eurasia Publishing House.

Course Outcomes (Students will be able to**

4. Calibrate discharge measuring apparatus when fluid is flowing through it.
5. Determine the major and minor in the pipes
6. Determine the impact of water jet flat and hemispherical vanes.

COs	Programme Outcomes (POs)												PSOs		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1							2	2		2			2
CO2	1	1							2	2		2			2
CO3	1	1							2	2		2			2
Average	1	1							2	2		2			2

22UCV407L	GEOTECHNICAL ENGINEERING LABORATORY	Credits: 1
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

List of experiments

1. Field identification of fine-grained soils.
2. Field density using
   Core cutter method
   Sand replacement method
3. Natural moisture content using oven drying method.
4. Specific gravity of soil using Pycnometer and density bottle
5. Grain size distribution of
   Coarse grained soil (Sieve analysis)
   Fine grained soil (Hydrometer Analysis)
6. Consistency index of soil
   Liquid limit
   Plastic limit
   Shrinkage limit
7. Permeability of fine-grained and coarse-grained soil
8. Optimum moisture content and maximum dry density using Standard Proctor test / Modified Proctor test
9. Relative density of soil.
10. Free swell index
11. Shear strength of fine and coarse grained soil
    Triaxial test (UU)
    Direct shear box
    Unconfined compression test.
12. California Bearing Ratio (CBR)
13. Coefficient of consolidation and compression index, Augers and samplers, field CBR, SPT, Rapid moisture meter (Demonstration).

Reference Books *

1. SP 36-1 (1987): Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for civil Engineering Purposes.
2. SP 36-2 (1988): Compendium of Indian Standards on Soil Engineering: Part-2 Field Testing of Soils For Civil Engineering Purposes.
3. B.C.Punmia, Ashok.K. Jain and Arun. K. Jain, Soil Mechanics and Foundation Engg.- Laxmi Publications Co. , New Delhi. 17th edition 2017.
4. Gopal Ranjan and A.S.R. Rao, Basic and Applied Soil Mechanics- New Age International (P) Ltd., New Delhi Fourth Edition 2022.
5. Geotechnical Laboratory Manual, BEC.

Course Outcomes (Students will be able to**

1. Identify different types of soils in laboratory and field.
2. Evaluate index and engineering properties of soil.
3. Operate the different soil testing equipment inside the laboratory and conduct test in the field.

COs	Programme Outcomes (POs)												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1							2	2		2		2	
CO2	1	1							2	2		2		2	
CO3	1	1							2	2		2		2	
Average	1	1							2	2		2		2	

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Scheme and Syllabus of 3rd year 2021 – 22 admitted batch

V semester

Sl. No.	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	PCC	21UCV501C	Analysis of Indeterminate Structures	3	3	0	0	50	50	100
2.	PCC	21UCV502C	Geotechnical Engineering	3	3	0	0	50	50	100
3.	PCC	21UCV503C	Water treatment and Supply Engineering	3	3	0	0	50	50	100
4.	PEC	21UCV5XXE	Professional Elective Course – I	3	3	0	0	50	50	100
5.	OEC	21UCV5XXN	Open Elective Course – I	3	3	0	0	50	50	100
6.	PCC	21UCV506L	Geotechnical Engineering Lab	1	0	0	2	50	50	100
8.	INT	21UCV507I	Summer Internship – II	3	NA			50	50	100
9.	AEC	21UHS521C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
			Total	**21**	**17**	**0**	**2**	**400**	**400**	**800**

Professional Elective Course – I				**Open Elective Course – I**			
Sl. No.	**Category**	**Subject Code**	**Subject Title**	**Sl. No.**	**Category**	**Subject Code**	**Subject Title**
1.	PEC	21UCV511E	Alternative Building Materials and Technologies	1.	OEC	21UCV522N	Green Building Technology
2.	PEC	21UCV512E	Advanced Surveying	2.	OEC	21UCV523N	Remote Sensing and GIS
3.	PEC	21UCV513E	Irrigation Engineering	3.	OEC	21UCV524N	Air Pollution and Control
4.	PEC	21UCV514E	Traffic Engineering				

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21UCV501C	**ANALYSIS OF INDETERMINATE STRUCTURES**	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Slope Deflection Method: Introduction, sign convention, development of slope deflection equation, analysis of continuous beams including settlements, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3	
UNIT–II	**10 Hrs.**
Moment Distribution Method: Introduction, Definition of terms, Development of method, Analysis of continuous beams with support yielding, Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy ≤ 3	
UNIT–III	**8 Hrs.**
Kani's Method: Introduction, Concept, Relationships between bending moment and deformations, Analysis of continuous beams with and without settlements, Analysis of frames with and without sway	
UNIT–IV	**12 Hrs.**
Matrix Method of Analysis (Flexibility Method) : Introduction, Axes and coordinates, Flexibility matrix, Analysis of continuous beams using system approach, with static indeterminacy ≤ 3 **Matrix Method of Analysis (Stiffness Method):** Introduction, Stiffness matrix, Analysis of continuous using system approach, with kinematic indeterminacy ≤ 3	

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
4. K.U. Muthu, H.Narendra etal, "Indeterminate Structural Analysis", IK International Publishing Pvt. Ltd.

Course Outcomes**

1. Determine the moment in indeterminate beams and frames having variable moment of inertia and subsidence using slope defection method
2. Determine the moment in indeterminate beams and frames of no sway and sway using moment distribution method.
3. Construct the bending moment diagram for beams and frames by Kani's method.
4. Construct the bending moment diagram for beams using flexibility method and stiffness method.

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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	2		2		1				1					
CO2		2		2		3									
CO3			3				3								
CO4			3	3	3			3							

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21UCV502C	SOIL MECHANICS	Credits: 3
L:T:P - 3:0:0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10Hrs.**
Introduction: Soil formation, Phase Diagram,basicdefinitions,andtheirinterrelationships. Numerical Problems Indexproperties- Definitionsandtheirdetermination,particlesizeanalysis(sieveandHydrometer analysis) consistency limits and indices, Plasticity chart. Activity of clay, Fieldidentificationtests, BIS soil classification (IS: 1498-1970). Numerical Problems ClayMineralogy:Soilstructure, Soil-Watersystem,Electricaldiffusedoublelayer,adsorbed water, base-exchange capacity, Clay mineralsandtheirstructures-Kaolinite,IlliteandMontmorilloniteandtheirapplicationinEngineering	
UNIT–II	**10 Hrs.**
Flow Through Soils: Darcy's law-assumption and validity, coefficient of permeabilityanditsdetermination(laboratory),factorsaffectingpermeability,permeability ofstratified soils, Seepage velocity, superficial velocity and coefficient of percolation, CapillaryPhenomena, Numerical Problems. Effective Stress – Theory and Numerical Problems. Seepage Analysis: Laplace equation, assumptions, derivation and limitations. Flownets-characteristics and applications. Flow nets for sheet piles and below the dam section, phreaticline (Casagrande's method–with and without toe filter)	
UNIT–III	**10 Hrs.**
CompactionOfSoil:Principleofcompaction,StandardandModifiedproctor's compaction tests, factors affecting compaction, effect of compaction on soil properties,Field compaction control- compactive effort, lift thickness and numberofpasses,Proctor'sneedle. Numerical Problems Consolidation Of Soil: Definition, Mass-spring analogy, Terzaghi's one dimensionalconsolidation theory, assumptions,derivationand limitations. Normally consolidated, underconsolidated and over consolidated soils, pre-consolidation pressure and its determination byCasagrande's method. Consolidation characteristics of soil (C_c, a_v, m_v and C_v), Time rate ofconsolidation. Numerical Problems.	
UNIT–IV	**10 Hrs.**
Shear Strength of Soils: Concept of shear strength, Mohr's strength theory, Mohr-coulomb theory, conventional and modified failure envelops, Total and effective shear strengthparameters, factors affecting shear strength of soils, Sensitivity andThixotropyofclay.MeasurementofshearparametersDirectsheartest,unconfinedcompression test, Triaxial compression test and vane shear test, Test under different drainageconditions. Numerical Problems. 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.	

Reference Books *

1. GopalRanjanandA.S.R.Rao,BasicandAppliedSoilMechanics-NewAgeInternational(P)Ltd., New Delhi Forth Edition 2022.

2. B.C.Punmia,Ashok.K.JainandArun.K.Jain,SoilMechanicsandFoundationEngg.-LaxmiPublications Co. ,New Delhi.17thedition 2017.
3. BrajaM.DasandNagaratnamSivakugan,PrinciplesofGeotechnicalEngineering-ClEngineeringIndia NinthEdition 2022.
4. V.N.S.Murthy,SoilMechanicsandFoundationEngineering-CBSPublishers&DistributorsNew Delhi, Fourth edition, 2018.
5. VenkatrahmaiahC.GeotechnicalEngineeringNewAgeInternational(P)Ltd.,NewDelhiFifth Edition 2017.
6. IqbalH.KhanTextBookofGeotechnicalEngineering-PHI,IndiaSecondEdition2005.
7. JosephBowles,FoundationAnalysisandDesign-McGrawHillPub.Co.NewYorkFifthEdition 2001.
8. Craig's, Soil Mechanics 9th Edition, CRC Press, 2019
9. Karl Terzagi and Ralph B. Peck, Soil Mechanics in Engineering Practice 3rd edition 2019.
10. T. Whitman Lambe and Robert V. Whitman, Soil Mechanics, Wiley India Pvt. Ltd. 2008

Course Outcomes**

After completion of the course student will be able to

1. analyse and interpret soil properties and clay mineralogy to effectively apply engineering principles in practical scenarios.
2. apply Darcy's law, seepage phenomena, and utilize flow nets to solve practical engineering problems related to flow through soils and seepage analysis.
3. apply the principles of compaction and consolidation to effectively control soil behavior in engineering projects.
4. Determine settlement of soils and utilize testing methods to find shear strength parameters.

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1						1				2
CO2	2	1										2
CO3	3	2		1				1				2
CO4	2	2		1				1				2

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21UCV503C	**WATER TREATMENT AND SUPPLY ENGINEERING**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs**
Quality of water: Wholesome, potable and palatable water, waterborne diseases. **Examination of Water -** Objectives – Physical, chemical and Microbiological Examinations. Drinking water standards-BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc. Sampling of water and types of water sampling. **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. Numerical problems. ***Self Study Component:*** Sources of water and different intake structures.	
UNIT–II	**10 Hrs.**
Population forecasting: Different methods with merits & demerits, variations in demand of water, peak factors, design periods. Design period, factors affecting for design period. Numerical problems. **Sedimentation**: Introduction, objectives, types of settling, factors affecting settling. Theory of settling, settling velocity, Stroke's equation, types of settling tanks, design of circular, rectangular tanks. **Modern water supply scheme:** Necessity, planning and execution of modern water supply scheme. **Self Study Component:** Treatment flow-charts for surface and ground water.	
UNIT–III	**10Hrs.**

Coagulation and Flocculation: Coagulant aided sedimentation: Objectives, common coagulants, factors affecting, jar test, chemical feeding, flash mixing, Flocculation and clari-flocculation.

Filtration: Slow-sand, rapid-sand and pressure filters including construction, operation, cleaning and design (excluding under drainage system), Numerical Problems. Operational troubles in filters.

Disinfection: Types of disinfectants, chlorination, chlorine demand, residual chlorine, use of bleaching powder, Numerical Problems. Minor methods of disinfection.

Self Study Component: Different methods of coagulant feeding, inlet and outlet arrangement for sedimentation tanks

UNIT–IV	**10 Hrs.**

Miscellaneous Treatment Methods: Softening- Lime soda process and Zeolite process, Numerical problems. 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, Numerical problems, Pipe appearances, pipefitting, Layout of water supply pipes in buildings.

Self Study Component : Nalgonda and Prasanti Techniques for defluoridation

Reference Books *

1. **Environmental Engineering**-Howard S. Peavy, Donald R. Rowe, George Tecno Bano Glous, McGraw Hill International Edition, 2017.
2. **Environmental Engineering-I** – B.C. Punmia & Ashok Jain, Lakshmi Publications (P)Ltd.
3. **Water supply Engineering** – S.K.Garg, Khanna Publishers, New Delhi.
4. **Manual on Water supply and treatment** –CPHEEO, Ministry of Urban Development,New Delhi.
5. **Water Supply and Sanitary Installations,** Panchadhari. A.C., New Age International Publishers, New Delhi.
6. **Handbook on Water Supply and Drainage,** SP 35 (1987): (with Special Emphasis on Plumbing) [CED 24: Public Health Engineering.]

Course Outcomes

After completion of the course student will be able to

1. Apply knowledge of basic science for testing and analyze the drinking water quality parameters from public health consideration as per standards.
2. Analysis of forecasting population to determinetotal quantity of water to meet demands of the community.
3. Design various water treatment units to remove selected impurities in raw water
4. Select miscellaneous treatment methods and analyze the community pipe network of water distribution.

Course Articulation Matrix (CAM)

Sl. No.	Course Outcomes (CO's)	Program outcomes (PO's)											
		1	2	3	4	5	6	7	8	9	10	11	12
01	CO1	3	3		2			3	2				2
02	CO2	3	2					2					2
03	CO3	2	2	3				3					2
04	CO4	2	3					3					2

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UCV511E	ALTERNATIVE BUILDING MATERIALS AND TECHNOLOGIES	**Credits: 3**
L:T:P - 4 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**
Energy in building materials, Environmental issues concerned to building materials, Embodied energy and life-cycle energy, Global warming and construction industry, Green concepts in buildings, Green building ratings – IGBC and LEED manuals – mandatory requirements, Rainwater harvesting , Environmental friendly and cost effective building technologies, Requirements for buildings of different climatic regions.	
UNIT–II	**10 Hrs.**
Fibre Reinforced Concrete (FRC) -Fibers- metal and synthetic, Properties and applications. Fibers organic and synthetic, Properties and applications, behavior of FRC member under Flexure, Shear and Tension conditions. Numerical Problems on FRC.	
UNIT–III	**10 Hrs.**
Ferrocement – Materials used in ferrocement, definition, materials properties of ferrocement, casting of ferrocement members, properties of ferrocement members, Building materials from agro and industrial wastes ,Types of agro wastes, Types of industrial and mine wastes, Properties and applications.	
UNIT–IV	**10 Hrs.**
Alternative Building Technologies: Alternate Roofing Systems: -Concepts, Filler slabs, Composite beam panel roofs **Prefabricated structures**: Introduction, Need, equipments used, method of casting prefabricated building components, Advantages**.**	

Reference Books *

1. KS Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, "Alternative Building Materials and Technologies", New Age International publications.
2. RJS Spence and DJ Cook, "Building Materials in Developing Countries", Wiley pub.
3. IGBC Green Homes Rating System, CII publications
4. Relevant IS Codes.

Course Outcomes**

After studying this course, students will be able to:

1. Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;

2. Select appropriate type of masonry unit and mortar for civil engineering constructions;.

3. Analyse different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner.
4. Recommend various types of alternative building materials and technologies and design a energy efficient building by considering local climatic condition and building material.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	2	2	3	-	2	1	-	-	-	-	-	-			
CO3	2	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

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UCV512E	ADVANCED SURVEYING	**Credits: 3**
L:T:P - 4 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10 Hrs.
Total station, GPS, DGPS, Drone survey - Introduction, Types of EDM instruments, Working principle, Applications.	
UNIT–II	**10 Hrs.**
Measurement of area: Cross staff survey, co-ordinates method, planimeter and digital planimeter. Measurement of volumes-trapezoidal and prismoidal formulae. Measurement of volume by mid ordinate method, trapezoidal and prismoidal formulae.	
UNIT–III	**10 Hrs.**
Aerial Photogrammetry: Uses, Aerial photographs, Definitions, Scale of vertical photograph, Ground Co-ordinates, Derivation of Relief Displacements formula, Ground control, Procedure of aerial survey, overlaps and pocket and mirror Stereoscope, Derivation of Parallax equations, and numerical problems. **Digital Photogrammetry**: Introduction, need, instruments used for digital photogrammetry	
UNIT–IV	**10 Hrs.**
Remote Sensing: 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, Idealized Remote Sensing System **Geographical Information System**: Components, concept, Data acquisition for GIS input-Spatial and Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.	

Reference Books *

1. B.C. Punmia, Surveying, Vol. 1 , 16th Edition, Laxmi Publications, New Delhi.2005
2. S. S. Bhavikatti, 'Surveying & Leveling Vol-I', I. K. International New Delhi, 2008
3. S.K. Duggal, "Surveying Vol. I & II", Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. R Subramanian, Surveying and Leveling, Second edition, Oxford University Press, New Delhi.
5. David Clerk, Plane and Geodetic Surveying Vol1 and Vol2, CBS publishers
6. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
7. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation, 5th edition, John Wiley and Sons India
8. James M Anderson and Adward M Mikhail, Surveying theory and practice, 7th Edition, Tata McGraw Hill Publication.

Course Outcomes**

After completion of the course student will be able to

1.Obtain distances and elevations in total station, conduct topographic surveys and generate profile drawings, apply the concept of drone in civil engineering surveys,

2. Determine areas and volumes of different terrains using different mathematical approaches

3 Generate Large Scale topographic maps for roads, irrigation works etc…

4.Interpret the satellite images for identifying various features on the ground, prepare base maps in soft copy and hard copy format, use the same for Land Use planning .

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

BVV Sangha's
Basaveshwar Engineering College, Bagalkote
Civil Engineering Department

UCV513E	Irrigation Engineering	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**

Irrigation Engineering - Introduction: Necessity, benefits and ill effects of irrigation, and its history of development, Water Resources of India and its Demand in Various Sectors 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.

Water requirement of Crops: Soil water system, 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.

UNIT–II	**10 Hrs.**

Canals: Classifications, Regime theory, Design of canals cross sections by Lacey's and Kennedy's method, 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.

UNIT–III	**10Hrs.**

Dams and Reservoirs

Investigation for reservoir site, storage zones, determination of storage capacity using mass curve for specific yield, economical height of dam.

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

Earthen Dams: Types, Construction, Causes of failure of earthen dams, Seepage control measures,

UNIT–IV	**10 Hrs.**

Irrigation Project Planning and Economics

Project Appraisal, implementation, monitoring and evaluation, Financial Analysis of an Irrigation Project, Scheme Investment Analysis, Irrigation Project budget and Costs, Basic Concepts and Terminologies in Economic Analysis. Numerical problems.

Reference Books *

1. Irrigation Engineering and Hydraulic Structures" by Santosh Kumar Garg, Khanna Publishers, 2015 (7th edition), ISBN: 978-8174092456.
2. "Irrigation Engineering" by N.N. Basak, Prentice-Hall of India Pvt. Ltd., 2012 (2nd edition), ISBN: 978-8120345309.
3. "Principles of Irrigation Engineering" by V. T. Chowdhury, Prentice-Hall of India Pvt. Ltd., 2004 (1st edition), ISBN: 978-8120323185.
4. "Irrigation Water Management" by A.M. Michael, New Age International Publishers, 2012 (1st edition), ISBN: 978-8122434679.
5. "Irrigation and Water Resources Engineering" by G.L. Asawa, New Age International Publishers, 2010 (4th edition), ISBN: 978-8122414602.

Course Outcomes (Students will be able to**

1. Able to classify and design the canals longitudinal sections and cross drainage works.
2. To comprehend various aspects of gravity dam analysis and design

3. To be able to understand concepts of construction and failure in earthen dams and design of major spillways.
4. To know concepts canal falls and regulator works and apply the knowledge in their design

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

BVV Sangha's
Basaveshwar Engineering College, Bagalkote
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UCV514E	**Traffic Engineering**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**
Introduction: Definition-Objective Scope of Traffic Engineering. Road User and Vehicle Characteristics Static and Dynamic characteristics- Power performance of vehicles- Resistances to the motion of vehicles- Reaction time of driver- Problems of above	
UNIT–II	**10 Hrs.**
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,	
UNIT–III	**10 Hrs.**
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	
UNIT–IV	**10 Hrs.**
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.	

Reference Books *

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, Jotin Khistey 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.

Course Outcomes**

After completion of the course student will be able to

1. Able to analyze the vehicles behavior and reaction time of driver
2. 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. Understand the traffic flow behavior able to design rotary and channelization
4. Design the signals by different methods and understands ITS

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	**1**			

BVV Sangha's
Basaveshwar Engineering College, Bagalkote
Civil Engineering Department

21UCV521N	**GREEN BUILDING TECHNOLOGY**	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
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 (Leadership in energy and environmental design) GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council) and Green star rating systems.	
UNIT–II	**10 Hrs.**
Principles and elements of design of green building; Sustainability: concept and reality 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 Shading devices and their effect.	
UNIT–III	**10 Hrs.**
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 Day lighting Ventilation.	
UNIT–IV	**10 Hrs.**
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 Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings.	
REFERENCE 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.Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984.IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
3. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
4. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
5. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
6. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
7. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley &Sons, New York, 2008.
8. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.
9. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987.
10. Energy Conservation building code (ECBC), Bureau of energy efficiency, 2011.

Course Outcomes**

After completion of the course student will be able to

1. understand, recognize, and evaluate green building's significance, principles, and advantages and disadvantages in sustainable construction.
2. gain a comprehensive understanding of green building design principles and sustainability concepts, with a focus on climate-responsive design processes, shading devices, and their effects on building performance.
3. proficiently optimize thermal comfort, daylighting, and ventilation in buildings, creating sustainable and comfortable indoor environments.
4. understand and apply water and material conservation techniques, grasp the concept of embodied energy and carbon emissions reduction, and analyze existing green buildings and the role of the Bureau of Energy Efficiency.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and**

quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	2	3	2	-	-	-	2		2	
CO2	3	2	-	-	-	1	3	2	-	-	-	2		2	
CO3	3	2	-	-	-	-	3	2	1	-	-	2		2	
CO4	2	2	-	-	-	1	3	2	1	-	-	2		2	

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21UCV522N	REMOTE SENSING AND GIS (OPENELECTIVE)	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**

UNIT-1

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.
Platforms: 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 - Ikonos, Quickbird, Risat.

UNIT–II	**10 Hrs.**

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.
Digital Image Processing (DIP):(No problems/programming on DIP) Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), Supervised Image Classification using minimum distance to means classifier algorithm- GIS integration –stages & procedure., Image Filtering (spatial filters) -Low Pass and High pass image filters.(Brief discussion only, no problems or programming)
Applications of REMOTE sensing in urban applications and water resource management

UNIT–III	**10 Hrs.**

Maps and Projections
Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)
GIS:
History, Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.
GIS functions in vector and raster data- Input, Analysis and out put
GIS Analysis (**Vector Data-** Buffering & Overlay analysis using overlay operators)
GIS Analysis **(Raster Data**-Local Operations and neighbourhood using arithmetic, Logical and Overlay operators)
Cartography-Definition, basic map layout, significance of cartography
Data Standards in GIS errors, precision and accuracy-Definition and Types

UNIT–IV	**10 Hrs.**

Advanced Concepts: LIDAR, Virtual GIS. (Brief Discussion only)
GPS.- Definition, working principle, segments and uses (Brief Discussion only)
Procedure of Compiling: geology map of a district.

Applications of GIS and Remote Sensing:
1**)** Identifying suitable site for urban development
2) Planning of network for sewage collection and transport (laying of sewer lines)
3) Ground water Vulnerability assessment.
4) Land Use Land Cover mapping (LU/LC).
Drainage Patterns-Definition, Types, significance.

Reference Books *

1. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
2. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation, 5^{th} edition, John Wiley and Sons India
3. Geographical Information Systems, C.P.Lo and Albert Yoing, 2^{nd} edition, Preintice hall publications-2005

Course Outcomes**

The student will be able to

1.Explore the advantages of remote sensing and procedure of using satellite image for various civil engineering applications.

2. Apply, Method of rectifying and acquiring required data from satellite image and carry out analysis to get object specific results.

3. Integrate data from various data sources and extract relevant information related to geography, by performing GIS data analysis.

4. Use recent technologies like GIS and RS, for civil engineering applications , to meet project/work requirements in short time and on large scale.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	1			

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21UCV523N	**Air Pollution and Control**	**Credits: 3**
L:T:P - 4 : 0: 0		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	**10 Hrs.**
Introduction: Definition, Sources, classification and characterization of air pollutants. Effects of air pollution on health, vegetation & materials. Atmosphere and water bodies, Photo-chemical Smog,	
UNIT–II	**10 Hrs.**
Meteorology: Temperature lapse rate & stability, wind velocity & turbulence, plume behavior, measurement of meteorological variables, wind rose diagrams, Plume Rise, estimation of effective stack height and mixing depths. Development of air quality models-Gaussian dispersion model	
UNIT–III	**10 Hrs.**
Sampling: Sampling of particulate and gaseous pollutants (Stack, Ambient & indoor air pollution), Monitoring and analysis of air pollutants ($PM_{2.5}$, PM_{10}, SO_X, NO_X, CO, NH_3) and Air pollution emission standards	
UNIT–IV	**10 Hrs.**
Control Techniques: Air pollution control devices, equipment and their design. Particulate matter and gaseous pollutants- settling chambers, cyclone separators, scrubbers, filters & ESP. Including Numerical problems	

Reference Books *

Text Books:

1. M. N. Rao and H V N Rao, "Air pollution", Tata Mc-G raw Hill Publication.
2. H. C. Perkins, "Air pollution". Tata McGraw Hill Publication
3. Mackenzie Davis and David Cornwell,"Introduction to Environmental Engineering" McGraw-Hill Co.

Reference Books:

1. Noel De Nevers, "Air Pollution Control Engineering" , Waveland Pr Inc.
2. Anjaneyulu Y, "Text book of Air Pollution and Control Technologies", Allied Publishers

Course Outcomes**
Course outcomes: After studying this course, students will be able to: 1. Identify the major sources of air pollution and understand their effects on health and environment. 2. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models. 3. Ascertain and evaluate sampling techniques for atmospheric and stack pollutants. 4. Choose and design control techniques for particulate and gaseous emissions.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO1**	**PSO2**	**PSO3**
CO 1	1	2	1								1	1	2		
CO 2	1	1	2								2	1	2		
CO 3	1	2	1								1	1	2		
CO 4	1	1	1								2	1	2		
Ave Attainment	**1**	**1.5**	**1.25**								**1.2**	**1**	**2**		

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21UCV506L-GEOTECHNICAL ENGINEERING LABORATORY

Pre-requisites: Geotechnical Engineering I

L	T	P	C
0	0	3	2

Course Outcomes

The student will be able to

CO1: To estimate index properties of soils (coarse and fine)
CO2: To estimate index properties of soils (coarse and fine)
CO3: To estimate shear strength of soils by direct shear test, triaxial shear test, vane shear test & unconfined compressive test
CO4: To estimate the engineering properties of the soils by density test, CBR test permeability test and consolidation test

List of experiments:

1. Specific gravity of coarse and fine grained soils
2. Sieve analysis
3. Atterberg's limits and indices
4. Determination of field density (a) sand replacement method, (b) Core cutter method
5. Determination of coefficient of permeability by (a) Constant head method, (b) Variable head method
6. Consolidation test
7. Compaction test (a) IS light compaction test, (b) IS heavy compaction test
8. California Bearing Ratio test
9. Direct shear test
10. Triaxial shear test
11. Unconfined compressive strength test
12. Laboratory vane shear test

References:

1. Relevant Indian standard codes
2. Geotechnical Laboratory Manual
3. SP 36-1 (1987): Compendium of Indian Standards on Soil Engineering: Part-1 Laboratory Testing of Soils for civil Engineering Purposes.
4. SP 36-2 (1988): Compendium of Indian Standards on Soil Engineering: Part-2 Field Testing of Soils For Civil Engineering Purposes.

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VI semester

Sl. No.	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UMA601C	Numerical Methods in Civil Engineering	3	3	0	0	50	50	100
2.	PCC	21UCV602C	Design of RC Structures	3	3	0	0	50	50	100
3.	PCC	21UCV603C	Design of Steel Structures	3	3	0	0	50	50	100
4.	PEC	21UCV6XXE	Professional Elective Course - II	3	3	0	0	50	50	100
5.	OEC	21UCV6XXN	Open Elective Course - II	3	3	0	0	50	50	100
6.	OEC	21UCV6XXN	Open Elective Course - III	3	3	0	0	50	50	100
7.	PCC	21UCV604L	Environmental Engineering Lab	1	0	0	2	50	50	100
8.	PCC	21UCV605L	Computer Aided Analysis and Detailing of RC Structures Lab	1	0	0	2	50	50	100
9.	MP	21UCV606P	Mini Project (Extensive Survey Project)	2	NA			50	50	100
10.	HSSM	21UBT621C	Environmental Studies	1	1	0	0	50	50	100
			Total	**23**	**22**	**0**	**4**	**500**	**500**	**100**

Open Elective Course - II				Open Elective Course - III			
Sl. No	**Category**	**Subject Code**	**Subject Title**	**Sl. No**	**Category**	**Subject Code**	**Subject Title**
1.	OEC	21UCV631N	Occupational Health and Safety	1.	OEC	21UCV642N	Green Building Technology
2.	OEC	21UCV632N	Project Management and Economics	2.	OEC	21UCV643N	Remote Sensing and GIS
3.	OEC	21UCV633N	Disaster Management	3.	OEC	21UCV543N	Process Economics and Plant Design

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21UMA601C	**NUMERICAL TECHNIQUES AND STATISTICAL ANALYSIS IN CIVIL ENGINEERING**	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10Hrs**

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.

UNIT–II	**10 Hrs.**

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

Computation of area of BMD drawn for statically determinate beams by Trapezoidal rule and Simpson's one third rule.

UNIT–III	**10 Hrs.**

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.

UNIT–IV	**10 Hrs.**

Application of probability and probability distribution in Civil Engineering problems:

Review of basic probability concepts, measures of central value (mean, median, mode), Probability distributions including Binomial, Poisson, Normal, test of hypothesis, chi-square test.

Reference Books *

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 S Sastry- 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.
7. Probability concepts in Engineering, Alferdo H S Ang and Wilson H Tang, 2nd Edition, John Wiley and Sons,

8. Probability and Statistics for Engineers – Richard A Johnson
9. Probability and Statistics for Science and Engineering – G Shankar Rao

Course Outcomes**

After completion of the course student will be able to

1. Solve linear system of equations related to civil engineering problems using Gauss elimination, Gauss-Siedel, Gauss-Jordan matrix inversion, Cholesky's decomposition methods. Evaluate the dispersion of air pollutants in the atmosphere and to develop air quality models.
2. Find roots of non-linear algebraic and transcendental equations related to civil engineering problems using bisection and Newton-Raphson method.
3. Solve differential equations by finite difference method for determinate and indeterminate beams and buckling of columns.
4. Apply probability and probability distributions, such as the binomial, Poisson, and normal distributions, as well as measures of central value and dispersion, in solving civil engineering problems and conducting hypothesis testing.

*__Books to be listed as per the format with decreasing level of coverage of syllabus__
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes**												**Programme Specific Outcomes**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	3											2	1	1
CO 2	3	3											2	1	1
CO 3	3	3	3	3									1	1	1
CO 4	3			2									2	2	1
Average	3	3	3	2.5									1.75	1.25	1

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21UCV602C	**DESIGN OF RC STRUCTURES**	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**11 Hrs**

General features reinforced concrete: of Introduction, Design loads, Materials for reinforced 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.

UNIT–II	**11 Hrs.**

Limit state: General aspects, Deflection limits in IS: 456-2000, Calculation of deflection (Theoretical method), Cracking Serviceability 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).

UNIT–III	**09 Hrs.**

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.

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.

UNIT–IV	**09 Hrs.**

Design of footings: Introduction, Load for foundation, Design basis (limit state method), Design of isolated square or rectangular footing for axial load.

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.

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, Vidyarthi Prakashan, Pune. 2017.
3. A.K. Jain, Limit state method of design, Nemchand and Bros, Roorikee, 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).

Course Outcomes**

After completion of the course student will be able to

1. Students will have the knowledge of methods of design of RC sections & will analyse the different RC sections.
2. Student will be able to solve the problems related to serviceability conditions and design different beam sections.
3. Student will be able to design different slab and columns.
4. Student will able to design staircase and isolated footing footings.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3											2	1	
CO 2	3	3											2	2	
CO 3	3	3	3	3									2	2	
CO 4	3			2									2	1	
Average	3	3	3	2.5									2	1.5	

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Civil Engineering Department

21UCV603C	**Design of Steel Structures**	**03-Credits (3:0:0)**
Hrs/Week : 03		CIE Marks:50
Total Hours: 40		SEE Marks:50

UNIT - I	**10 Hrs**

Introduction: Advantages & Disadvantages of steel structures, Loads & Load combinations, Limit State method of design, section classification.
Plastic behavior of structural steel: Introduction, Plastic theory, plastic hinge concept, plastic collapse load, condition of plastic analysis, theorem of plastic collapse, methods of plastic analysis, plastic analysis of continuous beam.

UNIT – II	**10 Hrs**

Bolted Connections: Introduction, Behavior of bolted joints, design strength of ordinary black bolts, simple connections, moment resistant connections, beam to beam connections.
Welded Connections: Introduction, advantages of welding, types and properties of welds, types of joints, weld symbols, weld specifications, effective area of welds, design of fillet welds, moment resistant connections, continuous beam to beam connections.

UNIT - III	**10 Hrs**

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, slab base connections.

UNIT - IV	**10 Hrs**

Design of Tension members: Introduction, Types of tension members, factors affecting the strength of tension member, design of tension member with bolted and welded connections.
Design of Flexural members
Introduction, beam types, section classification, design of laterally supported and unsupported beams.

Reference Books:

1. N. Subramanian, Design of Steel Structures, Oxford Publications, 2008
2. Ramachandra, Design of Steel Structures, Standard Book House, New Delhi, 2016.
3. Duggal, S. K, Design of Steel Structure, Tata McGraw Hill Publications, 2017.
4. Punmia, B. C, Comprehensive Design of Steel Structures, Laxmi Publications, 2015.
5. Karve, Design of Steel Structures (Limit State Method), Structures Publications, Pune.
6. Bhavikatti S.S, Design of Steel Structures (Limit State Method), I K International Publishing house Pvt. Ltd, 2012
7. Negi, Design of Steel Structures, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2017.

CODE BOOKS
IS-800-2007, Steel tables (to be supplied in examinations)

QUESTION PAPER PATTERN FOR SEE
1. Q. No. 1 is compulsory
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.
4. Any FOUR Full questions are to be answered choosing at least one from each unit.

Course Outcomes: After completion of the course students will be able to understand
1. Different types of loads and their combinations along with an approach to plastic analysis in designing the steel sections with limit state approach.
2. Different types of bolts and welds with their connections to different members in a joint.
3. Design the compression members along with different built up sections like lacings and battens.
4. Design tension members and flexural members their connections.

CO MAPPING WITH PO'S AND PSO'S

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	3	3	--	--	2	--	3	--	--	--	2	--	2	--
CO 2	3	3	3	--	--	2	--	3	--	--	--	2	--	2	--
CO	3	3	3	--	--	2	--	3	--	--	--	2	--	2	--

3															
CO4	3	3	3	--	--	2	--	3	--	--	--	2	--	2	--

21UCV604L	ENVIRONMENTAL ENGINEERING LAB	**Credits: 1**
L:T:P - 0 : 0: 2		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

I. Tests on Water Quality

i. Physical Parameters

1) To find the colour of a given sample of water.
2) To find the turbidity of a given sample of water.
3) To determine the conductivity of a given sample of water.
4) To determine the temperature of a given sample of water.

ii. Chemical Parameters

1) To find out total dissolved solid, settle able solids, suspended solids and volatile solids of the given sample
2) To determine the pH value of a given sample of water.
3) To determine the acidity of a given sample of water.
4) To determine the carbonate, bicarbonate, and hydroxide alkalinity of a sample.
5) To find out the concentration of chlorides in the given sample of water.
6) To estimate the hardness of the given sample of water by standard EDTA method.
7) To determine the sulphate of a given sample of water.
8) To determine the fluoride of a given sample of water.
9) To determine the Iron of a given sample of water.
10) To determine residual chlorine in a given sample of water.
11) To determine chlorine demand for the given sample of water.
12) To determine nitrate in a given sample of water.
13) To determine dissolved oxygen in a given sample of water.

iii. Bacteriological Parameters

1) To determine MPN of coliforms of the given sample.
2) Microbial Examination of Water Samples Using the Membrane Filtration Technique.

II. Tests on Sewage

1) To determine biochemical oxygen demand (BOD) exerted by the given waste water sample
2) To determine Chemical oxygen demand (COD) exerted by the given waste water sample

III. Other Tests

1) To determine the optimum dose of alum required to treat the given water.
2) To determine the percentage of chlorine present in the given bleaching powder.

References *

1. Manual of Water and Wastewater Analysis- NEERI Publication 1988.
2. Standard methods for Examination of Water and Wastewater Analysis APHA, AWWA. 2011.
3. Manual for Sewer and Sewerage, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India.
4. Manual for water supply and treatment, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India.

Course Outcomes**

After completion of the course student will be able to

1. Able to determine the physical, chemical and biological parameters for drinking purpose as per BIS standards.
2. Analyze the test results and recommend the water for its potability.
3. Identify and characterize wastewater using standard methods.
4. Analyze the test results and recommend wastewater for its disposal.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	2	2	2	2	-	2	1	-	2	3	2	3
CO2	3	3	2	2	1	1	2	-	1	1	-	2	3	2	2
CO3	3	3	2	2	2	1	2	-	2	1	-	2	3	2	3
CO4	3	2	-	-	-	-	-	-	-	-	-	-	2	2	-

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<table>
<tr><td>1UCV605L</td><td rowspan="3">COMPUTER AIDED ANALYSIS AND DETAILING OF RC STRUCTURES LAB</td><td>01-Credits (0:0:2)</td></tr>
<tr><td>Hrs/Week : 03</td><td>CIE Marks:50</td></tr>
<tr><td>Total Hours: 40</td><td>SEE Marks:50</td></tr>
<tr><td colspan="2">PART – A (STAAD-Pro)</td><td>10 Hrs</td></tr>
<tr><td colspan="3">ANALYSIS AND DESIGN SOFTWARES: Analysis and Design of structural Engineering components using commercially available Software's: Cantilevers, Simply supported beams, Propped Cantilevers, Fixed and Continuous Beams. 2D Portal frames - Single and Multistoried.</td></tr>
<tr><td colspan="2">PART – B (AUTO CAD)</td><td>10 Hrs</td></tr>
<tr><td colspan="3">1. Drawing of the Lay out plan of Residential Building showing position of the columns, beams and footing.
2. Drawing and Detailing of RC Lintels, Beams and Slab (One way, Two way and Cantilever)
3. Drawing and Detailing of RC Stair</td></tr>
<tr><td colspan="3">Reference Books:
N. Krishna Raju, Structural design and drawing Reinforced concrete and steel, 2nd edition, 2004, University Press, Hyderabad.
Training manuals, User manuals and relevant code books</td></tr>
<tr><td colspan="3">Laboratory assessment:
1. 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 marks for write-up, 10 marks for conduction, calculation, results etc.
3. Allocation of 50 marks for SEE.
25% write-up, 50% conduction, calculation, results etc., 25% viva-voce</td></tr>
<tr><td colspan="3">Course Outcomes:
5. Students will be able to use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work.
6. Students will be able to draw the RC elements and detail it.</td></tr>
</table>

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Basaveshwar Engineering College (Autonomous), Bagalkot
Civil Engineering Department
Professional Elective Course – II

21UCV611E	**MATRIX METHOD OF STRUCTURAL ANALYSIS**	**Credits: 3**
L:T:P - 3 : 0 : 0		**CIE Marks: 50**
Total Hours/Week: 3		**SEE Marks: 50**

UNIT-I	**11 Hrs.**

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.

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.

UNIT–II	**11 Hrs.**

Flexibility Method Continued: Analysis of indeterminate structures: analysis of plane trusses.

Stiffness Method: Introduction, element stiffness matrix, Principle of contragradience, construction of member and structure stiffness matrix, determination of member displacements, solution procedure, Analysis of indeterminate structures: continuous beams.

UNIT–III	**9 Hrs.**

Stiffness Method continued: Analysis of indeterminate structures: plane frames and plane trusses.

UNIT–IV	**9 Hrs.**

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.

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.

Course Outcomes**

1. 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. Evaluate member forces for trusses by flexibility matrix method. Knowledge ofconcepts associated with stiffness matrix method. Evaluate member forces for continuous beams by displacement transformation method.
3. Evaluate member forces for plane frames and trusses by displacement transformation method.
4. Knowledge of basic concepts associated with direct stiffness method. Evaluate member forces for continuous beams and trusses by direct stiffness method

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO 1	3	3	3	2	3	3	-	-	-	-	-	-	2	2	2
CO 2	3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO 3	3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
CO 4	3	3	3	3	3	3	-	-	-	-	-	-	2	2	2
Average	**3**	**3**	**3**	**2.75**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**

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21UCV612E	**GROUND IMPROVEMENT TECHNIQUES**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10Hrs**

Introduction: Principles and objectives of ground improvement and History of ground improvement developments. Classification of ground improvement techniques, Factors affecting ground improvement.

Soil improvements without additives - dynamic compaction - equipment used - application to granular soils - cohesive soils - depth of improvement - environmental considerations - induced settlements - compaction using vibratory probes - vibro techniques vibro equipment - the vibro compaction and replacement process - control of verification of vibro techniques - vibro systems and liquefaction

UNIT–II	**10 Hrs.**

Soil improvement- by thermal treatment, preloading techniques, surface compaction and introduction to bio technical stabilization, Gravel, sand, stone columns-construction techniques

Hydraulic modification: Filters, Control of ground water seepage, Sand drains and wick drains, Well point system, Vertical drains, Electro osmosis and its application in ground improvement.

UNIT–III	**10 Hrs.**

Chemical modification - lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils - control methods –lime fly ash columns.

Grouting - commonly used chemicals for grouting, grouting systems, grouting operations, applications. Compaction grouting – introduction, application and limitations. Plant for preparing grouting materials. Jet grouting- jet grouting process, geometry and properties of treated soils and applications.

UNIT–IV	**10 Hrs.**

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development. Anchored earth nailing reticulated micro piles, soil dowels, soil anchors and reinforced earth walls. Geotextiles - polymer type geotextiles, woven geotextiles, non woven geotextiles. Geo grids - physical and strength properties - behaviour of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability.

Reference Books *

1. Purushothama Raj., Ground Improvement Techniques, Laxmi Publications Pvt Ltd, 2nd edition, 2016
2. Manfired R.H. (1990), Engineering Principles of Ground Modification, McGraw-Hill

Pub.
3. Koerner R M., Construction and Geotechnical Methods in Foundation Engineering, McGrawHill Pub Co New York, 1985.
4. Hausmann, M R, Engineering Principles of Ground Modifications, McGraw Hill Pub Co NewYork, 1990.
5. Ingles O G and Metcalf J B., Soil Stabilisation: Principles and practice, Butterworths, London, 1972.
6. Nelson J D and Miller D J., Expansive soils, John Wiley and sons. Inc new, 1992.
7. Hausmann, M.R. (1990). Engineering Principles of Ground modification. McGraw-Hill Inc.,USA
8. Mooseley, M.P. and Kirsch, K. (2004). Ground Improvement. 2nd Edition, Spon Press, Taylor and Francis Group, London, United Kingdom
9. Jie Han. (2015) Principles and practice of Ground Improvement techniques 1st Edition, John Wiley and sons

Course Outcomes**

After completion of the course student will be able to

1. Suggest the soil properties without additives by using techniques like vibro compaction, dynamic tamping, compaction piles etc… and characterize the problematic soils
2. enhance the properties of soil in field using thermal, preloading, surface compaction Gravel, hydraulic techniques, stone columns.
3. explore the concept of soil chemical modification techniques and grouting system
4. recognize the need for Soil reinforcement technique like reinforcement with strip, in-situ ground reinforcement, ground anchors and soil nailing etc… and geosynthetics

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	3	2	3	3	-	-	-	-	-	2	2	2	2
CO 2	3	3	3	3	3	3	-	-	-	-	-	2	2	2	2
CO 3	3	3	3	3	3	3	-	-	-	-	-	2	2	2	2
CO 4	3	3	3	3	3	3	-	-	-	-	-	2	2	2	2
Average	3	3	3	2.75	3	3	-	-	-	-	-	2	2	2	2

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21UCV613E: MASONRY STRUCTURES
Credits 03 (3-0-0)

UNIT-I

MASONRY UNITS, MORTARS, TYPES AND MASONRY CONSTRUCTION: Brick, stone, concrete block, stabilized mud block masonry units-strength, modulus of elasticity,and initial rate of absorption (IRA) of brick, classification and properties of mortar, workability of fresh mortar, water retentivity of mortar,stress-strainbehavior of mortar, selection of mortars. Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking and remedial measures.

05 Hrs

STRUCTURAL MASONARY: Introduction, stresses in masonry in compression, factors influence compressive strength of masonry; effect of unit strength, unit height, hollowness and moisture absorption, effect of mortarstrength, plasticity, joint thickness, type of masonry loading, modular ratio of unit and mortar and direction of loading.Strength formulae and mechanism of failure for masonry prism subjected to direct compression.

05 Hrs

UNIT-II

DESIGN CONSIDERATIONS: Boundary conditions and the effective height of wall in the design of masonry wall and column; effective length of wall based onconditions of support and, effective thickness for solid wall, cavity wall with and without stiffeners; slenderness ratio;assessment of eccentricity of loading on walls.

05 Hrs

PERMISSIBLE STRESSES: Permissible compressive stress in masonry wall, stress reduction, area reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses in masonry wall.

0**4 Hrs**

UNIT-III

DESIGN OF MASONRY WALLS: Reduction of basic compressive strength to allow slenderness ratio and eccentricity; elastic buckling of brittle columns. Design of load bearing masonry for building up to three storeys using IS: 1905-1987.

05 Hrs

DESIGN OF SOLID WALLS: Design of axially loaded unstiffened solid wall; determination of safe load carrying capacity of wall. Design of solid wall with piers.solid wall supported at the ends by cross wall.

04 Hrs

UNIT-IV

DESIGN OF CAVITY WALL:Design of cavity wall with and without piers. Design of cavity wall with cross wall. Determination of safe load carrying capacity of cavity wall.

05 Hrs

DESIGN OF FREE-STANDING WALL: Transverse load acts perpendicular to plane of wall. Lateral load acts in the plane of wall. Design of free-standing walls with and without staggered, design of masonry tabular structure representing a chimney.

05 Hrs

TEXT BOOKS

1. Brick and Reinforced Brick Structures Dayaratnam P.: Oxford & IBH, 1987
2. Alternative Building Materials and Technologies, K S Jagadish, B V Venkatarama Reddy, K S Nanjunda Rao 2008
3. Design of Masonry structures Sinha B.P Davies S.R: E & FN spon 1997

REFERENCE BOOKS:

1. Structural Masonry Henry, A.W.: Macmillan Education Ltd, 1990
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: 1905-1987 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. Factors influence the compressive strength of masonry.
2	Students will learn boundary conditions and the effective height, length and thickness of wall in the design of masonry wall and column; slenderness ratio.	Determine the slenderness ratio of walls and reduction factors.To evaluate the permissible stresses.
3	Students will be able comprehend load considerations for masonry and design of axially loaded solid walls.	Analyse the reduction of basic compressive strength due to slenderness ratio and eccentricity, elastic buckling of brittle columns.Design of masonry up to three storeys.
4	Students will be able comprehend design of cavity walls and free- standing walls.	Design the cavity wall. Design the free-standing walls subjected to wind load perpendicular to plane of wall, and load acts in the plane of wall.

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21UCV614E	**FOUNDATION ENGINEERING**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**
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, sample disturbance, area ratio, recovery ratio, clearance stabilization of boreholes - typical bore log. Number and depth of boring for various civil engineering structures and soil exploration report. **Stress distribution in soils**: Introduction, Boussinesq's and Westergaard's theory concentrated load, circular and rectangular load, equivalent point load method, pressure distribution diagrams and contact pressure and Newmark's chart.	
UNIT–II	**10Hrs.**
Stability of earth slopes: Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of finite slopes - method of slices, Fellineous method and Taylor's stability number. **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.	
UNIT–III	**10Hrs.**
Bearing capacity of soil: field methods of determining bearing capacity of soil, proportioning foundation, - SPT and plate load test. Settlement of foundations: Settlement- Types of settlements and importance, Computation of immediate and consolidation settlement, permissible differential and total settlements (IS 8009 part 1).	
UNIT–IV	**10Hrs.**
Pile foundations: Types and classification of piles, load carrying capacity of single pile in cohesionless by static and Dynamic formulas, negative skin friction. **Well Foundations:** Introduction, Different shapes and characteristics of wells. Components of well foundation. Forces acting on well foundation. Sinking of wells. Causes and remedies of tilts and shifts.	
Reference Books *	
1. Jonathan Knappett and R.F.Craig,Craig's Soil Mechanics- CRC PressNinth Edition 2019. 2. Braja M. Das and NagaratnamSivakugan, Principles of Geotechnical Engineering- Cl-	

Engineering India Ninth Edition 2018.
3. V.N.S. Murthy, Soil Mechanics and Foundation Engineering- CBS Publishers & Distributors New Delhi 2018.
4. VenkatrahmaiahC.Geotechnical Engineering New Age International (P) Ltd., New Delhi Fifth Edition 2017.
5. Iqbal H. Khan Text Book of Geotechnical Engineering- PHI, India Second Edition 2005.
6. Joseph Bowles, Foundation Analysis and Design- McGraw Hill Pub. Co. New York Fifth Edition 2001.
7. Alam Singh and Chowdhary G.R., Soil Engineering in Theory and Practice CBS Publishers and Distributors Ltd., NewDelhi 1992.
8. P. C. Varghese, "Foundation Engineering" , PHI Publisher 2005.
9. Swami saran, Analysis and Design of sub structures 2nd edition 2018, oxford & IBH Co Pvt. Ltd.

Course Outcomes**

After completion of the course student will be able to

1. investigate the soil profile and Determine the vertical stresses below different shapes of footing
2. check the stability of the slopes and compute the lateral earth pressure on retaining wall.
3. calculate the bearing capacity of soil and proportionate the footing
4. determine the design parameters of expansive soil and examine the various deep foundation.

COURSE ARTICULATION MATRIX:

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	-	-	-	-	-	-	-		-	-	2	2	1	-
CO 2	3	1	-	-	-	-	-	-	-	-	-	2	2	1	1
CO 3	3	2	2	2	-	-	-	-	-	-	-	2	2	1	1
CO 4	3	2	2	2	-	-	-	-	-	-	-	2	2	1	1
Average	**3**	**1.6**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**	**1**

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21UCV615E	WASTEWATER TREATMENT ENGINEERING	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**

Introduction: Necessity for sanitation, Sewerage systems and their suitability.

Estimation of Wastewater flows: wet and dry weather flow, factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of sewage and storm discharge.

Sewerage Characteristics: Sewage Sampling. Physical, Chemical and Biological characteristics, with emphasis on DO, BOD & COD, Effluent standards, impacts of disposal. Sludge characterization.

UNIT–II	**10 Hrs.**

Design of Sewers: Types of sewers, factors affecting the selection of material for sewer construction, materials for sewers, joints in sewers, shapes of sewers, Self-cleansing and non-scouring velocities, Laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.

Sewage Treatment: Flow diagram of municipal wastewater treatment plant.

Primary treatment: Screening, grit chambers, skimming tanks, primary sedimentation tanks-theory and design. Numerical Problems.

UNIT–III	**10 Hrs.**

Secondary Treatments: Fixed film bioprocess-Trickling filter theory and design, Suspended growth system-Activated sludge process-Theory and design, Low-cost wastewater treatment - Septic tank, Sludge digestion tanks, Oxidation Pond and Oxidation ditches.

Tertiary Treatment of Sewage; Decentralized Sewage Treatment & Reuse.

UNIT–IV	**10 Hrs.**

Sewage Disposal: Dilution method - self-purification phenomenon. Streeter-Phelp's equation, Oxygen sag curve, Zones of purification, Land treatment: Sewage farming, sewage sickness, Numerical Problems on Disposal of sewage.

Sludge treatment methods: thickening, Sludge drying beds, Sludge Conditioning and Dewatering.

Self Study: 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.

Reference Books *

1. Environmental Engineering, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-HillInternational.
2. Water Supply and Sewerage, McGhee T. J ., McGraw-Hill Inc.,
3. Garg, S.K., "Environmental Engineering", Vol. 1 & II Khanna Publishers, New Delhi, 2005.
4. APHA, Standard Methods Examination of Water and Wastewater, American Public Health Association, Washington DC, 1995.
5. Waste water Engineering Treatment and Reuse, Metcalf & Eddy, McGraw Hill Education, 2017,4th Edition.
6. CPCB, Guide Manual: Water and Wastewater Analysis.

Course Outcomes**

After completion of the course student will be able to

1. Assess the quality and quantity of wastewater and to study the sewage characteristics.
2. Design the components of wastewater treatment systems.
3. Study the secondary treatment of wastewater and tertiary treatment of Sewage.
4. Design and plan suitable engineering systems for sludge treatment and disposal.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	3	3	-	-	-	-	2	2	3	3
CO2	3	-	-	3	2	3	3	-	-	-	-	1	3	2	3
CO3	2	2	1	2	2	3	3	-	-	-	-	2	2	2	2
CO4	3	3	3	2	2	2	3	-	-	-	-	1	3	3	3

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21UCV616E	**Railway and Airport Engineering**	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**
Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).	
UNIT–II	**10 Hrs.**
Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	
UNIT–III	**10 Hrs.**
Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, c o m p o n e n t s , layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.	
UNIT–IV	**10 Hrs.**
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	

Reference Books *

1. Y.H. Huang, Pavement Analysis and Design, Prentice Hall, New Jersey, 2003.
2. R. Horonjeff and F.X. Mckelvey, Planning andDesign of Airports, McGraw Hill, New York, 1994. **3**. S.C. Sexena and S.P. Arora, A Text Book of Railway Engineering, Dhanpat Rai & Sons, New Delhi, 1998.
4. W.W. Hay, Railroad Engineering, Wiley, New York, 1988.

Course Outcomes**

After completion of the course student will be able to

1 . Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify

required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunnelling activities.

*__Books to be listed as per the format with decreasing level of coverage of syllabus__
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1															
CO2															
CO3															
CO4															

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Open Elective Course - II

21UCV631C	OCCUPATIONAL HEALTH AND SAFETY	Credits: 3
L:T:P - 3:0:0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
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**	
UNIT–II	**10 Hrs.**
Ergonomics at Workplace: **Ergonomics Task analysis, Preventing Ergonomic Hazards, Workspace 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** 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.**	
UNIT–III	**10 Hrs.**
Health Considerations at Workplace: **types of diseases and their spread, Health Emergency. 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**	
UNIT–IV	**9 Hrs.**
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**	

Reference Books *

1. Goetsch D.L., (1999), "Occupational Safety and Heal th for Technologists, Engineers and Managers", Pren tice Hall.
2. Heinrich H.W., (2007), "Industrial Accident Prevent ion - A Scientific Approach", McGraw-Hill Book Company
3. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Poll ution Control Handbook
4. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
5. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

Course Outcomes**

After completion of the course student will be able to

1. Understand occupational hazards, safety principles, OSHA regulations, accident causation, and investigation methods, enabling them to ensure workplace safety and effectively investigate accidents as supervisors.
2. Apply ergonomic principles for task analysis and prevention of hazards, demonstrate knowledge of fire prevention and protection, including fire development and early detection, and possess the skills to ensure electrical safety and comply with product safety requirements.
3. recognize and prevent disease transmission, utilize appropriate PPE, mitigate exposure effects in engineering and waste management, and develop environment management plans for safety and sustainability in the workplace.
4. grasp occupational health and safety in water treatment, construction material manufacturing, and construction sites, and understand their respective roles and responsibilities for workplace safety.

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						2		2				3
CO2						2		2				3
CO3						2	3	2				3
CO4						2	3	2				3
Average						2	3	2				3

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21UCV632N	**PROJECT MANAGEMENT AND ECONOMICS**	Credits: 3
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
Concepts of Project Management: Concepts of projects, characteristics of project, Phases of project life cycle, Tools and techniques for project management, Computer based project management. **Project planning and estimating:** Feasibility report, Preparation of cost estimation, Evaluation of the project profitability.	
UNIT–II	**10 Hrs.**
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. 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.	
UNIT–III	**10 Hrs.**
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 Quality Planning and Project Kickoff:** Development of quality concepts, project quality management plan, project quality tools, kickoff project, baseline and communicate project management plan.	
UNIT–IV	**10 Hrs.**
Engineering Economics: Introduction, project feasibility report, basic concepts of economic analysis, Interest and time value of money: concept of simple and compound interest, interest formula for single payment, equal payment and uniform gradient series. **Comparison of alternatives:** Present worth, future worth, annual equivalent, capitalized and rate of return methods, break even analysis, Problems.	
Reference Books *	

1. Timothy J Kloppenborg, " Project Management" , Cengage Learning, Edition 2009.
2. Harold Kerzner, "Project Management, A systems approach to planning scheduling and controlling", CBS publication.
3. S. Choudhury, "Project Management" Mc Graw Hill Education (India) Pvt.Ltd. New Delhi, 2016.
4. Pennington Lawrence, "Project Management", Mc Graw hill, 2010.
5. Moder Joseph and A. Phillips "Project Management", New York, Van Nostrand, Reinhold, 2014.
6. Bhavesh M. Patel, Project Management, Vikas publishing House, 2018.

Course Outcomes After completion of the course the student will be able to**

1. Comprehend the concepts of project management, tools and techniques.
2. Plan and schedule the projects considering various engineering aspects.
3. Plan resources, Select quality management techniques and assess risk for the projects taking into account various engineering considerations.
4. Assess the profitability of the project with the help of different techniques.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	-	-	-	-	-	-	-		3	3	2		2
CO2	3	3	2	-	-	-	-	-	-	2	3	3	3	3	2
CO3	3	3	1	-	-	1	-	3	-	2	3	3	3	3	3
CO4	3	3	1	-	-	-	-	-	-	2	3	3	2	2	2

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21UCV633N	DISASTER MANAGEMENT	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	08 Hrs.

Introduction : Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency , capacity, impact, prevention, mitigation. India's natural disaster proneness and disaster prone zones

UNIT–II	10 Hrs.

Disasters classification : natural disasters (floods, draughts, cyclones, volcanoes, earthquakes, tsunamis . landslides etc.); manmade disasters(industrial pollution, artificial flooding in urban areas, nuclear radiation, transportation accidents ,terrorist strikes, etc.)

UNIT–III	10 Hrs.

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

UNIT–IV	12 Hrs.

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, Importance of disaster education and community awareness and preparedness in disaster management. Roles and responsibilities of citizens, technology, media, community, government and non government organizations in disaster management; Policies and legislation for disaster risk reduction; Disaster management system in India.

Reference Books *

1. R. Subramanian, 2021, Disaster Management, Vikas publishing house Pvt. Ltd., Noida, India.
2. A.K. Srivastava, 2021, Text book of Disaster Management, Scientific publishers, India.
3. Tushar Bhattacharya, 2012,Disaster science and Management, Tata McGraw Hill publications, New Delhi, India.

4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques and Guidelines, RajatPublication.
6. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.
7. Jagbir Singh, 2007, Disaster Management, I.K International Publishing House, New Delhi.
8. Vinod.K.Sharma, 2013,Disaster Management, second Edn., Scientific International Pvt. Ltd., New Delhi,India.
9. Carter.W.Nick, 1991, Disaster Management: A Disaster Manager's Hand book, Asia Development Bank, Manila.

Government of India website on Disaster Management : www.ndmindia.nic.in

Course Outcomes**

After completion of the course student will develop competencies in:

CO1: the application of disaster Concepts to management

CO2: analysing relationship between development and disasters.

CO3: ability to understand Categories of disasters.

CO4: realization of the responsibilities to society

***Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	1			

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Open Elective Course – II

21UCV641N	**GREEN BUILDING TECHNOLOGY**	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
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 (Leadership in energy and environmental design) GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council) and Green star rating systems.	
UNIT–II	**10 Hrs.**
Principles and elements of design of green building; Sustainability: concept and reality 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 Shading devices and their effect.	
UNIT–III	**10 Hrs.**
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 Day lighting Ventilation.	
UNIT–IV	**10 Hrs.**
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 Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings.	

REFERENCE BOOKS**

11. 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.
12. Renewable Energy and Environment -A Policy Analysis for India, H, Ravindranath, K Usha Rao, B Natarajan, P Monga, Tata McGraw Hill, 2000.Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984.IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
13. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
14. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
15. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
16. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
17. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley &Sons, New York, 2008.
18. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.
19. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987.
20. Energy Conservation building code (ECBC), Bureau of energy efficiency, 2011.

Course Outcomes**

After completion of the course student will be able to

5. understand, recognize, and evaluate green building's significance, principles, and advantages and disadvantages in sustainable construction.
6. gain a comprehensive understanding of green building design principles and sustainability concepts, with a focus on climate-responsive design processes, shading devices, and their effects on building performance.
7. proficiently optimize thermal comfort, daylighting, and ventilation in buildings, creating sustainable and comfortable indoor environments.
8. understand and apply water and material conservation techniques, grasp the concept of embodied energy and carbon emissions reduction, and analyze existing green buildings and the role of the Bureau of Energy Efficiency.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	-	-	-	2	3	2	-	-	-	2		2	
CO2	3	2	-	-	-	1	3	2	-	-	-	2		2	
CO3	3	2	-	-	-	-	3	2	1	-	-	2		2	
CO4	2	2	-	-	-	1	3	2	1	-	-	2		2	

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21UCV542N	REMOTE SENSING AND GIS (OPENELECTIVE)	**Credits: 3**
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	**10 Hrs.**

UNIT-1

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.
Platforms: 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 - Ikonos, Quickbird, Risat.

UNIT–II	**10 Hrs.**

Visual Image Interpretation: Definition, Objectives, Keys & Elements of Visual Image interpretation.
Digital Image Processing (DIP):(No problems/programming on DIP) Definition, Image Rectification & Restoration, image enhancement (contrast manipulation-Grey Level Thresholding, Level Slicing only), Supervised Image Classification using minimum distance to means classifier algorithm- GIS integration –stages & procedure., Image Filtering (spatial filters) -Low Pass and High pass image filters.(Brief discussion only, no problems or programming)
Applications of REMOTE sensing in urban applications and water resource management

UNIT–III	**10 Hrs.**

Maps and Projections
Map Projections Plane and geodetic , latitude and longitude map projections, types of map projections Spheroid, Datum (WGS84 Datum) and UTM (No Problems)
GIS:
History, Definition, Components, concept, Data acquisition for GIS input-Spatial (Vector, Raster & Surface data) & Non spatial data, rectification, processing, verification & Data Editing, Storage and Output.
GIS functions in vector and raster data- Input, Analysis and out put
GIS Analysis (**Vector Data-** Buffering & Overlay analysis using overlay operators)
GIS Analysis **(Raster Data**-Local Operations and neighbourhood using arithmetic, Logical and Overlay operators)
Cartography-Definition, basic map layout, significance of cartography
Data Standards in GIS errors, precision and accuracy-Definition and Types

UNIT–IV	**10 Hrs.**

Advanced Concepts: LIDAR, Virtual GIS. (Brief Discussion only)
GPS.- Definition, working principle, segments and uses (Brief Discussion only)
Procedure of Compiling: geology map of a district.

Applications of GIS and Remote Sensing:
1) Identifying suitable site for urban development
2) Planning of network for sewage collection and transport (laying of sewer lines)
3) Ground water Vulnerability assessment.
4) Land Use Land Cover mapping (LU/LC).
Drainage Patterns-Definition, Types, significance.

Reference Books *

1. B Bhatia, Remote Sensing and GIS, Oxford University Press, New Delhi.
2. T.M Lillesand, R.W Kiefer,. and J.W Chipman, Remote sensing and Image interpretation, 5th edition, John Wiley and Sons India
3. Geographical Information Systems, C.P.Lo and Albert Yoing, 2nd edition, Preintice hall publications-2005

Course Outcomes**

The student will be able to

1.Explore the advantages of remote sensing and procedure of using satellite image for various civil engineering applications.

2. Apply, Method of rectifying and acquiring required data from satellite image and carry out analysis to get object specific results.

3. Integrate data from various data sources and extract relevant information related to geography, by performing GIS data analysis.

4. Use recent technologies like GIS and RS, for civil engineering applications , to meet project/work requirements in short time and on large scale.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2	-	2	2	-	-	-	-	-	-			
CO2	3	2	3	-	2	1	-	-	-	-	-	-			
CO3	3	2	3	-	3	-	-	-	1	-	-	-			
CO4	2	1	1	-	2	1	-	-	1	-	-	1			

21UCV543N	**Process Economics and Plant Design (Open Elective)**	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
PROCESS DESIGN DEVELOPMENT: 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–II	**10 Hrs.**
CAPITAL INVESTMENTS: 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–III	**10 Hrs.**
COST ANALYSIS: 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–IV	**10 Hrs.**
PROFITABILITY ANALYSIS: Methods for the evaluation of profitability. Return on original investment, interest rate of return, Cash flow diagrams. Break-even analysis. Conceptual numerical.	
Reference Books *	

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 Outcomes**

Course outcomes:

After studying this course, students will be able to:

1. To understand the process design of plant.
2. To study the feasibility survey for the plant design.
3. To Calculate the project profitability and alternative investment
4. To Identify the cost analysis involved in the design of plant.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes											Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO 1	2	2	1	1			1	1	1		2		2		
CO 2	2	1	2	1			1	1	1		3		2		
CO 3	1	2	1	2			1	1	1		2		1		
CO 4	2	1	2	2			1	1	1		3		2		
Ave Attainment	**1.66**	**1.5**	**1.66**	**1.33**			**1**	**1**	**1**		**2.33**		**1.66**		

VII SEM									
Sl. No.	Subject code	Subject	Credits	Hours per week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UCV741C	Design of Steel Structures	3	2	2	-	50	50	100
2	UCV742C	Quantity Surveying and Estimation	3	2	2	-	50	50	100
3	UCV743C	Design of Pre-stressed Structures	3	2	2	-	50	50	100
4	UCV751E	Wastewater Treatment Engineering	3	3	-	-	50	50	100
5	UCV752E	Railway and Airport Engineering	3	3	-	-	50	50	100
6	UCV751N	Green Building Technology	3	3	-	-	50	50	100
7	UCV733N	Disaster Management	3	3	-	-	50	50	100
8	UCV743P	Extensive Survey Project	2	-	-	4	50	50	100
9	UCV741P	Project Phase –I	4	-	-	8	50	50	100
10	UCV742I	Internship	2	-	-	4	50	50	100
		Total	**23**	**12**	**6**	**16**	**400**	**400**	**800**

DEPARTMENT ELECTIVES - 5 [7th**Sem**]

Sl. No.	Subject code	Subject	Credits
1	UCV751E	Wastewater Treatment Engineering	3
2	UCV742E	Atmospheric Environmental Engineering	3
3	UCV743E	Environmental transport Process	3

OPEN ELECTIVES- 2 [7th**Sem**]

Sl. No.	Subject code	Subject	Credits
1	UCV751N	Green Building Technology	3
2	UCV752N	Environmental Management	3
3	UCV753N	Sustainable Materials	3

UCV741C: DESIGN OF STEEL STRUCTURES
3 Credits (3-0-0)
UNIT I

Introduction: Advantages & Disadvantages of steel structures, Loads & Load combinations, Design considerations, 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, simple connections, moment resistant connections, beam to beam connections.

UNIT II

Welded Connections: Introduction, advantages of welding, types and properties of welds, types of joints, weld symbols, weld specifications, effective area of welds, design of fillet welds, moment resistant connections, continuous beam to beam connections. **12 Hrs**

Plastic behavior of structural steel: Introduction, Plastic theory, plastic hinge concept, plastic collapse load, condition of plastic analysis, theorem of plastic collapse, methods of plastic analysis, plastic analysis of continuous beam. **8Hrs**

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 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. **10 Hrs**

UNIT IV

Design of Column Bases: Design of slab base and gusted base. **10 Hrs**

Design of Beams: Introduction, beam types, factors affecting lateral stability of beams, behavior of simple and built up beams in bending(without vertical stiffeners), design strength of laterally supported beams in bending, maximum deflection, design of beams and purlins.

TEXT BOOKS

1. N. Subramanian, Design of Steel Structures, Oxford Publications, 2008

REFERENCE BOOK

1. Ramachandra, Design of Steel Structures, Standard Book House, New Delhi, 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
6. Negi, Design of Steel Structures, Tata McGraw Hill Publications, New Delhi, 2nd Edition, 2017.

CODE BOOKS
IS-800-2007, Steel tables (to be supplied in examinations)

QUESTION PAPER PATTERN FOR SEE

1. Q. No. 1 is compulsory
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.
4. Any **FOUR** Full questions are to be answered choosing at least one from each unit.

After completion of the course student will be able to

1. 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. 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. Knowledge to design the tension member, lug angle, compression member, lacing and battens.

4. Knowledge to design different types of column bases including pedestal and also design the beam for given configuration.

CO MAPPING WITH PO'S AND PSO'S															
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO 1	3	3	3	--	2	--	--	--	--	--	--	2	--	2	--
CO 2	3	3	3	--	2	--	--	--	--	--	--	2	--	2	--
CO 3	3	3	3	--	2	--	--	--	--	--	--	2	--	2	--
CO4	3	3	3	--	2	--	--	--	--	--	--	2	--	2	--
AVG.	3	3	3	--	2	--	--	--	--	--	--	2	--	2	--

UCV742C	QUANTITY SURVEYING & ESTIMATION	Credits: 3
L:T:P – 2 : 2 : 0		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	13 Hrs.

Estimate: Different types of estimates, study of various drawing attached with estimates. Important terms, 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 cost center line method, long and short wall method. Preparation of detailed and abstract estimates for the following Civil Engineering works Buildings Masonry structures and framed structures with flat, sloped RCC roofs. Building components (Beams, Columns and Column Footings, RCC Roof Slabs).

UNIT–II	13 Hrs.

Estimates: Steel truss (Fink and Howe truss), RCC Slab culverts, manhole and septic tanks.

Specifications: Definition ofspecifications, objective of writing specifications, essentials in specifications, general and details specifications ofitems.

UNIT–III	13 Hrs.

Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items 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 andventilators.

Measurement of earthwork for roads: Methods for computation of earthwork cross sections mid section formula, trapezoidal or average end area or mean sectional are formula, prismoidal formula for different terrains.

UNIT–IV	13 Hrs.

Contracts: Types of contracts essentials of contract agreement legal aspects, penal provisions on breach 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 and issue 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,

Reference 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.
3. S. C. Rangwala "Estimating & Specifications", Charotar Publishing House, Anand, 17thEdition: (reprint) Jan2017.
4. G. S. Birdie "Estimating & Costing", Dhanpathi Rai publishing company Pvt., New Delhi. Jan2014.

Course Outcomes**

1. The students at the end of the course will be capable of applying different methods of estimate, CBRI formulae for the building estimate.
2. Estimating cost of load bearing / framed structures by long wall/ short wall and central line methods.
3. Estimating cost of the truss, culverts and septic tanks. Detailed specifications of the different items of civil works.
4. 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.

COURSE ARTICULATION MATRIX

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	3	3	2	2	3	3	-	-	-	-	-	2	2	2	2
CO 2	3	2	1	1	2	2	-	-	-	-	-	2	2	2	2
CO 3	3	2	2	2	3	2	-	-	-	-	-	2	2	2	2
CO 4	3	3	2	2	3	2	-	-	-	-	-	2	2	2	2
Average	**3**	**2.5**	**1.75**	**1.75**	**2.75**	**2.25**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**	**2**

UCV743C	DESIGN OF PRE-STRESSED CONCRETE STRUCTURES	Credits: 3
L:T:P-3:0:0		CIE Marks: 50
Total Hours/Week: 4		SEEMarks:50

UNIT I	10Hrs

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.

UNIT II	10Hrs

Analysis of sections for flexure: Stressesinconcreteduetoprestressand loads, stresses in steel due to loads, cable profile.

Losses of prestress: Variouslossesencounteredinpretensioningandpost tensioning methods, determination ofjackingforce.

UNITIII	10Hrs

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.

UNIT IV	10Hrs

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 forceandeccentricity.

REFERENCE BOOK*
1. N.KrishnaRaju,PrestressedConcreteDesign,McGrawHillPublications, 6thedition, 2018. 2. P. Dayaratnam, Prestressed Concrete Design, Medtech publishers, 7thedition,2017. 3. N. Rajgopalan, Prestressed Concrete Design, Narosa Publishers 2ndedition,2010. 4. E.G. Nawy, Prestressed Concrete Design, Pearson publication, 2ndedition,1995.
COURSEOUTCOMES**
1. Students will remember and recall materials used in PSC, their characteristics and basic principles of prestressing including pretensioning and posttensioning constructions. 2. Students will apply basic engineering principles to evaluate stresses due to loads in concrete and steel under flexure and shear. 3. Students will understand concepts and analyze the different losses and evaluate losses of prestress and deflections. 4. Students will understand the concepts and apply them to evaluate / estimate the ultimate resistance capacity of PSC members in flexure and shear.

COURSEARTICULATIONMATRIX

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	1	2	1	1	1	2	2	2	3	3	2
CO2	3	3	2	3	1	2	1	2	2	2	2	2	3	2	2
CO3	3	3	3	3	2	2	1	1	2	2	2	2	2	2	3
CO4	3	3	3	2	2	2	2	3	2	2	2	2	2	3	3
Average	**3**	**2.75**	**2.50**	**2.50**	**1.50**	**2**	**1.25**	**1.75**	**1.75**	**2**	**2**	**2**	**2.50**	**2.50**	**2.50**

21UCV751E	WASTEWATER TREATMENT ENGINEERING	**Credits: 3**
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	**10 Hrs.**
Introduction: Necessity for sanitation, Sewerage systems and their suitability. **Estimation of Wastewater flows:** wet and 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, Numerical problems. Laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers.	
UNIT–II	**10 Hrs.**
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, BIS and CPCB standards, Numerical problems.	
UNIT–III	**10 Hrs.**
Sewage Treatment - Primary Treatments: Flow diagram of municipal wastewater treatment plant. Primary treatment Screening, grit chambers, skimming tanks, primary sedimentation tanks- Theory and Design. **Secondary Treatments:** Fixed film bioprocess-Trickling filter theory, modifications and design. Suspended growth system-Activated sludge process-Theory and design.	
UNIT–IV	**10 Hrs.**
SEWAGE DISPOSAL: Dilution method: Self-purification phenomenon. Streeter-Phelps equation, Oxygen sag curve, Zones of purification. Land disposal: Sewage farming, sewage sickness, Numerical Problems. **Sludge treatment methods:** Sludge digestion tanks, Sludge drying beds. Low cost wastewater treatment -Septic tank, Oxidation Pond and Oxidation ditches, Numerical problems.	

Reference Books *

1. Environmental Engineering, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-Hill International.
2. Waste water Engineering Treatment and Reuse, Metcalf & Eddy, McGraw Hill Education, 2017, 4th Edition.
3. Santosh Kumar Garg , Sewage disposal and air pollution Engineering, Khanna Publisher, Vol. 2, ISBN-139788174092304, 39th Edition, 2018.
4. B C Punmia, Wastewater Engineering (Including Air Pollution), Laxmi Publishers New Delhi, 25th 2016.

Course Outcomes**
After completion of the course student will be able to 1. To estimate sewage and drainage quantity, for the design of sewers and drainage sections. 2. To demonstrate the characterization of sewage and sewer appurtenances. 3. To identify the impact of sewage disposal on water and land and minimum treatment necessary for sewage. 4. To design biological treatment units for sewage and knowledge of sludge disposal.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1	1	3	3	-	-	-	-	2	2	3	3
CO2	3	-	-	3	2	3	3	-	-	-	-	1	3	2	3
CO3	2	2	1	2	2	3	3	-	-	-	-	2	2	2	2
CO4	3	3	3	2	2	2	3	-	-	-	-	1	3	3	3

UCV752E	Railway and Airport Engineering	Credits: 3
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 3		SEEMarks:50

UNIT-I	10 Hrs.
Railway Planning: Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).	
UNIT–II	**10 Hrs.**
Railway Construction and Maintenance: Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construct ion & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	
UNIT–III	**10 Hrs.**
Airport Planning: Air transport characteristics, airport classification, airport planning: objectives, c o m p o n e n t s , layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection and ICAO stipulations, typical airport layouts, Parking and circulation area.	
UNIT–IV	**10 Hrs.**
Airport Design: Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	

Reference Books *

1. Y.H. Huang, Pavement Analysis and Design, Prentice Hall, New Jersey, 2003.
2. R. Horonjeff and F.X. Mckelvey, Planning andDesign of Airports, McGraw Hill, New York, 1994.
3. S.C. Sexena and S.P. Arora, A Text Book of Railway Engineering, Dhanpat Rai & Sons, New Delhi, 1998.
4. W.W. Hay, Railroad Engineering, Wiley, New York, 1988.

Course Outcomes**

After completion of the course student will be able to

1 . Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able

to determine the hauling capacity of a locomotive. **3.** Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same. **4.** Apply the knowledge gained to conduct surveying, understand the tunnelling activities.

*__Books to be listed as per the format with decreasing level of coverage of syllabus__

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1															
CO2															
CO3															
CO4															

UCV751N	GREEN BUILDING TECHNOLOGY	Credits: 3
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
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)	
UNIT–II	**08 Hrs.**
Principles and elements of design of green building; Sustainability: concept and reality 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 Shading devices and their effect.	
UNIT–III	**10 Hrs.**
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 Day lighting and Ventilation	
UNIT–IV	**12 Hrs.**
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 Bureau of energy efficiency: Functions, policies, guidelines, Energy Conservation Building Code, Study of existing green buildings Introduction to Energy efficiency software's, carbon calculators.	
REFERENCE 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.Energy and the Environment, JM Fowler, McGraw Hill, New York, 2nd Edition, 1984.
3. Handbook on functional requirements of buildings (SP41), BIS, New Delhi, 1987.
4. Energy Conservation building code (ECBC), Bureau of energy efficiency, 2011.
5. IGBC Green Homes Rating System, Version 2.0., Abridged reference guide, 2013, Indian Green Building Council Publishers.
6. GRIHA version 2015, GRIHA rating system, Green Rating for Integrated Habitat Assessment.
7. Non-Conventional Energy Resources by G. D. Rai, Khanna Publishers.
8. Sustainable Building Design Manual, Vol.1 and 2, TERI, New Delhi 2004.
9. Mike Montoya, Green Building Fundamentals, Pearson, USA, 2010.
10. Charles J. Kibert, Sustainable Construction – Green Building Design and Delivery, John Wiley &Sons, New York, 2008.
11. Regina Leffers, Sustainable Construction and Design, Pearson / Prentice Hall, USA, 2009.

Course Outcomes**

After completion of the course student will be able to

1. Students should be able to assess a building on the norms available for green building.
2. Students will learn to design eco-friendly buildings using green principles, sustainable concepts, and climate-smart techniques
3. Students will master indoor comfort design, covering factors, heat analysis, U values, and ventilation. They'll create energy-efficient, comfortable spaces for occupants' well-being.
4. Students will efficiently conserve water and materials, understand carbon emissions, and analyse green buildings. They'll apply eco-friendly materials and energy efficiency tools for sustainable design.

Department	**Civil Engineering**		**Semester**	**VII**
Subject Code	**UCV733N**	**Subject**	**Disaster Management**	
Faculty	**Prof. S. M. Kalagudi**			
Teaching Hours (L : T : P)	**3: 0 : 0**	**Total No. of teaching hours**	**40**	
CIE Marks	**50**	**SEE Marks**	**50**	

Course description:

This course is intended to provide the basic conceptual understanding of disasters, their causes, effects and mitigation measures. It highlights the importance of disaster education, role and responsibility of citizens, technology, media, community, government and non government organizations in disaster management. It emphasizes the need of harmonious relation of human beings with nature to reduce the risks of disasters.

Course outcomes:

The student will develop competencies in

CO1: the application of Disaster Concepts to Management

CO2: analyzing Relationship between Development and Disasters.

CO3: ability to understand Categories of Disasters and

CO4: realization of the responsibilities to society

Unit -1 (8 hours)

Introduction : Concepts and definitions: disaster, hazard, vulnerability, resilience, risks severity, frequency , capacity, impact, prevention, mitigation. India's natural disaster proneness and disaster prone zones

UNIT- II (10 hours)

Disasters classification : natural disasters (floods, draughts, cyclones, volcanoes, earthquakes, tsunamis . landslides etc.); manmade disasters(industrial pollution, artificial flooding in urban areas, nuclear radiation, transportation accidents ,terrorist strikes, etc.)

UNIT- III (10 hours)

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.

UNIT- IV (12 hours)

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,Importance of disaster education and community awareness and preparedness in disaster management. Roles and responsibilities of citizens, technology, media, community, government and non government organizations in disaster management; Policies and legislation for disaster risk reduction; Disaster management system in India..

Reference Books :

1. R. Subramanian, 2021, Disaster Management, Vikas publishing house Pvt. Ltd., Noida, India.
2. A.K. Srivastava, 2021, Text book of Disaster Management, Scientific publishers, India.
3. Tushar Bhattacharya, 2012,Disaster science and Management, Tata McGraw Hill publications, New Delhi, India.
4. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
5. Singh B.K., 2008, Handbook of Disaster Management: Techniques and Guidelines, RajatPublication.
6. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation.
7. Jagbir Singh, 2007, Disaster Management, I.K International Publishing House, New Delhi.
8. Vinod.K.Sharma, 2013,Disaster Management, second Edn., Scientific International Pvt. Ltd., New Delhi,India.
9. Carter.W.Nick, 1991, Disaster Management: A Disaster Manager's Hand book, Asia Development Bank, Manila.
10. Government of India website on Disaster Management : www.ndmindia.nic.in

VIII SEM									
Sl. No.	Subject code	Subject	Credits	Hours per week			Examination Marks		
				L	T	P	CIE	SEE	Total
1	UCV841H	Construction Management	3	2	2	-	50	50	100
2	UCV85XE	Dept Elective -6	3	3	-	-	50	50	100
3	UCV86XE	Dept Elective - 7	3	3	-	-	50	50	100
4	UCV841P	Project Phase - II	12	-	-	24	50	50	100
5	UCV842S	Seminar	1	-	-	02	50	50	100
		Total	**22**	**8**	**2**	**26**	**250**	**250**	**500**

DEPARTMENT ELECTIVES - 6 [8th Sem]

Sl. No.	Subject code	Subject	Credits
1	UCV851E	Sediment transport engineering	3
2	UCV852E	Advanced Design of RC Structures	3
3	UCV853E	Design of industrial building	3
4	UCV854E	Industrial waste water treatment	3

DEPARTMENT ELECTIVES - 7[8th Sem]

Sl. No.	Subject code	Subject	Credits
1	UCV861E	Pile Foundation Design	3
2	UCV862E	Advanced Concrete Technology	3
3	UCV863E	Basics of Soil Dynamics and Earthquake Engineering	3
4	UCV864E	Design of Bridges	3

UCV856E: 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 10262:2009 and correct American and British methods.

Durability of concrete: 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 fly ash concrete, self-compacting concrete concept, materials, properties and applications.

Fiber reinforced concrete- Fiber types and properties, Behaviors of FRC in compression, tension including pre-cracking stage and post cracking stages. 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 Theory and Practice, S.Chand and Co, New Delhi 2002
2. Concrete Technology A.R.SanthaKumar
3. Power T.C. ESFN, Properties of Fresh concrete, London 1969.
4. P.K.Metha & PTM Monteiro Concrete- Microstructures properties and Materials (Special student edition by ICI Chennai) - PH
5. IS: 10262:2009

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 from each unit.

Sl. No.	**Course Outcomes** Student will be able to
1.	Apply basic knowledge to understand compound composition of cement, hydration and products of hydration, phases in concrete and factor affecting strength and modulus of concrete. Apply basic knowledge to understand role of chemical and mineral admixtures and their effect on the strength and properties of concrete.
2.	Design the process of mix proportioning for different grades of concrete as per IS: 10262-2009. Analyse the factors affecting durability by knowing the concepts of producing durable concrete structures.
3.	Understand and assess new techniques in concrete production, leading to special concretes like RMC, FRC including materials used and properties.
4.	Understand and assess new techniques in concrete production, leading to special concretes like High Density Concrete and High performance concrete, materials, properties and applications. Analyse 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.

COURSE ARTICULATION MATRIX

Course Outcomes	Programme Outcomes												Programme Specific Outcomes		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO 1	1	2	2	2	3	3	2	3	3	2	2	3	2	3	2
CO 2	2	2	1	-	1	2	2	-	3	2	3	3	2	2	2
CO 3	2	1	-	-	3	3	2	3	3	2	2	3	3	3	3
CO 4	3	1	1	-	3	3	2	2	3	3	3	3	2	2	2
Average	2	1.5	1	0.5	2.5	2.75	2	2	3	2.25	2.5	3	2.25	2.5	2.25

SriBVVSangha's

BasaveshwarEngineeringCollege,(Autonomous) Bagalkot-587102

DepartmentofCivilEngineering

SYLLABUSFORPOSTGRADUATEPROGRAMME
M.

Tech.STRUCTURALENGINEE

RING

2023-2024

VisionoftheInstitution

Toberecognizedasthepremiertechnicalinstitutecommittedtodevelopingexemplaryprofessionals offering research based innovative solutions and inspiring inventions forholisticsocioeconomicdevelopments

MissionoftheInstitution

Topursueexcellencethroughstudentcentricdynamicteaching-learningprocesses,encouragingfreedomofinquiryandopennesstochange.

Tocarryoutinnovativecutting-edgeresearchandtransfertechnologyforindustrialandsocietalneeds.Toimbibemoralandethicalvaluesanddevelopcompassionate,humaneprofessionals.

VisionoftheDepartment

Tobeacenterofexcellenceofhigherlearningandresearchincivilengineeringencompassingethicalenvironmentalandeconomicalaspectofthesociety.

MissionoftheDepartment

Thedepartmentofcivilengineeringiscommittedtopreparegloballycompetentengineers,inresponsetorapideconomicandtechnologicalgrowth,throughadynamicprocessof teaching-learning,researchandsharingprofessionalexperiencesforthebettermentofthecommunity.

ProgrammeEducationalObjectives

PEO1

GraduatesoftheprogrammewillbecomeeffectiveStructuralengineersingovernment,industry,or other organizations; designing, improving and implementing efficient, sustainable Structuralengineeringpractices.

PEO2

Graduates of the programme will provide solutions to Structural engineering problems thataccount for economical, societal, ethical, as well as with standards both as individuals and inteamenvironments, by applying acquired engineering knowledge.

PEO3

Graduatesoftheprogrammewillcontinuetheirlifelonglearningtoremaineffectiveprofessionalsto maintain andenhancetechnical and professionalgrowth.

ProgrammeOutcomes

PO1

Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworktosolvepracticalp roblems.

PO 2

Anabilitytowriteand presentasubstantialtechnicalreport/document.

PO3

Studentsshouldbeabletodemonstrateadegreeofmasteryovertheareaasperthespecializationof the program. The mastery should be at a level higher than the requirements in the appropriatebachelorprogram.

PO4

Apply concepts of structural engineering through the use of analytical techniques, experiments, computer based methods and other modern engineering tools in the analysis and design of variety of civil engineering structures and their components.

PO 5

Solve structural engineering problems and evaluate alternative solutions considering economy, quality, safety, environmental and sustainability aspects.

PO 6

Use recent developments in structural engineering field for updating, life-long learning, imbibe ethical practices and social responsibilities for capacity building in up-coming areas of structural engineering.

Justification of consistency of the Department Vision and Mission with theInstitute VisionandMission

Vision

Institution Vision → / Department Vision ↓	To be recognized as the premiertechnical institute committed todeveloping exemplary professionalsofferingresearchbasedinnovative solutions	Inspiringinventions forholisticsocioeconomic developments
Tobecenterofexcellenceofhigherlearningandresearch incivilengineering	*	*
Toencompassthegraduatesethical, environmental andeconomicalaspectofthe society		*

<u>Mission</u>

Institution Mission → / Department Mission ↓	To pursue excellencethrough student centricdynamic teaching-learningprocesses, encouragingfreedom of inquiry andopennesstochange	To carry outinnovative cutting edgeresearch andtransfertechnology forindustrialand societalneeds.	To imbibemoral andethical valuesand developcompassionate,humaneprofessionals
To prepare globallycompetentengineers,in response to rapideconomicaland technologicalgrowth	*	*	
Dynamic process ofteaching-learning,researchandsharingprofessionalexperiences for thebettermentofthe Community	*	*	*

BasaveshwarEngineeringCollege,BagalkotDe partmentofCivilEngineering

M. Tech. Structural Engineering2022-23

SchemeofTeachingandExamination

Semester–I

Sl.No	Course	Course Code	Course Title	C	Hours/Week			ExamMarks		
					L	T	P	CIE	SEE	Total
1	BSC	22PSE101C	Advanced Computational Methods	3	3	0	0	50	50	100
2	IPCC	22PSE102C	Advanced Concrete Technology	4	3	0	2	50	50	100
3	PCC	22PSE103C	DynamicsofStructures	4	4	0	0	50	50	100
4	PCC	22PSE104C	TheoryofElasticity&Plasticity	3	3	0	0	50	50	100
5	PCC	22PSE105C	Advanced Design of RC Structures	3	3	0	0	50	50	100
6	PCCL	22PSE107L	Structural Engineering Lab	2	0	0	4	50	50	100
7	AUD/AEC	22PSE108O	Online Course	PP	Classes and evaluation procedures are as per the policy of the online course providers.					
8	MCC	22PSE106C	Research Methodology & IPR	3	3	0	0	50	50	100
			Total	**22**	**19**	**0**	**6**	**350**	**350**	**700**

Note:BSC-BasicScienceCourses,PCC:Professionalcore.IPCC-IntegratedProfessionalCoreCourses,MCC-MandatoryCreditCourse, AUD/AEC –Audit Course / Ability Enhancement Course(A pass in AUD/AEC is mandatory for the award of the degree), PCCL-Professional Core Course lab, **L-Lecture,P-Practical,T/SDA-Tutorial/SkillDevelopmentActivities**(Hoursareforinteractionbetweenfacultyandstudents)

Semester–II

Sl.No	Course	Course Code	Course Title	C	Hours/Week			ExamMarks		
					L	T	P	CIE	SEE	Total
1	IPCC	22PSE201C	Finite Element Method	4	3	0	2	50	50	100
2	PCC	22PSE202C	Pre-stressedConcreteMechanicsand Design	3	3	0	0	50	50	100
3	OEC	22PSE2XXN	Open Elective	3	3	0	0	50	50	100
4	PEC	22PSE2XXE	Elective–1	4	4	0	0	50	50	100
5	PEC	22PSE2XXE	Elective–2	3	3	0	0	50	50	100
6	PCCL	22PSE203L	Design Studio Lab	2	0	0	4	50	50	100
7	AUD/AEC	22PSE209O	Online Course	PP	Classes and evaluation procedures are as per the policy of online course providers.					
8	MPS	22PSE208P	Mini Project With Seminar	3	0	0	6	100	-	100
			Total	**22**	**16**	**0**	**12**	**350**	**350**	**700**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project withSeminar;AUD/AEC;AuditCourses/ Ability EnhancementCourses(Mandatory), PCCL-ProfessionalCoreCourse lab,
L-Lecture,P-Practical,T/SDA-Tutorial/SkillDevelopmentActivities(HoursareforInteractionbetweenfacultyandstudents)

Note:
1 **Mini Project:**
This may be hands - on practice, survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modeling of system, simulation, analyzing and authenticating, case studies, etc.
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. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.
The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question-and-Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester.There is no SEE for this course.

Semester–III

Sl.No	Course	Course Code	Course Title	C	Hours/Week			ExamMarks		
					L	T	P	CIE	SEE	Total
1	PEC	22PSE3XXE	Elective -3	3	3	0	0	50	50	100
2	PCC	22PSE301C	Advanced DesignofSteelStructures	3	3	0	0	50	50	100
3	SP	22PSE303P	Societal Project	3	0	0	6	100	-	100
4	INT	22PSE304I	Internship	6	0	0	12	50	50	100
5	PROJ	22PSE302P	Project Phase-01	3	0	0	6	50	50	100
			Total	**18**	**6**	**0**	**24**	**300**	**200**	**500**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses.MPS-Mini Project WithSeminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory), PCCL-Professional Core Course lab, **L-Lecture, P-Practical, T/SDA-Tutorial/ SkillDevelopmentActivities**(HoursareforInteractionbetweenfacultyandstudents)

Note:

Project Work Phase-1: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.
Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document and present a seminar.
CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE and SEE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

Societal Project: Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology to workout/proposing viable solutions for societal problems.
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 shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session integration of 50:25:25.
Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. **Internship:** All the students shall have to undergo a mandatory internship of 06 weeks during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Those, who have not pursued completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.
CIE marks shall be awarded by the Industry for 70 marks and it is converted to 50 marks and SEE is conducted for 50 marks by the committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE and SEE marks awarded for internship, shall be based on the evaluation of Report, Presentation skill, and performance in the Question and Answer session in the ratio of 70:30(As per BEC Exam Reforms-2020).

Semester–IV

Sl.No	Course	Course Code	Course Title	C	Hours/Week			ExamMarks		
					L	T	P	CIE	SEE	Total
1	PROJ	22PSE401P	Projectphase-II	18	0	0	08	100	100	200
			Total	**18**	**0**	**0**	**08**	100	100	200

Note:

1.ProjectWorkPhase-2:

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in caseof multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch ofstudents shall prepareproject document,and present aseminar.

CIEmarksshallbeawardedbyacommitteecomprisingofHoDasChairman,allGuide/sandco-guide/s(ifany)andaseniorfacultyof the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of Project Report,ProjectPresentationskill, andperformanceinthe QuestionandAnswersessionintheratioof50:25:25.

The SEE evaluation is conducted at the end of the IV semester project work, following a plagiarism check in accordance with university guidelines. The evaluation committee, chaired by the Head of the Department (HOD) or a nominee, along with all project guides, co-guides (if applicable), and an external examiner, will assess the phase-2 SEE of the project work. This three-member committee will evaluate the project report, awarding up to 50 marks each; the average of these scores will be used during the viva-voce. During the viva-voce, the same committee will assign 25 marks for the presentation and 25 marks for the question-and-answer session, totaling 100 marks (50 marks from the report evaluation average, 25 marks for the presentation, and 25 marks for the Q&A). This total will then be scaled down to 50 marks.

PROFESSIONAL CORE COURSES (PCC)

Sl.No	Subject	Credits
1	Advanced Concrete Technology	4
2	DynamicsofStructures	4
3	Finite Element Method	4
4	TheoryofElasticity&Plasticity	3
5	Advanced Design of RC Structures	3
6	Pre-stressedConcreteMechanicsand Design	3
7	Advanced DesignofSteelStructures	3
8	Pre-stressedConcreteMechanicsand Design	3

PROFESSIONAL ELECTIVE COURSES (PEC)

Sl.No	Subject	Credits	Code
1	Analysis and Design of Substructures	3	22UCV306E
2	Designof Bridges	3	22UCV307E
3	DesignofTallstructures	3	22UCV308E
4	TheoryofPlatesandShells	3	22UCV309E
5	MasonryStructures	3	22UCV310E
6	AdvancedFoundationEngineering	3	22UCV311E
7	ConstructionManagement	3	22UCV312E
8	Earthquake Resistant Design of Structures	3	22UCV209E
9	Stabilityanalysis ofstructures	4	22UCV314E
10	RepairandRehabilitationofStructures	4	22UCV315E
11	MatrixmethodsofStructuralAnalysis	4	22UCV316E
12	NumericalMethodsfor CivilEngineers	4	22UCV317E
13	StructuralDesign of Foundations	4	22UCV318E
14	OptimizationTechniquesinCivilEngineering	4	22UCV319E

ADVANCEDCOMPUTATIONALMETHODS
Credits :03
(3-0-0)

SubjectCode:22PSE101C IAMarks:50
DurationofExam:3Hrs Maximummarks:100

Courseoutcomes:

1. TheStudent will be able to apply the concept of probability to find the physical significance of various distribution phenomena
2. The Student will be able to determine eigen values and eigen vectors using matrix theory
3. The Student will be able to solve different types of differential equations
4. The Student will be able to apply numerical methods to solve system of equations.

Unit-I

Statistics: FrequencyDistribution–CharacteristicsofDistributions:Central tendency and dispersion. Methods of least square and regression,multipleregression,SolutionsofregressionanalysisproblemsAnalysis ofVariance.
Probability: Conceptofprobability,RandomVariables,Binomial,Poisson and Normal distribution – applications, Chi- squared test, F test,t-test. Applications to respective fields in Civil Engineering.

Unit-II

Matrix operation: Matrix operation Eigen value and Eigen vector by iterative methods. Diagonalisation and square matrix. Applications to respective fields in Civil Engineering.

Unit-III

Ordinary Differential Equation: Second order homogeneous equation, Euler-Cauchy's equation, non-homogeneous linear equation. Partial differential equation: wave equation – one and two dimensions. Applications to respective fields in Civil Engineering

Unit-IV

Numerical methods: Development of simultaneous using Gaussian elimination method, Gauss- Jordan matrix inversion method, Gauss- Siedel method, Cholesky decomposition method. Applications to respective fields in Civil Engineering.

BOOKS FOR REFERENCE

1. Rao, S.S. (1996), "Optimization: Theory and applications", Wiley Eastern Ltd. Publications
2. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi.
3. S S Sastry- Introductory Methods of Numerical Analysis, 5th edition, PHI,New Delhi , 2012.
4. E Balagurusamy- Numerical Methods, Tata Mc Graw Hill,2017.
5. H C Saxena- Examples in Finite Differences And Numerical Analysis, S Chand & Co. New Delhi,1975.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	The Student will be able to Apply the concept of probability to find the physical significance of various distribution phenomena	3		2			
2	The Student will be able to Determine eigen values and eigen vectors using matrix theory			2			
3	The Student will be able to Solve different types of differential equations	3		2	3		
4	The Student will be able to Apply numerical methods to solve system of equations	3		2			

ADVANCEDCONCRETETECHNOLOGY
4Credits
(3-0-2)

SubjectCode:22PSE102C IAMarks:50
DurationofExam:4Hrs Maximummarks: 100

Courseoutcomes:

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 design special concrete mixes for their desired properties and evaluate their fresh and hardened states.
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 projects.
4. Thestudentswillbeabletoevaluatedifferentmixingredientsandparametersformakingconcreteforhighstrengthandsuggestmix designforspecificconstructionproject.

UNIT1:

Components of modern concrete and developments in process and constituent materials- Role ofMineralandchemicaladmixtures,corrosioninhibitors,adhesivesandcoatings,recycledaggregates.
Concretemixdesignprocedure,ReadyMixedConcrete
Light weight concrete – Introduction, classification, properties, strength and durability, mixdesign. Designing a typical light weight concrete mix in the laboratory and studying its fresh and hardened state properties.

UNIT2:

High densityconcrete - Radiation shieldingabilityof concrete, materials for high densityconcrete,propertiesinfreshand hardenedstate,placementmethods
Ferrocement - materials, mechanical properties, cracking of ferrocement, strength and behaviorin tension, compression and flexure, design of ferrocement in tension, ferrocement constructions,durabilityand applications.

UNIT3:

Fibrereinforcedconcrete (FRC)– Constituentmaterials,distributionandorientationoffibers,interfacial bond, properties in fresh state, strength and behavior in tension, compression andflexure of steel fibre reinforced concrete, mechanical properties, crack arrest and tougheningmechanism,applications,selfcompactingconcrete (SCC),polymerconcrete,Introductiontofiberreinforcedpolymercomposites. Designing a SCC and FRC mixes in the laboratory and studying their fresh and hardened state properties.

UNIT4:

High strength concrete (HSC) – constituents, mix proportioning, properties in fresh and hardened states,applications and limitations, high performanceconcrete (HPC), reactive powder concrete, bacterialconcrete, Roller compacted concrete, Foam concrete, chemicals, Concept of composites andsmartconcrete. Designing a HSC and HPC mixes in the laboratory and studying their fresh and hardened state properties.

References:

1. Aitcin P.C., “High performance concrete”, E and FN, Spon, London, 1998
2. Kumar Mehta P, Panlo J. N. Monterio, “Concrete, Microstructure, Properties and Materials”. Tata McGraw Hill
3. Neville A.M, “Properties of Concrete”, Pearson Education Asis, 2000
4. Santhakumar A R, (2007) “Concrete Technology”, Oxford University Press, New Delhi.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Thestudentswillbeabletoidentifythecharacteristicsofdifferent ingredientmaterialsofconcreteandvarioustypesofconcretemixesfortheirsuitableusein construction.	2		2			
2	The students will be able to design special concrete mixes for their desired properties and evaluate their fresh and hardened states.	2		2			
3	Thestudentswillbeabletoevaluatedifferent mixingredientsandparametersformakingconcreteforhighperformanceandsuggestmix designforspecificconstructionproject.	3	2	3		2	2
4	Thestudentswillbeabletoevaluatedifferent mixingredientsandparametersformakingconcreteforhighstrengthandsuggestmix designforspecificconstructionproject.	2	2			2	2

DYNAMICSOFSTRUCTURES
4Credits
(4-0-0)

SubjectCode: 22PSE103C IAMarks:50
DurationofExam:4Hrs Maximummarks: 100

Courseoutcomes:

UNIT1:
Introduction to dynamics, concept of degrees of freedom, D'Alembert's principle, principle ofvirtualdisplacementandenergyprinciples.Single-degree-of-freedomsystems(SDOF):Mathematical model, free vibration response of damped and undamped systems, response toharmonic loading, support motion, evaluation of damping, vibration isolation, transmissibility,response to periodic forces, principle of vibration-measuring instruments – Seismometer andAccelerometer.

UNIT2:
Duhamelintegralanditsnumericalevaluation,Multi-degreefreedomsystems(MDOF):mathematical model, free vibration of systems with and without damping - natural frequenciesand mode shapes – orthogonality conditions, modal analysis of MDOF system – Shear buildingandStodola's method.

UNIT3:
Modal analysis of MDOF systems: Dunkarley's, Rayleigh's, Rayleigh-Ritz and matrix methods.Forcedvibrationsofsystemswithoutdamping–modesuperpositionmethod.Responsespectrum,timehistoryandequivalent forceconcepts.

UNIT4:
DynamicsofContinuoussystems: Freelongitudinalvibrationofbars,flexuralvibrationofbeams with different end conditions, response of beams under moving loads, Introduction torandom vibrations – Random variables and Stochastic processes, models of random dynamicloads.

References:

1. AnilK.Chopra,"DynamicsofStructures",PrenticeHallofIndia,4th edition2011
2. CloughRW&PenzienJ,"DynamicsofStructures",McGrawHill,2003
3. MarioPaz,"Structuraldynamics–TheoryandComputation",CBSPublishers,2nd Ed.2004
4. S.Rajasekaran,"Structuraldynamicsofearthquakeengineering-TheoryandapplicationusingMATHEMATICAandMATLAB",Woodheadpublishinglimited,2009
5. Paolo L. Gatti, "Applied structural and mechanical vibrations", CRC Press Taylor & FrancisGroup,2014
6. Mukyopadhyaya,"VibrationandStructuralDynamics",AneBooksPvtLtd,2008

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	ThestudentswillbeabletodescribefundamentaltheoryofstructuraldynamicsandderiveequationsofmotionforfreeandforcedvibrationsanddeterminedynamicresponsesofSDOFsystems.	2	1	3	3		
2	The students will be able apply numerical methods for determining dynamic analyses of structures in finding natural frequency and modeshapes	1		3	3		
3	Thestudentswillbeabletoevaluatethenaturalfrequency andmodeshapesforMDOFsystems.	2		3	3		
4	Thestudentswillbeabletoevaluatethenaturalfrequency andmodeshapesfor continuoussystems.	2		3	3		

THEORYOFELASTICITYANDPLASTICITY

3 Credits

(3-0-0)

SubjectCode: 22PSE104C IAMarks:50

DurationofExam:3Hrs Maximummarks:100

Courseoutcomes:

1. Apply concepts, theories and principles underlying elasticity to analyse stresses and strain in rigid body.
2. Analyse plane stress and plane strain problems to provide a solution to sructural engineering problem.
3. Solve elementary problems of elasticity in three dimensions
4. Apply theories of plasticity to solve bending and torsion problems related to structural engineering.

UNIT1:

Definitionofstresscomponentsofstressatapoint,Cartesianandpolarco-ordinates,Equilibriumequations,Transformationofstress,Principalstresses,invariantsofstress,hydrostaticand deviatricstress.

Definitionofstrain,componentsofstrainatapoint,Cartesianandpolarco-ordinates,Equilibriumequations, transformationofstrain,principal strain,invariantof strain, sphericalanddeviatoricstrains, maximum shearstrain, compatibilityequations.

UNIT2:

Compatibility equations, stress strain relations, constitutive relations- plane stress and planestrain. Problems in rectangular coordinates (2D) – boundary conditions Airy's stress functionapproach to 2-D problems of elasticity, simple problems on bending of beams. Solution of axi-symmetricproblems,stressconcentrationduetothepresenceofacircularholeinplates.Problemsinpolar coordinates (2D)

UNIT3:

3D problems: Elementary problems of elasticity in three dimensions, stretching of a prismaticalbarbyitsownweight,twistofcircularshafts,Torsion:torsionofnon-circularsections

UNIT4:

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,"TheoryofElasticity",McGrawHill,1951
2. SadhuSingh,"TheoryofElasticity",KhannaPublishers,1988
3. ChennW.PandHendryD.J,"PlasticityforStructuralEngineers",SpringerVerlag,1988
4. SadhuSingh,"AppliedStressAnalysis",KhannaPublishers,2000
5. SrinathL.S.AdvancedMechanicsofSolids,ThirdEdition,TataMcGrawHillpublishingcompany.New Delhi, 2008.
6. ValliappanS."ContinuumMechanicsFundamentals"(1982),OxfordIBH,ND.NewDelhi.
7. T.G.SitharamandL.GovindaRaju,"AppliedElasticity"–InterlinePublishing,2005.
8. ChakrabarthyJ,TheoryofPlasticity,ElsevierButterworth–Heinemann2006
9. VenkataramanandPatel"StructuralMechanicswithintroductiontoElasticityandPlasticity"–McgrawHill, 1990.

<u>CourseArticulationMatrix</u>

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Apply concepts, theories and principles underlying elasticity to analyse stresses and strain in rigid body.	1		3	2		
2	Analyse plane stress and plane strain problems to provide a solution to sructural engineering problem	2		3	2		
3	Solve elementary problems of elasticity in three dimensions	3		3	3		
4	Apply theories of plasticity to solve bending and torsion problems related to structural engineering.	2		3	3		

ADVANCED DESIGNOFRCSTRUCTURES

03 Credits

(3-0-0)

SubjectCode: 22PS105C IAMarks:50

DurationofExam:3Hrs Maximummarks:100

Courseoutcomes:

1. Students will be abletoanalyzeanddesign deep beams asperrelevantIScodes.
2. Students will be abletoanalyzeanddesign different water tanks.
3. Students will be abletoanalyseanddesignbunkers and silosstructures.
4. Students will be ableto plan and design module in prefabricated construction.

UNIT1:

Designofdeepbeams,Designoffoldedplates

UNIT2:

Designofwatertanks:Undergroundandaboveground

UNIT3:

Designofbunkersandsilos.

UNIT4:

Prefabricated Construction – necessity, advantages and disadvantages, modular coordination,basicmodule,planninganddesignmodule,modulargridsystem.Nationalbuildingcodes pecifications–standardization,dimensioningofproducts,preferreddimensionsandsizes.

References:

1. KrishnarajuN,“AdvancedDesignofRCStructures”,NewAgeInternational,2007.
2. ParkAandPaulay,“ReinforcedConcreteStructures”,JohnWileyandSons,1975.
3. PunmiaB.C.,AshokKumarJainandArunKumarJain,“ComprehensiveRCCDesign”.
4. UnnikrishnaSandPillaiMenonDevadas,“ReinforcedConcreteDesign”,TataMcGraw-Hill, 2010.
5. HassA.M.,“PrecastConcrete–Designandapplications”,Appliedscience,1983
6. DavidShepherd,“Plantcast,precastandprestressedconcrete”,McGrawHill,1989
7. BruggelingA.S.G.,“Prefabricationwithconcrete”,Taylor&Francis,1991

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will be abletoanalyzeanddesign deep beams asperrelevantIScodes.		2	3	2		
2	Students will be abletoanalyzeanddesign different water tanks.		2	1	2	3	
3	Students will be abletoanalyseanddesignbunkers and silosstructures.		2	3	2	2	
4	Students will be ableto plan and design module in prefabricated construction.	3		2	3	3	

STRUCTURALENGINEERINGLABORATORY
2Credits
(0-0-4)

SubjectCode:22PSE107L IAMarks:50
DurationofExam:3Hrs Maximummarks:100

Courseoutcomes:

1. Demonstrate knowledge and understanding of use of various IS codes in the design andtestingof fresh and hardenedconcrete like strength and durability.
2. Demonstrate knowledge and understanding of underlying principles of design andanalysisof RC structuressubjected to various loads.
3. Demonstrate knowledge and understanding of underlying principles of design andanalysisof steel structures subjected to various loads.

LISTOFEXPERIMENTS

1. ConcretemixdesignasperIS:10262-2009
2. ComputeraidedconcretemixdesignasperIS:10262-2009
3. ConcreteandRCCspecimenstestingusingNon-DestructiveTesting(NDT)equipmenttoevaluatebelow mentionedparameters
   a. Strength(Schmidtreboundhammertest)
   b. Permeability(Rapidchloridepenetrationtest)
   c. Resistivity(Half-cellelectricalpotentialmethod/Resistivitymeasurement)
4. Acidtestonconcretespecimen
5. EvaluationofModulusofelasticityandPoison'sratioofconcretespecimen
6. EvaluationofflexurestrengthofRCCbeamspecimen
7. Demonstrationonevaluationoffatiguestrengthofconcretespecimens
8. Earthquakeengineeringlaboratory
   a. Dynamicsofathreestoriedbuildingframesubjectedtoharmonicbasemotion
   b. Dynamicsofone-spanandtwo-spanbeams
   c. Earthquakeinducedwavesinrectangularwatertanks
9. AnalysisanddesignofRCbuildingsusingETABS/SAP2000
10. AnalysisanddesignofSteelstructuresusingETABS/SAP2000

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Demonstrate knowledge and understanding of use of various IScodes in the design and testing of fresh and hardened concretelikestrength and durability.	3	1	3	3		
2	Demonstrateknowledge andunderstandingofunderlying principles of design and analysis of RC structures subjected tovariousloads.	2	2	3	3		
3	Demonstrate knowledge and understanding of underlyingprinciplesofdesignand analysisofsteelstructuressubjectedtovariousloads.	2	2	3	3		

RESEARCH METHODOLOGY AND IPR
3Credits
(3-0-0)

SubjectCode: 22PSE106C IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

On completion of the course, students should be able to:

1. Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research
2. Demonstrate the application and utility of the Systematic approach and out of the box thinking concepts for research to be effective.
3. Demonstrate the procedures outlined for a systematic Literature Review
4. Analyze and prepare well-structured research proposal and research paper invoking clearly outlined principles
5. Describe and distinguish between different intellectual property rights.

UNIT1:

Foundations of Research – Definitions of Research, Mandatory Steps in Research, Types of Research, Relevance of Research for Innovation and Technology Development, Effective Research and Self Discipline

Out of the Box Thinkingand Systematic approach in Research – Transformation to Impossible Thinking, Convergent and Divergent Thinking, Generation, Evaluation and Selection of Ideas

UNIT2:

Literature Review – Importance of Literature Review, Constituents of Good Literature Review, Strategies for Literature Search, Referencing, Paraphrasing, and Summarizing, Academic Standards and Ethics

Statistical methods and data analysis. Data Collection, Analysis and Interpretation, Ethics in Business Research, Research Design and Approaches: Descriptive, Exploratory, Causal, Qualitative Research, Observation Studies, Surveys, Experiments, Measurements and Scales, Questionnaires, Data Analysis: Presentation, Exploring and Examining

UNIT3:

Research Proposal – Structure of a Good Research Proposal, Getting Started, Tips for Compilation of Good Research Proposal

Technical communication – Research paper for publication – significance of problem statement and its scope, formulation of hypothesis, adequacy of methodology, significant of presentation and discussion of results, relevance and importance of references.

Effective presentation – Preparation, templates, balance between good design and good content, planning and sequencing, pampers, (projection, articulation, modulation, punctuation, enunciation, repetition and speed) rule, people (position and gestures, eye contact,, orientation, proximation, looks and appearance, and expressions and emotion) rule, 4P’s rule (plan, prepare, practice and present), essentials of effectiveness, effective pausing and inclusive answering.

UNIT4:

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, 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, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
	On completion of the course, students should be able to:						
1	Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research	2	1	3			
2	Demonstrate the application and utility of the Systematic approach and out of the box thinking concepts for research to be effective	3	1	3			
3	Demonstrate the procedures outlined for a systematic Literature Review	2	3	2			3
4	Analyze and prepare well structured research proposal and research paper invoking clearly outlined principles	2	3	2			
5	Describe and distinguish between different intellectual property rights.			3			3

FINITEELEMENTMETHOD
4Credits
(3-0-2)

SubjectCode: 22PSE201C IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. The student will be able to apply the fundamental concepts, theories and principles underlying various finite element methods and analysis.
2. The student will be able to generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with generalized and natural coordinates
3. The student will be able to generate the governing FE equations and models for the evaluation of different isoparametric elements.
4. The student will be able to determine the behaviors and analyze various structures by adopting basic principles of FEM.

UNIT1:
Basic concepts of elasticity – kinematic and static variables, approximate methods of structuralanalysis: Rayleigh-Ritz method, finite difference method, finite element method. Principles of finiteelementmethod,advantagesanddisadvantages,finiteelementprocedure.Discretizationofstructures: Finite elements used for one, two and three dimensional problems, element aspectratio, mesh refinement versus higher order elements, numbering of nodes to minimize bandwidth.

UNIT2:
Displacement Model: Nodal displacement parameters, convergence criterion, compatibility requirements,geometric invariance, shape function, polynomial form of displacement function, generalized and naturalcoordinates,Lagrangianinterpolationfunction,shapefunctionsforone,twoandthreedimensionalelements.

UNIT3:
Concept of Isoperimetric Elements: Internal nodes and higher order elements, serendipity andLagrangianfamilyoffiniteelements,subparametricandsuperparametricelements,condensationof internal nodes, Jacobian transformation matrix, variation method andminimization of energyapproach of element formulation (development of strain – displacementmatrix and stiffnessmatrix)consistentloadvector,numerical integration.

UNIT4:
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-symmetricproblems using CST and quadrilateral elements. Application to plates and shells – Choice ofdisplacementfunction (C^o,C^1,C^2type),techniquesfornonlinearanalysis.

References:

1. BatheKJ,“FiniteElementProceduresinEngineeringAnalysis”,PrenticeHall,1982
2. CookRD,MalkanDS&PlestaM.E,“ConceptsandApplicationofFiniteElementAnalysis”,3rd

Edition,John Wileyand SonsInc., 1989
3. DarylL.Logan,“FiniteElementMethod”,ThomsonBrooks/Cole,2007
4. KrishnamoorthyCS,“FiniteElementAnalysis”,TataMcGrawHill,2007
5. Rajasekaran.S,“FiniteElementAnalysisinEngineeringDesign”,WheelerPublishing,1994

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	The student will be able to apply the fundamental concepts, theories and principles underlying various finite element methods and analysis.	2		3	2		
2	The student will be able to generate the governing FE equations and models for the evaluation of different displacement models for 1-D, 2-D and 3-D elements with generalized and natural coordinates	2		3	2		
3	The student will be able to generate the governing FE equations and models for the evaluation of different isoparametric elements.	3		3	2		
4	The student will be able to determine the behaviors and analyze various structures by adopting basic principles of FEM.	3		3	2		

PRE-STRESSEDCONCRETEMECHANICSANDDESIGN
3Credits
(3-0-0)

SubjectCode:22PSE202C IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. Studentswillbeabletodesignthemembersforflexure accordingtostressrangeapproach,Lin'sapproach, Magnel'sapproach.
2. Studentswillbeabletodesignthe PSC membersforshear and torsion.
3. Students will be able to analyse indeterminate pre-stressed concrete structures
4. Thestudents will be able toanalysethe behaviour of composite construction.

UNIT1:
Analysis for Flexure: General concept of stresses, resultant compression line, load balancingconcept. Analysis of members under axial load, analysis at transfer, analysis at services loads,analysisatultimatestrength.Designphilosophy: Limitstateofcollapseandserviceability.Design forflexure:Stressrangeapproach,Lin'sapproach,Magnel'sapproach.

UNIT2:
Design for shear and torsion: Mechanism of shear resistance in PSC beams, design for shear inPSC beams, shear in flanged beams and failure of concrete elements under torsion. Anchoragezonestresses: Pre-tensionedandPost-tensionedpre-stressedconcrete elements, detailingofreinforcementingeneral.

UNIT3:
Statically indeterminate structures: analysis of pre-stressed indeterminate structures, continuousbeams,lineartransformationandconcordancyofcableprofiles,frames.Designofonewaysl ab.

UNIT4:
Compositeconstruction:Needfor compositeconstruction,typesof compositeconstruction,flexuralstresses,longitudinalandtransversesheartransfer,creepandshrinkag eeffectsincompositeconstruction.

References

1. Krishnaraju,"Pre-StressedConcrete",TataMcgrawHill,2007
2. NRajagopalan,"PrestressedConcrete",Narosa,2nd Ed.,2006
3. Naaman,A.E.–"Pre-StressedConcreteAnalysisandDesign:Fundamentals",2ndEdition,TechnoPress, 2005
4. Nilson,"DesignofPre-StressedConcrete",2ndEdition,JohnWiley,1987.
5. LinAndBurns–"DesignofPre-StressedConcreteStructures",3rdEditions,JohnWiley,1981
6. Nawy-"Pre-StressedConcrete–AFundamentalApproach",5thEd.2009

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
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 will be able to design the PSC members for shear and torsion.	1	3	2			
3	Students will be able to analyse indeterminate pre-stressed concrete structures	2	1	3			
4	The students will be able to analyse the behaviour of composite construction.	2		2	3	2	

DESIGNSTUDIO
2Credits
(0-0-4)

SubjectCode:PSE203L CIEMarks:50
Max.Marks:100 ContactHours–hours/week:04

Courseoutcomes:

1. Students will be able to present information in a compelling, well-structured, and logicalsequence and show depth of knowledge of complex subjects, and develop their ability tosynthesize,evaluate andreflect on information.
2. Students will be able to demonstrate application of appropriate methodologies, test the strength oftheir problem statement, show insight into a topic, appropriate signposting, and clarity ofpurpose.
3. Students will be able to demonstrate application of problem-solving skills, use new tools and applytheoreticalknowledge.

Planning,Analysis,Design,DetailingandEstimationofanyResidential/Commercial/IndustrialStructureusingavailableSoftwarePackage.

Completereporttobesubmittedattheendofthesemester.CIEandSEEareevaluatedbythecommittee.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will be able to present information in a compelling, well-structured, and logical sequence and show depth of knowledge ofcomplex subjects, and develop their ability to synthesize, evaluateandreflect on information.	2	3	1	2		
2	Students will be able to demonstrate application of appropriate methodologies, test the strength oftheir problem statement, show insight into a topic, appropriate signposting, and clarity ofpurpose.	2	1	3	2		
3	Students will be able to demonstrate application of problem-solving skills, use new tools and applytheoreticalknowledge..	3	2	2			3

ADVANCED DESIGN OF STEEL STRUCTURES
3 Credits
(3-0-0)

SubjectCode: 22PSE301C | CIEMarks:50
Max.Marks:100 | ContactHours–hours/week:03

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.

CourseArticulationMatrix

Sl.No	Statement	PO1	PO2	PO3	PO4	PO5	PO6
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	3		1
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		3
3	Demonstrate the use of various IS codes in the design with the knowledge of minimum weight design.	2	3	3			3

LISTOF PROFESSIONAL ELECTIVE COURSES (PECs)

Sl.No	Subject	Credits
1	Stabilityanalysis ofstructures	4
2	RepairandRehabilitationofStructures	4
3	MatrixmethodsofStructuralAnalysis	4
4	NumericalMethodsfor CivilEngineers	4
5	StructuralDesign of Foundations	4
6	OptimizationTechniquesinCivilEngineering	4
7	DesignofTallstructures	3
8	TheoryofPlatesandShells	3
9	AdvancedFoundationEngineering	3
10	Designof Bridges	3
11	MasonryStructures	3
12	ConstructionManagement	3

STABILITYANALYSISOFSTRUCTRES
4Credits
(3-2-0)

SubjectCode: 22PSE01E IAMarks:50
DurationofExam:5Hrs Maximummarks: 100

Courseoutcomes:

1. Students will be able to apply mathematicalequationsintheanalysisofcolumnofdifferentendconditions.
2. Students will be able to identifyandanalysecriticalloadsforvariouscasesbyusingdifferentmethods.
3. Studentswillbeabletoapplytheknowledgeoffiniteelementapproachinthestudyofstabilityanalysisand behavior ofindividual componentsofstructures.
4. Studentswillbeableto analyse lateral buckling of beam due to various loading condition

UNIT1:
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-freeandfixed-pined column.

UNIT2:
Buckling of frames and continuous beams. Elastic Energy method – Approximate calculation ofcriticalloadsforacantilever.Exactcriticalloadforhinged-hingedcolumnusingenergyapproach.Bucklingofbaronelasticfoundation.Bucklingofcantilevercolumnunderdistributed loads. Determination of critical loads by successive approximation. Bars with varyingcross section. Effect of shear force on critical load. Column subjected to non-conservativefollowerand pulsatingforces.

UNIT3:
Stability analysis by finite element approach – deviation of shape function for a two noddedBernoulli-Euler beam element (lateral and translation) – element stiffness and element geometricstiffness matrices – assembled stiffness and geometric stiffness matrices for a discretised columnwith 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) –symmetricalsinglewayportalframe.

UNIT4:
Lateralbucklingofbeams–differentialequation–purebending–cantileverbeamwithtipload –simplysupportedbeamofIsectionsubjectedtocentralconcentratedload.PureTorsionofthin-walledbarswithofcrosssection.Non-uniformTorsionofthin-walledbarsofopencross section.Expressionforstrainenergyinplatebendingwithinplateforces(linearandnon-linear).Bucklingof simply supported rectangular plate-uniaxial load and biaxial load. Buckling of uniformlycompressed rectangular plate simply supported along two opposite sides perpendicular to thedirectionofcompressionandhavingvariousedgeconditionalongtheothertwosides.

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. Crodok,Malkus, Plesha,Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, John Wiley and Sons, 2007
8. Vazirani V N and Ratwani M M, “Advanced theory of structures and matrix methods”. 5 Edition, Khanna publishers, Delhi (1995).

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will be able to apply mathematical equations in the analysis of column of different end conditions.	3		3			
2	Students will be able to identify and analyse critical loads for various cases by using different methods.	2		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.	1		3	2		2
4	Students will be able to analyse lateral buckling of beam due to various loading conditions.	2		2		2	

REPAIRANDREHABILITATIONOFSTRUCTURES
3 Credits
(3-2-0)

SubjectCode: 22PSE02E IAMarks:50
DurationofExam:5Hrs Maximummarks: 100

Courseoutcomes:

1. Studentwillbe able to identify the causes for distress in concrete.
2. Studentwill be able to apply differentNDTtechniques
3. Identifythesuitablerepairmethodindifferentdistresscondition.
4. Abletoselect thedifferentmaterials for repair of concretestructures.

UNIT1:

Introduction: Causes of deterioration of concrete structures, diagnostic methods & analysis,preliminaryinvestigations,experimentalinvestigationsusingNDT,loadtesting,corrosionmapping and core drillingandotherinstrumentalmethods.Qualityassuranceforconcreteconstruction, strength, permeability,thermal properties and cracking. Influence on serviceabilityand durability:Effectsduetoclimate,temperature,chemicals,wearanderosion

UNIT2:

Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking,methodsofcorrosionprotection,corrosioninhibitors,corrosionresistantsteels,coatings,cathodicprotection.

Maintenance and Repair Strategies: repair and rehabilitation, facets of maintenance, importanceofmaintenance, preventive measures on various aspects,inspection, assessment procedure forevaluatingadamagedstructure, causesofdeterioration-testingtechniques.

UNIT3:

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements foraccelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferrocement,fiberreinforced concrete.
Techniques for Repair: Rust eliminators and polymers coating for rebar during repair, foamedconcrete,mortaranddrypack,vacuumconcrete,shotcrete,epoxyinjection,shoringandunderpinning.

UNIT4:

ExamplesofRepairtoStructures:Repairstoovercomelowmemberstrength,deflection,cracking,chemicaldisruption,weatheringwear,fire,leakage,marineexposure,engineereddemolitiontechniquesfordilapidatedstructures-casestudies

References:

1. AllenR.TandEdwardsS.C.,“RepairofConcreteStructures”,BlakieandSons,1987
2. DenisonCampbell,Allen&HaroldRoper,“ConcreteStructures–Materials,MaintenanceandRepair”,LongmanScientificandTechnical, 1991
3. RaikerR.N.,“LearningforfailurefromDeficienciesinDesign,ConstructionandService”,R&DCenter(SDCPL),1987
4. Sidney.,M.Johnson“Deterioration,MaintenanceandRepairofStructures”,1981

CourseArticulationMatrix

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
1	Studentwill be able to identify the causes for distress in concrete.	2		2			3
2	Studentwill be able to apply differentNDTtechniques	2		3			
3	Identifythesuitablerepairmethodindifferentdistresscondition.	3		3		3	
4	Abletoselect thedifferentmaterials for repair of concretestructures.	3		3		3	1

MATRIXMETHODSOFSTRUCTURALANALYSIS
4Credits
(3-2-0)

SubjectCode:22PSE03E IAMarks:50
DurationofExam:5 Hrs Maximummarks: 100

Courseoutcomes:

1. The students will be able to describe the fundamental concepts and modern methods ofstructural analysis and apply flexibility matrix method by element approach for theanalysisof beams, frames and trusses.
2. The students will be able to apply stiffness matrix method for the analysis of beams,framesandtrussesbyelementanddirectapproach.
3. Thestudents will beableto analyzegrid and spaceframesby stiffness matrix method.
4. The students will be able to analyze the trusses subjected to temperature changes and lack of fit, apply numerical techniques for simultaneous equations.

UNIT1:
Reviewofthebasicconcepts:staticandkinematicindeterminacy,linearandnon-linearstructural behavior, concepts of stiffness and flexibility, energy concepts, principle of minimumpotentialenergyandminimumcomplementaryenergy.
Flexibility method: Introduction, transformation of information from system forces to elementforces, applicationtotrusses,continuousbeams andportalframes.

UNIT2:
Stiffness method: Introduction, stiffness matrix for trusses, beams and portal frames. Assemblyofstructurestiffnessmatrixbydirectstiffnessmethod,analysisoforthogonalandnonorthogo nal skeletal structures, transformation of information from local to global axes and viceversa

UNIT3:
Stiffnessmatricesforgridandbeamelementsinthreedimensions,transformationofdisplacements and forces from local to global axes, analysis of grid and space frames, basicconceptsassociatedwithcomputerimplementationbystiffnessmethod.

UNIT4:
Effects of temperature change and lack of fit, numerical techniques for simultaneous equations,Gausseliminationand Choleskymethods andbandwidthconsideration.

References:

1. AslamKassimali,“Matrixanalysisofstructures”,Brooks/Cole,1999
2. BhattP,“Problemsinstructuralanalysisbymatrixmethods”,Constructionpress,1981
3. DevdasMenon,“AdvancedStructuralAnalysis”,AlphaScienceInternational,2009
4. PanditG.S.andGuptaS.P.,“Structuralanalysis:amatrixapproach”,TataMcGrawHill,2007.
5. RajasekaranS.,“ComputationalStructuralMechanics”,PHI,NewDehi2001.
6. ReddyC.S.,“BasicStructuralAnalysis”,TMH,NewDelhi2001.
7. WeaverW.andJ.H.Gere,“MatrixAnalysisofFramedStructures”,VanNastran,1980.

CourseArticulationMatrix

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
1	The students will be able to describe the fundamental concepts andmodern methods of structural analysis and apply flexibility matrixmethod by element approach for the analysis of beams, frames andtrusses.	2		3	2		
2	The students will be able to apply stiffness matrix method for theanalysisofbeams,framesandtrussesbyelementanddirectapproach.	1		3	2		
3	Thestudentswillbeabletoanalyzegridandspaceframesbystiffnessmatrixmethod.	1		3	2		
4	Thestudentswillbeabletoanalyze thetrussessubjectedtotemperature changes and lack of fit, apply numerical techniques for simultaneous equations.	3		3	2		

NUMERICALMETHODSFORCIVILENGINEERS
4Credits
(3-2-0)

SubjectCode:22PSE04E IAMarks:50
DurationofExam: 5 Hrs ExaminationofMarks:100

Courseoutcomes:

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. The students will be able to apply numerical integration for solving simple beam problems and Application of Finite difference technique in structural mechanics.
3. The students will be able to apply New-Mark's method for computation of slopes and deflections in statically determinate beams.
4. The students will be 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.

UNIT1:

Introduction:Historical development of Numerical techniques, role in investigations, researchanddesign inthefieldofcivil engineering.
Developmentofalgorithm/flowchartsforfollowingmethodsforsolutionoflinearSimultaneousequation:a)Gaussianeliminationmethodb)Gauss-Jordanmatrixinversionmethodc)Gauss-Siedelmethod d)Factorizationmethod
Applicationofsolutionoflinearsystemofequationstocivilengineeringproblems:Constructionplanning,slopedeflectionmethodappliedtobeams,framesandtrussanalysis.

UNIT2:

Applicationofrootfindingtocivilengineeringproblems:DevelopmentofalgorithmforBisection method and Newton-Raphson method and its applications for solution of non linearalgebraicandtranscendentalequationsfromproblemsinhydraulics,irrigationengineering,structuralengineeringandenvironmental engineering.
Applicationofnumericalintegrationforsolvingsimplebeamproblems:Developmentofalgorithm for Trapezoidal rule and Simpson's one third rule and its application for computationofareaofBMDdrawn forstaticallydeterminatebeams.

UNIT3:

New-Mark's method for computation of slopes and deflections in statically determinate beams.Developmentofalgorithmandapplicationofsolutionofordinarydifferentialequationtocivilengineeringproblems byEuler'smethodandRungeKutta4th ordermethod

UNIT4:

Applicationoffinitedifferencetechniqueinstructuralmechanics:

i. Introduction,expressionofderivativesbyfinitedifference:backwarddifferences,forwarddifferencesandcentraldifferences.
ii. Application of finite difference method for analysis of statically determinateindeterminatebeams

ApplicationofFinitedifferencetechniqueinstructuralmechanics(Contd..):BucklingofcolumnsandBeamsonelasticfoundation.

ReferenceBooks:

1. ChapraS.C.&CanaleR.P.,NumericalMethodsforEngineers,McGrawHill,1990.
2. KrishnaRajuN,MuthuK.U.,NumericalmethodsinEngineeringProblem,McMillanIndianLimited, 1990.
3. IqbalH.Khan,Q.Hassan,NumericalmethodsforEngineersandScientists,Galgotia,NewDelhi, 1997.
4. NumericalmethodsinComputerProgramsinC++"-PallabGhosh:PrenticeHallofIndiaPrivate Limited, NewDelhi,2006.
5. NumericalmethodsforengineersusingMATLABandC–IEditionSCHILLING"ThomsonPublications"

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
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		2	2		
2	The students will be able to apply numerical integration for solving simple beam problems and Application of Finite difference technique in structural mechanics.	2		3	2		
3	The students will be able to apply New-Mark's method for computation of slopes and deflections in statically determinate beams.	2		3	2		
4	The students will be 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		3	2		

STRUCTURALDESIGNOFFOUNDATIONS
4Credits
(3-2-0)

SubjectCode:22PSE05E IAMarks:50
DurationofExam: 5Hrs ExaminationofMarks:100

Courseoutcomes:

1. Students will able to apply principles of design in foundations design.
2. Students will able to do design and prepare detailing the shallow foundations according to codal provisions.
3. Students will able to design deep foundation for retaining walls, piles, pile group and caissons.
4. Students will able to 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.FundamentalsofGeotechnicalandStructuralDesign:ConceptsandPrinciple

s.

UNIT2:

IntroductiontoRCDesign-Codalprovisions:AreviewandAfewexamples.

Shallow Foundations: Geotechnical and Structural Design of Individual footings, Combinedfootings, Rafts, Ring foundations, etc. Detailing, Examples and Case Studies. Beams and PlatesonElasticFoundation:

UNIT3:

Deep Foundations: Geotechnical and Structural Design of Piles and Pile groups, Piers andCaissons.Detailing, ExamplesandCaseStudies.

FoundationsforRetainingStructures:ExamplesandCaseStudies.

UNIT4:

SpecialFoundations:Towers,Chimneys,High-RiseBuildings,PowerPlants,etc.

Earthquake Resistant Design of Foundations – A few Examples and Case Studies. Usage ofSoftware.

References:

1. Coduto,D.P.(2000).FoundationDesign:PrinciplesandPractices,Prentice-Hall,NewJersey.
2. Peck,R.B.,Hanson,W.E.andThornburn,T.H.(1974).FoundationEngineering,JohnWileyan d Sons,NewYork.
3. Bowles,J.E.(1996).FoundationAnalysisandDesign,McGraw-Hill,NewYork
4. Hemsley,J.A.(1998).ElasticAnalysisofRaftFoundations,ThomasTelford,London.
5. Hemsley, J. A. (Ed.), (2000). Design Applications of Raft Foundations, Thomas Telford,London.
6. Murthy,V. N.S.(2007).AdvancedFoundationEngineering,CBSPublishersandDistributors, NewDelhi.
7. Poulos,H.G.and

Davis,E.H.(1980).PileFoundationAnalysisandDesign,JohnWileyandSons,NewYork.

<u>CourseArticulationMatrix</u>

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will able to apply principles of design in foundations design.			2	3		
2	Students will able to do design and prepare detailing the shallow foundations according to codal provisions.	2	2	3			
3	Students will able to design deep foundation for retaining walls, piles, pile group and caissons.	2	2	3		2	
4	Students will able to design and prepare detailing of the foundations for special structures like chimneys, power plants and towers.	2	2	3		3	

OPTIMIZATIONTECHNIQUESINCIVILENGINEERING
4 Credits
(3-2-0)

SubjectCode: 22PSE06E IAMarks:50
DurationofExam:5Hrs Maximummarks: 100

Courseoutcomes:

1. Students will able to comprehend engineering applications of optimization.
2. Students will able to solve linear, non-liner and geometric programming, system of liner simultaneous equations, simplex algorithms and pivotal production of general system of equations.
3. Students will able toapply the different minimization methods for one dimensional, elimination, Fibonacci, golden section, interpolation, quadratic and cubic methods.
4. Students will 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.

UNIT1:
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.

UNIT2:
Linear programming, standard form of linear programming, geometry of linear programmingproblems, solution of a system of linear simultaneous equations, pivotal production of generalsystemsofequations,simplexalgorithms,revisedsimplermethods,dualityinlinearprogramming.

UNIT3:
Non-linearprogramming,onedimensionalminimizationmethods,eliminationmethods,Fibonacci method, golden section method, interpolation methods, quadratic and cubic methods,Unconstrained optimization methods, direct search methods, random search methods, descentmethods, constrained optimization techniques such as direct methods, the complex methods,cuttingplanemethod,exteriorpenaltyfunctionmethodsforstructuralengineeringproblems.

UNIT4:
Geometric programming, conversion of NLP as a sequence of LP/geometric programming,Dynamic programming conversionofNLPasasequenceofLP/Dynamicprogramming,StructuralOptimizationFormulationandsolutionofstructuraloptimizationproblemsbydifferenttechniques

References:

1. BhavikattiS.S.,-“Structuraloptimizationusingsequentiallinearprogramming”,Vikaspublishinghouse,2003
2. RaoS.S.,“Optimization–TheoryandPractice”,WileyEasternLtd,1996
3. RichardBronson,“OperationResearch”,Schaum’sOutlineSeries,2003
4. Spunt,“OptimumStructuralDesign”,PrenticeHall,1971
5. UriKrisch,“OptimumStructuralDesign”,McGrawHill,1981

<u>CourseArticulationMatrix</u>

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will able to comprehend engineering applications of optimization.	2		2			2
2	Students will able to solve linear, non-liner and geometric programming, system of liner simultaneous equations, simplex algorithms and pivotal production of general system of equations.	2		3			2
3	Students will able to apply the different minimization methods for one dimensional, elimination, Fibonacci, golden section, interpolation, quadratic and cubic methods.	2		1			2
4	Students will 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

DESIGNOFTALLSTRUCTURES
3Credits
(2-2-0)

SubjectCode:PSE003E IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. Students will able to apply the design philosophy and concepts in analysisand design of structure..
2. Students will able to identify and analyse the behaviorsandeffects of various factors in structural systems.
3. Students will able to analyse and design the various modelling techniques by considering various factors.
4. Students will able to analyse and design tall structures considering the factors which affect the design and itsservicelife.

UNIT1:
DesignCriteria:Designphilosophy,loading,sequentialloading,andmaterials–highperformance concrete, fiber reinforcedconcrete,lightweightconcrete, design mixes.Loadingand Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact,Gravity loading, Construction loads Wind loading: static and dynamic approach, Analytical andwindtunnelexperimentationmethod.Earthquakeloading:Equivalentlateralforce,modelanalysis,combinationsofloading,workingstressdesign, Limitstatedesign,Plasticdesign.

UNIT2:
Behaviour of Various Structural Systems: Factors affecting growth, Height and structural form;High rise behavior, Rigidframes, braced frames, in-filled frames, shear walls, coupled shearwalls,wall-frames,tubular,cores,Outrigger–bracedandhybridmegasystem.

UNIT3:
AnalysisandDesign:Modelingforapproximateanalysis,accurateanalysisandreductiontechniques, analysis of building as total structural system considering overall integrity and majorsubsystem interaction, analysis for member forces; drift and twist, computerized general threedimensional analysis. Structural elements: sectional shapes, properties and resisting capacities,design, deflection, cracking, pre-stressing, shear flow. Design for differential movement, creepandshrinkageeffects,temperatureeffectsand fire.

UNIT4:

StabilityofTallBuildings,overallbucklinganalysisofframes,wallframes,approximatemethods,second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Deltaanalysis, Transnational, Torsional instability, out of plum effects, stiffness of member in stability,effectof foundationrotation.

References:

1. BryanStaffordSmith&Alexcoull,“Tallbuildingstructures,AnalysisandDesign”,JohnWiley,1991
2. Dr.GuptaYP–Editor,“ProceedingsNationalSeminaronHighRiseStructures-DesignandConstructionpracticesformiddlelevelcities”,NewAgeInternationalLimited.
3. LinTN&.StotesBurryD,“StructuralconceptsandsystemforArchitectsandEngineers”,JohnWiley,1998
4. LynnS.Beedle,“AdvancesinTallBuildings”,CBSPublishersandDistributors,1996
5. TaranathB.S,“StructuralAnalysisandDesignofTallBuildings”,McGrawHill,1998WilfgangSchuller,“Highrisebuildingstructures”,JohnWiley,1977.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will able to apply the design philosophy and concepts in analysisand design of structure..	1		3	3	1	
2	Students will able to identify and analyse the behaviorsandeffects of various factors in structural systems.	2		3	3	1	
3	Students will able to analyse and design the various modelling techniques by considering various factors.	3		3	3	1	

THEORYOFPLATESANDSHELLS
3 Credits

(2-2-0)

SubjectCode:PSE005E IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. Able to demonstrate the application of plate theory and use governingdifferentialequationsviz.,Navier'sandLevy'ssolutionsfortheanalysisofplatessubjectedtovariousloadingandendconditions.
2. Abletoclassifyandidentifyvarioustypesofshells.
3. Ableto prepareadetailing report for plates and simpleshells.

UNIT1:
Introduction toplate theory, small deflectionof laterally loadedthinrectangular plates.Theoryofpurebendingofplates; Navier'sand Levy's solutionofplates forvariousloadingandboundaryconditions

UNIT2:
Use of energy methodsfor solution of plates with all edges clamped, symmetric loading ofcircular plates with various edge conditions for both solid and annular plates, design principlesanddetailingoffolded plates.

UNIT3:
Introduction to curved surfaces and classification of shells, membrane theory of spherical shells,cylindricalshells,hyperbolicparaboloids,elliptic,paraboloidandconoids,axi-symmetricbendingofshells of revolution.

UNIT4:
Closed cylindrical shells, water tanks, spherical shells and Geckler's approximation, bendingtheory of doubly curved shallow shells, detailing simple shell – spherical domes, water tanks,barrelvaults andhyperbolicparaboloid roofs

References:

1. ChandrashekharK,AnalysisofthinConcreteShells,NewAgeInternational,1995.
2. Chatterjee.B.K.–TheoryandDesignofConcreteShell,–Chapman&Hall,Newyork-thirdedition, 1988.
3. RamaswamyG.S.–DesignandConstructionsofConcreteShellRoofs,–CBSPublishersandDistributors– NewDelhi – 2005
4. SzilardR,Theoryandanalysisofplates-classicalandnumericalmethods,PrenticeHall,2010.
5. TimoshekoS.P.andWoinowsky-KriegerW,TheoryofPlatesandShells2ndEdition,McGraw-HillCo., NewYork, 1959.
6. Ugural,A.C.StressesinPlatesandShells,2ndedition,McGraw-Hill,1999

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Able to demonstrate the application of plate theory and use governing differential equationsviz.,Navier’sandLevy’ssolutionsfortheanalysisofplatessubjectedtovariousloadingandendconditions.	1	1	3			2
2	Abletoclassifyandidentifyvarioustypesofshells.	1	1	3			2
3	Ableto prepareadetailing reportfor platesand simpleshells.	1	2	3			2

ADVANCEDFOUNDATIONENGINEERING
3 Credits
(2-2-0)

SubjectCode:PSE022E IAMarks:50
DurationofExam:3Hrs Maximummarks:100

Courseoutcomes: Atthe endofthe coursethe studentwill beable to
1. Selectthetype offoundation,depth anddesign depending uponthetype of soil.
2. Decideandanalyzegeometricconfigurationandsafety,and economyoffoundation.
3. Analyzeandsuggestremedialmeasuresagainstfoundationfailures.

UNIT1:
Assessmentoffoundationloadsfor Engineeringstructures–Deadload,Liveload,windandseismicloadcombinations forthe Design, Coderequirements.Bearing Capacity
Settlementanalysis,Immediatesettlements,Consolidationsettlements,Totalsettlements,Relativesettlements, Various methods of estimation.

UNIT2:
ShallowFoundations-Conventionalstructuraldesignof Individualfootings,combinedfootingsandRafts.
PileFoundations–AnalysisandConventionalDesignofpilefoundationsforverticalandlateralloadsincluding design of pile cap.

UNIT3:
Piers and Well Foundations: Analysis and design of pier and well foundations.
Caissons.Foundationson expansivesoils, under reamed piles.

UNIT4:
Specialfoundations.DesignofSheetpiles
FoundationFailures -Typesandcausesoffailures,Remedialmeasures,ShoringandUnderpinning.

References:

1. BowelsJE.“FoundationAnalysisanddesign”,McGrawHillBookCo.,NewYork.
2. WinterkornandFang, “FoundationEngineeringHandbook”-VonNostrandReinholdCo
3. ShamsherPrakash,GopalRanjanandSwamiSaran“AnalysisanddesignofFoundationandRetainingstructures”, K.A.Rastogi Prakashan, Meerut, India.
4. Jain,G.R.S.,“HandBookonUnderreamedandBoredCompactionPileFoundations”,PublishedbyG. S. Jain Associates,Roorkee.
5. Das,B.M.,“PrinciplesofFoundationEngineering”,CengageLearning (2011)
6. Tomlinson,“FoundationDesignandConstruction”,ELBS,LongmanGroupLtd.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Select the type of foundation, depth and design depending upon the type ofsoil.	1		3	3	2	
2	Decideandanalyzegeometricconfigurationandsafety,andeconomyoffoundation.	2		3	3	2	
3	Analyzeandsuggestremedialmeasuresagainstfoundationfailures.	2		3	3	2	

DESIGNOFBRIDGES
3 Credits
(2-2-0)

SubjectCode:PSE011E IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. Analyze and predict the behavior of various types of bridges and design them as perrelevant codes.
2. Demonstrate the application of various types of bridges and theirprinciplesof design.
3. DesignandanalysisofPSCbridgeswithdifferent loadingsusingrelevantcodes.

UNIT1:

Introduction:siteselectionforbridges,classificationofbridges,reviewofIRCandIRSloadings,bridges ubstructures: abutments, piers, wingwalls andtheirfoundations, bearings,expansionjoints.Designofslabculvertandboxculvert fordifferentIRCloadingcases

UNIT2:

T-beambridgedesignusingCOURBON'Smethod,HENDRY-JAEGERandMORICE-LITTLEmethodsfor IRCloading

UNIT3:

Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simplysupportedportionanddesignofcantileverportion,designofarticulation.

UNIT4:

PSC Bridges: Introduction, proportioning of components, analysis and structural design of slaband main girder using COURBON's method for IRC Class AA tracked vehicle, calculation ofpre-stressing force, cable profile and calculation of stresses, design of end block and detailing ofmaingirder

References:

2. KrishnaRajuN,"DesignofBridges",Oxford&IBHPublishingCoNewDelhi,1998
3. Ponnuswamy.S,"BridgeEngineering",TataMcGrawHill,2007.
4. RainaV.K.,"ConcreteBridgePractice",TataMcGrawHill,2002
5. JohnsonD,Victor"EssentialsofBridgeEngineering",Oxford&IBHPublishingCoNewDelhi,2010.

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3
1	Analyzeandpredictthebehaviourofvarioustypesofbridgesanddesignthem withdetailed report asper relevant codes	3	2	3
2	Demonstratetheapplication of varioustypes of bridgesandtheirprinciples ofdesign.	2	3	2
3	Design and analysis of PSC bridges with different loadings usingrelevantcodes.	1	2	3

MASONRYSTRUCTURES
03 **Credits**
(2-2-0)

SubjectCode:PSE014E IAMarks:50
DurationofExam:3Hrs Maximummarks: 100

Courseoutcomes:

1. Studentswillcomprehendvariousmaterialtypes,characteristicsandpropertiesof thematerials usedin the masonrystructures.
2. Studentswillbeabletodesigntheloadbearingmasonryforbuildingsusing BIScodalprovisions.
3. Studentswillbeabletopredicttheeffectofthemasonryonthebehaviorofthebuildingsubjected toearthquakeforces.
4. Studentswillbeabletodesignearthquakeresistantmasonry

UNIT1:
Introduction, Masonry units, materials and types, history of masonry, characteristics of Brick,stone, clay block, concrete block, stabilized, mud block masonry units – strength, modulus ofelasticity and water absorption. Masonry materials – classification and properties of mortars,selectionofmortars.Strengthofmasonryincompression,behaviourofmasonryundercompression,strengthandelasticproperties,influenceofmasonryunitandmortarcharacteristics, effect of masonry unit height on compressive strength, influence of masonrybonding patterns on strength, prediction of strength of masonry in Indian context, failure theoriesofmasonryundercompression.Effectsofslendernessandeccentricity,effectofrateofabsorption,effectofcuring,effectofageing, workmanshiponcompressivestrength

UNIT2:
Flexuralstrengthandshearstrength,bondbetweenmasonryunitandmortar,testsfordetermining flexural, shear and bond strengths, factors affecting bond strength, effect of bondstrength on compressive strength, orthotropic strength properties of masonry in flexure, shearstrength of masonry, test procedures for evaluating flexural and shear strength. Permissiblestresses,stressreductionandshapereductionfactors,increaseinpermissiblestressesforeccentric,vertical and lateral loads.

UNIT3:
Design of load bearing masonry buildings: Permissible compressive stress, stress reduction andshape 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,slendernessratio,eccentricity,loaddispersion,archingaction, lintels; wall carrying axial load, eccentric load with different eccentricity ratios, wall withopenings, freestanding wall; design of load bearing masonry for buildings up to 3 to 8 storeysusingBIS codal provisions.

UNIT4:
Earthquakeresistantmasonry buildings:Behaviourofmasonry duringearthquakes,conceptsanddesignprocedureforearthquakeresistantmasonry,BIScodalprovisions,masonryarches,

domes and vaults, components and classification of masonry arches, domes and vaults, historicalbuildings, construction procedure.In-plane and out of plane behavior,behavior of masonrywallsandpiers:axialandflexurebehaviorofmasonrybuildings:unreinforcedmasonrybuildings,importanceof bandsandcornersandverticalreinforcement,reinforcedmasonrybuilding- cyclic loading and ductility of masonry walls, behavior of infills in RC frames, strutaction

References:

1. Curtin,“DesignofReinforcedandPrestressedMasonry”,ThomasTelford,1998
2. DayaratnamP,“BrickandReinforcedBrickStructures”,Oxford&IBH,1997
3. HendryA.W., “Structural masonry”, MacmillanEducationLtd.,2nd edition,1990
4. JagadishKS,VenkataramaReddyBVandNanjundaRaoKS,“AlternativeBuildingMaterialsandTechnologies”,NewAgeInternational.
5. SinhaB.P&DavisS.R.,“DesignofMasonrystructures”,E&FiN,1996

<u>CourseArticulationMatrix</u>

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Studentswillcomprehendvariousmaterialtypes,characteristicsandpropertiesof thematerials usedin the masonrystructures.	1		2	2		
2	Studentswillbeabletodesigntheloadbearingmasonryforbuildingsusing BIScodalprovisions.	1		2	2		
3	Studentswillbeabletopredicttheeffectofthemasonryonthebehaviorofthebuildingsubjectedtoearthquakeforces.	1		3	2		
4	Studentswillbeabletodesignearthquakeresistantmasonry			3	3		

CONSTRUCTIONMANAGEMENT
3 Credits
(2-2-0)

SubjectCode:PSE020E IAMarks:50
DurationofExam:3Hrs ExaminationofMarks:100

Courseoutcomes:

1. Students will be able to apply principles of construction economics for aconstructionproject.
2. Studentswill be able to apply inventory managementtechniques.
3. Students will be able to apply quality management concepts in construction industry.
4. Students will be able to apply independently ISO standards in quality and safety for construction.

UNIT1:
Stagesofconstruction-estimating,tendering,pricingandcontracting,equipmentplanningandwaitinglinesituations, inventorymanagement.
Engineeringeconomics andEconomicfeasibility–budget, break-evenanalysis,Balancesheets,cost benefit analysis, discounted cash flow, Life cycle costing, cost controloptimization

UNIT2:
Principlesandpracticeofprojectmanagement;workbreakdownstructures,criticalpathnetworks,PERT,resourcecharts,costcharts,S-curves,performanceratiosUpdatingofplans -purpose,frequencyandmethodsofupdating,commoncausesoftimeandcostoverrunsandcorrectivemeasures.

UNIT3:
Decisiontreeanddecisionanalysis,constructionsimulationandsimulationmodels,Appraisalofpublicinvestmentprojects,techno-economicsofprojectsprojectinvestmentanalysisanddecisions.

UNIT4:
Quality control - concept of quality, quality of constructed structure, use of manualsandchecklistsfor qualitycontrol,roleofinspection,basicsofstatisticalquality control,ISOstandards.
Safety andhealthonprojectsites-accidents;theircausesandeffects,costsofaccidents,occupational health problems in construction, organizing for safety and health, ISOstandards

References:

1. Varma,M.,“Constructionplanningandmanagementthroughsystemtechniques: MetropolitianBookCompany,NewDelhi1983
2. KumarNeerajJha,“ConstructionProjectManagement”,
3. PunmiaB.C.,KhandelwalK.K.,“ProjectPlanningandControlwithCPMandPERT”, LaxmiPublicationPrivateLtd.,NewDelhi,2004
4. ShrivastvaU.K.,“ConstructionPlanningandManagement”,GalgotiaPublicationsPvt.Ltd., New Delhi, 2010
5. PeurifoyR.J.,“Constructionplanning,equipmentandmethods,McGrawHillBookcompany, NewYork,2006
6. WlestJDandLevyFKAManagementgaidetoPEET/CAMwithCERT/PDM/DCPMandothernetworksPHI– London,1977
7. Pilcher,R.PrinciplesofConstructionManagement3rdEdMcGrawHill,1992

CourseArticulationMatrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Students will be able to apply principles of construction economics for aconstructionproject.		2	1		2	1
2	Studentswill be able to apply inventory managementtechniques.		3	2		2	1
3	Students will be able to apply quality management concepts in construction industry.		2	3		2	1
4	Students will be able to apply independently ISO standards in quality and safety for construction.			3		3	2

ANALYSIS AND DESIGN OF SUB STRUCTURES
03 credits
(3:0:0)

SubjectCode:22PSE306E IAMarks:50
DurationofExam:3Hrs ExaminationofMarks:100

Course Outcomes: Upon completing this course, the student will be able to
1. Design the various types of shallow foundations
2. Analyse and design pile foundations
3. Design foundations for bridges such as caisson and well foundations
4. Analyse and design foundations for common types of machines

Unit 1
Shallow Foundations : Introduction, Factors affecting bearing capacity and settlement. Criteria for depth of footings. Design of spread, combined and strap footings. Types of raft foundation. Design of raftfoundation. Settlement analysis of footings. 10 Hrs

Unit 2
Pile Foundations : Pile capacity based on static & dynamic methods. Capacity based on SPT. Design of pile groups. Computation of group capacity and group efficiency in different soils. settlement analysis of individual and group of piles. Negative skin friction.10 Hrs

Unit 3
Foundations for Bridges: Introduction, Well foundation. Its advantages. Forces acting on a well foundation. Grip length and its computation. Sinking of wells. caisson foundations-Types and applications, Bearing capacity of caissons, computation of sinking effort, thickness of concrete seal, perimeter shear and buoyancy. 10 Hrs

Unit 4
Machine Foundations: Introduction, types of machines and machine foundation. Degrees of freedom, resonance, general criteria for design. Basic definitions in theory of vibration, Mass spring system, Free vibration with and Without damping, forced vibration with damping. Determination of parameters, Natural frequency. Barken's method, Design criteria for reciprocating and impact type of machines, Design of foundation blocks. 10 Hrs

Text Books:

1. K. R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publishers.
2. C. Venkataramaiah, "Geotechnical Engineering", New Age International Publishers (P) Ltd.

Reference books:

1. Bowels J.E.,"Foundation analysis & design" –Mc Graw Hill international Edition
2. P.C. Verghese, "Foundation Engg." PHI Learning Pvt. Ltd.
3. Swamisaran, "Analysis & Design of sub structures", Oxford & IBH Pub. Co. Pvt. Ltd.
4. N.N. Som & S.C. Das, "Theory and practice of foundation design" – PHI learning Pvt. Ltd.

Course Articulation Matrix

Sl.No.	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Design the various types of shallow foundation		2	2	3		2
2	Analyse and design pile foundations		2	3	3		2
3	Design foundations for bridges such as caisson and well foundations		2	3	3		2
4	Analyse and design foundations for common types of machines		2	3	3		2

Shri BVV Sangha's

Basaveshwar Engineering College, Bagalkote-587102

Department of Civil Engineering

SYLLABUS FOR POST GRADUATE PROGRAMME

M. Tech.

GEOTECHNICAL ENGINEERING

2023-2024

VISVESVARAYA TECHNOLOGICAL UNIVERSITY, BELAGAVI
Scheme of Teaching and Examinations – 2023-24
M.Tech., GEOTECHNICAL ENGINEERING (CGT)
Choice Based Credit System (CBCS) and Outcome-Based Education(OBE)

I SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	BSC	22PGT101C	Advanced Computational Methods	03	00	00	03	50	50	100	3
2	IPCC	22PGT102C	Soil Exploration and Field Testing	03	02	00	03	50	50	100	4
3	PCC	22PGT103C	Geomechanics	04	00	00	03	50	50	100	4
4	PCC	22PGT104C	Advanced Foundation Engineering	03	00	00	03	50	50	100	3
5	PCC	22PGT105C	Ground Improvement Techniques	03	00	00	03	50	50	100	3
6	MCC	22PGT106C	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCL	22PGT107L	Geotechnical Engineering Laboratory	00	04	00	03	50	50	100	2
8	AUD/AEC	22PGT108O	Any SWAYAM/ NPTEL Geotechnical/Interdiscplinary engineering related ONLINE courses (conducting during current semester), whose lecture hours are not less than 8 weeks.	Classes and evaluation procedures are as per the policy of the online course providers.							PP
			TOTAL	**19**	**06**	**00**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- MandatoryCredit Course,
AUD/AEC –Audit Course / Ability Enhancement Course(A pass in AUD/AEC is mandatory for the award of the degree), PCCL-Professional Core Course lab, **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities**(Hours are for Interaction between faculty and students)

Integrated Professional Core Course (IPCC): **Integrated Professional Core Course (IPCC)**: Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses: These are prerequisite courses suggested by the concerned Board of Studies. Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs. **Ability Enhancement Courses**:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialisation as well allied fields that leads to employable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.
- The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

Basaveshwar Engineering College, Bagalkote
Scheme of Teaching and Examinations – 2023-24
M.Tech., GEOTECHNICAL ENGINEERING (CGT)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

II SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				Credits
				Theory	Practical/ Seminar	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	T/SDA					
1	IPCC	22PGT201C	Finite Element Method	03	02	00	03	50	50	100	4
2	PCC	22PGT202C	Critical State Soil Mechanics	04	00	00	03	50	50	100	4
3	PEC	22PGT2XXE	Professional Elective-I	03	00	00	03	50	50	100	3
4	PEC	22PGT2XXE	Professional Elective-II	03	00	00	03	50	50	100	3
5	OEC	22PGT2XXE	Open Elective	03	00	00	03	50	50	100	3
6	MPS	22PGT204P	Mini Project with Seminar	00	06	00	03	100	--	100	03
7	PCL	22 PGT203L	Computational Laboratory	00	04	00	03	50	50	100	02
8	AUD/AEC	22 PGT208O	Any SWAYAM/ NPTEL Geotechnical/Interdiscplinary engineering related ONLINE courses (conducting during current semester), whose lecture hours are not less than 8 weeks.	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**16**	**12**	**00**	**21**	**400**	**300**	**700**	**22**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory), PCCL-Professional Core Course lab,
L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities(Hours are for Interaction between faculty and students)

Professional Elective 1		Professional Elective 2	
Course Code under 22XXX23X	**Course title**	**Course Code under 22XXX24X**	**Course title**
22PGT 205E	Geotechnical Earthquake Engineering	22 PGT 210E	Pile foundation Analysis and Design
22 PGT 206E	Dynamics of Soils and Foundations Soil	22 PGT 211E	Design of Earth Retaining Structures
22 PGT 207E	Structure Interaction Problems	22 PGT 212E	Numerical Methods for Civil Engineers
22 PGT 208E	Earth and Rock-fill dams	22 PGT 213E	Design of Machine Foundations
22 PGT 209E	Construction Management Techniques	22 PGT 214E	Remote Sensing and GIS Application
Open Elective 1			
Course Code under 22XXX25X	**Course title**		
22PGT215N	Ecology and Environmental Impact Assessment		
22PGT216N	Repair and Rehabilitation of Structures		
22PGT217N	Green Buildings		

Note:

1 Mini Project with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc.

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. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be consideredfor vertical progression as well asfor the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

Basaveshwar Engineering College, Bagalkote
Scheme of Teaching and Examinations – 2023-24
M.Tech., GEOTECHNICAL ENGINEERING (CGT)
Choice Based Credit System (CBCS) and Outcome Based Education(OBE)

III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Hours /Week			Examination				
				Theory	Practical/ Mini–Project/ Internship	Tutorial/ Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
1	PCC	22PGT301C	Reinforced Earth Structure and Geosynthetics	03	00	00	03	50	50	100	3
2	PEC	22 PGT305E	Environmental Geo-Techniques	03	00	00	03	50	50	100	3
3	SP	22 PGT303P	Societal Project	00	06	00	03	100	--	100	3
4	INT	22 PGT304I	Internship	00	12	00	03	50	50	100	6
				(06-08 weeks Internship Completed during the intervening vacation of I and III semesters)							
5	PROJ	22PGT305P	Project Work (Phase-I)	00	06	00	03	50	50	100	3
TOTAL				**06**	**24**	**00**	**15**	**300**	**200**	**500**	**18**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory), PCCL-Professional Core Course lab, **L-Lecture, P-Practical, T/SDA-Tutorial / Skill Development Activities**(Hours are for Interaction between faculty and students)

	Professional elective 3
Course Code under 22PGT**32X**	**Course title**
22PGT304E	Advanced Pavement Design
22PGT305E	Environmental Geo-Techniques
22PGT306E	Structural Design of Foundations

Note:

1. Project Work Phase-1: The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary projectrequires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in caseof multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior facultyof the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report,Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

2. Societal Project: Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology toworkout/proposing viable solutions for societal problems.

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, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. Internship: Those, who have not pursued completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by the Industry for 70 marks and it is converted to 50 marks and SEE is conducted for 50 marks by the committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE and SEE marks awarded for internship, shall be based on the evaluation of Report, Presentation skill, and performance in the Question and Answer

M.Tech. Geotechnical Engineering (CGT) 2023-24										
IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/Fieldwork	Duration in hours	CIE Marks	SEE Marks Viva-voce	Total Marks	
				L	P					
1	Project	22PGT401P	Project work phase-2	--	08	03	100	100	200	18
			TOTAL	--	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1.Project Work Phase – 2 :

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1 to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.The CIE marks will be evaluate for 100 marks and it is reduced to 50 marks.

The SEE evaluation is carried out at the end of the IV semester Project work, following a plagiarism check as per University guidelines. The evaluation committee, led by the Head of the Department (HOD) as Chairman and including all project guides, co-guides (if applicable) and an external examiner, will assess the project work phase-2 SEE. This three-member committee will evaluate the project report, awarding 50 marks each; the average of these scores will be used. During the viva-voce, the same committee will assign 25 marks for the presentation and 25 marks for the question-and-answer session, totaling 100 marks (50 marks from the report evaluation average, 25 marks for presentation, and 25 marks for Q&A). This total will then be scaled down to 50 marks.

Total Credits 22+22+18+18 =**80**

ADVANCED COMPUTATIONAL METHODS
Credits: 03 (3-0-0)

Subject Code: 22PGT011 **IA marks: 50**
Duration of Exam: 3 h **Maximum marks: 100**

Unit-I

Statistics: Frequency Distribution – Characteristics of Distributions: Central tendency and dispersion. Methods of least square and regression, multiple regression, Solutions of regression analysis problems Analysis of Variance.

Probability: Concept of probability, Random Variables, Binomial, Poisson and Normal distribution – applications, Chi- squared test, F test, t-test. Applications to respective fields in Civil Engineering.

Unit-II

Matrix operation: Matrix operation Eigen value and Eigen vector by iterative methods. Diagonalisation and square matrix. Applications to respective fields in Civil Engineering.

Unit-III

Ordinary Differential Equation: Second order homogeneous equation, Euler-Cauchy's equation, non-homogeneous linear equation. Partial differential equation: wave equation – one and two dimensions. Applications to respective fields in Civil Engineering

Unit-IV

Numerical methods: Development of simultaneous equation using Gaussian elimination method, Gauss- Jordan matrix inversion method, Gauss-Siedel method, Cholesky decomposition method. Applications torespective fields in Civil Engineering.

BOOKS FOR REFERENCE

1. Rao, S.S. (1996), "Optimization: Theory and applications", Wiley Eastern Ltd. Publications
2. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi.
3. S S Sastry- Introductory Methods of Numerical Analysis, 5th edition, PHI,New Delhi , 2012.
4. E Balagurusamy- Numerical Methods, Tata Mc Graw Hill, 2017.
5. H C Saxena- Examples in Finite Differences and Numerical Analysis, S Chand & Co. New Delhi, 1975.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Apply the concept of probability to find the physical significance of various distribution phenomena.	3	2	-			
2	Make use of matrix theory to compute eigenvalues and eigenvectors.	3	2	0			
3	Analyse the solution of differential equations.	3	2	-			
4	Able to apply numerical method to solve systems of equations.	3	2	-			

SOIL EXPLORATION AND FIELD TESTING
04 Credits (3-2-0)

Subject Code: 22 PGT12 IA marks: 50
Duration of Exam: 3 h Maximum marks: 100

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

1. Select suitable site investigation methods and its extent for variety of structures including preliminary investigations.
2. Identify suitable geophysical investigation method for soil exploration.
3. Identify suitable in-situ tests and Appraise codal provisions for different soil conditions
4. Describe the basics of photogrammetry and remote sensing application in geotechnical exploration.

UNIT 1

Introduction to Exploration-

Role of engineer in the systematic exploration of a site; Need and Objectives; Rock and soil types and their formation; Soil profiles of various regions.; Field reconnaissance, Extent of Investigation for different types of structures (buildings, towers, industries, road, embankment, reservoir, Dams, retaining wall, etc.)

Basic of Exploration-

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 2

Geological exploration-

Relevance of geology to civil engineering, Basics of structural geology, Geological exploration of an engineering site; Engineering classification of intact and fissured rocks – RQD.

Geophysical methods-

Applied geophysical surveys, electrical conductivity, electrical resistivity, seismic reflection and seismic refraction methods, magnetic survey, surface wave method, Gravity survey In-situ state of stress in soils and rocks; In situ permeability; Importance of In-situ testing, Ground water exploration, site evaluation and reporting.

UNIT 3

In-situ Tests, Result interpretations and Codal provisions-

Plate load test (Theory and perform), pile load test, SPT test (Theory and perform), CPT test, flat dilatometer test, DCPT test, Vane shear test, pressure meter test, field CBR test, core cutter (lab), sand replacement test (lab), nuclear probe method, block shear test. Soil profiling, interpretation of exploration data and report preparation, various standards for soil investigations. Codal provisions.

UNIT 4

Photogrammetry and remote sensing in soil exploration-

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 EngineeringPurposes", Waterways Experiment station, Missisippi, 1949
2. Hunt R.E. "Geotechnical Engineering: Analysis and Evaluation" McGraw Hill BookCompany 1986
3. H. F. Winterkorn and H Y Fang, Foundation Engineering Hand Book, GalgotiaBooksource.
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 Freemanand 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	PO4	PO5	PO6
1	Apply the basics of site investigation methods and its extent for variety of structures including preliminary investigations.	2	-	2	2	-	-
2	Identify suitable geophysical investigation method for soil exploration.	3	-	2	2	1	-
3	Identify suitable in-situ tests and appraise codal provisions for different soil conditions	3	3	2	2	3	-
4	Apply the basics photogrammetry and remote sensing application in geotechnical exploration.	2	-	2	-	1	3
	Average	2.5	3	2	2	1.67	3

GEOMECHANICS
04 Credits (3-2-0)

Subject Code: 22PGT13 **IA Marks:** 50
Duration of Exam: 3 h **Maximum marks:** 100

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

1. Explain the concept of stress, direction cosines, stress transformation,principal stresses.
2. Describe the concept of strain, compatibility conditions and fundamentals of elasticity elastoplastic and plastic behavior of soils by using Hooke's law, limit equilibrium concept, Mohr – Coulomb failure theory, stress paths and yield criteria as applicable to soils.
3. Evaluate the total and time rate of settlement by applying the concepts of consolidation theory.
4. Select the type of shear tests of soil tests based on drainage conditions and also understand the mechanism of shear strength mobilization, factors influencingshear strength, measurement of shear strength.
5. Analyse the shear strength of cohesive and cohesionless soils indrained and un-drained conditions by interpreting the stress paths of soils.

UNIT 1

Introduction to geomechanics; 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 2

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.

UNIT 3

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 criteriaTresca, Von mises and Mohr coulomb criteria.

UNIT 4

Stability analysis of slope; Effective vs Total stress analysis (Approach), shape of slip surface, methods of slices, graphic methods, location of critical slip circle, wedge analysis method, stability during critical condition.

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. EdwardArnod (Pub) Ltd London(1962).
7. M.E.Harr., “Foundation of Theoretical Soil Mechanics”, McGraw Hill (1966).

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Explain the concept of stress, direction cosines, stress transformation, principal stresses.	1	-	2	2	-	-
2	Describe the concept of strain, compatibility conditions and fundamentals of elasticity elasto plastic and plastic behavior of soils by using Hooke’s law, limit equilibrium concept, Mohr – Coulomb failure theory, stress paths and yield criteria as applicable to soils.	1	-	2	1	-	-
3	Evaluate the total and time rate of settlement by applying the concepts of consolidation theory	2	-	3	-	-	-
4	Select the type of shear tests of soil tests based on drainage conditions and also understand the mechanism of shear strength mobilization, factors influencing shear strength, measurement of shear strength	2	-	3	-	-	-
5	Analyse the shear strength of cohesive and cohesionless soils in drained and un-drained conditions by interpreting the stress paths of soils.	2	-	3	-	-	-
	Average	1.6	-	2.6	0.6	-	-

ADVANCED FOUNDATION ENGINEERING

03 **Credits (3-0-0)**

Subject Code: 22PGT14 IA Marks: 50

Duration of Exam: 3 h Maximum marks: 100

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

1. Estimate the settlement of soil by assessing the different loads on the foundation.
2. Design the structural and geotechnical aspects of shallow foundations.
3. Design the deep foundations for different loads and type of soils.
4. 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 footingsand Rafts.

Pile Foundations – Analysis and Conventional Design of pile foundations for vertical and lateralloads 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 andRetaining structures”, K. A. Rastogi Prakashan, Meerut, India. Jain, G.R. S., “Hand Book on Underreamed and Bored Compaction PileFoundations”,Published by G. S. Jain Associates, Roorkee.
4. Das, B. M., “Principles of Foundation Engineering”, Cengage Learning (2011)
5. Tomlinson, “Foundation Design and Construction”, ELBS, Longman Group Ltd.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Estimate the settlement of soil by assessing the different loads on the foundation.	-	-	2	1	-	-
2	Design the structural and geotechnical aspects of shallow foundations	-	-	3	1	2	-
3	Design the deep foundations for different loads and type of soils.	-	-	3	1	2	-
4	Analyze and suggest remedial measures against foundation failures.	-	-	3	-	1	-
	Avg	-	-	2.6	1	1.67	-

GROUND IPROVEMENT TECHNIQUES
03 Credits (3-0-0)

Subject Code: 22PGT15 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 mechanical modification for shallow and deep compaction of soils.
2. Select the type of hydraulic modification required for cohesive and cohesionless soil
3. Choose the stabilization of soils using various admixture and various grouting techniques.
4. Choose the site specific method of soil improvement by inclusion and miscellaneous methods.

UNIT-1

Principles and objectives of ground improvement; 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
Methods of compaction, Shallow compaction, Deep compaction techniques – Vibro-floatation, Blasting, Dynamic consolidation, Pre-compression and compaction piles, Field compaction control, Specifications for field compaction

UNIT 2

Hydraulic Modification: Preloading by lowering ground water table, Filters, Control of ground water seepage, Sand drains and wick drains, open sumps and ditches, Well point system, Electro-osmosis, Vacuum dewatering wells, Vertical drains, and its application in ground improvement, pre-loading without and with sand drains, Design of vertical drains

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

Modification by Inclusion and Confinement: Applications of Geosynthetics for ground improvement;Ground Anchors: Types of ground anchors and their suitability, Uplift capacity of anchors.
Soil Confinement Systems: Concept of confinement, Gabion walls, Crib walls, Sand bags, Evergreen systems and fabric form work.
Miscellaneous Techniques: Expansive Soil Problems and Foundation Techniques, Construction andapplications of stone columns in soft clays, 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”., McGrawHill Pub Co New York.
3. Hausmann, M R (1990) “Engineering Principles of Ground Modifications”, McGraw Hill Pub Co NewYork.
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

P. Purushothama Raj., “ Ground Improvement Techniques”, Laxmi Publications Pvt Ltd

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Select the type of mechanical modification for shallow and deep compaction of soils.	1	1	1	-	-	2
2	Select the type of hydraulic modification required for cohesive and cohesionless soil	2	2	2	-	-	-
3	Choose the stabilization of soils using various admixture and various grouting techniques	2	1	2	-	-	-
4	Choose the site specific method of soil improvement by inclusion and miscellaneous methods	2	2	2	-	-	1
	Average	1.75	1.5	1.75	-	-	1.5

RESEARCH METHODOLOGY AND IPR

3 Credits

(3-0-0)

Subject Code: 22RMI16 IA marks: 50

Duration of Exam: 3 h Maximum marks: 100

On completion of the course, students should be able to:

1. Describe need for research design.
2. Assess and review steps in sampling design.
3. Study and understand statistics in research.
4. Apply research paper and IPR.

UNIT 1

Introduction to Research Methodology:

Meaning, Objective of research, Motivation in research, Type of research, research approaches, significance of research, Research methods versus Methodology, Research and scientific method , importance of knowing how research is done, research process, criteria of good research, problem encountered by research in India.

Defining the Research Problem:

What is research problem, Selecting the problem, necessity of defining the problem, technique involved in defining a problem, meaning of research design, need for research design, features of a good design, importance concepts relating to research design , different research design, basic principal of experimental design .

UNIT 2:

Sampling Design:

Census and sample survey, Implications of a sample design , steps in sampling design, criteria of selecting a Sampling procedure, characteristics of a good sample design, different type of sample designs, how to select a random sample, Radom sample from an infinite universe , complex random sampling designs.

Method of data collection:

Collection of primary data, observation method, interview method, collection of data through questionnaires, collection of data through schedules, different between questionnaires and schedules, some other method of data collection, collection of secondary data, selection of appropriate methodfor data collection ,case study method.

UNIT 3

Processing and analysis of data:

Processing operation, some problem in processing, elements of analysis, statistics in research , measures of central tendency, measures of central tendency, measures of dispersion, measures of asymmetry, measures of relationship, simple regression analysis , multiple correlation and regression ,partial correlation, association in case of attributes, other measures.

Testing of Hypothesis-I:

Hypothesis, Basic concept concerning testing of hypothesis ,procedure for hypothesis testing, flow diagram for hypothesis testing, measuring the power of a hypothesis test, test of hypotheses, important parametric tests, hypothesis testing of mean, hypothesis testing for different between means, hypothesis testing for comparing two related samples.

UNIT 4

Interpretation and Report Writing:

Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports,Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research report.

Nature of Intellectual Property:

Patents, Designs, Trade Mark and Copyright. Process of Patenting and Development: technological research, innovation, patenting & development. Procedure for grants of patents.

Text-books:

1. Kothari C.R.“Research Methodology “Methods & Techniques”, Wishwa prakashan, A Division of New Age International Pvt. Ltd.
2. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008.

Reference books:

1. RanjitKumar , “ Research Methodology”, Sage Publication , London, New Delhi,1999.
2. Meenakshi Raman & Sangeeta Sharma. “Technical Communication-Principles and Practice”Oxford University press,Jai Singh Road, New Delhi.
3. Ann M. Korner, Guide to Publishing a Scientific paper, Bioscript Press 2004.
4. Robert P. Merges, Peter S. Menell and Mark A. Lemley, “Intellectual Property in New Technological Age”, Aspen Publishers, 2016.
5. Mayall , “Industrial Design”, McGraw Hill, 1992.
6. Niebel , “Product Design”, McGraw Hill, 1974.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO3	PO4	PO6
1	Describe need for research design	2	1	3	2	1	3
2	Assess and review steps in sampling design.	3	1	3	3	1	3
3	Study and understand statistics in research	2	3	2	2	3	2
4	Apply research paper and IPR	2	3	2	2	3	2
	Average	2.25	2	2.5	2.25	2	2.5

Geotechnical Engineering Laboratory
02 Credits
(0-0-4)

Subject code- 22PGT17 **IA Marks- 50**
Duration of exam: 02 h **SEE Marks-100**

Course outcomes: At the end of the course students will be able to

1. Evaluate the gradation of soil by using dry and wet analysis.
2. Estimate the shear strength and penetration resistance of soil.
3. Evaluate the consolidation properties of soil.
4. Interpret geotechnical report and develop an appreciation the use of field tests in the engineering of civil infrastructure.

List of experiments

1. Grain size analysis of soil: wet and dry analysis.
2. Determination of relative density.
3. Shear tests on soil: Unconfined compression test, Direct Shear Test and Triaxial Test.
4. Determination of California Bearing Ratio (CBR).
5. Electrical Resistivity
6. Standard Penetration Test (SPT)
7. Determination of compression index and coefficient of consolidation.
8. Determination of dynamic properties of soil.
9. Geotechnical investigation report.

Reference books:

1. I.S. Code of Practice (2720): Relevant Parts, as amended from time to time
2. Lambe T.W.,- Wiley Eastern Ltd., Soil testing for engineers-New delhi
3. Head K.H., (1986)-Vol. I, II, III Manual soil laboratory testing-Princeton press, London.
4. Bowels J.E., (1988)- Engineering properties of soil & their measurements McGraw Hill Book Co. New York.

Laboratory Assessment:

1. Each laboratory subject is evaluated for 100 marks (50 CIE & 50 SEE)
2. Allocation of 50 marks for CIE

- Performance & journal write up: Marks for each experiment =30/ No. of proposed experiment
- One Practical test for 20marks. (5 write up, 10 conduction, calculation, results etc., 5 Viva-voce
- Allocation of 50 for SEE-25 % write up, 50% conduction, calculation, results etc., 25% viva-voce.

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Evaluate the gradation of soil by using dry and wet analysis.	-	2	1	-	-	2
2	Estimate the shear strength and penetration resistance of soil.	1	2	-	-	-	2
3	Evaluate the consolidation properties of soil.	1	2	2	-	-	2
4	Interpret geotechnical report and develop an appreciation the use of field tests in the engineeringof civil infrastructure.	-	3	2	-	-	2
	Average	1	2.25	1.25	-	-	2

BOS Recommended Online Courses

Subject code: 22AUD18/22AEC18

FINITE ELEMENT METHOD
4 Credits (3-2-0)

Subject Code: **22PGT21** 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. Describe the essential facts, concepts, theories andprinciples underlying various finite element methods and analysis.
2. Evaluate shape functions, nodal displacements using generalized and natural coordinates generalized for 1-D, 2-D and 3-D elements.
3. Develop stiffness matrix, strain-displacement matrix by using jacobian matrix for isoparametric elements.
4. Apply the concepts of FEM to solve 1-D and 2-D structures for plane stress, plane strain and axis-symmetric problems.

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	PO4	PO5	PO6
1	Describe the essential facts, concepts, theories and principles underlying various finite element methods and analysis.	-	-	3	-	-	-
2	Evaluate shape functions, nodal displacements using generalized and natural coordinates generalized for 1-D, 2-D and 3-D elements.	1	-	3	-	-	2
3	Develop stiffness matrix, strain-displacement matrix by using jacobian matrix for isoparametric elements	2	-	3	2	-	2
4	Apply the concepts of FEM to solve 1-D and 2-D structures for plane stress, plane strain and axis-symmetric problems.	3	-	3	2	-	2
	Average	2	-	3	2	-	2

CRITICAL STATE SOIL MECHANICS

04 **Credits (4-0-0)**

Subject Code: **22PGT22** 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. Describe the basic concepts of elasticity, plasticity, stress paths, stress invariants, total and effective stress.
2. Discuss the flow of water and volume change through soils by using Darcy's law, Laplace and consolidation theories for cohesionless and cohesive soils.
3. Investigate the behaviour of soils subjected to various loading and drainage conditions within unified framework of critical state soil mechanics.
4. Describe the basic elasto-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	PO5	PO6	PO7
1	Describe the basic concepts of elasticity, plasticity, stress paths, stress invariants, total and effective stress.	-	-	3	-	-	-
2	Discuss the flow of water and volume change through soils by using Darcy’s law, Laplace and consolidation theories for cohesionless and cohesive soils	1	-	3	2	-	-
3	Investigate the behaviour of soils subjected to various loading and drainage conditions within unified framework of critical state soil mechanics.	2	-	3	1	-	-
4	Describe the basic elasto-plastic models based on critical state soil mechanics like Cam-Clay and Granta Gravel.	2	-	3	-	-	-
	Average	1.25	-	3	0.75	-	-

DYNAMICS OF SOILS AND FOUNDATION
Credits (3-0-0)

Subject Code: **22PGT231** IA Marks: 50
Duration of Exam: 3 h **Maximum marks: 100**

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

1. Interpret the concept of dynamics in Geotechnical Engineering
2. Evaluate the dynamic properties of soils using laboratory and field tests.
3. Analyze liquefaction susceptibility of a site and suggest mitigation.
4. Investigate various isolation methods and classify the earthquake region.

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 toR 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 equipment for dynamic soil tests; In-situ measurements and field tests for evaluationof 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	PO4	PO5	PO6
1	Interpret the concept of dynamics in Geotechnical Engineering	1	-	2	-	-	-
2	Evaluate the dynamic properties of soils using laboratory and field tests.	2	-	3	1	1	-
3	Analyze liquefaction susceptibility of a site and suggest mitigation	2	-	3	1	2	1
4	Investigate various isolation methods and classify the earthquake region	3	-	3	2	2	-
	Average	2		2.75	1.33	1.67	0.5

SOIL STRUCTURE INTERACTION
03 Credits (3-0-0)

Subject Code: **22PGT232** IA Marks: 50
Duration of Exam: 3 h Maximum marks: 100

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

1. Describe the concepts of elasticity and plasticity in soils.
2. 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.
3. Evaluate the behaviour of the pile under static and dynamic loads.
4. Design the dynamics of foundations embedded in half-space and analyse the soil-structure in time domain.

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 Wileyand 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	PO4	PO5	PO6
1	Describe the concepts of elasticity and plasticity in soils.	-	-	3	-	-	-
2	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	-	3	1	1	1
3	Evaluate the behaviour of the pile under static and dynamic loads	2	-	3	2	-	2
4	Design the dynamics of foundations embedded in half-space and analyse the soil-structure in time domain.	3	-	3	2	-	2
	Average	2.33	-	3	1.67	1	1.67

GEOTECHNICAL EARTHQUAKE ENGINEERING
03 Credits (3-0-0)

Subject Code: **22PGT233** 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 liquefaction susceptibility of a site.
3. Analyze and design slopes, embankments, foundations and earth retaining structures for seismic conditions.
4. 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. Liquefactionphenomena and analysis of pore pressure development.

UNIT 3:
Analysis and design of slopes, embankments, foundation and earth retainingstructures 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	PO4	PO5	PO6
1	Demonstrate the understanding of Engineering seismology and dynamic behavior of the soil	1	-	-	-	-	-
2	Analyze liquefaction susceptibility of a site	2	-	2	1	1	1
3	Analyze and design slopes, embankments, foundations and earth retaining structures for seismic conditions.	3	1	3	2	2	2
4	Interpret the case histories, mitigation techniques and computer aided analysis.	2	2	3	2	2	2
	Average	2	1.5	2.67	1.67	1.67	1.67

EARTH AND ROCK FILL DAMS
03 Credits (3-0-0)

Subject Code: **22PGT235** 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. Describe the importance of earth–rock fill dams and select a suitable site.
2. Select the materials and equipment required for the construction of earth/rockfill dams .
3. Analyze and design the stability of Earth and Rockfill Dams.
4. 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	PO4	PO5	PO6
1	Describe the importance of earth–rock fill dams and select a suitable site.	-	-	1	-	-	-
2	Select the materials and equipment required for the construction of earth/rockfill dams .	1	-	1	-	1	1
3	Analyze and design the stability of Earth and Rockfill Dams.	2	1	2	2	2	-
4	Analyze seepage through a given earth/rockfill dam section and select effective seepagecontrol measures for the prevailing site conditions.	2	1	2	2	2	2
	Average	1.67	1	1.5	2	1.67	2

CONSTRUCTION MANAGEMENT
03 Credits (3-0-0)

Subject Code: **22PGT235** IA Marks: 50
Duration of Exam: 3 h 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. Apply inventory management techniques.
4. Apply quality management concepts and techniques in construction projects.

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 checklistsfor 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	PO4	PO5	PO6
1	Apply independently ISO standards in quality and safety for construction.	-	1	2	-	2	2
2	Prepare feasible report for a construction project.	1	3	2	-	1	2
3	Apply inventory management techniques.	2	-	2	-	1	2
4	Apply quality management concepts and techniques in construction projects.	1	-	2	-	1	2
	Average	1.33	1	2	0.0	1.25	2

PILE FOUNDATION ANALYSIS AND DESIGN
03 Credits (3-0-0)

Subject Code: **22PGT241** 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. Design of pile groups and laterally loaded piles under static and seismic conditions.
3. Design pile cap and under-reamed piles for cohesive soils.
4. Analyze and suggest remedial measures against foundation failures.

UNIT 1:
Shallow v/s deep foundations, classification, economics and capacity of a pileSingle 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-situpiles, case studies on failure of piles
Pile testing: Integrity of piles, corrosion resistance, durability, damage protectionto 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	PO4	PO5	PO6
1	Demonstrate the understanding and knowledge of underlined concept, facts and principles of pile foundation	1	-	1	-	-	-
2	Design of pile groups and laterally loaded piles under static and seismic conditions.	2	-	3	2	2	2
3	Design pile cap and under-reamed piles for cohesive soils.	2	-	3	2	2	2
4	Analyze and suggest remedial measures against foundation failures.	2	1	3	1	2	2
	Average	1.75	1	2.5	1.67	2	2

DESIGN OF EARTH RETAINING STRUCTURES
3 Credits (3-0-0)

Subject Code: 22PGT242 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.
4. Design the braced walls and coffer dams.

UNIT–I

Rankine's and Coulomb's earth pressure theories – concepts and drawbacks – earth pressure models – graphical methods and their interpretations Introduction to earth pressure – basic concepts – active, passive and at rest earth pressures

UNIT–II

Retaining walls – types – Design specifications and pressure distribution variations, Types of earth retaining structures – classifications – specifications

UNIT-3

Sheet Piles and Bulkheads in Granular and Cohesive Soils - Materials Used for Sheet Piles – Free Earth and Fixed earth Support Methods

UNIT-4

Braced Excavations: Arching in soils-soil pressures on braced walls and their design.Coffer dams, types and their design.

References

1. Terzaghi, KandPeck, 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", C R C press(2014)

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Demonstrate the understanding and knowledge of underlined concepts,facts and principles of earth retaining structures	-	-	1	1	-	-
2	Analyze and determine earth pressures based on various methods and field conditions.	1	1	1	2	2	1
3	Analyze and design different earth retaining structures by adopting basic principles.	2	1	2	2	2	2
4	Design the braced walls and coffer dams	2	1	3	2	2	2
	Average	1.57	1	1.75	1.75	2	1.67

NUMERICAL METHODS FOR CIVIL ENGINEERS
Credits (3-0-0)

Subject Code: **22PGT243** 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 beams, 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 4th 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 determinateindeterminate 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,NewDelhi, 1997
4. Ghosh Pallab., Numerical methods in computer programs in C++ , Prentice Hall ofIndiaPrivate 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	PO4	PO5	PO6
1	Apply the solution of linear system of equations to civil engineering problems, construction planning, slope deflection method applied to beams, frames and truss analysis.	1	-	2	1	-	-
2	Apply numerical integration for solving simple beam problems and application of finite difference technique in structural mechanics.	2	-	2	2	-	2
3	Apply New-Marks method for computation of slopes and deflections in statically determinate beams.	1	-	2	1	-	1
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	-	2	2	-	2
	Average	1.5	-	2	1.5		1.67

DESIGN OF MACHINE FOUNDATIONS
02 Credits (3-0-0)

Subject Code: **22PGT244** 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 freedomsystems 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	PO4	PO5	PO6
1	Demonstrate the understanding of theory of vibration single and two degree of freedom systems with and without damping.	1	-	3	1	-	-
2	Analyze the dynamic response of block foundation	1	-	3	1	1	-
3	Design Machine Foundations using Spring Mass dashpot idealization and elastic half space method.	2	-	3	2	2	1
4	Design framed foundations, vibration control and isolation, use of IS codes provision	2	-	3	2	2	2
	Average	1.5	-	3	1.5	1.67	1.5

REMOTE SENSING AND GIS
03 Credits(3-0-0)

Subject Code: **22PGT245** 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. Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring
3. Understand vector-based and raster-based data data analysis
4. Apply available Remote Sensing technologies and be able to match these to particular kinds of Geo-environmental and Geotechnical engineering problem.

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 and 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	PO4	PO5	PO6
1	Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.	-	-	3	-	-	-
2	Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.	2	-	3	1	-	-
3	Understand vector-based and raster-based data analysis.	2	-	3	1	-	-
4	Apply available Remote Sensing technologies and be able to match these to particular kinds of Geo-environmental and Geotechnical engineering problem.	2	-	3	2	1	2
	Average	2	-	3	1.33	1	2

Computational Laboratory
02 Credits (0-0-4)

Subject Code: 22 PGT L27 IA Marks: 50
Duration of Exam: 2 Hrs Maximum marks: 100

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

1. Understand the concept of software based numerical modeling.
2. Apply different soil models in solving geotechnical engineering problems
3. Analyse stability of slopes, retaining walls, tunnels, shallow and deep foundations under differentloading conditions using FEM/FDM packages
4. Carry out seismic hazard analysis and ground response analysis using CRISIS and EDUSHAKE seismosoft, deep soil and opensees.

Course Content

Engineering aspect of finite element method - Basic tools of the design software – Different soil models – modelling of substructure and under different loading conditions – analysis of the response of the shallow and deep foundations, slope stability analysis, Retaining walls, reinforced earth structures, tunnelling using geotechnical software packages
Seismic hazard analysis and ground response analysis.

References

1. C. S., Desai and J. T., Christian, Numerical Methods in Geotechnical Engineering, Mc. Graw Hill, 1977.
2. D. J., Naylor and G. N., Pande, "Finite Elements in Geotechnical Engineering", Pineridge Press Ltd., U.K.
3. S. L., Kramer, "Geotechnical Earthquake Engineering", Pearson Education, 2004
4. PLAXIS 2D & 3D manuals
5. FLAC3D User guide
6. GeoStudio software user manual
7. GEO5 Manuals

Course Articulation Matrix

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	To understand the concept of software based numerical modeling.	-	3	3	-	1	1
2	Apply different soil models in solving geotechnical engineering problems	1	3	3	1	1	1
3	Analyse stability of slopes, retaining walls, tunnels, shallow and deep foundations under different loading conditions using FEM/FDM packages.	2	3	2	2	2	2
4	Carry out seismic hazard analysis and ground response analysis using CRISIS and EDUSHAKE seismosoft, deep soil and opensees.	2	3	2	2	2	2
	Average	1.67	3	2.5	1.67	1.5	1.5

REINFORCED EARTH STRUCTURES AND GEOSYNTHETICS
04 Credits (4--0)

Subject Code: **22PGT31** IA Marks: 50
Duration of Exam: 3 h Maximum marks: 100

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

1. Discuss basic principles and mechanics of reinforced earth structures.
2. Identify and select different geosynthetics for intended purpose.
3. Evaluate properties of geosynthetics and design reinforced soil structures to fulfill variousfunctions.
4. 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 usingsynthetic 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	PO4	PO5	PO6
1	Discuss basic principles and mechanics of reinforced earth structures.	1	-	1	-	-	-
2	Identify and select different geosynthetics for intended purpose.	1	1	3	-	2	1
3	Evaluate properties of geosynthetics and design reinforced soil structures to fulfill various functions	2	2	3	2	2	1
4	Apply geocomposite systems to solve contemporary geotechnical problems.	2	2	3	1	2	1
	Average	1.5	1.67	2.5	1.5	2	1

ADVANCED PAVEMENT DESIGN
04 Credits (4-0-0)

Subject Code: **22PGT321** IA Marks: 50
Duration of Exam: 3 h 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 for roadways and airport pavements using different methods.
3. Analysis and design of rigid pavements using different methods.
4. Demonstrate the understanding of behaviour of the stresses and deflections at differentloading 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	PO4	PO5	PO6
1	Demonstrate the importance of sub grade soil properties on pavement performance.	-	-	1	-	-	-
2	Design of flexible pavements for roadways and airport pavements using different methods.	2	-	2	2	1	1
3	Analysis and design of rigid pavements using different methods.	2	-	2	2	1	1
4	Demonstrate the understanding of behaviour of the stresses and deflections at differentloading and soil conditions	1	-	2	2	-	-
	Average	1.67	-	1.75	2	0.67	0.67

ENVIRONMENTAL GEOTECHNIQUES
03 Credits (3-0-0)

Subject Code: **22PGT322** IA Marks: 50
Duration of Exam: 3 h Maximum marks: 100

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

1. Assess the Physical-chemical and biological Interaction in soil and study the effects of contaminants on the properties of soil.
2. Design the landfill, liner system and understand the contaminant containment structures.
3. Design the barrier systems and assess the subsurface contaminant transport mechanics.
4. Apply various techniques or remedial measures for polluted zones and reuse of various wastematerials engineering constructions

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	PO4	PO5	PO6
1	Assess the Physical-chemical and biological Interaction in soil and study the effects of contaminants on the properties of soil.	-	-	3	-	-	-
2	Design the landfill, liner system and understand the contaminant containment structures	1	-	3	1	2	1
3	Design the barrier systems and assess the subsurface contaminant transport mechanics.	2	-	3	1	2	2
4	Apply various techniques or remedial measures for polluted zones and reuse of various waste materials engineering constructions	1	-	3	-	2	1
	Average	1.33	-	3	0.67	2	1.33

STRUCTURAL DESIGN OF FOUNDATIONS
Credits (4-0-0)

Subject Code: **22PGT323** IA Marks: 50
Duration of Exam: 3 h Maximum marks: 100

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

1. Describe 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	PO4	PO5	PO6
1	Describe the knowledge about the principles of designing foundations.	-	-	1	-	-	1
2	Design and detail the shallow foundations according to codal provisions.	1	-	2	1	2	2
3	Design foundation for retaining walls and also deep foundations	2	-	2	1	2	-
4	Design and detail the foundation for special structure like Chimneys, power plants and towers.	2	-	2	1	2	-
	Average	1.67	-	1.75	1	2	0.75

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

2023-2024

VISION OF THE INSTITUTION

"To be recognized as a premier technical institute committed to developing exemplary professionals, offering research based innovative solutions and inspiring inventions for holistic-socioeconomic developments"

MISSION OF THE INSTITUTE

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

VISION OF THE DEPARTMENT

To be Center of Excellence of Higher learning and Research in Civil Engineering Encompassing Ethical, Environmental and Economical aspects of the Society.

MISSION OF THE DEPARTMENT

1. The Department of Civil Engineering is committed to prepare globally competent engineers.

2. In response to rapid economical and technological growth through a dynamic process of teaching learning, research and sharing professional experiences for the betterment of the community.

3. To Provide Knowledge base and consultancy services to the community in all areas of Civil Engineering.

Programme Educational Objectives (PEOs)

PEO1: Graduates of the Programme will be effective and efficient environmental engineers to serve in various industry, academia and research organizations.

PEO2: Graduates will be able to apply appropriate concepts and modeling techniques for a sustainable environmental engineering system.

PEO3: Graduates are able to apply new emerging technologies and tools in solving complex real life environmental engineering problems and carry out interdisciplinary research to provide efficient, sustainable and ethical solutions.

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.
PO4: Apply mathematical and computer based tools to formulate and analyse the real life problems in environmental engineering.
PO5: Adopt changing environmental technologies and innovative methods to meet the challenges emanating outof climate change and environmental issues.
PO6: Exhibit professional and intellectual integrity and ethics for socially responsible and competent environment engineer.

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 socio economic 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	*	*	*

M.Tech.Environmental Engineering (CEE)2022												
I SEMESTER												
Sl.	Course	Course Code	Course Title	Teaching Hours per Week			Examination					Credit
				Theory	Practical / Seminar	Tutorial / Skill Development Activities	Duration in hours	CIE Marks	SEE Marks	Total Marks		
				L	P	T/SDA						
1	BSC	22PEV101C	Advanced Computational Methods	03	00	00	03	50	50	100	3
2	IPCC	22 PEV102C	Environmental Chemistry and Microbiology	03	02	00	05	50	50	100	4
3	PCC	22 PEV103C	Advanced Wastewater Treatment	04	00	00	04	50	50	100	4
4	PCC	22 PEV104C	Advanced Solid Waste Management	03	00	00	03	50	50	100	3
5	PCC	22 PEV105C	Hazardous Waste Management	03	00	00	03	50	50	100	3
6	MCC	22PEV106C	Research Methodology and IPR	03	00	00	03	50	50	100	3
7	PCCL	22 PEV107L	Environmental Engineering Lab	00	03	00	03	50	50	100	2
8	AUD/ AEC	22PEV108O	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
TOTAL				**20**	**03**	**00**	**23**	**350**	**350**	**700**	**22**

Note:

BSC-Basic Science Courses, **PCC –** Professional core. **IPCC**– Integrated Professional Core Courses, **MCC** – Mandatory Credit Course.

**Audit Course / Ability Enhancement Course (AUD/AEC): ** A pass in AUD/AEC is mandatory for the award of the degree:

PCCL-Professional Core Course lab.

L-Lecture, P-Practical, T/SDA-Tutorial/ Skill Development Activities (Hours are for Interaction between faculty and students)

Integrated Professional Core Course (IPCC):

Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses):

Audit Courses: These are prerequisite courses suggested by the concerned Board of Studies.

Ability Enhancement Courses: These will be suggested by the BoS if prerequisite courses are not required for the programs.

•These courses are prescribed to help students to enhance their skills in fields connected to the field of specialization as well allied fields that leads to employable skills. Involving in learning such courses are impetus to lifelong learning.

•The courses under this category are online courses published in advance and approved by the concerned Board of Studies.

•Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.

•In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appear for the same course if offered during the next session or register for a new course offered during that session, in consultation with the mentor.

•The Audit Ability Enhancement Course carries no credit and is not counted for vertical progression. However, a pass in such a course is mandatory for the award of the degree.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium,and large).
2. Involve in research/testing/projects to understand their problems and help creative and innovative methods to solve the problem.
3. Involve in case studies and field visits/ fieldwork.
4. According to the use of standards /codes etc.,to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modeling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output the interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical –activities which will enhance their skill. The prepared report shall be evaluated for CIE marks.

M.Tech.Environmental Engineering (CEE)2022												
II SEMESTER												
Sl.No	**Course**	**Course Code**	**Course Title**	**Teaching Hours/Week**			**Examination**				**Credits**
				Theory	**Practical /Seminar**	**Tutorial/Skill Development Activities**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
				L	P						
1	PCC	22PEV201C	Air Pollution and Control	04	00	00	04	50	50	100	4
2	IPCC	22PEV202C	Industrial Effluent Treatment	03	02	00	05	50	50	100	4
3	PEC	22PEV20XE	Professional Elective -1	03	00	00	03	50	50	100	3
4	PEC	22PEV20XE	Professional Elective- 2	03	00	00	03	50	50	100	3
5	OEC	22 PEV20XN	Open Elective	03	00	00	03	50	50	100	3
6	MPS	22PEV204P	Mini Project	00	06	00	--	50	50	100	3
7	PCCL	22PEV203L	Computer Application in Environmental Engineering Lab	00	04	00	03	50	50	100	2
8	AUD	22PEV205O	Suggested ONLINE Courses	Classes and evaluation procedures are as per the Policy of the online course providers.							PP
			TOTAL	**17**	**12**	**00**	**20**	**350**	**350**	**700**	**22**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project with Seminar; AUD/AEC; Audit Courses/ Ability Enhancement Courses(Mandatory), PCCL-Professional Core Course lab, **L-Lecture,P-Practical,T/SDA-Tutorial/Skill Development Activities**(Hours are for Interaction between faculty and students).

Professional Elective - 1		**Professional Elective - 2**	
Course Code under 22PEV2XXE	**Course title**	Course Code under 22PEV2XXE	**Course title**
22 PEV206E	Waste to Energy	22 PEV210E	**Non -Point sources of pollution and management**
22 PEV207E	**Biological Process for Wastewater Treatment**	22 PEV211E	Water Resources Engineering
22 PEV208E	Green Technology	22 PEV212E	Energy and Environmental Engineering
22 PEV209E	Occupational Safety and Health	22 PEV213E	Plastic waste management
			Green Technology

Note:

1 Mini Project with Seminar: This may be hands-on practice, survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modeling of system, simulation, analyzing and authenticating, case studies, etc.

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. Students can present the seminar based on the completed mini-project.

Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar, shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question-and-Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

3. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the internship shall be declared as f ail in the internship course and have to Complete the same during the subsequent University examination after satisfying the internship requirements.

M.Tech. Environmental Engineering (CEE)2022												
III SEMESTER												
Sl.No	**Course**	**Course Code**	**Course Title**	**Teaching hours/Week**			**Examination**				**Credits**
				Theory	**Practical Mini Project**	**Tutorial/Skill Development Activities**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
				L	P	SDA					
1	PCC	22PEV301C	Design of water and wastewater treatment plants	03	00	00	03	50	50	100	3
2	PEC	22PEV3XXE	Professional Elective- 3	03	00	00	03	50	50	100	3
3	PROJ	22PEV302P	Project Work Phase-1	00	06	00	06	50	50	100	3
4	SP	22PEV303P	Societal Project	00	06	00	--	100	--	100	3
5	INT	22PEV304I	Internship	(06 weeks Internship Completed during the intervening vacation of I and III semesters.)			03	50	50	100	6
Total				**06**	**12**	**00**	**15**	**300**	**200**	**500**	**18**

Note: PCC: Professional core courses, **PEC**: Professional Elective Courses, **IPCC**-Integrated Professional Core Courses. **MPS**-Mini Project with Seminar; **AUD/AEC**; **Audit Courses / Ability Enhancement Courses (Mandatory)**, **PCCL**-Professional Core Course lab, **L-Lecture, P-Practical, T/SDA-Tutorial/ Skill Development Activities** (Hours are for Interaction between faculty and students).

Professional Elective - 3		Open Elective -1	
Course Code under 22 PEV**3XXE**	**Course title**	**Course Code under 22** PEV**2XXN**	**Course title**
22 PEV305	Reuse-Recycle Technology	22 PEV214N	Ecology and Environmental Impact Assessment
22 PEV306	Global warming and climate change	22 PEV215N	Advanced atmospheric Environmental Engineering
22 PEV307	Environmental Planning and Management	22 PEV216N	Environmental Biochemistry and Biotechnology
22 PEV308	Water Reclamation and Reuse	22 PEV217N	Environmental Disaster Management

Note:

1. **Project Work Phase-1:** The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/ sand co-guide/s (if any)and a senior faculty of the concerned departments. The CIE marks awarded for project work phase-1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

2. **Societal Project:** Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology to workout/proposing viable solutions for societal problems.

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 shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session integration of50:25:25.

Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. **Internship:** Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

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 - I, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of 50:25:25.

M.Tech. Environmental Engineering (CEE)2022										
IV SEMESTER										
Sl. No	Course	Course Code	Course Title	Teaching Hours /Week		Examination				Credits
				Theory	Practical/ Fieldwork	Duration in hours	CIE Marks	SEE Marks Viva-voce	Total Marks	
				L	P					
1	Project	22PEV401P	Project work phase-2	--	08	03	100	100	200	18
			TOTAL	--	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1.Project Work Phase – 2 :

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -2, shall be based on the evaluation of the Project Report, Project Presentation skill, and performance in the Question-and-Answer session in the ratio of50:25:25.

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 University norms.

TotalCredits22+22+18+18=**80**

ADVANCED COMPUTATIONAL METHODS
Code: 22PSE101C/ 22PGT101C/ 22PEV101C
Credits: 03

Subject Code: 22PEV101C **CIE Marks: 50**
Duration of Exam: 3Hrs **SEE marks: 100**

Unit-I

Statistics: Frequency Distribution–Characteristics of Distributions: Central tendency and dispersion. Methods of least square and regression, multi pleregression, Solutions of regression analysis problems Analysis of Variance.
Probability: Concept of probability, Random Variables, Binomial, Poisson and Normal distribution – applications, Chi- squared test, F test, t-test. Applications to respective fields in Civil Engineering.

Unit-II

Matrix operation: Matrix operation Eigen value and Eigen vector by iterative methods. Diagonalisation and square matrix. Applications to respective fields in Civil Engineering.

Unit-III

Ordinary Differential Equation: Second order homogeneous equation, Euler-Cauchy's equation, non-homogeneous linear equation. Partial differential equation: wave equation – one and two dimensions. Applications to respective fields in Civil Engineering

Unit-IV

Numerical methods: Development of simultaneous using Gaussian elimination method, Gauss- Jordan matrix inversion method, Gauss- Siedel method, Cholesky decomposition method. Applications to respective fields in Civil Engineering.

BOOKS FOR REFERENCE

1. Rao, S.S. (1996), "Optimization: Theory and applications", Wiley Eastern Ltd. Publications
2. Grewal. B.S., and Grewal. J.S., "Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi.
3. S S Sastry- Introductory Methods of Numerical Analysis, 5th edition, PHI,New Delhi, 2012.
4. E Balagurusamy- Numerical Methods, Tata Mc Graw Hill,2017.
5. H C Saxena- Examples in Finite Differences and Numerical Analysis, S Chand & Co. New Delhi,1975.

ENVIRONMENTAL CHEMISTRY AND MICROBIOLOGY
4 Credits

Sub Cod: 22PEV102C **CIE Marks: 50**
Hrs/Week: 04 **SEE Marks: 50**

Course Outcomes:
Students will be able to

1. Analyse the chemical reactions, trace contaminants and applications of electrochemistry.
2. Apply the principles of physical, electrochemistry and analytical chemistry in Environmental Engineering process.
3. Identify the importance of microbiology in the environment and microbiology to solve the environmental problems.
4. Demonstrate the microbial experiments to evaluate water quality parameters and study the morphology of the bacteria, fungi, protozoa and virus.

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.
Colorimetry**-** 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, Biomagnifications 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. McKinneyR.E.(1962)"MicrobiologyforSanitaryEnginers",NewyorkMcGrawHill.
2. Sawyer C.N. and Mc Charty 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)"Text bookofMicrobiology"5theditionTataMcGraw Hill Publishing Co.Ltd., New Delhi.
4. Gaudy and Gaudy(1980)"Microbiology for Environmental Scientists and Engineers" McGraw Hill.
5. APHA,(2002)"StandardMethodsforExaminationofWaterandWastewater"21stEdition.
6. Stumn and Morgan(1970),"Aquatic Chemistry", John Willey & Sons NewYork.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Design the appropriate technology on applying basics of environmental chemistry and microbiology to solve the environmental problems.	3	1		2		1
2	Apply the principles of Physical, Electrochemistry and Analytical chemistry in Environmental Engineering process.	2	1		2	1	
3	Conduct experiments to evaluate water quality parameters.	2	1	2		2	
4	Demonstrate the microbial experiments to evaluate water quality parameters and study the morphology of the bacteria, fungi, protozoa and virus.	1		2		2	2
Average		2.00	0.75	1.00	1.00	1.25	0.75

ADVANCED WASTEWATER TREATMENT
4 Credits

Sub Code: 22PEV103C	**CIE Marks: 50**
Hrs/Week: 04	**SEE Marks: 50**

COURSE OUTCOMES

Students will be able to

1. Design Appropriate treatment component for municipal and certain industrial effluents.
2. Evaluate the operational problems of treatment units and apply the solutions in water and wastewater treatment plant.
3. Construct appropriate treatment schemes to remove certain pollutants present in water or wastewater.
4. Construct the alternative sludge processing techniques apply the knowledge in nutrient removal from the wastewater.

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, plugflow, 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.

REFERENCES:

1. Metcalf and Eddy-Wastewater Engineering, Tata Mc Glaw Hill Publishing Company Ltd.,New Delhi 2003
2. Eckenfelder and0'Conner- Biological Waste treatment.
3. Gaudy–Advanced Waste Water treatment
4. Ramalho,R.S.1983.IntroductiontoWastewaterTreatmentProcesses.NewYork:AcademicPublishers
5. KariaG.L.andChristianR.A.“WastewaterTreatmentConceptsandDesignApproach”Prentice Hall of India Pvt., Ltd., New Delhi(2001)
6. Santoshkumar Garg.“Sewage Disposal and Air Pollution Engineering “Hanna Publishers New Delhi2006
7. Punmia B.C.and Arunkumar Jain,“Environmental Engineering II,Laxmi Publishers Pvt.Ltd, NewDelhi, 2000
8. HowardS.Peavy,DonaldR.Rowe,GeorgeT,“EnvironmentalEngineering”,McGrawHill, International editions,19

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Design Appropriate treatment component for municipal and certain industrial effluents.	2		2	3		
2	Evaluate the operational problems of treatment units and apply the solutions in water and wastewater treatment plant.	1		3	2	1	2
3	Construct appropriate treatment schemes to remove certain pollutants present in water or wastewater.	2		1		2	1
4	Construct the alternative sludge processing techniques apply the knowledge in nutrient removal from the wastewater.	3			1		2
Average		2.00		1.50	1.50	0.75	1.25

ADVANCED SOLID WASTE MANAGEMENT

3 Credits

Sub Code: 22PEV104C **CIE Marks: 50**

Hrs/ Week: 03 **SEE Marks : 50**

COURSE OUTCOMES

Students will be able to

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 collection and treatment of waste and recovery of value from waste.
3. Select the different disposal methods and prevention measures.
4. Construct the waste and resource management importance in achieving environmental sustainability.

UNIT – I

Solid Waste: Definition and scope, Necessity and importance, Sources, Classification, Integrated Solid Waste Management (ISWM), Hierarchy of waste management options, 4 R's - reduce, recover, recycle and reuse, Physical, Chemical and Biological characteristics of municipal solid waste (MSW), Generation rates and methods, Chemical composition, Numerical problems.

Functional elements: Flow chart, Waste generation, Storage, Collection, Transfer and transport, Processing and recovery, Disposal.

Collection,Transfer and Transport: Collection equipment, systems of collection - hauled container system, stationary container system, numerical problems; Transfer stations, Bailing and Compacting.

UNIT – II

Separation and Processing Technologies: Size reduction, Size separation, Density separation, Magnetic & Electric Field separation, Densification (Compaction), Design of Material Recovery Facilities (MRFs), Numerical problems.

Thermal Treatment Processes: Combustion Systems (Mass-Fired Combustion Systems, RDF-Fired Combustion Systems, Fluidized Combustion Systems, Hear recovery systems, Water wall Combustion Systems, Waste heat boiler) Pyrolysis Systems, Gasification Systems, Environmental Control Systems, Energy Recovery Systems

Biological and Chemical Conversion Processes: Aerobic Composting (Aerated static pile composting, In-vessel composting, Windrow composting, Vermi composting), Indore and Bangalore processes of composting, Anaerobic Digestion (low solids & high solids), Other Biological Transformation processes, Chemical Transformation processes, Energy production from biological conversion products.

UNIT – III

Disposal methods: Types, Selection of suitable site, Ocean disposal,Feeding to hogs, Merits and demerits of various disposal methods.

Open dumping: Environmental implications of open dumping, Construction debris - management & handling, Rag pickers and their role

Sanitary land filling: Definition, methodology, Types - trench, area, ramp, pit methods, Basic steps involved, Site selection, Prevention of site pollution, Landfill remediation, Geo-technical considerations, Densification - earthen, Geo-membrane, Geo-synthetics and Geo-textiles

UNIT – IV

Operational aspects of Landfills: Daily cover, Final cover, Leachate disposal, Ground water monitoring, Leachate and its treatment, Gas collection and re-circulation systems,Post-closure environmental monitoring.

Treatment of other wastes: E-Waste Management, Hazardous waste management and Bio-medical waste.

Recent Developments in Solid Wastes Reuse and Disposal: Power Generation, Blending with construction materials and Best Management Practices (BMP), Community based waste management, Waste as a Resource concept, Public Private Partnership (PPP), Role of various organizations in Solid Waste Management: Governmental, Non-Governmental Citizen Forums.

REFERENCES:

1. George Tchobanoglous, Hilary Theisen, Samuel A. Vigil, Integrated Solid Waste Management-Engineering Principles and Management Issues, McGraw-Hill, International Editions, 1993.

2. Ramachandra T.V., Management of Municipal Solid Waste, The Energy and Resources Institute, TERI, ISBN: 9788179931875, 9788179931875, 2006

3. Peavy and Tchobanoglous, Environmental Engineering, McGraw-Hill International Editions, 1985.

Reference Books:

1. D. Bhide and B. B. Sunderashan, Solid Waste Management in developing countries Bhide and Sunderashan, 14,Satsang vihar marg, Sansanwal marg special institutional area, New Delhi 110067, 1983
2. Stephen Burnley, Solid Waste Management, ISBN: 978-1-118-86393-0, Wiley publications, 2014
3. C.L. ell, Solid Waste Management, John Wiley, 1975.
4. P.W. Powers. How to dispose of toxic substances and industrial Waste, Noyes Data Corporation, England, 1976.
5. CPHEEO manual on solid waste management. 2010
6. J.L Pavoni, Hand Book of Solid Waste Disposal. New York .1975
7. Biomedical waste handling rules - 2000.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Apply the basic scientific and sustainability principles behind waste management, for solving practical waste management challenges	2		1	1	2	
2	Evaluate the fundamental principles of existing and emerging technologies for collection and treatment of waste and recovery of value from waste.	2		3	1		1
3	Select the different disposal methods and prevention measures.	1		3		1	
4	Construct the waste and resource management importance in achieving environmental sustainability.			2		2	1
	Average	1.25		2.25	0.5	1.25	0.5

HAZARDOUS WASTE MANAGEMENT

Sub Code: 22PEV105C **CIE Marks: 50**
Hrs/Week: 03 **SEE Marks:50**

COURSEOUTCOMES

Students will be able to

1. Assess the special characteristics of hazardous waste material generated from different industries and understand rules and regulations for management of hazardous waste.
2. Evaluatetherisksofhandlingandmanagingthehazardouswastebyscientificallyunderstandingandpr acticingthetreatmentofhazardouswastebyvariousphysico-chemicaltreatment methods.
3. Construct the various rules and regulations for safe transportation, handling and management of hazardous waste materials.
4. Apply the solid waste management systems of waste reduction at source, collection techniques and disposal techniques.

UNIT– I

Introduction- Definition, Sources and Classification, Land mark episodes (DDT, Mercury, PCB and PBB, Bhopal Gas Tragedy) Large and Small quantity Generators, Hazardous WasteCharacterization,Corrosivity,Reactivity,Toxicity,EPA-designatedhazardouswastes,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 Super fund 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.

UNIT – III

Types of Incinerators- 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.

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. Sitting a Landfill, Design considerations, Operating a land fill. 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. La Grega M.D.,Mercer,"Hazardous Waste Management",2ndEdition,McGrawHill2001.
3. Cornwell,"Introduction to Environmental Engineering" 3rd edition, Mc Graw Hill 1998.

Course out come	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Assess the special characteristics of hazardous waste material generated from different industries and understand rules and regulations for management of hazardous waste.	1		2		3	1
2	Evaluate 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.	2	1		2	2	
3	Construct the various rules and regulations for safe transportation, handling and management of hazardous waste materials.		2	1		2	2
4	Apply the solid waste management systems of waste reduction at source, collection techniques and disposal techniques.1			1	2	2	
Average		0.75	0.75	1.00	1.00	2.25	0.75

ENVIRONMENTAL ENGINEERING LAB
Credits 2

Sub Code : 22PEV107L **CIE Marks : 50**
Hrs/Week: 3 **SEE Marks :50**

Course Outcome:

Students will be able to

1. Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.
2. Apply the laboratorial results to problem identification, quantification and basic Environmental design and technical solutions.
3. Analyse and interpret laboratorial results and recommend the air quality monitoring and wastewater for its disposal.
4. Demonstrate the ability to work in groups and to write clear technical laboratorial reports.

LISTOFEXPERIMENTS

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. USEPA 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.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Perform common environmental experiments relating to water and wastewater quality, and know which tests are appropriate for given environmental problems.	2		1			2
2	Apply the laboratorial results to problem identification, quantification and basic environmental design and technical solutions.		3		2	1	
3	Analyse and interpret laboratorial results and recommend the air quality monitoring and wastewater for its disposal.	2		2		2	
4	Demonstrate the ability to work in groups and to write clear technical laboratorial reports.		3		1	1	1
Average		1.00	1.5	0.75	0.75	1.00	0.75

RESEARCH METHODOLOGY AND IPR
3 Credits

Subject Code: 22PEV106C	**CIE Marks : 50**
Duration of Exam: 3Hrs	**SEE marks: 100**

On completion of the course, students should be able to:

1. Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research.
2. Demonstrate the application and utility of the Systematic approach and out of the box thinking concepts for research to be effective.
3. Demonstrate the procedures outlined for a systematic Literature Review.
4. Analyze and prepare well structured research proposal and research paper invoking clearly outlined principles.
5. Describe and distinguish between different intellectual property rights.

UNIT1:

Foundations of Research – Definitions of Research, Mandatory Steps in Research, Types of Research, Relevance of Research for Innovation and Technology Development, Effective Research and Self Discipline.

Out of the Box Thinking and Systematic approach in Research – Transformation to Impossible Thinking, Convergent and Divergent Thinking, Generation, Evaluation and Selection of Ideas.

UNIT 2:

Literature Review – Importance of Literature Review, Constituents of Good Literature Review, Strategies for Literature Search, Referencing, Paraphrasing, and Summarizing, Academic Standards and Ethics.

Statistical methods and data analysis. Data Collection, Analysis and Interpretation, Ethics in Business Research, Research Design and Approaches: Descriptive, Exploratory, Causal, Qualitative Research, Observation Studies, Surveys, Experiments, Measurements and Scales, Questionnaires, Data Analysis: Presentation, Exploring and Examining.

UNIT 3:

Research Proposal – Structure of a Good Research Proposal, Getting Started, Tips for Compilation of Good Research Proposal.

Technical communication – Research paper for publication – significance of problem statement and its scope, formulation of hypothesis, adequacy of methodology, significant of presentation and discussion of results, relevance and importance of references.

Effective presentation – Preparation, templates, balance between good design and good content, planning and sequencing, pampers, (projection, articulation, modulation, punctuation, enunciation, repetition and speed) rule, people (position and gestures, eye contact, orientation, proximation, looks and appearance, and expressions and emotion) rule, 4P's rule (plan, prepare, practice and present), essentials of effectiveness, effective pausing and inclusive answering.

UNIT 4:

Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Intellectual Property: The Concept, Intellectual Property System in India, Development of TRIPS Complied Regime in India, Patents Act, 1970, Trade Mark Act, 1999,The Designs Act, 2000, The Geographical Indications of Goods (Registration and Protection) Act1999, Copyright Act,1957,The Protection of Plant Varieties and Farmers' Rights Act, 2001,The Semi-Conductor Integrated Circuits Layout Design Act, 2000, Trade Secrets, Utility Models, IPR and Biodiversity, The Convention on Biological Diversity (CBD) 1992, 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, Right of Priority, Common Rules, Patents, Marks, Industrial Designs, Trade Names, Indications of Source, Unfair Competition, Patent Cooperation Treaty (PCT), Advantages of PCT Filing, Berne Convention for the Protection of Literary and Artistic Works, Basic Principles, Duration of Protection, Trade Related Aspects of Intellectual Property Rights(TRIPS) Agreement, Covered under TRIPS Agreement, Features of the Agreement, Protection of Intellectual Property under TRIPS, Copyright and Related Rights, Trademarks, Geographical indications, Industrial Designs, Patents, Patentable Subject Matter, Rights Conferred, Exceptions, Term of protection, Conditions on Patent Applicants, Process Patents, Other Use without Authorization of the Right Holder, Layout-Designs of Integrated Circuits, Protection of Undisclosed Information, Enforcement of Intellectual Property Rights, UNSECO.

10 hr

CO	**Statement**	**PO1**	**PO2**	**PO3**
	On completion of the course, students should be able to:			
1	Describe the value, scope, relevance and mandatory steps of research as well as principles of effective research	2	1	3
2	Demonstrate the application and utility of the Systematic approach and out of the box thinking concepts for research to be effective	3	1	3
3	Demonstrate the procedures outlined for a systematic Literature Review	2	3	2
4	Analyze and prepare well structured research proposal and research paper invoking clearly outlined principles	2	3	2

INDUSTRIAL EFFLUENT TREATMENT
4 Credits (3-2-0)

Sub Code : 22PEV202C **CIE Marks : 50**
Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES
Students will be able to

1. Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality.
2. Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.
3. Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost-effective practice.
4. Demonstrate the understanding of green environment and practicing the environmental friendly processes for the manufacture of various industrial products 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 there upon. 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	PO4	PO5	PO6
1	Assess the impact of industrial waste discharges on the water quality of stream and take the necessary measures to protect the water quality.	3		2		2	
2	Analyze the economics of industrial wastewater treatment vis -a- vis water quality of the stream for its best designated uses.	2			3	1	1
3	Implement the modern technical tools like waste minimization, strength reduction etc, in efficient and cost-effective practice.			2		2	2
4	Demonstrate the understanding of green environment and practicing the environmental friendly processes for the manufacture of various industrial products and also implementing the state-of-art technologies for wastewater treatment.			2	1	2	2
	Average	1.25		1.50	1.00	1.75	1.25

AIR POLLUTION AND CONTROL
4 Credits

Sub Code :22PEV201C **CIE Marks: 50**
Hrs/Week :04 **SEE Marks: 50**

COURSEOUTCOMES
Students will be able to
1. Understand the science of air pollution, air pollution episodes and its monitoring.
2. Design the hoods and ducts including stacks for ventilation and interpret the meteorology **c**omposition and structure of the atmosphere.
3. Identify the control technologies and design the air quality models.
4. Identify anthropogenic sources and atmospheric effects to pollutions.

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.

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.

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, Downwind pollutant concentrations under temperature inversion.
Particulates-Collection mechanism and efficiency, deposition of particulates from stacks, HoodandDuctdesign.ParticulatePollutionControlequipmentDesignconsiderationsofsettingchambers ,Cyclone separators, Wet collectors, Fabric filters, Electrostatic precipitators.

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.

REFERENCES:

1. Perkins-Air Pollution. McGraw Hill Higher Education (1Jan1974).
2.Kenneth Wark and Cecil F Warner-Air Pollution -its origin and control, Harper and Row, Publishers, New York.
2. Environmental Engineers Hand Book, Edition-Liptak Chilton Book Co.USA.
3. Magill, Holden and Ackley-Air Pollution handbook, Mc Graw Hill NewYork 1956.
4. Stern A.C. (ed) Vol.V – Air Quality Management.
5. Seinfeld N.J.-Air Pollution Mc Graw Hill 1975.
6. M N Rao and H V N Rao, Air Pollution" Tata Mc Graw Hill publication.

Course out come	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Understand the science of air pollution, air pollution episodes and its monitoring.	3		2			2
2	Design the hoods and ducts including stacks for ventilation and interpret the meteorology composition and structure of the atmosphere.	1			3	3	1
3	Identify the control technologies and design the air quality models.		1	2	3	1	
4	Identify anthropogenic sources and atmospheric effects to pollutions.		2		1	2	1
	Average	1.00	0.75	1.00	1.75	1.50	1.0

COMPUTER APPLICATIONS IN ENVIRONMENTAL ENGINEERING
(Credit-02)

Sub Code : 22PEV203L **CIE Marks : 50**
Hrs/ Week : 04 **SEE Marks : 50**

COURSE OUTCOMES
Students will be able to

1. Outlines and writes programmers related to population forecasting and water supply and treatment system design.
2. Develop skill of writing programmers for water supply and treatment unit design.
3. Construct the C-programme related to wastewater collection and primary treatment units
4. Design and write the C-Programme on wastewater secondary treatment system.

LISTOFEXPERIMENTS

C- Programming on

1. Population Forecast Programs: Arithmetic Increase Method, Geometric Increase Method and Incremental Increase Method.
2. Water Supply and Treatment Programs: Rising main design, pumping unit, Water treatment units design -Cascade aerator, plain sedimentation tank, clariflocculator tank, filters (rapid and slow) and disinfection.
3. Wastewater Collection and Treatment Units Programs: wastewater treatment units – Screen and Grit chamber, Primary settling tank, Aeration tank.
4. Secondary treatment units: Secondary settling tank of ASP, Trickling filter unit, Sludge drying beds and Septic tank.

REFERENCES:

1. Thomann, R. V., and Mueller, J.A., (1987), "Principles of Surface Water Quality Modeling and Control" –Harper Int. Edition.
2. Krishna Murthy, C.S., and Rajeev, S., (1998), "Computer Aided Design software and Analytical Tools"– Norosa Publishing House.
3. Wark K. Warner, G.F., and Davis, W.T., (1998), "Air Pollution its Origin and Control" – Addison- Wesley.
4. Sincero, A.P., and Sincero, G.A., (1999), "Environmental Engineering – A Design Approach"Prentice Hall of India.
5. Water Supply and Treatment – CPHEEO Manual (Latest version), New Delhi.
6. Wastewater Collection, Treatment & Disposal – CPHEEO Manual (Latest version), New Delhi.

Course out come	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Outlines and writes programmers related to population forecasting and water supply and treatment system design.	3	3		2		2
2	Develop skill of writing programmers for water supply and treatment unit design.	1	2		3	2	
3	Construct the C-programme related to wastewater collection and primary treatment units.	3	1		1		
4	Dsign and write the C-Programme on wastewater secondary treatment system.		2		2	3	1
	Average	1.75	2.00		2.00	1.25	0.75

REMOTE SENSING AND GIS APPLICATIONS IN ENVIRONMENTALENGINEERING

3 Credits

Sub Code :22PEVXXXE **CIE Marks: 50**

Hrs/ Week :03 **SEE Marks: 50**

COURSEOUTCOMES

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 the set particular kinds of Geo environmental engineering problem.
3. Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.
4. Capacity to extrapolate GIS data of ground water mapping, erosion studies, watershed management and drainage.

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 class if cation 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 compress techniques, Data Base Structures. Basics of Photogrammetric: 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 oils, 3D mapping for sub surface stratum.

UNIT-4

Advanced Applications GIS assisted seismic hazard studies, study of soil drainage characteristic assisted with remote sensing, study of ground water prospects, soil mapping, and rock spectra form internal 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. Energy Pater A Burraugh Rachal A McDonnas "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	PO4	PO5	PO6
1	Develop a sound understanding of the nature, purpose and underlying principles of Remote Sensing.	2		3		2	1
2	Apply available Remote Sensing technologies and be able to match the set particular kinds of Geo environmental engineering problem.		1		2	2	
3	Develop a critical awareness of the strengths and limitations of monitoring using Remote Sensing and the wider monitoring.	3	1	2			2
4	Capacity to extrapolate GIS data of ground water mapping, erosion studies, watershed management and drainage.		1			2	2
	Average	1.25	0.75	1.25	0.5	1.50	1.25

ENERGY AND ENVIRONMENTAL ENGINEERING
3 Credits

Sub Code: 22PEV212E **CIE Marks :50**
Hrs/Week: 03 **SEE Marks :50**

COURSEOUTCOMES
Students will be able to

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. 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. Ind ian scenario**-** Energy consumption, needs and crisis.

UNIT-II

Energy production, utilization, Laws and Principles. Renewable source so for 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.

Reference Books

1. Wilber LC."Handbook of Energy Systems "Engineering Wiley andSons1989.
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. Raoand Parulekar R R Energy Technology- Non-conventional Renewable and Conventional, Second Edition Khanna Publication 1997.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Outline the need and application of various alternative fuels.	2	2		1		2
2	Apply various methods / technologies to harness various renewable energy sources and non-renewable energy sources.			2	3	1	1
3	Understand the energy scenario of renewable and non-renewable energy sources.	2		3		3	1
4	Critically think about the global climatic changes-causes and effects.	1	2			3	2
	Average	1.25	1.00	1.25	1.00	1.75	1.50

BIOLOGICAL PROCESS FOR WASTEWATER TREATMENT

3 Credits

Sub Code : 22PEV207E **CIE Marks : 50**

Hrs/ Week : 03 **SEE Marks : 50**

COURSE OUTCOMES

Students will be able to

1. Identify various parameters of biological methods of analysis of waste water.
2. Design the appropriate biological wastewater treatment processes and discuss pros and cons of each process.
3. Analyze the various problems encountered in aerobic and anaerobic treatment of waste water.
4. Construct the treatment methods for sludge obtained during the water and wastewater treatment.

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.

10 hr

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.

10 hr

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.

10 hr

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.

10 hr

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.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Identify various parameters of biological methods of analysis of waste water.	2		2		2	
2	Design the appropriate biological wastewater treatment processes and discuss pros and cons of each process.		2	3	2		2
3	Analyze the various problems encountered in aerobic and anaerobic treatment of waste water.	2		1	3	2	
4	Construct the treatment methods for sludge obtained during the water and wastewater treatment.			2	1	2	1
Average		1.00	0.5	1.75	1.50	1.50	0.75

PROJECT MANAGEMENT
(03 Credits)

Sub Code :22PEVXXXE **CIEMarks:50**
Hrs/Week: 03 **SEEMarks:50**

COURSE OUTCOMES:
Students will be able to

1. Identify the potential project and understand the strategic planning and analysis of the project.
2. Analyse the project scope, WBS and scheduling projects.
3. Perform the project on time and acquire the knowledge management, perform administrative work.
4. Construct the network analysis in project and MS Project to perform CPM /PERT analysis.

UNIT-1

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.

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.

UNIT-III

Performing Projects: Project supply chain management: – Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management. 28 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.

UNIT-IV

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.

Text Books:

1. Project Management Timothy J Kloppenborg Cengage Learning Edition 2009.
2. Project Management -A systems approach to planning scheduling and controlling Harold kerzner CBS publication.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Identify the potential project and understand the strategic planning and analysis of the project.	2		3			1
2	Analyse the project scope, WBS and scheduling projects.		3	2	1	2	1
3	Perform the project on time and acquire the knowledge management, perform administrative work.	1	1			1	2
4	Construct the network analysis in project and MS Project to perform CPM /PERT analysis.			2	2	1	
	Average	0.75	1.00	1.75	0.75	1.00	1.00

OCCUPATIONAL SAFETY AND HEALTH
3 Credits

Sub Code : 22PEV209E **CIE Marks:50**
Hrs/Week: 03 **SEE Marks:50**

COURSEOUTCOMES

Students will be able to

1. Design policies and regulations for the development and maintenance of a healthy and safe work environment.
2. 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.Analyse the change by advancing OH&S principles within management systems, cultures, practices, and priorities.
4. Construct the Occupational Health and Safety Considerations in Wastewater Treatment Plants.

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 Rolein Accident investigation. Human Error Model, Petersew's Model, Epidemiological Models.

Ergonomics- Ergonomics at workplace, 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, ISO14001Standards, 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 Nostr and 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	PO4	PO5	PO6
1	Design policies and regulations for the development and maintenance of a healthy and safe work environment.		2		1	2	1
2	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.	2	1			2	1
3	Analyse the change by advancing OH&S principles within management systems, cultures, practices, and priorities.	1			2	1	1
4	Construct the Occupational Health and Safety Considerations in Wastewater Treatment Plants.		2			3	2
	Average	0.75	1.25		0.75	2.00	1.25

NON–POINT SOURCES OF POLLUTION AND MANAGEMENT
3 Credits

Sub Code : 22PEV210E **CIE Marks: 50**
Hrs /Week :03 **SEE Marks:50**

COURSE OUTCOMES

Students will be able to

1. Utilize Simulation Models for tracing non point source pollution.
2. Develop management solutions for non point source pollution control.
3. Construct the non-point source Pollution Simulation Models.
4. Select best management solutions for non point 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 –fallout, rain fall, Over land routing of the precipitation excess, inter flow 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

Nonpoint 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 and 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 Pollution Control: Introduction, Water Quality Planning Process, and 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 Nostr and Reinhold Environmental Engineering Series, New York.

2. Pavoni J L, (Ed) “Hand Book of Water Quality Management Planning”, Van No strand Reinhold, Environmental Engineering Series. New York

3. Pluarg, Pollution from Land Use Activities Reference Group Novotny V and Chesters G,“Hand Book of Non-point Pollution, Sources and Management”, Van Nostrand ReinholdCompany.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Utilize Simulation Models for tracing non point source pollution.	1		3	1		2
2	Develop management solutions for non point source pollution control.			1	3	3	
3	Construct the non-point source Pollution Simulation Models.	2		1	1		2
4	Select best management solutions for nonpoint source pollution control.	1		2		2	1
Average		1.00		1.75	1.25	1.25	1.25

WATER RESOURCES ENGINEERING
3Credits

Sub Code : 22PEV211E **CIE Marks: 50**
Hrs/Week : 03 **SEE Marks: 50**

COURSEOUTCOMES

Students will be able to

1. Evaluate the hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment.
2. Estimate rainfall, optimum rain gauges and consistency with the concept hydrology.
3. Analyse the water hammer effects and flow measurement using different methods.
4. Apply the concepts of hydraulics to design water mains, steady state ground water 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 hydro graph, Flowrouting–Muskingham method, Low flow 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 offlow. Flow into well sin unconfined and confined aquifer sunder steady and unsteady conditions, Sea water intrusion. Artificial recharge, Ground water pollution. Borewells -types and design principles.

REFERENCES:

1. VenTE. Chow-Handbook of Applied hydrology.
2. Todd-Ground water hydrology, John Willey NewYork 2001
3. Ranganath. H.M.- Advanced hydrology.
4. Subramnya.K.S.-Advanced hydrology.
5. Ven.TE. Chow-Open channel hydraulics, McGraw Hill BookCo-Singapur1973
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. RamS.Gupta, Hydrology and Hydraulic System,
10. John Permankian, Water Hammer Analysis.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Evaluate the hydrological systems and processes at a wide range of scales in both space and time for the purpose of water resources assessment.	2		2		2	1
2	Estimate rainfall, optimum rain gauges and consistency with the concept hydrology.			3	2	1	
3	Analyze the water hammer effects and flow measurement using different methods.	2	2			1	2
4	Apply the concepts of hydraulics to design water mains, steady state ground water problems.		1		1		1
	Average	1.00	0.75	1.25	0.75	1.00	1.00

WASTE TO ENERGY
3 Credits

Sub Code : 22PEV206E **CIE Marks : 50**
Hrs/ Week : 03 **SEE Marks : 50**

Course Outcomes:

Students will be able to

1. Understand of the concept of Waste to Energy.
2. Analyse the technical and management principles for production of energy form waste.
3. Discuss about the best available technologies for waste to energy.
4. Develop the skills in the decision-making process.

UNIT I

The Principles of Waste Management and Waste Utilization. Waste Management, Hierarchy and 3R, Principle of Reduce, Reuse and Recycle. Waste as a Resource and Alternate Energy source.

Waste Sources & Characterization

Waste production in different sectors such as domestic, industrial, agriculture, postconsumer, waste etc. Classification of waste – agro based, forest residues, domestic waste, industrial waste (hazardous and non-hazardous). Characterization of waste for energy utilization. Waste Selection criteria.

UNIT II

Biomass Pyrolysis Types, slow fast, Manufacture of charcoal, Methods, Yields and application, Manufacture of pyrolytic oils and gases, yields and applications.

UNIT III

Biomass Gasification, Gasifiers, Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

UNIT IV

Biomass Combustion, Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors. Biogas, Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo-chemical conversion, Direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, Types of biogas Plants, Applications, Alcohol production from biomass, Bio diesel production, Urban waste to energy conversion, Biomass energy programme in India.

Reference Books:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I &II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Understand of the concept of Waste to Energy.	2		2		1	
2	Analyse the technical and management principles for production of energy form waste.			2	3	1	2
3	Discuss about the best available technologies for waste to energy.			3	1	1	
4	Develop the skills in the decision-making process.	1	2	1			1
	Average	0.75	0.5	2.00	1.00	0.75	0.75

PLASTIC WASTE MANAGEMENT AND RECYCLING

Sub Code : 22PEV213E **CIE Marks : 50**
Hrs/ Week : 03 **SEE Marks : 50**

OBJECTIVES:

Students will be able to
1. Analyse the various sources of plastics waste generation and the segregation methods for recycling the plastics and recycling codes of commodity and engineering plastics.
2. Demonstrate the waste treatment of various plastic plants.
3. To learn about primary recycling techniques with examples/case studies.
4.To understand the recycling of various commodity and engineering plastics.

Unit -I

Plastic & environment value additions, global policy, regulations, waste energy management.Recycling & recovery of various plastic items/materials their effect on environment.

Unit -II

Waste treatment of various plastic plants, estimations of power requirement & efficiency of size reduction operation of plastics, environment pollution aspects. Need for recycling – Sorting and segregation of waste – Plastics identification- Plastics Production and composition– Plastics waste – Composition, quantities and disposal alternatives

Unit -III

Primary recycling – Equipments for primary recycling. Specific recycling techniques – PE films, PP battery case – Crushing and separation – PET films.

Unit -IV

Recycling of plastics from urban waste – rheology, density, mechanical behavior. Secondary recycling Plastics wastes containing paper – hydrolytic treatment – processing methods – processing of mixed plastics waste – household waste – industrial sector – TPO based materials.

Use of recyclable plastics in motor vehicles – recoverable materials – disposal of residuals – recyclable plastic components – virgin and recycled HDPE – Fluorinated and unfluorinated HDPE – fuel tanks. Tertiary recycling – Reactors used – Advantages – Dry method wet method - use of recyclable plastics in automobiles.

REFERENCES

1. “Plastic Waste Management" Nabil Mustafa, Marcel Dekker, New York, 1995.
2. John Schiles, Polymer Recycling.
3. Recycling & Plastics Waste Management, Edited by Dr.J.S.Anand, CIPET, 1997.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Analyse the various sources of plastics waste generation and the segregation methods for recycling the plastics.	2		1		3	1
2	Demonstrate the waste treatment of various plastic plants.		2	1	2	1	
3	Demonstrate the primary recycling techniques with case studies.	2		2	2		
4	Understand the recycling of various commodity and engineering plastics.			2		1	3
	Average	1.00	0.5	1.50	1.00	1.25	1.00

GREEN TECHNOLOGY

Sub Code: 22PEVXXXE **CIE Marks:50**
Hrs/Week: 03 **SEE Marks:50**

Course Outcomes:

Students will be able to

1. Understand the principles of green chemistry and engineering.
2. Design processes those are benign and environmentally viable.
3. Design processes and products those are safe and hazard free.
4. Learn to modify chemical processes making hazardous products and make them green safe and economically acceptable by using biotechnology.

UNIT I

Fundamentals of Green Chemistry and Technology- Principles of Green Chemistry and technology, green chemistry metrics (atom economy, atom efficiency, E-factor, and other green chemistry metrics, Green processes- Microwave assisted reactions, ultra-sonication assisted reactions, ionic liquids as solvent, water as a reaction medium, solvent free reactions, supercritical solvents, safe product and process design, case studies.

UNIT II

Industrial Safety and Hazard analysis- Introduction to ISO standards, hazard identification, life cycle analysis, and safety aspects related to transport, handling and storage of hazardous chemicals. green technologies for addressing the problems of Water, Energy, Health, Agriculture and Biodiversity- WEHAB (eco-restoration/ phyto-remediation, ecological sanitation, renewable energy technologies, industrial ecology, agro ecology and other appropriate green technologies, global warming; greenhouse gas emissions, impacts, mitigation and adaptation

UNIT III

Green Nanotechnology – Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste Management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

UNIT IV

Advances in separation process- Adsorption, Distillation, filtration, membrane separation, precipitation, crystallization.

10 hr

REFERENCES:

1. Khan B.H, Non-conventional energy resources, Tata McGraw-Hill, New Delhi 2006.
2. Rashmi Sanghi and M.M. Srivastava, Green Chemistry-Environment Friendly Alternatives, NarosaPublishing House, New Delhi 2009.
3. Paul L. Bishop, Pollution prevention –Fundamentals and Practices, McGraw-Hill- international2000.
4. N. Vinutha bai, R. Ravindra, Energy efficient and green technology concepts, International Journal of Research in Engineering and Technology p 253-258, Volume: 03, Special Issue: 06, 2014, ISSN: 2319-1163 pISSN: 2321-7308.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Understand the principles of green chemistry and engineering.			3	2	1	
2	Design processes those are benign and environmentally viable.			2		2	2
3	Design processes and products those are safe and hazard free.	1		2		2	1
4	Learn to modify chemical processes making hazardous products and make them green safe and economically acceptable by using biotechnology.	1		1		1	
	Average	0.5		2.00	0.5	1.50	0.75

DESIGN OF WATER AND WASTEWATER TREATMENT PLANTS

3 Credits

Sub Code: 22PEV301C **CIE Marks:50**

Hrs/Week: 03 **SEE Marks:50**

Course Outcomes

Students will be able to

1. Understand the different unit operations involved in water and wastewater treatment.
2. Know about the design criteria and suitability of unit operations involved.
3. Analyse the suitability of treatment schemes for a variety of input parameters.
4. Apply the knowledge of design principles in the design of water and wastewater treatment Plants.

UNIT I

Water Treatment flow sheets, Treatment Plant Hydraulics, Head Loss Types and Calculations, Manifold Hydraulics, Intake Facilities, Design of Aeration Systems, Design of Chemical Mixing, ChemicalPrecipitation.

UNIT II

Flocculation Process Design, Sedimentation Tank Design, Filter Design, Ion Exchange Process and Equipment Design, Membrane Unit Design, Disinfection and Sludge Handling.

UNIT III

Wastewater treatment flow sheets, Screens- Design and Hydraulics, Grit Chamber, Proportional Weir, Sedimentation Tanks- Inlet and Outlet Design.

UNIT IV

Biological Waste Treatment- Activated Sludge Process, Extended Aeration, Bio filter, UASB Reactor, Fluidized /Expanded Bed System, Ponds and Lagoon Design, Sludge Digestion andDrying Beds. 10 hr

Text Books and/or Reference Materials

1. Metcalf and Eddy "Wastewater Engineering: Treatment and Reuse, Tata McGraw Hill Edition. 2. Ronald L Droste, "Theory and Practice of water and Wastewater Treatment", Wiley Publications.

3. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Understand the different unit operations involved in water and wastewater treatment.	2		2	1		2
2	Know about the design criteria and suitability of unit operations involved.		2	3		1	2
3	Analyse the suitability of treatment schemes for a variety of input parameters.			1		2	3
4	Apply the knowledge of design principles in the design of water and wastewater treatment Plants.	1			3	1	1
	Average	0.75	0.5	1.50	1.00	1.00	2.00

REUSE – RECYCLE TECHNOLOGY

Sub Code: 22PEV305E **CIE Marks: 50**
Hrs/Week: 03 **SEE Marks: 50**

COURSE OUTCOMES
Students will be able to
1. Understand the different wastes as fuel and conversion devices to convert waste to energy.
2. Apply the metal recovery in various fields.
3. Apply the existing technologies for the treatment of biomass and design the devices.
4. 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 (Centralized, 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 Heidel berg(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	PO4	PO5	PO6
1	Understand the different wastes as fuel and conversion devices to convert waste to energy.			2		3	2
2	Apply the metal recovery in various fields.	2		1	3	1	
3	Apply the existing technologies for the treatment of biomass and design the devices.	1		2		2	2
4	Appreciate the increasing importance of waste and resource management in achieving environmental sustainability.			2		1	2
	Average	0..75		1.75	0.75	1.75	1.50

GLOBAL WARMING AND CLIMATE CHANGE

Sub Code: 22PEV306E **CIE Marks:50**

Hrs/Week: 03 **SEEMarks:50**

COURSE OUTCOMES

Students will be able to

1. Analyse the climate factors with their changes in the environment.
2. Demonstrate the effects of climate change models for future climate change.
3. Identify the effects of climate change on ecosystem.
4. Construct the possible ways to deal with 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 CO2 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 CO2 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”.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Analyse the climate factors with their changes in the environment.	2	2		2	3	1
2	Demonstrate the effects of climate change models for future climate change.	1				2	2
3	Identify the effects of climate change on ecosystem.		1	2		1	2
4	Construct the possible ways to deal with energy issues and alternate energy sources.			3	1	2	2
	Average	0.75	0.75	1.25	0.75	2.00	1.75

ENVIRONMENTAL PLANNING AND MANAGEMENT

Sub Code: 22PEV307E **CIE Marks: 50**
Hrs/Week: 03 **SEE Marks: 50**

COURSE OUTCOMES
Students will be able to
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. Demonstrate the engineering economics and apply the cleaner technologies and their roles in environmental protection.
4. 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,CashFlows.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.

EFERENCES:

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.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
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.	2	2			3	1
2	Develop the most appropriate policies and planning for environmental protection by making proper environmental cost benefit analysis.		1	1		2	
3	Demonstrate the engineering economics and apply the cleaner technologies and their roles in environmental	2		1	2	3	1

	protection.						
4	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.	1			2	2	
	Average	1.25	0.75	0.5	1.00	2.50	0.5

WATER RECLAMATION AND REUSE

3 Credits

Sub Code: 22PEV308E **CIE Marks: 50**

Hrs/Week: 03 **SEE Marks: 50**

COURSE OBJECTIVES

Students will be able to

1. Understand the wastewater reuse applications for various processes.
2. Apply the concepts of advanced wastewater treatment processes for different reuse purposes.
3. Analyse the suitability and management of advanced filtration systems for reuse applications of wastewater.
4. Evaluate the feasibility of different treatment flow sheets for waste water management in zero effluent discharge.

UNIT I

Overview of wastewater treatment processes. Wastewater reuse applications in irrigation, groundwater recharge and recreational purposes. Effluent standards for different reuse applications.

UNIT II

Advanced Wastewater Treatment Processes: Adsorption, Ion Exchange, Advanced Oxidation Processes – Fenton's, Photo Fenton, UV and Ozonation.

UNIT III

Advanced Filtration Processes, Ultrafiltration, Microfiltration, Nanofiltration and Reverse Osmosis Processes, Design of Reverse Osmosis processes, Reject Management, Thermal Evaporators.

UNIT IV

Concept of Zero Effluent Discharge, Karnal Technology, Impact of discharge of treated wastewater on land and groundwater. Effluent Treatment Plant for an Industry with zero effluent discharge.

REFERENCES:

1.Syed R Qasim, Edward M Motley and Guang Zhu, Water Works Engineering: Planning Design and Operation, Prentice Hall.

2.Metcalf and Eddy "Wastewater Engineering: Treatment and Reuse, Tata McGraw Hill Edition.

3. Rittman Bruce "Environmental Biotechnology", McGraw Hill Publications.

4. Syed R Qasim, "Wastewater Treatment Plants – Planning, Design and Operations, CRC Press.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Understand the wastewater reuse applications for various processes.	2		2	1		2
2	Apply the concepts of advanced wastewater treatment processes for different reuse purposes.		1	2		2	
3	Analyse the suitability and management of advanced filtration systems for reuse applications of wastewater.	1			1	2	
4	Ealuate the feasibility of different treatment flow sheets for waste water management in zero effluent discharge.		1	1	3	1	1
	Average	0.75	0.50	1.25	1.25	1.25	0.75

OPERATION AND MAINTENANCE OF ENVIRONMENTAL FACILITIES

3 Credits

SubCode:22PEV325 **CIEMarks:50**
Hrs/Week:03 **SEEMarks:50**

COURSE OUTCOMES

Students will be able to

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.
4. construct the Air Pollution Control Facilities- Regular inspection of Devices.

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.

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.

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.

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.

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.

Courseoutcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Apply basic principles, organizational structure, work planning and scheduling and cost estimates of O&M.			3	1		1
2	Prepare drawings, plans, record keeping, need for operational manual and SOP.	2	2			2 1	
3	Solve operational problems in water treatment and supply facilities, wastewater collection and treatment facilities, air pollution control systems.			1	1		2
4	construct the Air Pollution Control Facilities- Regular inspection of Devices.	1	1		1	2	1
	Average	0.75	0.75	1.00	0.75	1.25	1.00

ECOLOGY AND ENVIRONMENTAL IMPACT ASSESSMENT

SubCode:22 PEV214N **CIEMarks:50**
Hrs/Week:03 **SEEMarks:50**

COURSE OUTCOMES
Students will be able to

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.

4. Understand the practical considerations in preparing Environmental Impact Assessment and salient features of the project activity.

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.10 hr

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.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Identify different Components of ecosystem and their interactions and interrelationships.		1			2	2
2	Outline the systematic process for environmental impact assessment along with different methodologies.	3		2	2		3
3	Identify and assess the impacts on environmental attributes from developmental projects, Explain importance of public participation, EMP and DMP in EIA process.	1	2		2	1	
4	Understand the practical considerations in preparing Environmental Impact Assessment and salient features of the project activity.			2		3	1
	Average	0.75	0.75	1.00	1.00	1.50	1.50

ADVANCED ATMOSPHERIC ENVIRONMENTAL ENGINEERING

SubCode:22 PEV332 **CIEMarks:50**
Hrs/Week:03 **SEEMarks:50**

COURSE OUTCOMES
Students will be able to

1. Discuss theatmospheric processes and chemical reactions.
2. Asses the urban air quality simulation modeling.
3. Interpret the mobile sources of pollution and design the models for dispersion of heavy gases.
4. Investigate the indoor air pollution and effectively utilize knowledge of design on industrial ventilation systems.

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.10 hr

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.10 hr

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.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	1. Discuss the atmospheric processes and chemical reactions.	1		2		2	1
2	Asses the urban air quality simulation modeling.	2			3	1	
3	Interpret the mobile sources of pollution and design the models for dispersion of heavy gases.			2	1		2
4	Investigate the indoor air pollution and effectively utilize knowledge of design on industrial ventilation systems.	2		1		1	1
	Average	1.25		1.25	1.00	1.00	1.00

ENVIRONMENTAL BIOCHEMISTRY AND BIOTECHNOLOGY

SubCode:22 PEV333 **CIEMarks:50**

Hrs/Week:03 **SEEMarks:50**

COURSE OUTCOMES

Students will be able to

1. Discuss the metabolism - stoichiometry arid energetic, thermodynamic principles, metabolic reaction and coupling, EMP pathway.

2. Infer the molecular genetics and its control system.

3. Use the biotechnology in the field of environmental and apply the microbes in sewage treatment system.

4. Apply the technologies for bioremediation of soil, water and air.

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, Meerut, 2002.
4. P.K. Guptha, Elements of Biotechnology, Restogi Publishers, Meerut, 2003.

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Discuss the metabolism - stoichiometry and energetic, thermodynamic principles, metabolic reaction and coupling, EMP pathway.	2		2	1	2	
2	Infer the molecular genetics and its control system.			2	3		1
3	Use the biotechnology in the field of environmental and apply the microbes in sewage treatment system.	1		1		3	
4	Apply the technologies for bioremediation of soil, water and air.	1		1			2
	Average	1.00		1.50	1.00	1.50	0.75

ENVIRONMENTAL DISASTER MANAGEMENT

SubCode:22PEV334 **CIEMarks:50**
Hrs/Week:03 **SEEMarks:50**

Course Objectives

1. Find out solution for a sustainable earth for future generation.
2. Make the stakeholder aware of their rights, responsibilities, consequence of their conduct towards nature and build resilience.
3. Develop a sense of equitable use of resources and their preservation for the future generation.
4. Sensitize the stakeholders on disaster and pandemic preparedness.

UNIT-I

The Environment: The Atmosphere, Lithosphere, Hydrosphere, Biosphere.
Ecosystem: Energy flow in the ecosystem, Biogeochemical Cycle: Water Cycle, Carbon Cycle, Nitrogen Cycle.
Pollution: Water Pollution, Air Pollution, Soil Pollution, Radiation Pollution, Industrial Pollution,Light Pollution, Sound Pollution.
Environmental Laws: (Water Act 1974, Air act 1981, The Wildlife Protection Act 1972, TheEnvironment Protection Act 1986), The Forest Conservation Act 1980.

UNIT-II

Climate Change & Sustainable Development:
Population Ecology: Individuals, Species, Population, Community, Human Population Growth, Population Control Methods, Urbanization and its effect on society.
Climate Change: Cause, Effect, Global Warming, Carbon Footprint and environmental protectionStep taken towards Sustainable Development: Ban of single-use plastic automobile ScrappingPolicy, Promotion of Electrical Vehicles, Brief idea on Sustainable Development Goals (SDGs), Agenda 21 of Rio Earth Summit.

UNIT-III

Disaster Management: Types of Disasters (Natural and Man-made and their cause and effect)Vulnerability Assessment and Risk Analysis: Vulnerability to various disasters (Flood, Cyclone,Earthquake, Heat waves and Lightning)
Institutional Framework: Institutional arrangements for disaster management (National DisasterManagement Authority (NDMA), State Disaster Management Authority (SDMA), DistrictDisaster Management Authority (DDMA), National Disaster Response Force (NDRF) and OdishaDisaster Rapid Action Force (ODRAF).
Preparedness Measure: Disaster Management Cycle, Early Warning System, Pre-Disaster and PostDisaster Preparedness, Strengthening of SDMA and DDMA, Community Preparedness,StakeholderParticipation, Corporate Social Responsibility (CSR).
Survival Skills: Survival skills adopted during and after disaster Flood, Cyclone, Earthquake, Heat waves and Lightning.

UNIT-IV

Public Health Management:
Brief idea on Epidemics and Pandemics Non-Communicable Diseases with special reference to cardiovascular diseases, Cancer, Hypertension and Obesity and their prevention. Communicable Diseases with special reference to Covid-19, Flu, Hepatitis, AIDS and Tuberculosis andtheir transmission.
Dynamics of Disease Transmission: Mode of transmission (Direct/Indirect), Events after infection: Immunity (Active vrs Passive, Innate vrs Acquired, Herd Immunity), Incubation Period.
Prevention of Epidemics/Pandemics Disease: Preventing Measures (Quarantine, Sanitization,

PersonalProtective measures such as Hand Washing and use of protective devices, Vaccination); Control Measures(Surveillance, Isolation, Contact Tracing), Life Style Management (Diet, Physical Exercise, Yoga and sleeping habit, Role of Different Sectors in managing Health Disaster: Role of Government (Centre and State),Community, Civil Society, Student mass, NGOs.

Course outcome	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Select the solution for a sustainable earth for future generation.			1		3	2
2	Apprise the stakeholder aware of their rights, responsibilities, consequence of their conduct towards nature and build resilience.	2		1	2		
3	Develop a sense of equitable use of resources and their preservation for the future generation.	2	2		1		2
4	Sensitize the stakeholders on disaster and pandemic preparedness.			2		1	1
	Average	1.00	0.50	1.00	0.75	1.00	1.25

ENVIRONMENTAL GEO-TECHNOLOGY

SubCode:22 PEV335 **CIEMarks:50**

Hrs/Week:03 **SEEMarks:50**

COURSE OBJECTIVE

Students will be able to

1. Create awareness about subsurface contamination and its sources.
2. Infer the geotechnical aspects of planning and design of facilities for disposal of different solid waste.
3. Discuss about detection & monitoring of subsurface contamination and its remediation.
4. Evaluate the rehabilitation of waste dumps and geotechnical re-use of waste.

UNIT-1

Sources and effects of subsurface contamination; Physical, Chemical and biological characteristics of solid wastes; Soil-waste interaction; Contaminant transport, Concepts of Integrated SWM & Geoenvironmental Engineering.

UNIT-2

Waste disposal on land, Types of landfills: Sitting criteria; waste containment principles; Typesof barrier materials; Planning and design aspects relating to waste disposal in landfills, in ash ponds and tailing ponds, and in rocks Principles and Planning of Landfills, Liners for Landfills, Landfill Covers.

10 hr

UNIT-3

Generation and Control of Leachate and Gas from Landfills, Stability of Slopes and Settlement of Landfills.Environmental monitoring around landfills; Detection, control and remediation of subsurface Contamination.

UNIT-4

Engineering properties and geotechnical reuse of waste, demolition waste dumps; Regulations; Planning & Design, Incremental Raisings and Failures of Slurry Ponds, Environmental Control Measures at Slurry Ponds, Geotechnical Reuse of Waste Case studies.

REFERENCES:

1. Sharma, H. and Reddy, K.R., 2004. Geoenvironmental Engineering: Site Remediation, Waste Containment, and Emerging Waste Management Technologies. Wiley.
2. Daniel, D.E., 1993. Geotechnical Practice for waste disposal. Chapman and Hall, London.
3. Koerner, R.M., 2005. Designing with Geosynthetics. Prentice Hall, New Jersey.
4. Reddi, L.N. and Inyang H.I., 2000. Geoenvironmental Engineering: Principles and Applications, Marcel Dekker Inc Publication.

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Create awareness about subsurface contamination and its sources.	2		1	1	2	1
2	Infer the geotechnical aspects of planning and design of facilities fordisposal of different solid waste.			2	1	1	
3	Discuss about detection & monitoring of subsurface contamination andits remediation.	1				3	2
4	Evaluate the rehabilitation of waste dumps and geotechnical re-use ofwaste.	1		2	1		
	Average	1.00		1.25	0.75	1.50	0.75

PROJECT WORK PHASE - I
Credits 3

SubCode:22PEV302P **CIEMarks:100**
Hrs/Week:06 **SEEMarks:100**

COURSE OBJECTIVE

Students will be able to
1. Identify a current problem through literature/field/case studies.
2. Analyse the background objectives and methodology for solving the same study.
3. Infer and design the technologies developed through literature for the solving the same study.
4. Apply and develop a technology/process to address the problem.

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Identify a current problem through literature/field/case studies.	2	3			2	1
2	Analyse the background objectives and methodology for solving the same study.	1		3	1		1
3	Infer and design the technologies developed through literature for the solving the same study.	1	3	1		2	
4	Apply and develop a technology/process to address the problem.		1		2	1	1
	Average	1.00	1.75	1.00	0.75	1.25	0.75

Societal Project
Credits 3

Sub Code: 22PEV303P **CIEMarks:100**
Hrs/Week: 06

COURSE OBJECTIVE

Students will be able to
1. Collect, assimilate, analyze and interpret the technical information/data.
2. Analyse the technical information/data pertaining to the recent environmental engineering related topics.
3. Infer and design the technologies developed through literature for the solving the same study.
4. Demonstrate writing and Communication skills effectively.

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Collect, assimilate, analyze and interpret the technical information/data.	1	3			1	
2	Analyse the technical information/data pertaining to the recent environmental engineering related topics.	2		2	3		1
3	Infer and design the technologies developed through				1		2

	literature for the solving the same study.						
4	Demonstrate writing and Communication skills effectively.		3			2	1
	Average	0.75	1.50	0.50	1.00	0.75	1.00

PROJECT WORK PHASE - II

18 Credits

SubCode:22PEV401P **CIEMarks:100**

Hrs/Week:08 **SEEMarks:100**

COURSE OBJECTIVE

Students will be able to

1. Identify a current problem through literature/field/case studies and define the background objectives and methodology for solving the same.
2. Analyse the background objectives and methodology to address the problem.
3. Infer, design and implement and evaluate the technologies developed through literature for the solving the same study.
4. Demonstrate the writing and communication skills effectively.

CO	Statement	PO1	PO2	PO3	PO4	PO5	PO6
1	Identify a current problem through literature/field/case studies and define the background objectives and methodology for solving the same.	2	3			2	1
2	Analyse the background objectives and methodology for solving the same study.	1		3	1		1
3	Infer and design the technologies developed through literature for the solving the same study.	1	3	1		2	
4	Demonstrate the writing and communication skills effectively.		1		2	1	1
	Average	1.00	1.75	1.00	0.75	1.25	0.75

Basaveshwar Engineering College (A), Bagalkote

Department of Computer Science and Engineering

Scheme and Syllabus for 2023-24

3rd to 4th semester BE for 2022-23 Admitted Batch

III Semester B.E. (CSE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1	BSC	22UMA301C	Numerical Techniques and Integral Transforms	3	3	0	0	50	50	100
2	PCC	22UCS307C	Digital Systems	3	3	0	0	50	50	100
		22UCS302C	OOPS with Java	3	2	0	2			
3	PCC	22UCS303C	Computer Organization	3	3	0	0	50	50	100
4	PCC	22UCS304C	Data Structures	3	2	2	0	50	50	100
6	PCC	22UCS305L	Digital Systems Lab	1	0	0	2	50	50	100
7	PCC	22UCS306L	Data Structures Lab	1	0	0	2	50	50	100
8	AEC	22UBT308C	Biology for Engineers	2	2	0	0	100	0	100
	AEC	22UCS309C	Data analytics using R	1	0	2	0	100	0	100
9	NCMC	22UCS310M	Yoga/NSS/Sports#	0	0	0	0	50	50	100
		22UMA300M	Bridge Course Mathematics-I *	0	3	0	0	50	50	100
Total				20	18	4	6	500	500	1000
*Only for Lateral Entry students # To be completed during the intervening semester of III to VIII semester										

BSC	ESC	HSMC	AEC	PCC	PEC	OEC	PROJ	INT	SEMI	MAN(UHV)
03	--	--	03	14	--	--	--	--	--	--

22UCS307C	Digital Systems	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
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.	
UNIT–II	**10 Hrs.**
Simplifications 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.	
UNIT–III	**10 Hrs.**
Logic Design with MSI Components and Programmable Logic Devices: Binary adders and Subtractor, Decimal adders, Comparators, Decoders, Multiplexers. Programmable logic devices (PLDs), Programmable read only memories (PROMs), Programmable logic arrays (PLAs), Programmable array logics (PALs)	
UNIT–IV	**10 Hrs.**
Flip-Flops and Applications: The Basic Bistable Element: Latches, Master-Slave flip-flops (Pulse-Triggered flip-flops), Edge triggered flop-flops, Characteristic equations.	

Registers: Serial In Serial Out, Serial In Parallel Out Parallel in Parallel Out, Parallel In Serial Out, Circular, Universal Shift Registers.

Counters: Binary Ripple Counter, Synchronous Binary Counters, Mod and Ring counters. Design of Synchronous Counters.

HDL implementations of combinational and sequential circuits.

Reference Books

1. D.D. Givone, , "Digital Principles and Design", McGraw Hill, 8^{th} Edition, 2017
2. R. D. Sudhakar Samuel, "Logic Design - A simplified approach", Sanguine Technical Publications, Revised Edition, 2005
3. Malvino, Leach and Saha, "Digital Principles and applications", McGraw Hill, 6^{th}Edition, 2007
4. McGraw Hill, "Fundamental of digital Logic with Verilog Design", McGraw Hill, 2^{nd}Edition, 2002

Course Outcomes

After completion of the course student will be able to

1. Demonstrate the understanding of Boolean algebra.
2. Describe the working of Combinational circuits.
3. Apply the Boolean theorems, K-Map, Q-M and VEM methods to simplify Boolean expressions.
4. Describe the working of Sequential circuits.
5. Simulate combinational circuits using HDL programming.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	1	-	1
CO3	2	-	-	-	-	-	-	-	-	-	-	1	1	-	1

CO4	1	1	2	-	-	-	-	-	-	-	-	1	1	-	2
CO5	1	1	2	-	-	-	-	-	-	-	-	1	1	-	2

22UCS302	**Object Oriented Programming with Java**	**Credits: 03**
L:T:P - 2 : 0: 2		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	**8 Hrs.**

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, String Handling.

UNIT–II	**8 Hrs.**

Inheritance , Packages and Interfaces

Exception Handling : Exception-Handling Fundamentals – Exception Classes , Exception Types, Uncaught Exceptions, Using try and catch, Multiple catch clauses,

UNIT–III	**8 Hrs.**

Lambda Expressions: Fundamentals, Block Lambda expressions, Passing Lambda Expressions as argument, Lambda Expressions and Exceptions.

Multithreaded Programming: The Java Thread Model, The Main Thread, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Inter thread communication.

UNIT–IV	**8 Hrs.**

JAVA 2 ENTERPRISE EDITION OVERVIEW, DATABASE ACCESS: The Concept of JDBC; JDBC Driver Types; JDBC Packages, A Brief Overview of the JDBC process, Database Connection; Associating the JDBC/ODBC Bridge with the Database, Statement object, ResultSet Objects, Transaction Processing.

Reference Books

1. Herbert Schildt, Java The Complete Reference, MGH Education, 9th Edition, 2014

2. Jim Keogh, J2EE - The Complete Reference, Tata McGraw Hill, 2007

3. Cay S Horstmann ,Gary Cornell,Core Java Volume 1- Fundamentals, Pearson Education, 8th Edition, 2007

4. E Balagurusamy, Programming with Java, MGH Education, 6th Edition, 2019

Course Outcomes
After completion of the course student will be able to 1. Explain the object-oriented concepts and other features of JAVA. 2. Identify classes, objects, members of a class and relationships among them needed for a specific problem. 3. Demonstrate the concepts of polymorphism, inheritance, exception handling and other features of JAVA. 4. Write Java application programs using OOP principles and proper program structuring. 5. Design and develop standalone applications using Java.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2													
CO2	3	3		3									2		1
CO3	3	3		2									3	2	2
CO4	3	3		2									3	3	3
CO5	3	3		3									3	3	3

22UCS303C	Computer Organization	Credits: 03
L:T:P -3:0:0		CIE Marks: 50
Total Hours: 40		SEE Marks: 50

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, 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 super scalar operations,	

Clock rate, Instruction set, compiler, performance measurement
Reference Books
1. Hamcher, ZvonkoVranesic, Safwatzaky, Computer Organization, 5th edition, TMH, 2011 2. J. P. Hayes, Computer Architecture and Organization, 3rd edition, TMH, 2006 3. William Stallings Computer Organization and Architecture, 7th edition, PHI, 2007
Course Outcomes
After completion of the course student will be able to 1. Explain the design and function of different units of computer 2. Perform the various operations on given data 3. Analyze the execution of the program and different organizations of functional units 4. Develop an assembly programs and micro programs for simple machine instructions 5. Design the basic functional units of computer

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1											1	1		
CO2		3										1	1		2
CO3		2	2									1	1		2
CO4			3									1	1	2	2
CO5			3									1	1		3

22UCS304C	Data Structures	Credits: 03
L:T:P –2:2:0		CIEMarks:50
Total Hours/Week: 04		SEEMarks:50

UNIT-I	12 Hrs.
Pointer applications: Arrays and pointers, pointer arithmetic and arrays, passing an array to a function, Using pointers to functions. **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. **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 implementations:** 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 Implementation using array**	
UNIT–II	**12 Hrs.**
Stack applications: **Reversing data:** Reverse a list, Convert decimal to binary, Infix to postfix transformation, Evaluating postfix expressions **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	
UNIT–III	**12 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	**12 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.

Reference Books

1. Behrouz A,Forouzan& Richard F Gilberg, Computer Science A Structured Programming Approach Using C, 3rd Edition, Cengage Learning India Private Limited, 2007

2. Behrouz A. Forouzan and Richard F. Gilberg, Data Structure A Pseudocode Approach with C, ,2nd Edition, Cengage Learning Publisher, 2005.
3. Aaron M. Tenanbaum,YedidyahLangsam,Data Structures Using C,1st Edition, Pearson, 2019
4. YeshwantKanetkar,Data Structures Through C,3rd Edition, BPB, 2019

Course Outcomes

After completion of the course student will be able to

1. Demonstrate the understanding of pointers, dynamic memory allocation, recursion and data structures.
2. Explain implementation of data structures with and without ADT
3. Identify the data structures needed to solve given problem.
4. Design and develop solutions for simple problems using the data structures
5. Compare and contrast different data structures

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	-	2	2	2	2	-	-	-	-	-	-	-	**3**	-	**2**
CO2	-	2	2	2	2	-	-	-	-	-	-	-	**2**	-	**2**
CO3	-	3	3	3	3	-	-	-	-	-	-	-	**3**	-	**3**
CO4	-	3	3	3	3	-	-	-	-	-	-	-	**3**	-	**3**
CO5	-	3	3	3	3	-	-	-	-	-	-	-	**3**	-	**3**

22UCS305L	Digital Systems Laboratory	Credits: 01
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

Practice Assignments Using Digital IC's
1. Implementation of Boolean Expressions of basic logic gates such as 2-input/3-input AND, OR, NAND, NOR, EX-OR Gates. 2. 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 ExOR Gates. 2. Given any 4-variable logic expression, simplify using K-MAP/QuineMcCliskey 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 subtractor 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 gates. 7. Design and implement a mod-n (n<8) synchronous Down counter using J-K Flip-Flop and basic gates. 8. Design and implementan asynchronous counter using decade counter IC to count up from 0 to mod-n (n<=9) & display the numbers using 7-segment display. 9. Design a Ring and Johnson Counter using a 4-bit Shift Register IC.
Part B (Software Implementation)
1. Write the Verilog/VHDL code for Binary to Gray Code converter and verify it's working. 2. Write the Verilog/VHDL code for an 8:1 multiplexer. Simulate and verify it's 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 it's working.
6. Write the Verilog/VHDL code for switched tail counter. Simulate and verify its working

Note:

- For part-B any simulation package like MaxPlus-II/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.

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):

Course Outcomes

After completion of the course student will be able to

1. Design and implement combinational circuits.
2. Design and Implement sequential Circuits.
3. Simulate sequential and combinational circuits using VHDL/Verilog Programming.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	1	-	1
CO3	2	1	2	-	-	-	-	-	-	-	-	1	1	-	1

22UCS306L	Data Structures Lab	Credits:-1
L:T:P-0:0:2		CIEMarks:50
Total Hours/Week: 02		SEEMarks:50

Assignment List

1. Write C program to perform the following using function pointer concept.
   i. **complex_sum( )** takes addresses of the two complex numbers as parameters as void* and returns the result as void *
   ii. **int_sum( )** takes two integer operand as void* as parameters and returns the result as void*.
   iii. **float_sum( )** takes two integer operand as void* as parameters and returns the result as void*.
   iv. **sum_two_nos( )** that takes addresses of two operands and address of the function that is to be invoked on these two operands
   v. **getfun( )** that accepts from the user appropriate function based on users choice.
   vi. **main( )**method that invokes these function based on users choice.
2. Write Recursive function for the followings:
   a. To find sum of first N natural numbers.
   b. To print first N Fibonacci series.
   c. To convert given decimal number to binary.
   d. Write main ( ) to call above functions.
3. Develop linked stack ADT and create stack of integer using the ADT's defined.
4. Develop array stack ADT and create stack of students using the ADT's defined.
5. Develop linked Queue ADT and create Queue of floats using the ADT's defined.
6. Develop array Queue ADT and create Queue of strings using the ADT's defined.
7. Create Linked list ADT and use the same to create list of student's information.
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. Insert an element ii. Delete an element iii. Search an element iv. Tree is balanced or not v. No of occurrences of key element vi. No of nodes, no of leaf nodes, no of intermediate node vii. Find parent of key node viii. Traverse in preorder, postorder, inorder, breadth first order ix. To copy tree x. To print elements in descending order

Course Outcomes

After completion of the course student will be able to

1. Write C programs to use data structures to represent, organize and manipulate data for given problem.
2. Design and implement solutions for organization of data using different data structures.
3. Choose appropriate data structures for representing, organizing and manipulating data for different kinds of problems

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO2	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**-**	**3**
CO3	**-**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**3**

22UCS306C	Professional Communication	CREDITS: 1
L:T:P - 0 : 2: 0		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

Tutorials	14 Hrs.

- **Communication skills (Verbal and Non Verbal):** Self-Introduction, organizing the material - Introducing the topic – answering questions.
- **Listening skills:** Exercises based on Listening (audio, speech, lectures, songs, listen and draw/speak etc)
- **Conversations and Dialogues-** Exercises based onsituations, scenarios, skits, telephonic.
- **Public Speaking-** Exercises based on different topics.
- **Presentation skills-** individual presentation practice–– presenting the visuals effectively, qualities of a good presentation with emphasis on body language and use of visual aids.
- **Group Discussions-** Participating in group discussions – understanding group dynamics - brainstorming the topic -– questioning and clarifying –GD strategies- activities to improve GD skills, instruction activities.
- **Interview skills-** Interview etiquette – dress code – body language – attending job interviews– telephone/Skype interview -one to one interview &panel interview – FAQs related to job interviews.
- **Writing/Reading skills (resume, letter)-**Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building.
- **Document search and clustering Skills:** Preparing content retrivility based on search engine, formation of search queries, effective search retrivility and document mapping skills.

- **Computer Tool Assisted Learning:** Effective usage of advanced AI based communication tool used for professional communication to build documents like chat GPT and other AI applications.

Activities	14 Hrs.

- **Communication skills (Verbal and Non Verbal)**
  - Speaking on the topic given.
- **Listening skills:**
  - Given a topic, a student should speak about it and the others should summarize the information using proper listening skills.
  - Given instructions from the teacher, students should apply it and exhibit it.
- **Conversations and Dialogues**
  - Given a situation the students should carry out proper conversation.
  - Carrying out telephonic conversations with different categories of persons.
- **Public Speaking**
  - Topics to be given to the student for giving awareness to the public.
- **Presentation skills-**
  - Presentation on technical topic using proper visual aids.
- **Group Discussions**
  - Participating in group discussions to solve any given situation.
  - Carrying out debate.
- **Interview skills.**
  - Carrying out mock face-to-face interview.
- **Writing skills(resume,letter)**
  - Resume writing.
  - Formal letter writing (leave application, job application etc).
- **Reading Skills:**

- Reading Comprehension and answering the questions.
- **Search Query Buidling skills**
  - Usage of Google Search
  - Poster Preparation/ Concept preparation
- **Computer Tool Assisted skills:**
  - AI Tool Usage like ChatGPT
  - Professional Social Connectivity Building like Linked-In groups.

Reference Books

1. Meenakshi Raman and Sangeeta Sharma, Technical Communication Principles and practices, 3rd Edition, Oxford University Press, 2004
2. Muralikrishna C., Sunita Mishra "Communication Skills for Engineers" 2nd edition, Pearson, New Delhi, 2010
3. Vyas Manish A., Yogesh L. Patel, "Tasks for the English Classroom", MacMillan, New Delhi, 2012.
4. AcharDeeptha, CharulJian and et al, English for Academic Purposes,Book-1&2 University Granthnirman Board,Gujarat, 2011
5. Michael vince, 'Advanced Language Practice', Macmillan Education, Oxford,2003
6. Eisenbach Iris, "English for Materials Science and Engineering", Springer Fachmedien Wiesbaden GmbH 2011
7. Lougheed Lin, Business Correspondence: A Guide to Everyday Writing', Longman, Pearson Education, Inc,2003

Course Outcomes

After completion of the course student will be able to

1. *Analyze the variety of communication and listening skills.*
2. *Discuss a given technical/non-technical topic effectively in groups.*
3. *Create effective technical reading,writing and presentations skills*
4. *Usage of Advanced Computer Tools for effective and Techno-social communication*

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1				2			2	1	1			3	1		
CO2				1				1	1			1	1	1	

CO3							1	2	2			2			
CO4								1				3			2

IV Semester B.E. (CSE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	22UMA401C	Statistics and Probability Distribution	3	3	0	0	50	50	100
2.	PCC	22UCS401C	Database Management System	3	2	2	0	50	50	100
3.	PCC	22UCS402C	Operating Systems	3	2	2	0	50	50	100
4.		22UCS403C	Systems Software	3	2	0	2	50	50	100
5.	PCC	22UCS404C	Finite Automata and Formal Languages	3	3	0	0	50	50	100
6.	PCC	22UCS405L	Database Management System Lab	1	0	0	3	50	50	100
8.	PCC	22UCS407L	Operating Systems Lab	1	0	0	2	50	50	100
9.	PCC	22UCS408L	Python Application Programming Lab	2	0	2	2	50	50	100
10.	HSMC		Universal Human Values – II	1	1	0	0	50	50	100
		21UMA400M	Bridge Course Mathematics-II *	0	3	0	0	50	50	100
Total				20	16	6	9	450	450	900
* Only for Lateral Entry students										

BSC	ESC	HSMC	AEC	PCC	PEC	OEC	PROJ	INT	SEMI	MAN(UHV)
03	--	01	--	16	--	--	--	--	--	--

22UCS401C	Database Management Systems	Credits: 3
L:T:P 2: 2: 0		CIEMarks:50
Total Hours/Week: 4		SEEMarks:50

Unit -I	10 Hrs.
Databases and database users: Introduction, an example, Characteristics of Database approach, Actors on the scene, Workers behind the scene, Advantages of using the DBMS approach. **Database System Concepts and Architecture:**Data models, schemas and instances, Three-schema architecture and data independence, Database languages and interfaces, The database system environment. **Data modelling using the Entity relationship model (ER Model):**Using High-Level Conceptual Data Models for Database Design, An sample 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.	
Unit II	**10 Hrs.**
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. **Relational Database Design Using ER to Relational Mapping:** **Relational algebra and Relational Calculus:**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.	
Unit III	**10 Hrs.**
Basic SQL:SQL Data Definition and Data Types, Specifying Basic Constraints in SQL, Basic retrievalQueries in SQL. INSERT, DELETE and UPDATE statements in SQL. **More SQL: Complex queries,Triggers,Views and schema modification:**More Complex SQL Queries, Views (Virtual Table in SQL).Schema Change Statement in SQL. **Basics of Functional Dependencies and Normalization for Relational Databases:**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, Multivalued	

Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form.

Unit IV	10 Hrs.

Relational Database Design Algorithms and Further Dependencies: Further topics in functional dependencies: Inference rules, equivalence and minimal cover. Properties of relational decompositions.

Introduction to Transaction ProcessingConcepts and Theory: Introduction to transaction processing, Transaction and System concepts, Desirable Properties of transaction, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based onSerializability.

Concurrency Control Techniques: Two-Phase Locking Technique for concurrency Control(2PL).

Reference Books

1. Elmasri and Navathe, Fundamentals of Database Systems, 7th Edition, Addison Wesley, 2018
2. Silberschatz, Korth and Sudharshan, Database System, 5thEdition, Mc-GrawHill, 2006
3. Raghurama Krishnan, Johannes Gehrke, Database Management Systems, 3rd Edition, Tata McGrawHill, 2014

Course Outcomes

After completion of the course student will be able to

1. Explain the concepts of database management system and OLTP.
2. Model Entity-Relationship diagrams for enterprise level databases.
3. Formulate Queries using SQL and Relational Formal Query Languages.
4. Apply normalization concepts to refine designed database.
5. Design and develop database application for real life problem.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3											2			
CO2		3	3		2							2	3		2
CO3	2	3	3	2	3							2	3		3

CO4	2	3	3						3		3	2	3		3
CO5	2	2	3	3	3						2	2	3		3

22UCS402C	OPERATING SYSTEMS	Credits: 03
L:T:P – 2: 2: 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	(6+4) Hrs.

Introduction: WhatOperatingSystemsDo?, Computer-SystemOrganization, Computer-SystemArchitecture, Operating-SystemOperations,

PROCESS: Processes Process Concept, Process Scheduling, operations on Processes, Interposes Communication, IPC in Shared-Memory Systems, IPC in Message-passing Systems.

Threads&Concurrency: overview, MulticoreProgramming, MultithreadingModels,

CPUScheduling: BasicConcepts, SchedulingCriteria, SchedulingAlgorithms,

UNIT–II	(6+4) Hrs.

Synchronization Tools: Background, The Critical-Section Problem, Peterson's Solution, Hardware Support for Synchronization, Mutex Locks, Semaphores, Monitors, Classic problems of synchronization.

Deadlocks: SystemModel, DeadlockinMultithreaded Applications, DeadlockCharacterization, MethodsforHandlingDeadlocks, MethodsforHandlingDeadlocks, DeadlockAvoidance, DeadlockDetection, RecoveryfromDeadlock

UNIT–III	(6+4) Hrs.

MainMemory: Background, ContiguousMemoryAllocation, Paging StructureofthePageTable, Swapping.

VirtualMemory: Background, DemandPaging, Copy-on-Write, PageReplacement, AllocationofFrames, Thrashing

UNIT–IV	(6+4) Hrs.

File-SystemInterface: File Concept, AccessMethods, DirectoryStructure, Protection

File-SystemImplementation: File-SystemStructure, File-SystemOperations, DirectoryImplementation, AllocationMethods, Free-SpaceManagement

File-SystemInternals: FileSystems, FileSystemMounting, PartitionsandMounting, fileSharing, VirtualFileSystems.
Reference Books
4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts (TenthEdition, , John Wiley &Sons, Inc. 2018 5. D. M. Dhamdhere, Operating Systems-A Concept Based Approach, 3rd Edition, Tata McGraw-Hill, 2013 6. Andrew S. Tanenbaum and Herbert Bos, Modern Operating Systems,4th edition, Pearson, 2014
Course Outcomes
After completion of the course student will be able to 1. List and explain goals, service, of operating systems 2. Explain functioning of process management, process coordination, memory management and file system management. 3. Analyze the performances of different process scheduling, memory management, file system implementation. 4. Apply scheduling and memory allocation policies for solving scheduling and memory management problems. **5.** Develop simple concurrent applications using processes and threads

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1			1								1	1		
CO2	1	2	1	1								1	1		1
CO3	1	2	1	1								1	1		1
CO4	1	2	3	1								1	1		1

CO5	1	2	3	1								1	1		3

22UCS403C	**System Software**	**Credits: 03**
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	**10 Hrs.**

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.

UNIT–II	**10 Hrs.**

Assemblers: Machine Independent Assembler Features: Literals, Symbol-Definition Statements, Expression, Program Blocks, Control Sections and Programming Linking.

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.

UNIT–III	**10 Hrs.**

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.

Compilers: Basic Compiler Function - Grammars, Lexical Analysis, Syntactic Analysis, Code Generation, Machine Dependent Compiler Features Intermediate Form of the Program. Machine-

Dependent Code Optimization.	
UNIT–IV	**10 Hrs.**
Lex And Yacc: The Simplest Lex Program, Recognizing Words with LEX, Grammars, Parser-LexerCommunication, 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.	

Reference Books

1. Leyland. L. Beck, System Software – An Introduction to Systems Programming,3rd Edition, Pearson Education,2012
2. John. R. Levine, Tony Mason and Doug Brown, Lex and Yacc, O'Reilly, SPD. 1999
3. System Programming and Operating Systems, D. M. Dhamdhere, McGraw Hill Education, 3rd Edition, 1996

Course Outcomes

After completion of the course student will be able to

1. List and define features/concepts of machine architectures and system softwares.
2. Explain characteristics/concepts/basic operations of machines architectures, system softwares.
3. Write programs to implement simple assembler, loader, linker, macroprocessor, lexical analyzer and syntactic analyzer.
4. Compare and contrast types of software, machine architectures, system software and Lexical and syntactic analyzer.
5. Modify assembler and loader algorithms to incorporate machine independent features and feasible alternative designs.

Course Outcomes	Programme Outcomes (POs)	Program Specific Outcomes (PSOs)

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

22UCS404C	Finite Automata and Formal Languages	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to the Theory of Computation: Three Basic Concepts Languages Grammars Automata, Some Applications. **Deterministic Finite Accepters:** Deterministic Accepters and Transition Graphs, Languages and Dfa's, Regular Languages. **Nondeterministic Finite Accepters:** Definition of a Nondeterministic Accepter Equivalence of Deterministic and Nondeterministic Finite Accepters, Reduction of the Number of States in Finite Automata.	
UNIT–II	**10 Hrs.**
Regular Languages and Regular Grammars: Regular expressions; Formal Definition of a Regular Expression, Languages Associated with Regular Expressions. **Connection between Regular Expression and Regular Languages**: Regular Expressions Denote Regular Languages, Regular Expressions for Regular Languages. **Regular Grammars:**Right- and Left-Linear Grammars, Right-Linear Grammars for Regular Languages **Properties of Regular Languages:** Closure under Simple Set Operations, Closure under Other Operations; Identifying Non-regular Languages: A Pumping Lemma (4 Hours)	
UNIT–III	**10 Hrs.**
Context-Free Languages: Context-Free Grammars; Examples of Context-Free Languages, Leftmost and Rightmost Derivations, Derivation Trees. **Parsing and Ambiguity:**Ambiguity in Grammars and Languages. **Simplification of Context-Free Grammars and Normal Forms:** A Useful Substitution Rule, Removing Useless Productions, Removing λ-Productions,Removing Unit-Productions. **Two Important Normal Forms:**Chomsky Normal Form, Greibach Normal Form (3 Hours)	
UNIT–IV	**10 Hrs.**
Pushdown Automata: Nondeterministic Pushdown Automata: Definition of a Pushdown Automaton, The Language Accepted by a Pushdown Automaton. **Pushdown Automata and Context-Free Languages:**Pushdown Automata for Context-Free Languages, Context-Free Grammars for Pushdown Automata.	

Turing Machines: Definition of a Turing Machine, Turing Machines as Language Accepters, Turing Machines as Transducers.

Turing Machine with More Complex Storage: Multitape and Multidimensional Turing Machines.

Reference Books

1. Peter Linz, Introduction to Formal Languages and Automata,6th Edition, Jones and Bartlett Student Edition, 2015
2. Hopcroft, Motwani, and Ullman, Introduction to Automata Theory, Languages and Computation, 3rd Edition, Pearson Education India, 2014
3. Michael Sipser, Introduction to the Theory of Computation, 3rd Edition, Cengage Learning, 2012
4. E Rich, Automata, Computability and Complexity: Theory and Applications, 1st Edition, Pearson Education India, 2012
5. Martin and John C, Introduction to languages and the theory of computation, 4th Edition, McGraw-Hill, 2013
6. K L P Mishra and N. Chandrasekaran, Theory of Computer Science, 3rd Edition, PHI Learning Pvt. Ltd., 2012

Course Outcomes

After completion of the course 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.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	3	3	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	2	3	-	-	-	-	-	-	-	-	1	-	-

CO3	1	3	3	2	1	-	-	-	-	-	-	-	1	-	-
CO4	3	2	3	2	2	-	-	-	-	-	-	-	1	-	3
CO5	1	2	1	3	3	-	-	-	-	-	-	-	2	-	3

22UCS405L	**Database Management System Lab**	**Credits: 01**
L:T:P - 0: 0: 2		**CIE Marks: 50**
Total Hours/Week: 02		**SEE Marks: 50**

Assignment List

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. Implement the queries for Updation, Selection, Deletion operations. Use ROLL BACK, COMMIT & SAVE POINTS Concepts with UPDATE, SELECT, DELETE statements.
3. Implement the queries (along with sub-Queries) using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT clauses.
4. Implement the queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY and HAVING clauses.
5. Implement the query to create a view and access the content of view and drop the view.
6. Develop PL/SQL program using PROCEDURE.
7. Develop PL/SQL program using FUNCTIONS.
8. Develop PL/SQL program using CURSOR.
9. Develop PL/SQL Programs using TRIGGERS.
10. Develop PL/SQL programs using PACKAGES.

Course outcomes:

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

1. Create and maintain database using SQL.
2. Query the given database to solve given problem.
3. Design database for given application.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	2	3				3	1	2	3	3	2	2
CO2	2	3	3	3	3				2	1	2	3	3	2	2
CO3	2	3	3	3	3				3	3	3	3	3	3	3

22UCS407L	Operating System Laboratory	Credits: 01
L:T:P – 0:0:2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

Assignment list
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.
6. Demonstration of synchronization using semaphores.
7. Implementation of UNIX like shell commands.
8. Developing concurrent applications using Threads.

Course Outcomes

After completion of the course student will be able to

1. Simulate and demonstrate different functionalities of operating system
2. Implement UNIX like Shell commands.
3. Develop simple applications using concurrent programming

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2										3		3
CO2	2	2	2										3		3
CO3	2	3	3		1								3	1	3

22UCS408C	PYTHON APPLICATION PROGRAMMING	Credits: 3
L:T:P- 2: 0: 2		CIEMarks:50
Total Hours/Week: 40 **(28T+12L)**		SEEMarks:50

Unit -I	XX Hrs.

Sequence data types and associated operations: String, List, Tuple, Dictionaries.

Regular Expressions in python.

Exceptions: exceptions, exception handling, types of exceptions, user defined exceptions.

Unit II	XX Hrs.

Object Oriented 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.

Unit III	XX Hrs.

Threads

Graphical user Interfaces.

Unit IV	XX Hrs.

How to work with Database: How to use SQLite Manager to work with a database, How to use python to work with database.

Web Scrapping: Beautiful Soup.

Introduction to DJango: Features of DJango, DJango web server, Understanding DJango environment, A simple 'Hello world' application.

Reference Books

1. Dr. R. Nageswawa Rao, (2018), "Core Python Programming", (2nd Edition), Dreamtech press.
2. Gowrishankar S. Veena A.(2019)." Introduction to Python Programming",(1st Edition), CRC Press Taylor & Francis Group.

3. Michael Urban and Joel Murach ,(2016),"Python Programming", (1st Edition) ,Mike MurachElizabeth Drake.
Course Outcomes
At the end of the course the student will be able to: 1. Demonstrate the use of strings, lists, dictionaries and tuples in simple applications. 2. Write simple applications using regular expressions, multiple threads. 3. Build simple database applications with GUI. 4. Build simple python applications using DJango and Web Scrapping. 5. Analyze the given problem and select appropriate data types and modules to develop the solution.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	3		1								3	1	1
CO2	3	3	3		1								3	1	1
CO3	3	3	3		1								3	1	3
CO4		2	1		2										
CO5	2	3	1		1								3	1	1

V Semester B.E. (CSE)

Sl. No.	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	IPCC	22UCS501C	Analysis and Design of Algorithms	3	2	0	2	50	50	100
2.	PCC	22UCS502C	Software Engineering	3	3	0	0	50	50	100
3.	PCC	22UCS503C	Web Technologies	3	2	0	2	50	50	100
4.	PEC	22UCSXXXE	Professional Elective Course - I	3	3	0	0	50	50	100
5.	OEC	22UCSXXXN	Open Elective-I	3	3	0	0	50	50	100
6.	AEC	22UHS521C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
7.	PROJ	22UCS505P	Miniproject	2	0	0	4	100	0	100
8.	HSMC	22UHSXXX	Environmental Studies	1	1	0	0	50	50	100
Total				20	17	0	4	450	350	800

BSC	ESC	HSMC	AEC	PCC	PEC	OEC	PROJ	INT	SEMI	MAN(UHV)
--	--	01	02	09	03	03	02	--	--	--

22UCS501C	Analysis and Design of Algorithms	Credits:03
L:T:P - 2 : 0: 2		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	06Hrs.
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. **Brute Force:** Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.	
UNIT–II	**06 Hrs.**
Divide and Conquer: Mergesort, Quicksort, Binary Search, Multiplication of large integers and Stressen's Matrix Multiplication. **Decrease and Conquer:**Depth First Search, Breadth First Search, Topological Sorting.	
UNIT–III	**06 Hrs.**
Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction **Space and Time Tradeoffs:** Sorting by Counting, Input Enhancement in String Matching **Dynamic Programming:**Warshall's and Floyd's Algorithms. The Knapsack Problem and Memory Functions.	
UNIT–IV	**06 Hrs.**
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Backtracking:** N-Queens Problem, Sum of Subsets, **Branch-and-Bound**.	
Reference Books *	
1. Levitin A., Introduction to The Design & Analysis of Algorithms, 3rd Edition, Pearson Education, 2017 2. Cormen T. H., Leiserson C. E., Ronal L., Rivest C. S., Introduction to Algorithms, 2nd Edition, PHI, 2001	
Course Outcomes	
After completion of the course student will be able to 1. Analyzeandcomparetherunning timeofalgorithmsusingasymptoticnotations. 2. Demonstrate the working of major algorithms divide-and-conqueranddecrease-and-conquer	

strategies.

3. Design and implement thedynamicprogrammingandgreedystrategyparadigm.
4. Demonstrate the working ofbacktrackingandbranch-and-boundapproaches.
5. Interprettheefficientalgorithmsincommonengineeringdesignsituations.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	3	-	1	-	-	-	-	-	-	2	-	3	3
CO2	2	3	3	2	3	-	-	-	-	-	-	-	-	2	
CO3	2	2	3	2	3	-	-	-	-	-	-	3	-	3	2
CO4	2	2	3	3	2	-	-	-	-	-	-	-	-	2	-
CO5	2	2	3	2	-	-	-	-	-	-	-	-	3	1	2

22UCS502C	SOFTWARE ENGINEERING	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction: Introduction to Software engineering, Professional and ethical responsibility. Softwareprocesses: Models, Process iteration, Process activities; Copingwithchange, Processimprovement Agilesoftwaredevelopment: Agilemethods, Agiledevelopmenttechniques, Agileproject management, Scaling agilemethods	
UNIT–II	**10 Hrs.**
Requirementsengineering:Functionalandnon-functionalrequirements, Requirementsengineeringprocesses, Requirement'selicitation, Requirementsspecification, Requirementsvalidation, Requirementschange Systemmodeling: Contextmodels, Interactionmodels, Structuralmodels Behavioralmodels model-drivenarchitecture Designandimplementation:Object-orienteddesignusingtheUmL, Designpatterns, Implementationissues, Open-sourcedevelopment	
UNIT–III	**10 Hrs.**
Dependable Systems: Dependability properties, Socio-technical systems, Redundancy and diversity, Dependable process, Formal methods and dependability Reliability and Safety engineering: Availability and reliability, Reliability requirements,Safety-critical systems, safety requirements, safety engineering process,safety cases Security Engineering: Security and dependability, Security and organizations, Security requirements, Secure systems design, Security testing and assurance	
UNIT–IV	**10 Hrs.**
Softwaretesting: Developmenttesting, Test-drivendevelopment, Releasetesting, Usertesting Project management: Risk management, managing people, Teamwork Project planning: Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques, COCOmO cost modeling.	
Reference Books *	

1. Sommerville, I., Software Engineering, 10th Edition, Pearson Education Limited, Boston, 2016
2. Michael Blaha, James Rumbaugh: Object Oriented Modelling and Design with UML, 2nd Edition, Pearson Education, 2005.
3. Roger S. Pressman: Software Engineering-A Practitioners approach, 8th Edition, Tata McGraw Hill, 2019

Course Outcomes

After completion of the course student will be able to

1. Analyze a complex software problem and to apply principles of computer science to identify solutions.

2. Design, implement, and evaluate a software solution to meet a given set of functional, non-functional, and domain requirements.

3. Understand professional, ethical, and social responsibilities of a software engineering professional.

4. Use the techniques, skills, and modern engineering tools necessary for engineering practice

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1				2				1			1	1	
CO2	2	1	2							1			1	2	
CO3	1	1											1	1	
CO4	1	1										2	1	1	

22UCS503C	Web Technologies	Credits: 03
L:T:P - 2 : 0: 2		CIE Marks: 50
Total Hours/Week: 40		SEE Marks: 50

UNIT-I	6 Hrs.
Fundamentals: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators. **Introduction to HTML/XHTML :** Origins and Evolution of HTML and XHTML, Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists; Tables, Forms :TheAudio Element, The Video Element, Organization Elements, The Time Element, Syntactic Differences between HTML and XHTML.	
UNIT–II	**6 Hrs.**
Cascading Style Sheets: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color: The Box Model, Background Images, The span and div Tags, Conflict Resolution. **The Basics of 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, And Example, Constructors, Pattern Matching Using Regular Expressions.	
UNIT–III	**7 Hrs.**
JavaScript and HTML Documents: The JavaScript Execution Environment**,** The Document Object Model**,** Element Access in JavaScript**,** Events and Event Handling. Handling Events from Body Elements**,** Handling Events from Button Elements Handling Events from Textbox and Password, **Dynamic Documents with JavaScript:** Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.	
UNIT–IV	**6 Hrs.**
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 ,Cookies, Session Tracking. **Database Access through the Web:** Database Access with PHP and MySQL.	

List of Experiments
1. Design and develop static web page using HTML to demonstrate tables, different forms of hypertext links and frames. 2. Design and develop web page to demonstrate CSS (Use different font styles, set background

image for both the page and single elements on page, Control the repetition of image with background-repeat property, define style for links as a:link, a:active, a:hover,a:visited)
3. Develop web page to demonstrate Form validation using JavaScript.
4. Develop dynamic web page to demonstrate Positioning Elements, Moving Elements,
5. Implement web page to demonstrate Element Visibility, Changing Colors and Fonts,
6. Develop dynamic web page to demonstrate Dynamic Content,
7. Develop dynamic web page to demonstrate Stacking Elements, Locating the Mouse Cursor, reacting to a Mouse Click
8. PHP program to demonstrate Cookie creation, display and deletion.

Reference Books

1. Robert W. Sebesta, Programming the World Wide Web, 8th Edition, Pearson Education, 2014
2. Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006
3. Robin Nixon, Learning PHP, MySQL & JavaScript, 5th Edition, O'Reilly Publications, 2015

Course Outcomes

After completion of the course student will be able to

1. Implement web concepts using different tools like HTML/XHTML/CSS/JavaScript /XML/XSLT/jQuery/AngularJS.
2. Design web applications using client-side Java Scripts.
3. Implement web applications using server –side PHP.
4. Develop web application for real world problem.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	3	2	-	2	2	-	-	-	-	-	-	1		2
CO2	2	-	1	-	3	1	-	-	-	-	-	-		1	
CO3	1	2	-	-	2	-	-	-	1	-	-	-	2		1
CO4	2	1	1	-	2	1	-	-	1	-	-	1		1	2

22UCS505P	MINI PROJECT	Credits: 02
L:T:P - 0 : 0: 8		CIEMarks:50
Total Hours/Week: 04		SEEMarks:50

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 to present the progress of the Mini Project work during the semester as per the schedule provided by the Department Project Coordinator.	

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.

Course Outcomes

After completion of the course student will be able to

1.Develop the ability to solve real life problems related to software development.

2.Identify the issues and challenges in the domain.

3.Explain the deeper understanding in specific functional areas of the real problems.

4.Explore career opportunities in their areas of interest.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	2	2			3	3	2	3	2	2	3
CO2	-	3	2	2	-	-	-	-	3	3	1	3	-	2	3
CO3	3	3	3	2	3	-	-	-	2	2	3	2	3	3	3
CO4	-	3	3	2	2	-	-	-	1	2	2	3	2	1	1

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**

Rubrics for CIE Evaluation

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

Detailed syllabi for 5th to 6th semester BE (CSE)

2021-22 Admitted Batch

V Semester B.E. (CSE)

Sl. No.	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	IPCC	21UCS501C	Analysis and Design of Algorithms	3	2	0	2	50	50	100
2.	PCC	21UCS502C	Computer Networks	4	4	0	0	50	50	100
3.	IPCC	21UCS503C	Web Programming	3	2	0	2	50	50	100
4.	PEC	21UCSXXXE	Professional Elective Course - I	3	3	0	0	50	50	100
5.	OEC	21UCSXXXN	Open Elective-I	3	3	0	0	50	50	100
6.	PCC	21UCS504L	Computer Networks Lab	1	0	0	2	50	50	100
7.	AEC	21UHS521C	Quantitative Aptitude and Professional Skills	2	2	0	0	50	50	100
8.	INT	21UCS505I	Summer Internship - II	3	0	-	-	100	0	100
9.	HSMC	21UBT5XXC	Environmental Studies	1	1	0	0	50	50	100
Total				23	17	0	6	500	400	900

BSC	ESC	HSMC	AEC	PCC	PEC	OEC	PROJ	INT	SEMI	MAN(UHV)
--	--	01	02	11	03	03	--	03	--	--

21UCS501C	Analysis and Design of Algorithms	Credits: 3
L:T:P - 2 : 0: 2		CIE Marks: 50
Total Hours/Week: 4		SEE Marks: 50

UNIT-I	06Hrs.
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. **Brute Force:** Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.	
UNIT–II	**06 Hrs.**
Divide and Conquer: Mergesort, Quicksort, Binary Search, Multiplication of large integers and Stressen's Matrix Multiplication. **Decrease and Conquer:**Depth First Search, Breadth First Search, Topological Sorting.	
UNIT–III	**06 Hrs.**
Transform and Conquer: Presorting, Balanced Search Trees, Heaps and Heapsort, Problem Reduction **Space and Time Tradeoffs:** Sorting by Counting, Input Enhancement in String Matching **Dynamic Programming:**Warshall's and Floyd's Algorithms. The Knapsack Problem and Memory Functions.	
UNIT–IV	**06 Hrs.**
Greedy Technique: Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees. **Backtracking:** N-Queens Problem, Sum of Subsets, **Branch-and-Bound**.	

Reference Books

7. Levitin A., Introduction to the Design & Analysis of Algorithms, 3rd Edition, Pearson Education2017.
8. Cormen T. H., Leiserson C. E., Ronal L., Rivest C. S., Introduction to Algorithms, 2nd Edition, PHI. 2001.

Course Outcomes

After completion of the course student will be able to

6. Analyzeandcomparetherunning timeofalgorithmsusingasymptoticnotations.
7. Demonstrate the working of major algorithms divide-and-conqueranddecrease-and-conquer strategies.
8. Design and implement thedynamicprogrammingandgreedystrategyparadigm.
9. Demonstrate the working ofbacktrackingandbranch-and-boundapproaches.
10. Interprettheefficientalgorithmsincommonengineeringdesignsituations.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	3	-	1	-	-	-	-	-	-	2	-	3	3
CO2	2	3	3	2	3	-	-	-	-	-	-	-	-	2	
CO3	2	2	3	2	3	-	-	-	-	-	-	3	-	3	2
CO4	2	2	3	3	2	-	-	-	-	-	-	-	-	2	-
CO5	2	2	3	2	-	-	-	-	-	-	-	-	3	1	2

21UCS502C	Computer Networks	Credits: 04
L:T:P - 4 : 0 : 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction: Data Communications: Components, Data representations, Data flow, Networks: Distributed Processing, Network Criteria, and Physical structures, Categories of Networks [LAN, WAN, MAN], Protocols and Standards, 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, Addressing: physical, logical and port addresses and specific address. Physical Layer: Transmission Impairment, Transmission Modes.	
UNIT–II	**13 Hrs.**
Data Link Layer: Introduction, Block Coding, Error detection and correction: Cyclic codes: Checksum. Data link control: Framing, Flow and Error control, Protocols: Noiseless channels: Noisy channels. Channelization: FDMA, TDMA, CDMA. Connecting Devices: Passive Hubs, Repeaters, Active Hubs, Bridges, Routers, Gateways, Virtual LANs.	
UNIT–III	**13 Hrs.**
Network Layer: Logical Addressing: IPv4 Addresses: Address Space, Notation, Classful Addressing, Classless Addressing, **IPv6 Addresses:** Structure. Network Layer: Internet Protocol: IPv4 Datagram, IPv6, Transition from IPv4 to IPv6 Network Layer: Address Mapping, **Error Reporting:** ARP, RARP, BOOTP, DHCP and ICMP. **Network Layer:** Delivery, Forwarding & Routing: Delivery, Forwarding: Routing Table, Unicast Routing Protocols: Distance Vector Routing, Link State Routing, Path Vector Routing.	
UNIT–IV	**13 Hrs.**
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. Quality of Service. **Application Layer:** Domain Name System: Name Space, Domain Name Space, DNS In The Internet, Resolution. Registrars. DDNS. Remote Logging, Electronic Mail and File Transfer: **Remote logging:** Telnet, **Electronic mail:** Architecture, User Agent, MIME, SMTP POP and IMAP. File Transfer: FTP.	

Reference Books

1. Behrouz A. Forouzan, "Data Communications and Networking", 4th Edition,Tata McGrawHill, 2006.
2. Alberto LeonGarcia and IndraWidjaja, "Communication Networks –Fundamental Concepts and Key Architectures", 2nd Edition, Tata McGrawHill,2004.
3. Nader F. Mir, "Computer and Communication Networks", 8th Edition, Pearson Education 2007.

4. Larry L. Peterson and Bruce S. David, "Computer Networks – A Systems Approach, 4th Edition, Elsevier, 2007.

Course Outcomes

After completion of the course student will be able to

1. Explain the fundamental concepts of Computer Networks.
2. Analyze different network protocols.
3. Apply techniques for efficient handling of Computer Networks.
4. Formulate Routing and Congestion Control Algorithms.
5. Implement Application Layer protocols.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO2	1	3	1	2	1	-	-	-	-	-	-	-	3	-	-
CO3	2	2	3	1	-	-	1	2	-	-	-	-	1	2	3
CO4	1	3	1	3	1	-	-	-	-	-	-	-	3	-	-
CO5	1	2	3	2	-	3	1	1	-	-	-	-	1	2	2

21UCS503C	Web Programming	Credits: 03
L:T:P - 2 : 0: 2		CIE Marks: 50
Total Hours/Week: 40		SEE Marks: 50

UNIT-I	6 Hrs.
Fundamentals: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators. **Introduction to HTML/XHTML :** Origins and Evolution of HTML and XHTML, Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists; Tables, **Forms :**TheAudio Element, The Video Element, Organization Elements, The Time Element, Syntactic Differences between HTML and XHTML.	
UNIT–II	**6 Hrs.**
Cascading Style Sheets: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color: The Box Model, Background Images, The span and div Tags, Conflict Resolution. **The Basics of 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, And Example, Constructors, Pattern Matching Using Regular Expressions.	
UNIT–III	**7 Hrs.**
JavaScript and HTML Documents: The JavaScript Execution Environment**,** The Document Object Model**,** Element Access in JavaScript**,** Events and Event Handling. Handling Events from Body Elements**,** Handling Events from Button Elements Handling Events from Textbox and Password, **Dynamic Documents with JavaScript:** Introduction, Positioning Elements, Moving Elements, Element Visibility, Changing Colors and Fonts, Dynamic Content, Stacking Elements, Locating the Mouse Cursor, Reacting to a Mouse Click, Slow Movement of Elements, Dragging and Dropping Elements.	
UNIT–IV	**6 Hrs.**
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 ,Cookies, Session Tracking. **Database Access through the Web:** Database Access with PHP and MySQL.	

List of Experiments

9. Design and develop static web page using HTML to demonstrate tables, different forms of hypertext links and frames.
10. Design and develop web page to demonstrate CSS (Use different font styles, set background image for both the page and single elements on page, Control the repetition of image with background-repeat property, define style for links as a:link, a:active, a:hover,a:visited)
11. Develop web page to demonstrate Form validation using JavaScript.
12. Develop dynamic web page to demonstrate Positioning Elements, Moving Elements,
13. Implement web page to demonstrate Element Visibility, Changing Colors and Fonts,
14. Develop dynamic web page to demonstrate Dynamic Content.
15. Develop dynamic web page to demonstrate Stacking Elements, Locating the Mouse Cursor,

reacting to a Mouse Click.

16. PHP program to demonstrate Cookie creation, display and deletion.

Reference Books

1. Robert W. Sebesta, Programming the World Wide Web, 8th Edition, Pearson Education2014.
2. Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
3. Robin Nixon, Learning PHP, MySQL & JavaScript, 5thEdition, O'Reilly Publications, 2015.

Course Outcomes

After completion of the course student will be able to

5. Implement web concepts using different tools like HTML/XHTML/CSS/JavaScript /XML/XSLT/jQuery/AngularJS.
6. Design web applications using client-side Java Scripts.
7. Implement web applications using server-side PHP.
8. Develop web application for real world problem.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	2	-	2	2	-	-	-	-	-	-	1		2
CO2	2	-	1	-	3	1	-	-	-	-	-	-		1	
CO3	1	2	-	-	2	-	-	-	1	-	-	-	2		1
CO4	2	1	1	-	2	1	-	-	1	-	-	1		1	2

21UCS504L	Computer Networks Laboratory	Credits: 01
L:T:P - 0 : 0 : 2		CIE Marks: 50
Exam Hours: 03		SEE Marks: 50

Part –A (Simulation Exercises)
Introduction Part Introduce students to network simulation through the Network simulation Package, create a simple network model with multiple scenarios, Collect statistics on network performance through the use of simulator tools, Analyze and draw conclusion on network performance 1. Simulate four nodes' point-to-point network and study how the loss, utilization and transmission of wireless LAN (IEEE 802.11b) network varies as the distance between access point and wireless nodes. 2. Simulate point-to-point network which consists of 4 to 6 nodes and study network performance analysis of different scheduling technique like First In Out (FIFO), Priority, Round Robin, Weight Fair Queue (WFQ) using NetSim. 3. Simulate and study the throughputs of slow start, Congestion avoidance (also known as Old Tahoe) and First Retransmit (also known as Tahoe), Congestion Control Algorithms during client-server TCP downloads. 4. Create a network topology which consists of six nodes, simulate and study the working and routing table formation of Interior Routing Protocol i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF).
PART – B (Programming)
1. Write a program for error detecting code using CRC-CCITT (16 bit) 2. Write a program for hamming code generation for error detection and correction. 3. Write a program for distance vector algorithm to find suitable path for transmission. 4. Write a program for congestion control using leaky bucket algorithm. 5. Write a C program to develop a DNS client server to resolve the given hostname. 6. Write a client-server application for chat using UDP. 7. Using TCP / IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents to the requested file if present. 8. Write a program for simple RSA algorithm to encrypt and decrypt the data.
Course Outcomes
After completion of the course student will be able to 1. Simulate the network with different configurations to measure the performance parameters

2. Implement the data link, network layer and application layer protocols.

3. Analyze routing algorithm to find the suitable path for transmission and control of flow rate.

4. Enable communication between the peers using TCP/IP and UDP sockets.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	3	3	3	2		2					2	**1**	2	**3**
CO2		3	3	3	3	1	3					2	**1**	2	**3**
CO3	1	3	3	3	1	1	2					**2**	**1**	2	**3**
CO4		3	3	2	3	1	2		2			**2**	**1**	2	**3**

21UCS505I	Summer Internship– II	Credits:03
L:T:P - 0 : 0 : 2		CIEMarks:50
Exam Hours: 03		SEEMarks:50

Internship of 04 weeks during the intervening period of IVth and Vthsemesters. (1)All the students shall have to undergo a mandatory internship of 04 weeks during the intervening period of IV and V semesters. The internship shall be slated for CIE only and will not have SEE. The letter grade earned through CIE shall be included in the Vth semester grade card. The internship shall be considered as a head of passing and shall be considered for vertical progression and for the award of degree. Those, who do not takeup/complete the internship shall be considered under F(fail) grade and shall have to complete during subsequently after satisfying the internship requirements. (2)Innovation/Entrepreneurship Internship shall be carriedoutatindustry,StateandCentral Government/Non-governmentorganizations(NGOs),micro,smallandmediumenterprise(MSME), InnovationcentersorIncubationcenters.Innovationneednotbeasinglemajorbreakthrough;Itcan alsobeaseries of smallorincremental changes.Innovationof anykindcanalsohappenoutsideof the businessworld.Entrepreneurshipinternshipsoffersachancetogainhandsonexperienceintheworld ofentrepreneurshipandhelpstolearnwhatittakestorunas smallentrepreneurialbusinessby performinginterndutieswithanestablishedcompany.Thisexperiencecanthenbeappliedtofuture businessendeavors.Start-upsandsmallcompaniesareapreferredplacetolearnthebusinesstack ticksforfutureentrepreneursaslearninghowasmallbusinessoperates willservetheinternwellwhen he/shemanageshis/herowncompany.Entrepreneurshipactsasacatalysttoopenthemindsto creativityandinnovation.Entrepreneurshipinternshipcanbefromseveralsectors,including technology,smallandmedium-sized,andtheservicesector. (3)Societalorsocialinternship.Urbanizationisincreasingonaglobalscale;andyet,halftheworld's populationstillresidesinruralareasandisdevoidofmanythingsthaturbanpopulationenjoy.Ruralinternship,isawork-basedactivityinwhichstudentswillhaveachancetosolve/reducetheproblems ofthe ruralplaceforbetterliving. AsproposedundertheAICTEruralinternshipprogramme,activitiesunderSocietalorsocial internship,particularlyinruralareas,shallbeconsideredfor40pointsunderAICTEactivitypoint programme.
CourseOutcomes
Aftercompletion of thecourse, students willbeableto 1. Demonstratetheknowledgegainedduringtheinternship. 2. Exhibitabilities to usetheoreticalconceptsandpractical knowledge intheir

fieldofstudy.

3. Demonstratecommunication,interpersonalandother criticalskills intheir profession

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		2	2	2	2	2				2			2	1	1
CO2		2	2	2	2	2				2			2	1	1
CO3		1	1	1	1	1				1			1		1

VI Semester B.E. (CSE)

Sl. No	Category	Subject Code	Subject Title	Credits	HOURS/ WEEK			EXAMINATION MARKS		
					L	T	P	CIE	SEE	Total
1.	BSC	21UCS601C	Theory of Computation (DMS)	3	3	0	0	50	50	100
2.	PCC	21UCS602C	Compiler Design	4	4	0	0	50	50	100
3.	PCC	21UCS603C	Machine Learning	3	3	0	0	50	50	100
4.	PEC	21UCSXXXE	Professional Elective Course - II	3	3	0	0	50	50	100
5.	OEC	21UCSXXXN	Open Elective – II	3	3	0	0	50	50	100
6.	OEC	21UCSXXXN	Open Elective – III	3	3	0	0	50	50	100
7.	PCC	21UCS604L	Machine Learning Lab	1	0	0	2	50	50	100
8.	MP	21UCS605P	Mini Project	2	0	0	4	50	50	100
9.	AEC	21UHS600C	Indian Knowledge Systems	1	1	0	0	50	50	100
Total				23	19	0	6	400	400	800

BSC	ESC	HSMC	AEC	PCC	PEC	OEC	PROJ	INT	SEMI	MAN(UHV)
03	--	--	---	08	03	06	02	--	--	--

21UCS601C	Discrete Mathematics	Credits: 3
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

UNIT-I	10 Hrs.
Set Theory: Sets and Subsets, Set Operations and Laws of Set Theory, Counting and Venn Diagrams, Countable and uncountable sets **Fundamentals of Logic:** Basic connectives and truth tables, logical equivalence, Laws of Logic, Logical implications, Rules of Inference, Use of quantifiers, Definitions and proofs of theorems	
UNIT–II	**10 Hrs.**
Properties of Integers: Mathematical Induction, The Well-ordering Principle, Recursive definitions **Relations and Functions:** Cartesian products and relations, plane and one-to-one, onto functions, Sterling's number of the second kind, special functions, the Pigeonhole principles, Function composition and inverse functions. **Properties of relations:** Computer recognition, 0-1 matrices and directed graphs, partial order, Hasse diagrams, equivalence relations and partitions	
UNIT–III	**10 Hrs.**
Groups: Definitions, Examples and elementary properties, homomorphism and isomorphism and cyclic groups, cosets and Lagrange's theorem. **Coding theory:** Elements of coding theory, the Hamming metric, Parity check and generator matrices	
UNIT–IV	**10 Hrs.**
Graph Theory: Basic terminology, Representation of graphs, connectivity, Eulerian and Hamiltonean graphs, Planar graphs, Directed Graphs, Applications of Graphs, Binary trees and traversal.	

Reference Books

1. Ralph P. Grimaldi: Discrete and Combinatorial Mathematics, 5th Edition, Pearson Education, 2004
2. Kenneth H. Rosen: Discrete Mathematics and Its Applications, 7th Edition, McGraw Hill, 2010
3. JayantGanguly: A Treatise on Discrete Mathematical Structures, Sanguine-Pearson, 2010
4. D. S. Malik and M. K. Sen: Discrete Mathematical Structures: Theory and Applications, Cengage Learning, 2004
5. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008

Course Outcomes

After completion of the course student will be able to

1. Determine if the argument is or is not valid, using logical notation.
2. Demonstrate the ability to write and evaluate a proof using truth tables and propositional logic.
3. Analyze the basic principles of sets and operations in sets and prove basic set equalities.
4. Apply the understanding of relations and functions and determine their properties.
5. Model problems in Computer Science using various discrete structures.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	2	3	-	-	-	-	-	-	-	-	-	2	-	3	3
CO2			3	-	-	-	-	-	-	-	-	-	-	2	
CO3	2	2	-	-	-	-	-	-	-	-	-	3	-	3	2
CO4		3	-	3	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	-	2	-	-	-	-	-	-	-	3	1	2

21UCS602C	CompilerDesign	Credits: 03
L:T:P – 2:2:0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction, lexical analysis: Language processors; The structure of a Compiler; Grouping of Phases into Passes, Compiler Construction Tools, Applications of Compiler Technology **Lexical analysis:** The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens. Lexical Analyzer generator	
UNIT–II	**10 Hrs.**
Syntax analysis – 1: Introduction; Context-free Grammars; Writing a Grammar; Top-down Parsing. **Syntax analysis – 2:** Bottom-up Parsing; Introduction to LR Parsing: Simple LR, Using Ambiguous Grammars, Parser Generators.	
UNIT–III	**10 Hrs.**
Syntax-directed translation: Syntax-Directed definitions; Evaluation order for SDDs; Applications of Syntax-directed translation; Syntax-directed translation schemes. **Intermediate Code Generation:** Variants of syntax trees; Three-address code; Types and declarations; Translation of expressions; Type checking;	
UNIT–IV	**10 Hrs.**
Control flow: short circuit,Backpatching.. **Code Generation:** Issues in the design of Code Generator; The Target language; Addresses in the target code; Basic blocks and Flow graphs; Optimization of basic blocks, sample code generation	

Reference Books

1. **Alfred V Aho, Monica S Lam, Compilers-Principles,Techniques and Tools,** 2ndEdition,Addison-Wesley, 2007.
2. John Levine, DougBrown, TonyMason ,L**ex&Yacc,**2ndEdition ,O'Reilly Media , 1992.
3. AndrewWApple,**ModernCompilerImplementationinC,** Cambridge UniversityPress.

Course Outcomes

After completion of the course student will be able to

1. Demonstratethe understanding ofdifferentphasesofCompilation
2. Express programming language tokens using regular expressions, and language constructs using context free grammar.
3. Construct Lexical Analyzer , parser/parsing tables and Syntax directed translation schemesforsimpleinputs
4. Generateintermediatecodeforstatementsin highlevellanguage
5. Applyoptimizationtechniquestointermediatecodeandgeneratemachinecodeforhighlevellanguageprogram.

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1	1	--	--	--	--	--	--	--	--	--	--	**1**	--	--
CO2	1	3	3	--	--	--	--	--	--	--	--	--	**3**	--	**3**
CO3	--	3	3	--	--	--	--	--	--	--	--	**1**	**3**	--	**3**
CO4	--	3	3	--	--	--	--	--	--	--	--	**1**	**3**	--	**3**
CO5	--	3	3	--	--	--	--	--	--	--	--	**1**	**3**	--	**3**

21UCS603C	Machine Learning	Credits : 3
L:T:P – 3:0:0		CIE Marks : 50
Total Hours/Week : 3		SEE Marks : 50

UNIT-I	10 Hrs.
Introduction to Machine Learning: Introduction**,** What is Machine Learning?, Applications of Machine Learning, Types of Machine Learning, Well posed learning problems, issues in Machine Learning. **Preparing for model**: Introduction, Machine Learning Activities **Linear Regression:** Introduction, Example of Regression, Common regression algorithm **Concept Learning:** Introduction, Concept learning task, Concept Learning as search, Find-s, Candidate elimination algorithm	
UNIT–II	**10 Hrs.**
Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space searching in decision tree learning, Issues in decision tree learning **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..	
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, Naïve 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 **Dimensionality Reduction :** Introduction, Subset Selection, Principal Components Analysis, Linear discriminate analysis	
UNIT–IV	**10 Hrs.**
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. **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	
Reference Books	

1. Tom,Machine Learning,2nd Edition ,Mitchell McGraw - Hill, 2013
2. Miroslav Kubat,An Introduction to Machine Learning,2ndEdition,Springer 2017.
3. Massachusetts,Introduction to Machine Learning,2ndEdition EthemAlpayd in MIT press, Cambridge,, London 2010.
4. Robert Tipeshirani, Jerome Fredman, Elements of Statistical Learning Trevor Hastie,

2nd Edition, Springer 2010.
5. Luis Pedro Coelho and WilliRichart,Building Machine Learning Systems with Python 2ndEdition, PACKT Publication 2013.

Course Outcomes

After completion of the course student will be able to

1. Define machine learning and types of learning algorithms
2. Explain various machine learning algorithms.
3. Apply machine learning algorithm to solve problems of moderate complexity.
4. Analyze performance of algorithms by varying some parameters
5. To formulate machine learning model for the simple problem

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	1	1									1		1
CO2	1	2	2	2									2		2
CO3	1	3	3	2	3								3		3
CO4	1	3	3	3	3								3		3
CO5	1	3	3	3	3								3		3

21UCS604L	Machine Learning Lab	Credits : 1
L:T:P – 0:0:2		CIE Marks : 50
Total Hours/Week : 2		SEE Marks : 50

	12 Hrs.

1. Assignment on Practice of NumPy Library
2. Assignment on Practice of Pandas Library
3. Assignment on Find S algorithm. Let's assume we have a dataset of customers with two attributes: 'age' and 'annual_income'. Divide customers into two groups: "Young Customers" and "High-Income Customers" using the Find-S algorithm.
4. Assignment on candidate elimination algorithm: consider a simplified dataset with two binary attributes ('A' and 'B') and a binary target variable ('Target'). Apply Candidate Elimination algorithm to find the most specific and most general hypotheses that cover all positive and negative examples
5. Assignment on simple regression: Build an application where it can predict a salary based on year of experience using Single Variable Linear Regression (Use Salary dataset from Kaggle). Display the coefficient and intercept. Also visualize the results by plotting the graphs on both training and testing dataset.
6. Assignment on multi-regression: Build an application where it can predict price of a house using multiple variable Linear Regression (Use USA_Housing dataset from Kaggle). Display all the coefficients.
7. Assignment on binary classification using Decision Tree Classifier: Build an application to decide on whether to play the tennis using Decision Tree. Use Tennis data from Kaggle. Do the required data processing. Display Accuracy score, Classification report and Confusion matrix.
8. Assignment on binary classification using Perceptron: Implement Perceptron model. Use this model to classify a patient that she is having cancer or not. Use Breast cancer dataset from sklearn library. Display Accuracy score, Classification report and Confusion matrix.
9. Assignment on Multi classification using Multilayer Perceptron (MLP): Buid an application to classify a given flower into its specie using MLP. Use Iris dataset from Kaggle. Display Accuracy score, Classification report and Confusion matrix.
10. Assignment on regression using KNN: Build an application where it can predict a salary based on year of experience using KNN (Use Salary dataset from Kaggle).
11. Assignment on Classification using KNN: Buid an application to classify a given flower into its specie using KNN (Use Iris dataset from sklearn library)
12. Assignment on Naïve Bayes classifier: Using Naïve Bayes classifier, build an application to classify a given text. Use text data from sklearn (Text classification)
13. Assignment on Image Processing: Build an application to recognize a Digit from an image using MLP (Use Digit image Dataset from sklearn)
14. Assignment on Dimensionality Reduction using PCA.
15. Assignment on clustering: Generate random data points and apply following algorithms to form clusters based on the distance between the data points. Compare results.
    i. Hierarchical clustering

ii. K-mean Clustering:

Reference Books

1. Tom Mitchell Machine Learning 2nd Edition McGraw - Hill, 2013
2. MiroslavKubat An Introduction to Machine Learning 2nd Edition, Springer, 2017
3. Ethem Alpayd Introduction to Machine Learning 2nd Edition in MIT press, Cambridge, Massachusetts London, 2010
4. Trevor Hastie. Robert Tipeshirani, Jerome Fredman Elements of Statistical Learning 2ndEdition Springer, 2010
5. Luis Pedro Coelho and WilliRichart Building Machine Learning Systems with Python 2ndEdition, PACKT Publication, 2013

Course Outcomes

After completion of the course student will be able to

6. To formulate machine learning model for the simple problem
7. Apply machine learning algorithm to solve problems of moderate complexity.
8. Analyze performance of algorithms by varying some parameters

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	1	1									1		1
CO2	1	2	2	2									2		2
CO3	1	3	3	2	3								3		3

21UCS605P	MINI PROJECT	Credits: 02
L:T:P - 0 : 0: 4		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

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 to present the progress of the Mini Project work during the semester as per the schedule provided by the Department Project Coordinator.	
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.	

Course Outcomes

After completion of the course student will be able to

1. Develop the ability to solve real life problems related to software development.
2. Identify the issues and challenges in the domain.
3. Explain the deeper understanding in specific functional areas of the real problems.
4. Explore career opportunities in their areas of interest.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	3	2	2	2	2	2			3	3	2	3	2	2	3
CO2	-	3	2	2	-	-	-	-	3	3	1	3	-	2	3
CO3	3	3	3	2	3	-	-	-	2	2	3	2	3	3	3
CO4	-	3	3	2	2	-	-	-	1	2	2	3	2	1	1

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 4. HOD/Nominee 5. Project Coordinator/Guide 6. Examiner
Total Marks			**100**

Rubrics for CIE Evaluation

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

Detailed syllabi for 7th and 8th semester BE (CSE)

2020-21 Admitted Batch

7thSemester B.E. Computer Science &Engg

Sl.No.	Subject Code	Subjects	Hrs/Week			C			
			L	T	P		CIE	SEE	Total
1.	UCS761C	Machine Learning	3	0	0	3	50	50	100
2.	UCS762C	CyberSecurity	3	0	0	3	50	50	100
3.		Open Elective II	3	0	0	3	50	50	100
4.		Elective IV	3	0	0	3	50	50	100
5.		Elective V	3	0	0	3	50	50	100
6.	UCS763L	Machine Learning Lab	0	0	2	1	50	50	100
7.	UCS764P	Project Phase I	0	0	6	3	50	50	100
8.		MOOCs /Swayam	3	0	0	3	50	50	100
9.	UCS756I	Internship	0	0	4	2	50	50	100
			15	**2**	**16**	**24**	**450**	**450**	**900**

UCS761C	Machine Learning	Credits : 3
L:T:P – 3:0:0		CIE Marks : 50
Total Hours/Week : 3		SEE Marks : 50

UNIT-I	10 Hrs.
Introduction to Machine Learning: Introduction**,**What is Machine Learning?, Applications of Machine Learning, Types of Machine Learning, Well posed learning problems, issues in Machine Learning. **Preparing for model**: Introduction, Machine Learning Activities **Linear Regression:** Introduction, Example of Regression, Common regression algorithm **Concept Learning:** Introduction, Concept learning task, Concept Learning as search, Find-s, Candidate elimination algorithm	
UNIT–II	**10 Hrs.**
Decision Tree Learning: Introduction, Decision tree representation, Appropriate problems for decision tree learning, the basic decision tree learning algorithm, Hypothesis space searching in decision tree learning, Issues in decision tree learning **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..	
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, Naïve 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 **Dimensionality Reduction :** Introduction, Subset Selection, Principal Components Analysis, Linear discriminate analysis	
UNIT–IV	**10 Hrs.**
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

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

Reference Books

1.Tom Mitchell, Machine Learning,2nd Edition, McGraw - Hill, 2013

2.MiroslavKubat, An Introduction to Machine Learning,2ndEdition, Springer,2017

3.EthemAlpayd,Introduction to Machine Learning,2ndEdition, in MIT press, Cambridge, Massachusetts, London,2010

4. Trevor Hastie. Robert Tipeshirani, Jerome Fredman,Elements of Statistical Learning,2ndEdition, Springer,2010

5.Luis Pedro Coelho and WilliRichart,Building Machine Learning Systems with Python,2ndEdition, PACKT Publication,2013

Course Outcomes

After completion of the course student will be able to

9. Define machine learning and types of learning algorithms
10. Explain various machine learning algorithms.
11. Apply machine learning algorithm to solve problems of moderate complexity.
12. Analyze performance of algorithms by varying some parameters
13. To formulate machine learning model for the simple problem

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		1	1	1									1		1
CO2	1	2	2	2									2		2
CO3	1	3	3	2	3								3		3
CO4	1	3	3	3	3								3		3

CO5	**1**	**3**	**3**	**3**	**3**								**3**		**3**

UCS762C	Cyber Security	Credits: 03
L: T:P - 3: 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.

Introduction to Cybercrime: Definition and Origins of the Word, Cybercrime, and Information Security, who are Cybercriminals? Classifications of Cybercrimes, the legal perspective, An Indian Perspective, Hacking and Indian Laws., Global Perspectives

Cyber Offences: How Criminals Plan Them: Introduction, how criminals plan the attacks, Social Engineering, Cyber Stalking, Cybercafé & cybercrimes,

UNIT–II	10 Hrs.

Cyber Offences: Botnets: The fuel for cybercrime, Attack Vector

Cybercrime:Mobile and Wireless Devices; Trends in Mobility, Credit card Frauds in mobile and wireless computing, security challenges posed by mobile devices, Registry setting for mobile devices, Authentication Service security, Attacks on mobiles, Mobile Devices: security implications for organizations

UNIT–III	10 Hrs.

Tools and Methods used in Cybercrime: Introduction, Proxy Servers, Anonymizers, Phishing, Password Cracking, Key Loggers and Skyways, Virus and Worms, Trozen Horses and Backdoors, Steganography, DoS and DDOS Attacks, Attacks on Wireless networks.

Phishing and Identity Theft: Introduction, methods of phishing, phishing, phising techniques, spear phishing, types of phishing scams, phishing toolkits and spy phishing, counter measures, Identity Theft

UNIT–IV	10 Hrs.

Understanding Computer Forensics: Introduction, Historical Background of Cyberforensics, Digital Forensics Science, Need for Computer Forensics, Cyber Forensics and Digital Evidence, Digital Forensic Life cycle, Chain of Custody Concepts, network forensics.

Approaching a computer forensic investigation: solving a computer forensic case, computer forensic and steganography, relevancy of the OSI 7-layer model to computer forensic, Forensic, and social networking sites, challenges in computer forensics, Spatial tools and techniques. Forensic auditing, ant forensics

Reference Books

9. SunitBelapure and Nina Godbole, “Cyber Security: Understanding Cyber Crimes, Computer Forensics And Legal Perspectives”, Wiley India Pvt Ltd, ISBN: 978-81- 265-21791, 2011, First

Edition

10. Surya PrakashTripathi, RitendraGoyal, Praveen Kumar Shukla, Introduction to Information Security and Cyber Laws. Dreamtech Press, 2015
11. Sammons, John, and Michael Cross, The Basics of Cyber Safety: Computer and Mobile Device Safety Made Easy, Elsevier, 2016
12. Brooks, Charles J., Christopher Grow, Philip Craig, and Donald Short,Cybersecurity essentials. John Wiley & Sons,2018

Course Outcomes**

After completion of the course student will be able to

1.Explain the cybercrime terminologies

2.Describe Cyber offenses and Botnets

3.Illustrate Tools and Methods used on Cybercrime,Phishing and Identity Theft.

4.Justify the need of computer forensics

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	1							2					1		
CO2		2		3	3									1	
CO3					2			2					1		
CO4						3						3	1	1	

UCS763L	Machine Learning Lab	Credits : 1
L:T:P – 0:0:2		CIE Marks : 50
Total Hours/Week : 2		SEE Marks : 50

	12 Hrs.

16. Assignment on Practice of NumPy Library

17. Assignment on Practice of Pandas Library

18. Assignment on Find S algorithm.Let’s assume we have a dataset of customers with two attributes: 'age' and 'annual_income'. Divide customers into two groups: "Young Customers" and "High-Income Customers" using the Find-S algorithm.

19. Assignment on candidate elimination algorithm: consider a simplified dataset with two binary attributes ('A' and 'B') and a binary target variable ('Target'). Apply Candidate Elimination algorithm to find the most specific and most general hypotheses that cover all positive and negative examples

20. Assignment on simple regression: Build an application where it can predict a salary based on year of experience using Single Variable Linear Regression (Use Salary dataset from Kaggle). Display the coefficient and intercept. Also visualize the results by plotting the graphs on both training and testing dataset.

21. Assignment on multi-regression: Build an application where it can predict price of a house using multiple variable Linear Regression (Use USA_Housing dataset from Kaggle). Display all the coefficients.

22. Assignment on binary classification using Decision Tree Classifier: Build an application to decide on whether to play the tennis using Decision Tree. Use Tennis data from Kaggle. Do the required data processing. Display Accuracy score, Classification report and Confusion matrix.

23. Assignment on binary classification using Perceptron: Implement Perceptron model. Use this model to classify a patient that she is having cancer or not. Use Breast cancer dataset from sklearn library. Display Accuracy score, Classification report and Confusion matrix.

24. Assignment on Multi classification using Multilayer Perceptron (MLP): Buid an application to classify a given flower into its specie using MLP. Use Iris dataset from Kaggle. Display Accuracy score, Classification report and Confusion matrix.

25. Assignment on regression using KNN: Build an application where it can predict a salary based on year of experience using KNN (Use Salary dataset from Kaggle).

26. Assignment on Classification using KNN: Buid an application to classify a given flower into its specie using KNN (Use Iris dataset from sklearn library)

27. Assignment on Naïve Bayes classifier: Using Naïve Bayes classifier, build an application to classify a given text. Use text data from sklearn (Text classification)

28. Assignment on Image Processing: Build an application to recognise a Digit from an image using MLP (Use Digit image Dataset from sklearn)

29. Assignment on Dimensionality Reduction using PCA.

30. Assignment on clustering: Generate random data points and applyfollowing algorithms to form clusters based on the distance between the data points. Compare results.

iii. Hierarchical clustering

iv. K-mean Clustering:

Course Outcomes

After completion of the course student will be able to

14. To formulate machine learning model for the simple problem
15. Apply machine learning algorithm to solve problems of moderate complexity.
16. Analyze performance of algorithms by varying some parameters

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		**1**	**1**	**1**									**1**		**1**
CO2	**1**	**2**	**2**	**2**									**2**		**2**
CO3	**1**	**3**	**3**	**2**	**3**								**3**		**3**

UCS764P	Project Phase-I	Credits: 3
L:T:P – 0:0:6		CIE Marks: 50
Total Hours/Week: 3		SEE Marks: 50

Procedure

- Students are informed to submit the synopsis, re-tune the synopsis and conduct literature survey/review to consolidate the idea and technical viabilities, in consultation with the project guide
- Students present the progress of the work periodically.
- The internal evaluation panel (consisting of Head, Project coordinator and Guide(s)) monitors the progress, checks the feasibility and evaluates as per the Project Rubrics R#A1.1 and suggests appropriate modifications if required.
- Student will go through three evaluations, one at the beginning of 7th semester, mid of the semester and other towards the end of semester and other towards the end of semester
- Marks obtained in three evaluations are summed up to award marks obtained out of 50 marks as CIE marks
- The evaluation panel (consisting of Head, Project coordinator and Guide(s)will evaluate Semester End Examination (SEE) for 50 marks
- Apart from this, the guide continuously monitors the progress of the project

Evaluation Criteria

Sl. No	Criteria	Marks
	CIE 50 marks Evaluation	
1	1st Evaluation: Synopsis Presentation • Motivation for the project work • Literature Survey • Identification of Issues and Challenges	15
2	2nd Evaluation • Problem Definition	15

	• Proposed Solution • Feasibility Study	
3	3rd Evaluation: CIE • Organization of Report on Project Phase-I • Plan of Implementation • Presentation and Interaction	20
	Total	50
SEE 50 marks evaluation		
1	Identification of Problem Domain and Detailed analysis of Feasibility	10
2	Objectives and Methodology of Project Proposal	10
3	Design Methodology	10
4	Planning of Project Work	10
5	Presentation	10
	Total	50

Course Outcomes

After completion of the course student will 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.

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			2	1	1	1	3	1	2	2	1	1	2
CO2		3			2	1	1	1	3	2	1	2	1	1	2

CO3		**3**			**2**	**1**	**1**	**1**	**3**	**2**	**2**	**2**	**1**	**1**	**2**

UCS756I	Internship	Credits: 02
L:T:P - 0 : 0 : 04		CIE Marks: 100
Total Hours/Week: 04		

Internship:

Students need to meet following criteria to successfully complete the internship course.

1. **Student's Diary/ Daily Log**

   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 based on the following criteria:

   - Regularity in maintenance of the diary.
   - Adequacy & quality of information recorded.
   - Drawings, sketches, and data recorded.
   - Thought process and recording techniques used.
   - Organization of the information.

2. **Internship Report**

The Internship report will be evaluated based on following criteria:

- Originality.
- Internship certificate from the industry.
- 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.

Evaluation:

The industrial training of the students will be evaluated in three stages:

1. Evaluation by Industry.
2. Evaluation through seminar presentation
3. Viva-voce at the Institute.

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.

Summary of Internship Evaluation(IndustryRepresentative)	
EvaluationCriteria	**Scorefromthe abovetables**
QualityofWork	10
AbilitytoLearn	10
InitiativeandCreativity	10
CharacterTraits	10
Dependability	10
OrganizationalFit	10
ResponsetoSupervision	10
	70
InternshipGuide	
Demonstrationofexperience	10
Report	10
Presentation	10
	30
TotalScore	**100**

Total CIE 100 = 70 (Industry Evaluation) + 30 (CIE). No SEE conducted for Internship.

Course Outcomes

After completion of the course student will be able to

1. Demonstrate the knowledge gained during the internship at the industry.
2. Exhibit abilities to use theoretical concepts in solving practical problems in their field of study.
3. Demonstrate communication, interpersonal and other critical skills in their profession.

*

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		2	2	2	2	2				2			2	1	1
CO2		2	2	2	2	2				2			2	1	1
CO3		1	1	1	1	1				3			1		1

8th Semester B.E. Computer Science &Engg

Sl.No	Subject Code	Subjects	Hrs/Week			C				culty for framing syllabus
			L	T	P		CIE	SEE	Total	
1.		Elective V	3	0	0	3	50	50	100	
2.		Elective VI	3	0	0	3	50	50	100	
3.		Elective VII	3	0	0	3	50	50	100	
4	UCS852P	Project Phase II	0	0	24	12	50	50	100	SKG, VHN
5	UCS851S	Seminar	0	0	2	1	50	50	100	SPS, VHN
			9	**0**	**26**	**22**	250	250	500	

UCS851S	Seminar	Credits: 01
L:T:P - 0 : 2: 0		CIEMarks: 100
Total Hours/Week: 20		SEEMarks: 100

Course Outcomes

After completion of the course student will be able to

1. Establish motivation for any topic of interest and develop a thought process for technical presentation.
2. Organize a detailed literature survey and build a document with respect to technical publications.
3. Analysis and comprehension of proof-of-concept and related data.
4. Effective presentation and improve soft skills.
5. Make use of new and recent technology (e.g. Latex) for creating technical report

refer these madam

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3	-	-	-	-	-	-	-	1	-	2	-	-	-
CO2	1	3		1	2	-	-	-	-	-	-	2	2	1	2
CO3	1	-	-	-	-	-	-	-	-	2	-	2	-	-	-
CO4	1	-	-	-	-	-	-	-	-	2	-	2	-	-	-
CO5	1	-	-	-	-	-	-	-	-	2	-	2	-	-	

UCS852P	Project Phase-II	Credits: 12
L:T:P – 0:0:24		CIE Marks: 50
Total Hours/Week: 12		SEE Marks: 50

Procedure

- Students are monitored to carry the project as per the time table displayed atthe beginning of the semester.
- The progress of project work is monitored and evaluated in three evaluations by the panel of internal committee (Head, project coordinator and Guide)
- Marks obtained in three evaluations are summed up to award marks obtained out of 50 marks as CIE marks
- A panel consisting of Head, project coordinator and internal examiner evaluatesand awards the SEE marks

Evaluation Criteria

Sl. No	Criteria	Marks
	CIE 50 marks Evaluation	
1	1st Evaluation: • Work Done (25%) • Work to be done • Presentation and Interaction	15
2	2nd Evaluation: • Work done (75%) • Incorporating of Suggestions • Outline of project report	15
3	3rd Evaluation: CIE • Final Output of Project • Organization of Report on Project Phase-II • Result analysis and Discussion • Presentation and Interaction	20
	Total	50
	SEE 50 marks evaluation	
1	Presentation	10
2	Designs and implementation	10
3	Results and Demonstration	10
4	Project report Organization	10
5	Interaction	10

	Total	50

Course Outcomes

After completion of the course student will be able to:

1. To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same
2. To train the students in preparing project reports and to face the reviews and viva-coce
3. To work in teams

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	3			2	1	1	1	3	1	2	2	1	1	2
CO2		3			2	1	1	1	3	2	1	2	1	1	2
CO3		3			2	1	1	1	3	2	2	2	1	1	2

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

Vision, Mission Statements and Values

Vision

To achieve excellence in electronics and communication engineering through quality education and research for developing competent professionals.

Mission

1. Foster a dynamic teaching and learning process.
2. Encourage research through innovation and collaboration.
3. Imbibe moral, ethical values and social responsibilities.

Values

The values of the department are

1. Work is Worship
2. Ethics and Integrity
3. Empathy and Compassion
4. Indian Ethos
5. Mutual Respect

BVVS

Basaveshwar Engineering College, Bagalkote

Department of Electronics and Communication Engineering

SWOC Analysis

S:Strength:

1. Infrastructure
   - (i.) ICT enabled classrooms/seminar hall with good ambience.
   - (ii.) Well equipped laboratories to cater curriculum requirements.
   - (iii.) Department library with good number of titles and volumes.
   - (iv.) Scope for academic extension programmes.
2. Faculty
   - (i.) 75% of faculty with Ph.D.
   - (ii.) Faculty with minimum of 12 years teaching experience.
   - (iii.) Faculty retention ratio is 100 %.
3. Students
   - (i.) Students with academic and competitive bent of mind.
   - (ii.) 75% of the students are placed in reputed industries.
   - (iii.) 10% to 15% of the students are registering for B.E. Honours Degree.
4. Curriculum
   - (i.) Research and industry oriented adaptive curriculum.
   - (ii.) Curriculum with integrated courses.
5. Alumni
   - (i.) Alumni works in reputed organizations across the world.
   - (ii.) Alumni interactions with students and faculty to bridge the gap between campus and corporate.

W:Weakness:

1. IPR competencies are inadequate.
2. Relatively less number of memberships in professional bodies.
3. Limited collaborative activities.
4. Less number of inter-disciplinary courses and projects.
5. Less number of industry supported laboratories/courses.
6. Inadequate number of funded projects.
7. Less scope for co-curricular and cultural activities.

O:Opportunities:

1. Establishment of Distant Learning Center (DLC) using existing resources.
2. Participation in collaborative projects/ research work with allied institutions.
3. Fostering alumni participation in academics and placement activities.
4. Establishment of Skilling Centers for students.
5. Faculty exchange programs with academia and industry.
6. Organizing conferences.
7. Facilitating incubation centers for alumni.
8. Scope for academic extension programmes
9. Training on computer usage/ programming languages for general public.
10. Enhancing consultancy activities.

C:Challenges:

1. To incorporate experiential teaching learning process.
2. Adapting curriculum to future industry needs.
3. Fostering collaboration to enhance research, innovation and entrepreneurship activities.
4. Attracting diversified students.
5. Strategies to strengthen the placement activities for higher packages and core companies.
6. Secure additional research grants and consultancy opportunities.
7. Enhance quality publications and file patents.

Programme Outcomes

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.

Programme Specific Outcomes (PSOs)

1. Analyze and design systems for electronics, communication, and signal processing applications.
2. Use domain specific tools for design, analysis, synthesis, and validation of VLSI and embeddedsystems
3. Demonstrate the conceptual knowledge with respect to architecture, design analysis and simulationof computer networking and applications

Programme Educational Objectives (PEOs)

1. Prepare students with thorough understanding of science, engineering, and technology to develop innovative solutions for challenges in industry and society

2. Enable students to excel in academia, industry, entrepreneurship and engage in research and lifelong learning

3. Train students to work effectively as individuals and in multidisciplinary environments with high integrity, ethics, human values and societal responsibility

4. Impart skills to the students to design, develop and provide novel solutions for Electronics and Communication engineering problems

5. Equip students with strong leadership, communication, and teamwork skills to succeed in dynamic professional environments and contribute meaningfully to the global challenges

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III SEMESTER

Sl. No	Course	Course Code	Course Title	Teaching Department (TD)and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	SDA	Duration inhours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UMA312C	AV Mathematics-III for EC Engineering	MATHEMATICS	3	0	0	0	03	50	50	100	3
2	IPCC	22UEC311C	Digital System Design using Verilog	ECE DEPT.	3	0	2	0	03	50	50	100	4
3	IPCC	22UEC312C	Electronic Principles and Circuits	ECE DEPT.	3	0	2	0	03	50	50	100	4
4	PCC	22UEC313C	Network Analysis	ECE DEPT.	3	0	0	0	03	50	50	100	3
5	PCCL	22UEC314L	Analog and Digital Systems Design Lab	ECE DEPT.	0	0	2	0	03	50	50	100	1
6	ESC	22UEC315X	ESC/ETC/PLC	ECE DEPT.	3	0	0	0	03	50	50	100	3
7	UHV	22UHS317L	Social Connect and Responsibility	HSS DEPT.	0	0	2	0	01	100	---	100	1
8	AEC/ SEC	22UEC316X	Ability Enhancement Course/Skill EnhancementCourse– III	ECE DEPT.	If the course is a Theory					50	50	100	1
					1	0	0	0	01				
					If a course is a laboratory								
					0	0	2	0	02				
9	MC	22UHS001M	Yoga	YOGA TEACHER	0	0	2	0		25	---	25	0
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR									
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
		22UHS004M	Music	MUSIC TEACHER									
				Total	**15/16**	**0**	**12**		**22**	**475**	**350**	**825**	**20**

Sl. No.	Ability Enhancement Course (AEC)	Subject Code	Engineering Science Course (ESC)	Subject Code	Skill Enhancement Course (SEC)	Subject Code
1.	C++ Basics	22UEC316A	Electronic Devices	22UEC315A	MATLAB Programming	22UEC316C
2.	IOT for Smart Infrastructure	22UEC316B	Computer Organization and Architecture	22UEC315B	LABVIEW programming	22UEC316D
3.			Sensors and Instrumentation	22UEC315C		
4.			Applied Numerical Methods for EC Engineers	22UEC315D		

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit),**AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course,**L:**Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SXX**:

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IV SEMESTER													
Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self -Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PCC	22UEC410C	Electromagnetic Theory	ECE DEPT.	3	0	0	0	03	50	50	100	3
2	IPCC	22UEC411C	Principles of Communication Systems	ECE DEPT.	3	0	2	0	03	50	50	100	4
3	IPCC	22UEC412C	Control Systems	ECE DEPT.	3	0	2	0	03	50	50	100	4
4	PCCL	22UEC413C	Communication Lab	ECE DEPT.	0	0	2	0	03	50	50	100	1
5	ESC	22UEC4XXC	ESC/ETC/PLC	ECE DEPT.	3	0	0	0	03	50	50	100	3
6	AEC/ SEC	22UEC4XXC	Ability Enhancement Course/Skill Enhancement Course- IV	ECE DEPT.	If the course is Theory				01	50	50	100	1
					1	0	0	0					
					If the course is a lab				02				
					0	0	2	0					
7	BSC	22UBT407C	Biology For Engineers	ECE DEPT.	3	0	0	0	03	50	50	100	3
8	UHV	22UHS424C	Universal human values course	ECE DEPT.	1	0	0	0	01	50	50	100	1
9	MC	22UHS001M	Yoga	YOGA TEACHER									
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR	0	0	2	0		25	---	25	0
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
		22UHS004M	Music	MUSIC TEACHER									
				Total	**16/17**	**0**	**10**		**24**	**500**	**400**	**900**	**20**

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit),**AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course,**L:**Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SXX**:

Sl. No.	Ability Enhancement Course AEC	Subject Code	Engineering Science Course ESC	Subject Code	Skill Enhancement Course (SEC)	Subject Code
1.	Octave Programming	22UEC415A	Data Structures using C	22UEC414A	Data Structures Lab using C	22UEC415C
2.	Programmable Logic Controllers	22UEC415B	Microcontrollers	22UEC414B	Microcontroller Lab	22UEC415D
3.			Industrial Electronics	22UEC414C		
4.			Operating Systems	22UEC414D		
5.			Signals and Systems	22UEC414E		

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V SEMESTER														
Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination					Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks		
					L	T	P	S						
1	HSMS	22UEC512C	Technological Innovation and Management Entrepreneurship	ECE DEPT.	3	0	0	0	03	50	50	100		3
2	IPCC	22UEC513C	Digital Signal Processing	ECE DEPT.	3	0	2	0	03	50	50	100		4
3	PCC	22UEC514C	Digital Communication	ECE DEPT.	4	0	0	0	03	50	50	100		4
4	PCCL	22UEC515L	Digital Communication Lab	ECE DEPT.	0	0	2	0	03	50	50	100		1
5	PEC	22UEC5XXE	Professional Elective Course	ECE DEPT.	3	0	0	0	03	50	50	100		3
6	PROJ	22UEC517P	Mini Project	ECE DEPT.	0	0	4	0	03	100	--	100		2
7	AEC	22UHS507C	**Research Methodology and IPR**	ECE DEPT.	2	2	0	0	02	50	50	100		3
8	MC	22UBT508C	Environmental Studies	ANY DEPARTMENT	2	0	0	0	02	50	50	100		2
9	MC	22UHS001M	Yoga	YOGA TEACHER	0	0	2	0		25	---	25		0
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR										
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR										
		22UHS004M	Music	MUSIC TEACHER										
10	AC	22UHS521C	Qualitative Aptitude and Soft Skills	TPC	2	0	0	0	2	100	--	100		0
Total					**19**	**2**	**10**	**0**	**24**	**650**	**350**	**1000**		**22**

Professional Elective Course		
1.	Intelligent Systems and Machine Learning Algorithms	22UEC521E
2.	Digital Switching and Finite Automata Theory	22UEC522E
3.	Data Structure using C++	22UEC523E
4.	Satellite and Optical Communication	22UEC524E

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit),**AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course,**L:**Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SXX**:, **AC**: Audit Course

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VI SEMESTER

Sl.No	Course and Course Code		Course Title	Teaching Department(TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22UEC611C	Embedded System Design	ECE DEPT	3	0	2	0	03	50	50	100	4
2	PCC	22UEC612C	VLSI Design and Testing	ECE DEPT	4	0	0	0	03	50	50	100	4
3	PEC	22UEC6XXE	Professional Elective Course	ECE DEPT	3	0	0	0	03	50	50	100	3
4	OEC	22UECXXXN	Open Elective Course	RESPECTIVE DEPT	3	0	0	0	03	50	50	100	3
5	PROJ	22UEC619P	Major Project Phase I	ECE DEPT	0	0	4	0	03	100	--	100	2
6	PCCL	22UEC620L	VLSI Design and Testing Lab	ECE DEPT	0	0	2	0	03	50	50	100	1
7	AEC	22UHS600C	Indian Knowledge System	ECE DEPT	If the course is offered as a Theory				01	50	50	100	1
					1	0	0	0					
					If course is offered as a practical								
					0	0	2	0					
8	MC	22UHS001M	Yoga	YOGA TEACHER	0	0	2	0		25	---	25	0
		22UHS002M	National Service Scheme (NSS)	NSS COORDINATOR									
		22UHS003M	Physical Education (PE) (Sports and Athletics)	PHYSICAL EDUCATION DIRECTOR									
		22UHS004M	Music	MUSIC TEACHER									
Total					**14/13**	**0**	**12/10**	**0**	**19**	**500**	**300**	**800**	**18**

Sl. No.	Professional Elective Course (PEC)	Subject Code	Open Elective Course (OE)	Subject Code
1.	Multimedia Communication	22UEC621E	Digital System Design using Verilog	22UECXXXN
2.	Digital Image Processing	22UEC622E	Electronic Communication Systems	22UECXXXN
3.	Computer and Data Security	22UEC623E	Consumer Electronics	22UECXXXN
4.	FPGA System Design using Verilog	22UEC624E	Basic VLSI Design	22UECXXXN

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VII SEMESTER (Swappable VII and VIII SEMESTER)

Sl. No	Course and Course Code		Course Title	Teaching Department(TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	IPCC	22UEC720C	Microwave Engineering and Antenna Theory	ECE DEPT	3	0	2	0	03	50	50	100	4
2	IPCC	22UEC721C	Computer Networks and Protocols	ECE DEPT	3	0	2	0	03	50	50	100	4
3	PCC	22UEC722C	Wireless Communication Systems	ECE DEPT	4	0	0	0	03	50	50	100	4
4	PEC	22UEC7XXE	**Professional Elective Course**	RESPECTIVE DEPT	3	0	0	0	03	50	50	100	3
5	OEC	22UECXXXN	**Open Elective Course**	ECE DEPT	3	0	0	0	03	50	50	100	3
6	PROJ	22UEC724P	**Major Project Phase-II**	ECE DEPT	0	0	12	0	03	100	100	200	6
					16	0	16	0	18	**350**	**350**	**700**	**24**

Sl. No.	**Professional Elective Course (PEC)**	Subject Code	**Open Elective Course (OE)**	Subject Code
1.	Application Specific Integrated Circuit	22UEC731E	E-waste Management	22UECXXXN
2.	Automotive Electronics	22UEC732E	Embedded System Applications	22UECXXXN
3.	Cyber Security	22UEC733E	Automotive Electronics	22UECXXXN
4.	Radar Communication	22UEC734E	Sensors and Actuators	22UECXXXN

L:Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SEE**:SemesterEndEvaluation.**TD-**TeachingDepartment,**PSB**: PaperSettingdepartment,**OEC**:OpenElectiveCourse,**PEC**:ProfessionalElectiveCourse.**PROJ**:Projectwork,**INT**:IndustryInternship/ResearchInternship/RuralInternship

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VIII SEMESTER (Swappable VII and VIII SEMESTER)														
Sl.No	Course and Course Code		Course Title	Teaching Department(TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	PEC	22UECXXXX	**Professional Elective (Online Courses) MOOCS**		3	0	0	0	03	50	50	100	3
2	OEC	22UECXXXX	**Open Elective (Online Courses) MOOCS**		3	0	0	0	01	50	50	100	3
3	INT	22UEC811T	**Internship (Industry/Research) (14-20weeks)**		0	0	12	0	03	100	100	200	10
			Total		6	0	12	0	07	**200**	**200**	**400**	**16**

Professional Elective Course

	BOS Recommended Course		BOS Recommended Course
	BOS Recommended Course		BOS Recommended Course

Open Elective Courses

	BOS Recommended Course		BOS Recommended Course
	BOS Recommended Course		BOS Recommended Course

L:Lecture,**T**:Tutorial,**P**:Practical**S=SDA**:SkillDevelopmentActivity,**CIE**:ContinuousInternalEvaluation,**SEE**:SemesterEndEvaluation.**TD-**TeachingDepartment,**PSB**: PaperSettingdepartment,**OEC**:OpenElectiveCourse,**PEC**:ProfessionalElectiveCourse.**PROJ**:Projectwork,**INT**:IndustryInternship/ResearchInternship/RuralInternship

III Semester Syllabus

AV Mathematics-III for EC Engineering		Semester	3
Course Code	**22UMA312C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives:

1. Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis and to enable the student to express non-periodic functions to periodic functions using the Fourier series and Fourier transforms.
2. Analyze signals in terms of Fourier transforms
3. Develop the knowledge of solving differential equations and their applications in Electronics & Communication engineering.
4. To find the association between attributes and the correlation between two variables

Teaching-Learning Process Pedagogy (General Instructions):

These are sample Strategies; teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   i. As an introduction to new topics (pre-lecture activity).
   ii. As a revision of topics (post-lecture activity).
   iii. As additional examples (post-lecture activity).
   iv. As an additional material of challenging topics (pre-and post-lecture activity).
   v. As a model solution of some exercises (post-lecture activity).

Module-1: Fourier series and practical harmonic analysis

Periodic functions, Dirichlet's condition. Fourier series expansion of functions with period 2π and with arbitrary period: periodic rectangular wave, Half-wave rectifier, rectangular pulse, Saw tooth wave. Half-range Fourier series. Triangle and half range expansions, Practical harmonic analysis, variation of periodic current. **(8 hours)**

Module-2: Infinite Fourier Transforms

Infinite Fourier transforms, Fourier cosine and sine transforms, Inverse Fourier transforms, Inverse Fourier cosine and sine transforms, discrete Fourier transform (DFT), Fast Fourier transform (FFT). **(8 hours)**

Module-3: Z Transforms
Definition, Z-transforms of basic sequences and standard functions. Properties: Linearity, scaling, first and second shifting, multiplication by n. Initial and final value theorem. Inverse Z- transforms. Application to difference equations. **(8 hours)**
Module-4: Ordinary Differential Equations of Higher Order Higher-order linear ODEs with constant coefficients - Inverse differential operator, problems. Linear differential equations with variable Coefficients-Cauchy's and Legendre's differential equations–Problems. Application of linear differential equations to L-C circuit and L-C-R circuit. **(8 hours)**
Module-5: **Curve fitting, Correlation, and Regressions** Principles of least squares, Curve fitting by the method of least squares in the form $y = a + bx$, $y = a + bx + cx^2$, and $y = ax^b$. Correlation, Coefficient of correlation, Lines of regression, Angle between regressions lines, standard error of estimate, rank correlation. **(8 hours)**
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Demonstrate the Fourier series to study the behavior of periodic functions and their applications in system communications, digital signal processing, and field theory. 2. To use Fourier transforms to analyze problems involving continuous-time signals 3. To apply Z-Transform techniques to solve difference equations 4. Understand that physical systems can be described by differential equations and solve such equations 5. Make use of correlation and regression analysis to fit a suitable mathematical model for statistical data
Internal Assessment Test question paper is designed to attain the different levels ofBloom's taxonomy as per the outcome defined for the course. **Semester-End Examination:** Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).** 1. The question paper will have ten questions. Each question is set for 20 marks. 2. There will be 2 questions from each module. Each of the two questions under a module(with a maximum of 3 sub-questions), **should have a mix of topics** under that module. 3. The students have to answer 5 full questions, selecting one full question from each module. 4. Marks scored shall be proportionally reduced to 50 marks
Suggested Learning Resources: **Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)Text Books:** 1. **B. S. Grewal**: "Higher Engineering Mathematics", Khanna Publishers, 44thEd., 2021. 2. **E. Kreyszig**: "Advanced Engineering Mathematics", John Wiley & Sons, 10thEd., 2018. **Reference Books:**

1. **V. Ramana:** “Higher Engineering Mathematics” McGraw-Hill Education, 11thEd., 2017
2. **Srimanta Pal & Subodh C.Bhunia**: “Engineering Mathematics” Oxford University Press, 3rdEd., 2016.
3. **N.P Bali and Manish Goyal**: “A Textbook of Engineering Mathematics” Laxmi Publications, 10thEd., 2022.
4. **C. Ray Wylie, Louis C. Barrett:** “Advanced Engineering Mathematics” McGraw–HillBook Co., New York, 6thEd., 2017.
5. **Gupta C.B, Sing S.R and Mukesh Kumar:** “Engineering Mathematic for Semester I andII”, McGraw Hill Education(India) Pvt. Ltd 2015.
6. **H.K. Dass and Er. Rajnish Verma:** “Higher Engineering Mathematics” S. Chand Publication, 3rdEd.,2014.
7. **James Stewart: “**Calculus” Cengage Publications, 7thEd., 2019.

Web links and Video Lectures (e-Resources):

- http://nptel.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- VTU e-Shikshana Program
- VTU EDUSAT Program.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Digital System Design using Verilog		Semester	3
Course Code	**22UEC311C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/Practical		

Course objectives:

This course will enable students to:

1. To impart the concepts of simplifying Boolean expression using K-map techniques and Quine- McCluskey minimization techniques.
2. To impart the concepts of designing and analyzing combinational logic circuits.
3. To impart design methods and analysis of sequential logic circuits.
4. To impart the concepts of Verilog HDL-data flow and behavioral models for the design of digital systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world-and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.
10. Give Programming Assignments.

MODULE-1

Principles of Combinational Logic: Definition of combinational logic, Canonical forms, Generation of switching equations from truth tables, Karnaugh maps up to 4 variables, Quine-McCluskey Minimization Technique. Quine-McCluskey using Don't Care Terms. (Section 3.1 to 3.5 of Text1).

MODULE-2

Logic Design with MSI Components and Programmable Logic Devices: Binary Adders and Subtractors, Comparators, Decoders, Encoders, Multiplexers, Programmable Logic Devices (PLDs) (Section 5.1 to 5.7 of Text 2)
MODULE-3
Flip-Flops and its Applications: The Master-Slave Flip-flops (Pulse-Triggered flip-flops): SR flip- flops, JK flip flops, Characteristic equations, Registers, Binary Ripple Counters, Synchronous Binary Counters, Counters based on Shift Registers, Design of Synchronous mod-n Counter using clocked T, J K, D and SR flip-flops. (Section 6.4, 6.6 to 6.9 (Excluding 6.9.3) of Text 2), State diagrams.
MODULE-4
Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles o Description. (Section 1.1 to1.6.2, 1.6.4 (only Verilog), 2 of Text 3) **Verilog Data flow description:** Highlights of Data flow description, Structure of Data flow description. (Section 2.1 to 2.2 (only Verilog) of Text 3)
MODULE-5
Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Multiplexers (2:1, 4:1, 8:1). (Section 3.1 to 3.4 (only Verilog) of Text 3) **Verilog Structural description**: Highlights of Structural description, Organization of structural description, Structural description of ripple carry adder.(Section 4.1 to 4.2 of Text3)

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted either using any circuit simulation software or discrete components)*

Sl. No.	Experiments
1	To simplify the given Boolean expressions and realize using Verilog program
2	To realize Adder/Subtract or (Full/half) circuits using Verilog data flow description.
3	To realize 4-bit ALU using Verilog program.
4	To realize the following Code converters using Verilog Behavioral description a) Gray to binary and vice versa b) Binary to excess3 and vice versa
5	To realize using Verilog Behavioral description: 8:1 mux, 8:3 encoder, and Priority encoder
6	To realize using Verilog Behavioral description: 1:8 De-mux, 3:8 decoder, 2–bit Comparator
7	To realize using Verilog Behavioral description: Flip-flops: a) JK type b) SR type c) T type and d) D-type
8	To realize Counters-up/down (BCD and binary) using Verilog Behavioral description.
9	Write Verilog code for the given sequential circuit problem statement or state diagram.
Demonstration Experiments (For CIE only–not to be included for SEE) Use FPGA/CPLD kits for down loading Verilog codes and check the output for inter facing experiments.	
10	Verilog Program to interface a Stepper motor to the FPGA/CPL D and rotate the motor in the specified direction (by N steps).

11	Verilog programs to interface Switches and LEDs to the FPGA/CPLD and demonstrate its working.

Course outcomes (Course Skill Set):

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

1) Simplify Boolean functions using K-map and the Quine-McCluskey minimization technique.
2) Analyze and design combinational logic circuits.
3) Analyze the concepts of flip-flops (SR, D, T, and JK) and design synchronous sequential circuits using flip-flops.
4) Model combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.

Assessment Details (Both CIE and SEE):

The weightage of Continuous Internal Evaluation (CIE) is 50%, and the weightage for the Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 out of 50), and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50). A student is declared to have passed the course if he/she secures a minimum of 40% (40 marks out of 100) in the combined total of the CIE and SEE. The **IPCC** refers to the practical portion integrated with the theory of the course. CIE marks for the theory component are 25 marks, and the practical component is also 25 marks.

CIE for the Theory Component of the IPCC:

1. The 25 marks for the theory component are split into 15 marks for two Internal Assessment Tests (each test is 15 marks with duration of 1 hour) and 10 marks for other assessment methods mentioned in 22OB4.2. The first test is conducted after 40-50% of the syllabus is covered, and the second test after 85-90% of the syllabus is covered.
2. The scaled-down marks from the sum of the two tests and other assessment methods will be the CIE marks for the theory component of the IPCC (out of 25 marks).
3. The student must secure 40% of the 25 marks to qualify in the CIE for the theory component of the IPCC.

CIE for the Practical Component of the IPCC:

1. 15 marks are allocated for the conduction of experiments and the preparation of the laboratory record, and 10 marks are allocated for a test to be conducted after the completion of all laboratory sessions.
2. Upon completing each experiment/program in the laboratory, students will be evaluated, including a viva-voce, and marks will be awarded on the same day.
3. The CIE marks for the practical component will be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. The total marks for all experiment write-ups will be added and scaled down to 15 marks.
4. A laboratory test (duration of 2-3 hours) will be conducted after the completion of all experiments, with a maximum score of 50 marks, scaled down to 10 marks.
5. The scaled-down marks from the write-up evaluations and the test will be added to form the CIE marks for the laboratory component of the IPCC, out of 25 marks.
6. The student must secure 40% of the 25 marks to qualify in the CIE for the practical component of the IPCC.

SEE for IPCC:

The Theory SEE will be conducted by the university as per the scheduled timetable, with common question papers for the course (duration: 3 hours).

1. The question paper will have ten questions, each worth 20 marks.
2. There will be two questions from each module. Each of the two questions under a module (with a maximum of three sub-questions) will cover a mix of topics from that module.
3. Students must answer five full questions, selecting one full question from each module.
4. The marks scored by the student will be proportionally scaled down to 50 marks.

The theory portion of the IPCC will be assessed through both CIE and SEE, while the practical portion will have a CIE component only. Questions in the SEE paper may include content from the practical component.

1. The minimum marks required in CIE to be eligible for SEE are 10 (40% of the maximum marks—25) in the theory component and 10 (40% of the maximum marks—25) in the practical component. The laboratory component of the IPCC is assessed through CIE only, but SEE may include questions from the practical component. A maximum of 4-5 sub-questions from the practical component of the IPCC can be set, with a total weightage of no more than 20 marks.
2. SEE will be conducted for 100 marks, and students must secure 35% of the maximum marks to qualify for SEE. Marks scored in SEE will be scaled down to 50.
3. A student is declared to have passed the course if he/she secures a minimum of 40% (40 marks out of 100) in the combined total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination).

Suggested Learning Resources:

Books:

1. *Digital Logic Applications and Design* by John M. Yarbrough, Thomson Learning, 2001.
2. *Digital Principles and Design* by Donald D. Givone, McGraw Hill, 2002.
3. *HDL Programming: VHDL and Verilog* by Nazeih M. Botros, 2009 reprint, Dreamtech Press.

Reference Books:

1. *Fundamentals of Logic Design* by Charles H. Roth Jr., Cengage Learning.
2. *Logic Design* by Sudhakar Samuel, Pearson/Sanguine, 2007.
3. *Fundamentals of HDL* by Cyril P. R., Pearson/Sanguine, 2010.

Web links and Video Lectures (e-Resources):

www.chipverify.com

Activity-Based Learning (Suggested Activities in Class) / Practical-Based Learning:

Programming assignments and mini-projects can be assigned to improve programming skills.

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	A	b	c	d	e	f	g	h	i	j	k	l	m	n	o
CO1: Simplify Boolean functions using K-map and the Quine-McCluskey minimization technique.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO2: Analyze and design combinational logic circuits.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO3: Analyze the concepts of flip-flops (SR, D, T, and JK) and design synchronous sequential circuits using flip-flops.	2	3	1	2	0	0	0	0	0	0	0	0	0	3	0
CO4: Model combinational circuits (adders, subtractors, multiplexers) and sequential circuits using Verilog descriptions.	2	2	1	2	3	0	0	0	0	0	0	0	0	3	0

Electronic Principles and Circuits		Semester	3
Course Code	**22UEC312C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	
Examination nature (SEE)	Theory/Practical/Viva-Voce /Term-work/Others		

Course objectives:
This course will enable students to

1. Design and analyze the BJT circuits as an amplifier and voltage regulation.
2. Design of MOSFET Amplifiers and analyze the basic amplifier configurations using small signal equivalent circuit models
3. Design of operational amplifiers circuits as Comparators, DAC and filters.
4. Understand the concept of positive and negative feedback.
5. Analyze Power amplifier circuits in different modes of operation.
6. Construct Feedback and Oscillator circuits using FET.
7. Understand the thyristor operation and the different types of thyristors.

Teaching-Learning Process (General Instructions)
These are sample Strategies; which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE -1

Transistor Biasing: Voltage Divider Bias, VDB Analysis, VDB Load line and Q point, Two supply Emitter Bias, Other types of Bias.

BJT AC models: Base Biased Amplifier, Emitter Biased Amplifier, Small Signal Operation, AC Beta, AC Resistance of the emitter diode, two transistor models, Analyzing an amplifier, H parameters, Relations between R and H parameters.

Voltage Amplifiers: Voltage gain, Loading effect of Input Impedance.

CC Amplifiers: CC Amplifier, Output Impedance.

[Text1]

MODULE -2

MOSFET

Biasing in MOS amplifier circuits: Fixing VGS, Fixing VG, Drain to Gate feedback resistor. Small signal operation and modelling: The DC bias point, signal current in drain, voltage gain, small signal equivalent circuit models, trans conductance, The T equivalent circuit model. MOSFET Amplifier configuration: Basic configurations, characterizing amplifiers, CS amplifier with and without source resistance, The Common Gate Amplifier, Source follower. [Text 2]

MODULE-3

Linear Op-amp Circuits: Summing Amplifier and D/A Converter, Nonlinear Op-amp Circuits: Comparator with zero reference, Comparator with non-zero references. Comparator with Hysteresis.

Oscillator: Theory of Sinusoidal Oscillation, The Wein-Bridge Oscillator, RC Phase Shift Oscillator, The Colpitts Oscillator, Hartley Oscillator, Crystal Oscillator.

The 555 timer: Monostable Operation, Astable Operation. [Text1]

MODULE-4

Negative Feedback: Four Types of Negative Feedback, VCVS Voltage gain, Other VCVS Equations, ICVS Amplifier, VCIS Amplifier, ICIS Amplifier (No Mathematical Derivation).

Active Filters: Ideal Responses, First Order Stages, VCVS Unity Gain Second Order Low Pass Filters, VCVS Equal Component Low Pass Filters, VCVS High Pass Filters, MFB Band Pass Filters, Band stop Filters. [Text1]

MODULE-5

Power Amplifiers: Amplifier terms, two load lines, Class A Operation, Class B operation, Class B push pull emitter follower, Class C Operation.

Thyristors: The four-layer Diode, SCR, SCR Phase control, Bidirectional Thyristors, IGBTs, Other Thyristors. [Text1]

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted either using any circuit simulation software or discrete components)*

Sl.NO	Experiments
1	Design and Test Bridge Rectifier with Capacitor Input Filter Zener voltage regulator
2	Design and Test Biased Clippers – a)Positive, b) Negative , c) Positive-Negative Positive and Negative Clampers with and without Reference.
3	Plot the transfer and drain characteristics of a JFET and calculate its drain resistance, mutual conductance and amplification factor.
4	Plot the transfer and drain characteristics of n-channel MOSFET and calculate its parameters, namely; drain resistance, mutual conductance and amplification factor.
5	Design and test Emitter Follower
6	Design and plot the frequency response of Common Source JFET/MOSFET amplifier
7	Test the Op-amp Comparator with zero and non-zero reference and obtain the Hysteresis curve.
8	Design and test Full wave Controlled rectifier using RC triggering circuit.
9	Design and test Precision Half wave and full wave rectifiers using Op-amp
10	Design and test RC phase shift oscillator

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1. Understand the characteristics of BJTs and FETs for switching and amplifier circuits.
2. Design and analyze amplifiers and oscillators with different circuit configurations and biasing conditions.
3. Understand the feedback topologies and approximations in the design of amplifiers and oscillators.
4. Design of circuits using linear ICs for wide range applications such as ADC, DAC, filters and timers.
5. Understand the power electronic device components and its functions for basic power electronic circuits.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory componentare **25 marks** and that for the practical component is **25 marks**.

CIE for the theory component of the IPCC

25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.

- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write- ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.

2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will

have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

1. The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.
2. SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.
3. The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Suggested Learning Resources:

Books

1. Albert Malvino, David J Bates, Electronic Principles, 7th Edition, Mc Graw Hill Education, 2017, ISBN:978-0-07-063424-4.

Microelectronic Circuits, Theory and Applications, Adel S Sedra, Kenneth C Smith, 6thEdition, Oxford, 2015.ISBN:978-0-19-808913-1

Web links and Video Lectures (e-Resources):

1. Integrated Electronics: Analog and Digital Circuits and Systems, Jacob Millman, Christos C. Halkias, McGraw-Hill, 2015.
2. Electronic Devices and Circuit, Boylestad & Nashelsky, Eleventh Edition, Pearson, January 2015.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Course Articulation Matrix:

Course Outcomes	**POs**												**PSOs**		
	A	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Determine currents and voltages using source transformation / mesh/nodal analysis and reduce given network using star delta transformation.	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO2: Solve problems by applying Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions	**3**	**3**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO3: Analyze the circuit parameters during switching transients	**3**	**3**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO4: Apply Laplace transform to solve the given network	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO5: Evaluate the frequency response for resonant circuits and the network parameters for two port networks	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**			
Course Contribution to POs	**3.00**	**2.4**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**0**	**1**	**3**	**0**	**0**

Network Analysis		Semester	3
Course Code	**22UEC313C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Module-1

Basic Concepts: Practical sources, Source transformations, Network reduction using Star - Delta transformation, Loop and node analysis with linearly dependent and independentsources for DC and AC networks.

Module-2

Network Theorems: Superposition, Millman's theorems, Thevenin's and Norton's theorems, Maximum Power transfer theorem.

Module-3

Transient behavior and initial conditions: Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for AC and DC excitations.

Module-4

Laplace Transformation &Applications: Solution of networks, step, ramp and impulse responses, waveform Synthesis.

Module-5

Two port network parameters: Definition of Z, Y, h and Transmission parameters, modeling with these parameters, relationship between parameters sets.

Resonance:

Series Resonance: Variation of Current and Voltage with Frequency, Selectivity and Bandwidth, Q-Factor, Circuit Magnification Factor, Selectivity with Variable Capacitance, Selectivity with Variable Inductance.

Parallel Resonance: Selectivity and Bandwidth, Maximum Impedance Conditions with C, L and f Variable, current in Anti-Resonant Circuit, The General Case-Resistance Present in both Branches.

Course outcomes

At the end of the course, the student will be able to:

1. Determine currents and voltages using source transformation / mesh/ nodal analysis and reduce given network using star delta transformation.
2. Solve problems by applying Network Theorems and electrical laws to reduce circuit and to arrive at feasible solutions.
3. Analyze the circuit parameters during switching transients
4. Apply Laplace transform to solve the given network
5. Evaluate the frequency response for resonant circuits and the network parameters for two port networks

Suggested Learning Resources:Books

1. M. E. Van Valkenburg (2000), Network Analysis, Prentice Hall of India, 3rd edition, 2000, ISBN:9780136110958.
2. Roy Choudhury-Networks and Systems, 2nd edition, New Age International Publications,2006,

ISBN: 9788122427677

Reference Books:

3. Hayt, Kemmerly and Durbin – “Engineering Circuit Analysis”, **TMH**7th Edition, 2010.
4. J. David Irwin/ R.Mark Nelms – “Basic Engineering Circuit Analysis”, John Wiley, 8th Ed, 2006.
5. Charles K Alexander and Mathew, N. O. Sadiku- “Fundamentals of Electric Circuits”, Tata
6. McGraw-Hill, 3rd Ed, 2009.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108105159
- https://nptel.ac.in/courses/108102042
- https://psim.software.informer.com/11.1/
- https://www.ni.com/multisim

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Demonstrate the operation of the following circuits using suitable simulation software (Open source such as Psim, Pspice, Proteus, Simulink, eSim)

- Determination of current through each branch of a given network using mesh analysis
- Determination of current through each branch of a given network using nodal analysis
- Simplification of given network using source transformation and finding the current in load
- Verification of Superposition, Millman's, Thevenin's and, Maximum Power transfer theorems using practical based approach

Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**	**m**	**n**	**o**
CO1: Determine currents and voltages using source transformation / mesh/nodal analysis and reduce given network using star delta transformation.	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO2: Solve problems by applying Network Theorems and electrical laws to reduce circuit complexities and to arrive at feasible solutions	**3**	**3**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO3: Analyze the circuit parameters during switching transients	**3**	**3**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO4: Apply Laplace transform to solve the given network	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**	**3**	**0**	**0**
CO5: Evaluate the frequency response for resonant circuits and the network parameters for two port networks	**3**	**2**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**1**	**1**			
Course Contribution to Pos	**3.00**	**2.4**	**1**	**2**	**1**	**1**	**0**	**1**	**1**	**1**	**0**	**1**	**3**	**0**	**0**

<table>
<tr><td colspan="2">Analog and Digital Systems Design Laboratory</td><td>Semester</td><td>3</td></tr>
<tr><td>Course Code</td><td>22UEC314L</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week (L:T:P: S)</td><td>0:0:2</td><td>SEE Marks</td><td>50</td></tr>
<tr><td>Credits</td><td>01</td><td>Exam Hours</td><td>100</td></tr>
<tr><td>Examination type (SEE)</td><td colspan="3">Practical/Viva-Voce</td></tr>
<tr><td colspan="4">Course objectives:
This laboratory course enables students to
1. Understand the electronic circuit schematic and its working
2. Realize and test amplifier and oscillator circuits for the given specifications
3. Realize the op-amp circuits for the applications such as DAC, implement mathematical functions and precision rectifiers.
4. Study the static characteristics of SCR and test the RC triggering circuit.
5. Design and test the combinational and sequential logic circuits for their functionalities.
6. Use the suitable ICs based on the specifications and functions.</td></tr>
</table>

Sl.NO	**Experiments (***All the experiments has to be conducted using discrete components***)**
1	Design and set up the BJT common emitter voltage amplifier with and without feedback and determine the gain- bandwidth product, input and output impedances.
2	Design and set-up BJT/FET i) Colpitts Oscillator, ii) Crystal Oscillator
3	Design and set up the circuits using op-amp: i) Adder, ii) Integrator, iii) Differentiator and iv) Comparator
4	Design 4-bit R – 2R Op-Amp Digital to Analog Converter (i) for a 4-bit binary input using toggle switches (ii) by generating digital inputs using mod-16
5	Design and implement (a) Half Adder & Full Adder using basic gates and NAND gates, (b) Half subtractor & Full subtractor using NAND gates, (c) 4-variable function using IC74151(8:1MUX).
6	Realize (i) Binary to Gray code conversion & vice-versa (IC74139), (ii) BCD to Excess-3 code conversion and vice versa
7	a) Realize using NAND Gates: i) Master-Slave JK Flip-Flop, ii) D Flip-Flop and iii) T Flip-Flop b) Realize the shift registers using IC7474/7495: (i) SISO (ii) SIPO (iii) PISO (iv) PIPO (v) Ring counter and (vi) Johnson counter.
8	Realize a) Design Mod – N Synchronous Up Counter & Down Counter using 7476 JK Flip-flop b) Mod-N Counter using IC7490 / 7476 c) Synchronous counter using IC74192

	Demonstration Experiments (For CIE)
9	Design and Test the second order Active Filters and plot the frequency response, i) Low pass and High pass Filter ii) Band pass and Band stop Filter
10	Design and test the following using 555 timer i) Monostable Multivibraator ii) Astable Multivibrator
11	Design and Test a Regulated Power supply
12	Design and test an audio amplifier by connecting a microphone input and observe the output using a loudspeaker.

Course outcomes (Course Skill Set):

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

1. Design and analyze the BJT/FET amplifier and oscillator circuits.
2. Design and test Op-amp circuits to realize the mathematical computations, DAC and precision rectifiers.
3. Design and test the combinational logic circuits for the given specifications.
4. Test the sequential logic circuits for the given functionality.
5. Demonstrate the basic circuit experiments using 555 timer.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural

knowledge will carry a weightage of 60% and the rest 40% for viva-voce.

- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero. The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. David A Bell, "Fundamentals of Electronic Devices and Circuits Lab Manual", 5th Edition, 2009, Oxford University Press.
2. Albert Malvino, David J Bates, Electronic Principles, 7th Edition, Mc Graw Hill Education, 2017.
3. Fundamentals of Logic Design, Charles H Roth Jr., Larry L Kinney, Cengage Learning, 7th Edition.

Electronic Devices		Semester	3
Course Code	22UEC315A	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives: This course will enable students to:

1. Understand the basics of semiconductor physics and electronic devices.
2. Describe the mathematical models BJTs and FETs along with the constructional details.
3. Understand the construction and working principles of optoelectronic devices
4. Understand the fabrication process of semiconductor devices and CMOS process integration.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method(L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative(Group)Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real-world and when that's possible, it helps improve the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.

Module-1

Semiconductors

Bonding forces in solids, Energy bands, Metals, Semiconductors and Insulators, Direct and Indirect semiconductors, Electrons and Holes, Intrinsic and Extrinsic materials, Conductivity and Mobility, Drift and Resistance, Effects of temperature and doping on mobility, Hall Effect. **(Text1:3.1.1, 3.1.2, 3.1.3, 3.1.4, 3.2.1, 3.2.3, 3.2.4, 3.4.1, 3.4.2, 3.4.3, 3.4.5).**

Module-2

PN Junctions: Forward and Reverse biased Junctions-Qualitative description of Current flow at a junction, reverse bias, Reverse bias breakdown- Zener breakdown, avalanche breakdown, Rectifiers. **(Text1:5.3.1, 5.3.3, 5.4, 5.4.1, 5.4.2, 5.4.3)** Optoelectronic Devices Photodiodes:

Current and Voltage in an Illuminated Junction, Solar Cells, Photodetectors. Light Emitting Diode: Light Emitting materials.

(Text1:8.1.1, 8.1.2, 8.1.3, 8.2, 8.2.1),

Module-3

Bipolar Junction Transistor

Fundamentals of BJT operation, Amplification with BJTS, BJT Fabrication, the coupled Diode model (Ebers-Moll Model), Switching operation of a transistor, Cutoff, saturation, switching cycle, specifications, Drift in the base region, Base narrowing, Avalanche breakdown.

(Text1:7.1, 7.2, 7.3, 7.5.1, 7.6, 7.7.1, 7.7.2, 7.7.3)

Module-4

Field Effect Transistors

Basic p-n JFET Operation, Equivalent Circuit and Frequency Limitations, MOSFET-Two terminal MO S-structure- Energy band diagram, Ideal Capacitance -Voltage Characteristics and Frequency Effects, Basic MOSFET Operation MOSFET structure, Current-Voltage Characteristics.

(Text2:9.1.1, 9.4, 9.6.1, 9.6.2, 9.7.1, 9.7.2, 9.8.1, 9.8.2).

Module-5

Fabrication of p-n junctions

Thermal Oxidation, Diffusion, Rapid Thermal Processing, Ion implantation, chemical vapour deposition, photolithography, Etching, metallization. **(Text 1: 5.1)**

Integrated Circuits

Background, Evolution of ICs, CMOS Process Integration, Integration of Other Circuit Elements. **(Text 1:9.1, 9.2, 9.3.1, 9.3.3).**

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Understand the principles of semiconductor Physics
2. Understand the principles and characteristics of different types of semiconductor devices
3. Understand the fabrication process of semiconductor devices
4. Utilize the mathematical models of semiconductor junctions for circuits and systems.
5. Identify the mathematical models of MOS transistors for circuits and systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of

the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at theend of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers forthe course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:Books

1. Ben. G. Streetman, Sanjay Kumar Banerjee, "Solid State Electronic Devices",7thEdition, PearsonEducation, 2016, ISBN978-93-325-5508-2.
2. Donald A Neamen, Dhrubes Biswas, "Semiconductor Physics and Devices", 4thEdition, McGraw **Hill** Education, 2012, ISBN 978-0-07- 107010-2.

Reference Books:

3. S.M. Sze, KwokK.Ng,"PhysicsofSemiconductorDevices",3rdEdition, Wiley,2018.
4. AdirBar-Lev,"SemiconductorandElectronicDevices",3rd Edition, PHI, 1993

Sensors and Instrumentation		Semester	3
Course Code	22UEC315C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives:

1. Understand various technologies associated in manufacturing of sensors
2. Acquire knowledge about types of sensors used in modern digital systems
3. Get acquainted about material properties required to make sensors
4. Understand types of instrument errors and circuits for multirange Ammeters and Voltmeters.
5. Describe principle of operation of digital measuring instruments and Bridges.
6. Understand the operations of transducers and instrumentation amplifiers.

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teacher can use to accelerate the attainment of the various courseoutcomes.

1. Lecture method(L) does not mean only traditional lecture method, but different type ofteaching methods may be adopted to develop the outcomes.
2. Encourage collaborative(Group)Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotescritical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recallit.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come upwith their own creative ways to solve them.
7. Discuss how every concept can be applied to the real-world and when that's possible, it helpsimprove the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and
9. have discussions on the topic in the succeeding classes.

Module-1

Introduction to sensor based measurement systems:
General concepts and terminology, sensor classification, Primary Sensors, material for sensors,
micro sensor technology. (Text 1)

Module-2

Self-generating Sensors-Thermoelectric sensors, piezoelectric sensors, pyroelectric sensors, photovoltaic sensors, electrochemical sensors. (Text 1)

Module-3

Principles of Measurement: Static Characteristics, Error in Measurement, Types of Static Error. (Text2: 1.2-1.6)
Multirange Ammeters, Multirange voltmeter. (Text2:3.2,4.4)
Digital Voltmeter: Ramp Technique, Dual slope integrating Type DVM, Direct Compensation typeand Successive Approximations type DVM (Text 2: 5.1-5.3, 5.5,5.6)

Module-4

Digital Multimeter: Digital Frequency Meter and Digital Measurement of Time, Function Generator. **Bridges:** Measurement of resistance: Wheatstone's Bridge, AC Bridges - Capacitance andInductance Comparison bridge, Wien's bridge.
(Text2:refer 6.2,6.3 up to 6.3.2, 6.4 up to 6.4.2, 8.8, 11.2, 11.8 -11.10, 11.14).

Module-5

Transducers: Introduction, Electrical Transducer, Resistive Transducer, Resistive position Transducer,Resistance Wire Strain Gauges, Resistance Thermometer, Thermistor, LVDT. (Text2:13.1-13.3,13.5, 13.6 up to 13.6.1,13.7,13.8,13.11).
Instrumentation Amplifier using Transducer Bridge, Temperature indicators using Thermometer,Analog Weight Scale(Text2:14.3.3, 14.4.1, 14.4.3).

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Understand the material properties required to make sensors
2. Understand the principle of transducers for measuring physical parameters.
3. Describe the manufacturing process of sensors
4. Analyze the instrument characteristics and errors.
5. Describe the principle of operation and develop circuits for multirange Ammeters, Voltmeters and Bridges to measure passive component values and frequency.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then onlyone assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at

the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)

4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. "Sensors and Signal Conditioning", Ramon Pallas Areny, JohnG. Webster,2nd edition, John Wiley and Sons,2000
2. H.S.Kalsi, "Electronic Instrumentation", Mc Graw Hill,3rd Edition,2012,ISBN:9780070702066.

Reference Books

1. David A. Bell, "Electronic Instrumentation & Measurements", Oxford University Press PHI 2nd Edition, 2006, ISBN 81-203-2360-2.
2. D. HelfrickandW.D. Cooper, "Modern Electronic Instrumentation and MeasuringTechniques", Pearson, 1stEdition, 2015, ISBN: 9789332556065.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Computer Organization and Architecture		Semester	3
Course Code	22UEC315B	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type (SEE)	Theory		

Course objectives: This course will enable students to:

1. Explain the basic sub systems of a computer, their organization, structure and operation.
2. Illustrate the concept of programs as sequences of machine instructions.
3. Demonstrate different ways of communicating with I/O devices
4. Describe memory hierarchy and concept of virtual memory.
5. Illustrate organization of simple pipelined processor and other computing systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world-and when that's possible,it helps improve the students' understanding.
8. Adopt Flipped class technique by sharing the materials/Sample Videos prior to the class and have discussions on the topic in the succeeding classes.

Module-1

Basic Structure of Computers: Computer Types, Functional Units, Basic Operational Concepts, Bus Structures, Software, Performance -Processor Clock, Basic Performance Equation**(upto1.6.2ofChap1ofText).**

Machine Instructions and Programs: Numbers, Arithmetic Operations and Characters, IEEE standard for Floating Point Numbers, Memory Location and Addresses, Memory Operations, Instructions and Instruction Sequencing **(up to 2.4.6 of Chap 2 and 6.7.1 of Chap 6 of Text).**

Module-2

Addressing Modes, Assembly Language, Basic Input and Output Operations, Stacks andQueues, Subroutines, Additional Instructions **(from 2.4.7 of Chap2, except 2.9.3, 2.11 & 2.12 of Text).**

Module-3

Input/ Output Organization: Accessing I/O Devices, Interrupts -Interrupt Hardware, Enabling and Disabling Interrupts, Handling Multiple Devices, Controlling Device Requests, Direct Memory Access
(up to 4.2.4 and 4.4 except 4.4.1of Chap 4 of Text).

Module-4

Memory System: Basic Concepts, Semiconductor RAM Memories-Internal organization of memory chips, Static memories, Asynchronous DRAMS, Read Only Memories, Cash Memories, Virtual Memories, Secondary Storage Magnetic Hard Disks **(5.1, 5.2, 5.2.1, 5.2.2, 5.2.3, 5.3, 5.5 (except 5.5.1 to** 5.5.4), 5.7 (except5.7.1), 5.9, 5.9.1 of Chap 5 of Text).

Module-5

Basic Processing Unit: Some Fundamental Concepts, Execution of a Complete Instruction, Multiple Bus Organization, Hardwired Control, Microprogrammed Control **(up to 7.5 except 7.5.1 to7.5.6 of Chap 7 of Text).**

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Explain the basic organization of a computer system.
2. Describe the addressing modes, instruction formats and program control statement.
3. Explain different ways of accessing an input/ output device including interrupts.
4. Illustrate the organization of different types of semiconductor and other secondary storage memories.
5. Illustrate simple processor organization based on hard wired control and micro-Programmed control.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE(Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments atthe end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall bescaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.

There will be 2 questions from each module. Each of the two questions under a module (witha maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

Book

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky: Computer Organization, 5th Edition, Tata McGrawHill,2002.

Reference Books:

2. David A. Patterson, John L. Hennessy: Computer Organization and Design-The Hardware/ Software Interface ARM Edition, 4th Edition, Elsevier,2009.
3. William Stallings: Computer Organization &Architecture,7th Edition, PHI, 2006.
4. Vincent P. Heuring & Harry F. Jordan: Computer Systems Design and Architecture, 2nd Edition, Pearson Education, 2004.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Course Outcomes	Pos												PSOs		
	a	**b**	**c**	**d**	**E**	**f**	**g**	**h**	**i**	**J**	**k**	**l**	**m**	**n**	**O**
CO1: Explain the basic organization of a computer system.	2	2	2	1	2	-	-	-	-	-	2	1	2	-	2
CO2: Describe the addressing modes, instruction formats and program control statement.	3	2	1	1	1	-	-	-	-	-	2	1	1	1	2
CO3: Explain different ways of accessing an input/output device including interrupts.	2	1	2	1	1	-	-	-	-	-	2	1	2	1	1
CO4: Illustrate the organization of different types of semiconductor and other secondarystorage memories	1	2	3	1	3	1	-	-	-	-	2	1	2	1	-
CO5: Illustrate simple processor organization based on hard wired control and micro-programmed control.	1	2	2	1	2	-	-	-	-	-	2	1	3	-	1
Course Contribution to POs	**1.8**	**1.8**	**2**	**1**	**1.8**	**1**					**2**	**1**	**2**	**1**	**1.5**

Applied Numerical Methods for EC Engineers		Semester	3
Course Code	22UEC315D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course objectives:

1. To provide the knowledge and importance of error analysis in engineering problems
2. To represent and solve an application problem using a system of linear equations
3. Analyze regression **data** to choose the most appropriate model for a situation.
4. Familiarize with the ways of solving complicated mathematical problems numerically
5. Prepare **to solve** mathematical models represented by initial or boundary value problems

Teaching-Learning Process Pedagogy
(General Instructions):

These are sample Strategies, teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied Mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will assign homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students to group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
   i. As an introduction to new topics (pre-lecture activity).
   ii. As a revision of topics (post-lecture activity).
   iii. As additional examples (post-lecture activity).
   iv. As an additional material of challenging topics (pre-and post-lecture activity).
   v. As a model solution of some exercises (post-lecture activity).

Module-1: Errors in computations and Root of the equations

Approximations and Round Off -Errors in computation: Error definitions, Round-Off errors, Truncation errors and the Taylor series-The Taylor series, Error Propagation, Total numerical error, Absolute, Relative and percentage errors, Blunders, Formulation errors and data uncertainty. Roots of equations: Simple fixed point iteration methods. Secant Method, Muller's method, and Graeffe's Roots Squaring Method. Aitkin's Method. **(8 hours)**

Module-2: Solution of System of Linear Equations

Rank of the matrix, Echelon form, Linearly dependent and independent equations, Solutions for linear equations, Partition method, Croute's Triangularisation method. Relaxation method. Solution of non-linear simultaneous equations by Newton-Raphson method. Eigen Values and properties, Eigen Vectors, Bounds on Eigen Values, Jacobi's method, Given's method for symmetric matrices. **(8 hours)**

Module-3: Curve Fitting
Least-Squares Regression: Linear Regressions, Polynomial regressions, Multiple Linear regressions, General Linear Least squares, Nonlinear Regressions, QR Factorization. Curve Fitting with Sinusoidal Functions Introduction to Splines, Linear Splines, Quadratic Splines, Cubic Splines. Bilinear Interpolation. **(8 hours)**
Module-4: Numerical integration, Difference equations and Boundary Value Problems
Romberg’s method, Euler-Maclaurin formula, Gaussian integration for n = 2 and n=3. Numerical double integration by trapezoidal and Simpson’s 1/3 rd rule. Solution of linear difference equations. Boundary-Value Problems, Introduction. The Shooting Method, Finite-Difference Methods. **(8 hours)**
Module-5: Numerical solution of partial differential equations
Classifications of second-order partial differential equations, Finite difference approximations to partial derivatives. Solution of: Laplace equation, Poisson equations, one-dimensional heat equation and wave equations. **(8 hours)**
Course outcome (Course Skill Set) At the end of the course, the student will be able to: 1. Explain and measure errors in numerical computations 2. Test for consistency and solve a system of linear equations. 3. Construct a function which closely fits given n- n-points of an unknown function. 4. Understand and apply the basic concepts related to solving problems by numerical differentiation and numerical integration. 5. Use appropriate numerical methods to study phenomena modelled as partial differential equations.
Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20marks out of 50) and for the SEE, the minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the **CIE** (Continuous Internal Evaluation) and **SEE** (Semester End Examination) taken together. **Continuous Internal Evaluation:** 1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component. 2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project- based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

The Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books (Name of the author/Title of the Book/Name of the publisher/Edition and Year)Text Books:

1. **Steven C. Chapra & Raymond P. Canale: "**Numerical Methods for Engineers and Scientists", McGraw Hill, 8^{th} Edition, 2020.
2. **Steven C. Chapra**: "Applied Numerical Methods with MATLAB for Engineers and Scientists", McGraw Hill, Fifth Edition, 2023.
3. **B. S. Grewal**: "Numerical Methods in Engineering & Science with programs in C, C++and MATLAB", Khanna Publishers, 10^{h}Ed., 2015.

Reference Books:

1. **John H. Mathews & Kurtis D. Frank**: "Numerical Methods Using MATLAB", PHI Publications, 4th Edition, 2005.

Won Young Yang, Wenwu Cao, Tae Sang Chung, John Morris: "Applied Numerical Methods Using MATLAB**",** WILEY Inter science**,** Latest Edition, 2005.

Activity-Based Learning (Suggested Activities in Class)/Practical-Based Learning

- Quizzes
- Assignments
- Seminar

Lab VIEW Programming		Semester	3
Course Code	22UEC316D	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Total	100
		Exam Hours	2
Examination type (SEE)	Practical		

Course objectives:

1. Aware of various front panel controls and indicators.
2. Connect and manipulate nodes and wires in the block diagram.
3. Locate various tool bars and pull-down menus for the purpose of implementing specific functions.
4. Locate and utilize the context help window.
5. Familiar with LabVIEW and different applications using it.

Sl. NO	VI Programs(using LabVIEW software)to realize the following:
1	Basic arithmetic operations: addition, subtraction, multiplication and division
2	Boolean operations: AND, OR, XOR, NOT and NAND
3	Sum of ‘n’ numbers using ‘for’ loop
4	Factorial of a given number using ‘for’ loop
5	Determine square of a given number
6	Factorial of a given number using ‘while‘ loop
7	Sorting even numbers using ‘while’ loop in an array
8	Finding the array maximum and array minimum
	Demonstration Experiments (For CIE)
9	Build a Virtual Instrument that simulates a heating and cooling system. The system must be able to be controlled manually or automatically.
10	Build a Virtual Instrument that simulates a Basic Calculator (using formula node).
11	Build a Virtual Instrument that simulates a Water Level Detector.
12	DemonstratehowtocreateabasicVIwhichcalculatestheareaandperimeterofacircle.

Course outcomes (Course Skill Set):

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

1. Use LabVIEW to create data acquisition, analysis and display operations
2. Create user interfaces with charts, graph and buttons
3. Use the programming structures and data types that exist in LabVIEW
4. Use various editing and debugging techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between

the schedule mentioned in the academic calendar of the University.

- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. Virtual Instrumentation using LABVIEW, Jovitha Jerome, PHI,2011
   Virtual Instrumentation using LABVIEW, Sanjay Gupta, Joseph John, TMH, McGraw-Hill, Second Edition, 2011.

MATLAB Programming		Semester	3
Course Code	22UEC316C	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0	SEE Marks	50
Total Hours of Pedagogy	14	Total Marks	100
Credits	01	Exam Hours	1
Examination type (SEE)	Theory		

Course objectives:

- Understand the MATLAB commands and functions.
- Create and Execute the script and function files
- Work with built in function, saving and loading data and create plots.
- Work with the arrays, matrices, symbolic computations, files and directories.
- Learn MATLAB programming with script, functions and language specific features.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Adopt Problem Based Learning (PBL), which fosters students' analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
2. Give programming assignments.

Module-1

Introduction: Basics of MATLAB, Simple arithmetic calculations, Creating and working with arrays and numbers.

Module-2

Creating and printing simple plots, Creating, saving and executing a script file, Creating and executing a function file, Working with arrays and matrices.

Module-3

Working with anonymous functions, Symbolic Computations, Importing and exporting data, Working with files and directories.

Module-4

Interactive computations: Matrices and vectors, Matrix and array operations, Character strings, Command line functions, Built-in functions, Saving and loading data, Plotting simple plots.

Module-5

Programming in MATLAB: Script Files, Function Files, Language specific Features.

Course outcome (Course Skill Set)

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

1. Understand the syntax of MATLAB for arithmetic computations, arrays, matrices.
2. Understand the built in function, saving and loading data, and create plots
3. Create program using symbolic computations, Importing and exporting data and files
4. Create program using character strings, Command line functions and Built-in functions.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

1. For the Assignment component of the CIE, there are 25 marks and for the Internal AssessmentTest component, there are 25 marks.
2. The first test will be administered after 40-50% of the syllabus has been covered, and the secondtest will be administered after 85-90% of the syllabus has been covered
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
4. For the course, CIE marks will be based on a scaled-down sum of two tests and other methods ofassessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

OR

MCQ (Multiple Choice Questions) are preferred for 01 credit courses, however, if course content demands the general question paper pattern that followed for 03 credit course, then

1. The question paper will have ten questions. Each question is set for 10 marks.
2. There will be 2 questions from each module. Each of the two questions under a module may or may nothave the sub-questions (with maximum sub-questions of 02, with marks distributions 5+5, 4+6, 3+7).
3. The students have to answer 5 full questions, selecting one full question from each module.
4. **The duration of the examinations shall be defined by the concerned board of studies**

Suggested Learning Resources: Book

1. Rudra Pratap, Getting Started with MATLAB – A quick Introduction for scientists and Engineers, Oxford University Press, 2010.

Web links and Video Lectures (e-Resources):

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

C++ Basics		Semester	4
Course Code	22UEC316A	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	1	Exam Hours	02
Examination nature (SEE)	Practical		

Course objectives:

- Understand object-oriented programming concepts, and apply them in solving problems.
- To create, debug and run simple C++ programs.
- Introduce the concepts of functions, friend functions, inheritance, polymorphism and function overloading.
- Introduce the concepts of exception handling and multithreading.

Sl. No	Experiments
1	Write a C++ program to find largest, smallest & second largest of three numbers using inline functions MAX & Min.
2	Write a C++ program to calculate the volume of different geometric shapes like cube, cylinder and sphere using function overloading concept.
3	Define a STUDENT class with USN, Name & Marks in 3 tests of a subject. Declare an array of 10 STUDENT objects. Using appropriate functions, find the average of the two better marks for each student. Print the USN, Name & the average marks of all the students.
4	Write a C++ program to create class called MATRIX using two-dimensional array of integers, by overloading the operator == which checks the compatibility of two matrices to be added and subtracted. Perform the addition and subtraction by overloading + and – operators respectively. Display the results by overloading the operator <<. If (m1 == m2) then m3 = m1 + m2 and m4 = m1 – m2 else display error
5	Demonstrate simple inheritance concept by creating a base class FATHER with data members: *First Name, Surname, DOB & bank Balance* and creating a derived class SON, which inherits: Surname & Bank Balance feature from base class but provides its own feature: First Name & DOB. Create & initialize F1 & S1 objects with appropriate constructors & display the FATHER & SON details.
6	Write a C++ program to define class name FATHER & SON that holds the income respectively. Calculate & display total income of a family using Friend function.
7	Write a C++ program to accept the student detail such as name & 3 different marks by get_data () method & display the name & average of marks using display () method. Define a friend function for calculating the average marks using the method mark_avg ().
8	Write a C++ program to explain virtual function (Polymorphism) by creating a base class polygon which has virtual function areas two classes rectangle & triangle derived from polygon & they have area to calculate & return the area of rectangle & triangle respectively.

9	Design, develop and execute a program in C++ based on the following requirements: An EMPLOYEE class containing data members & members functions: i) Data members: employee number (an integer), Employee_ Name (a string of characters), Basic_ Salary (in integer), All_ Allowances (an integer), Net_Salary (an integer). (ii) Member functions: To read the data of an employee, to calculate Net_Salary & to print the values of all the data members. (All_Allowances = 123% of Basic, Income Tax (IT) =30% of gross salary (=basic_ Salary_All_Allowances_IT).
10	Write a C++ program with different class related through multiple inheritance & demonstrate the use of different access specified by means of members variables & members functions.
11	Write a C++ program to create three objects for a class named count object with data members
	such as roll no & Name. Create a members function set data () for setting the data values & display ( ) member function to display which object has invoked it using „this‟ pointer.
12	Write a C++ program to implement exception handling with minimum 5 exceptions classes including two built in exceptions.

Course outcomes (Course Skill Set):

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

1. Write C++ program to solve simple and complex problems
2. Apply and implement major object-oriented concepts like message passing, function overloading, operator overloading and inheritance to solve real-world problems.
3. Use major C++ features such as Templates for data type independent designs and File I/O to deal with large data set.
4. Analyze, design and develop solutions to real-world problems applying OOP concepts of C++

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Object oriented programming in TURBO C++, Robert Lafore, Galgotia Publications, 2002
2. The Complete Reference C++, Herbert Schildt, 4th Edition, Tata McGraw Hill, 2003.
3. Object Oriented Programming with C++, E Balaguruswamy, 4th Edition, Tata McGraw Hill, 2006.

IoT for Smart Infrastructure		Semester	3
Course Code	22UEC316B	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	14	Total Marks	100
Credits	01	Exam Hours	1
Examination type (SEE)	Theory/Practical		

Course objectives:

- To provide an understanding of the concepts, principles, and applications of IoT in the context of smart infrastructure.
- To explore the role of IoT technologies in transforming infrastructure into smart, efficient, and sustainable systems and analyze the challenges, opportunities, and considerations in implementingIoT for smart infrastructure.
- To examine real-world case studies and successful implementations of IoT in smart cities, buildings, transportation, and energy management and explore future trends and emerging technologies shaping the field of IoT for smart infrastructure.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

- **Interactive Lectures:** Conduct interactive lectures to present the theoretical concepts and foundational knowledge of IoT for smart infrastructure.
- **Case Studies and Group Discussions:** Utilize case studies to analyze real-world implementations of IoT in smart infrastructure projects. Divide students into groups and assign them specific cases to discuss and analyze.
- **Hands-on Workshops and Simulations:** Organize hands-on workshops or simulations where students can interact with IoT devices and technologies relevant to smart infrastructure.
- **Guest Lectures and Industry Experts:** Invite guest speakers or industry experts who have hands-on experience in implementing IoT in smart infrastructure projects. They can share their insights, challenges, and success stories, providing students with a real-world perspective
- **Project-Based Learning:** Assign students to work on individual or group projects relatedto IoT for smart infrastructure. Provide a project brief with specific objectives and deliverables. Students can apply their knowledge and skills to design, develop, or analyze IoT solutions for smart infrastructure challenges.

Module-1
Introduction to IoT and Smart Infrastructure Introduction to IoT: Definition of IoT and its basic components, Overview of IoT applications in various industries, Importance of IoT in transforming infrastructure. Smart Infrastructure Overview: Introduction to smart infrastructure and its key components, Benefits and challenges of implementing smart infrastructure, Case studies showcasing successful smart infrastructure projects. IoT Technologies for Smart Infrastructure: Sensors and actuators: Types, functionalities, and applications; Communication protocols: Wi-Fi, Bluetooth, cellular networks, and their use in IoT;
Cloud computing and data analytics in IoT for infrastructure; Edge computing: Real-time decision-making at the edge. Security and Privacy in IoT for Smart Infrastructure: Security challenges and threats in IoT, Privacy considerations and data protection in smart infrastructure, best practices and solutions for ensuring IoT security and privacy.
Module-2
IoT Applications in Smart Cities Introduction to Smart Cities - Definition and key features of smart cities, Role of IoT in transforming cities into smart cities, Benefits and challenges of smart city implementations. IoT Applications in Smart City Infrastructure - Smart transportation: Intelligent traffic management and transportation systems, Smart buildings: Energy management and occupant comfort; Smart grids: Optimizing energy distribution and consumption; Waste management, water management, and environmental monitoring. Case Studies of Smart City Implementations: Showcase of successful smart city projects around the world; Analysis of the IoT technologies and strategies implemented; Lessons learned from these case studies. Future Trends in Smart Cities: Emerging technologies shaping the future of smart cities, Role of IoT, AI, and 5G in advancing smart city infrastructure, Opportunities and challenges for future smart city developments.
Module-3
IoT Applications in Smart Buildings Introduction to Smart Buildings: Definition and key features of smart buildings, Benefits of IoT in improving energy efficiency and occupant comfort, Challenges and considerations in implementing smart building technologies. IoT Technologies for Smart Buildings: Building automation systems and controls; Energy management and monitoring using IoT devices; Indoor environmental quality monitoring and optimization; Smart lighting and HVAC systems. Case Studies of Smart Building Implementations: Showcase of successful smart building projects; Analysis of IoT technologies and solutions deployed; Lessons learned from these case studies. Future Trends in Smart Buildings: Emerging technologies for smart buildings; Integration of IoT with AI and machine learning; Potential impact of 5G on smart building applications.

Module-4
IoT Applications in Smart Transportation Introduction to Smart Transportation: Definition and key features of smart transportation; Role of IoT in intelligent traffic management and transportation systems; Challenges and opportunities in implementing smart transportation solutions. IoT Technologies for Smart Transportation: Traffic sensors and monitoring systems; Intelligent transportation systems (ITS); Vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication; Real-time data analysis and predictive analytics.
Case Studies of Smart Transportation Implementations: Showcase of successful smart transportation projects; Analysis of IoT technologies and solutions deployed; Lessons learned from these case studies. Future Trends in Smart Transportation: Emerging technologies shaping the future of smart transportation; Role of IoT, AI, and autonomous vehicles; Potential impact of 5G on smart transportation applications.
Module-5
IoT for Smart Grids and Energy Management Introduction to Smart Grids: Definition and key features of smart grids: Role of IoT in optimizing energy distribution and consumption; Benefits and challenges of smart grid implementations. IoT Technologies for Smart Grids: Smart meters and energy monitoring devices; Demand response and load management; Grid optimization and fault detection using IoT; Renewable energy integration and grid stability. Case Studies of Smart Grid Implementations: Showcase of successful smart grid projects, Analysis of IoT technologies and solutions deployed, Lessons learned from these case studies. Future Trends in Smart Grids and Energy Management: Emerging technologies for smart grids;Integration of IoT, AI, and block chain in energy management; Potential impact of 5G on smartgrid applications.
Course outcome (Course Skill Set) At the end of the course the student will be able to: • Define and explain the core concepts and components of IoT and its relevance to smart infrastructure. Identify and evaluate the key technologies and communication protocols used in IoT for smart infrastructure. • Assess the benefits, challenges, and ethical considerations associated with implementing IoT in smart infrastructure projects and analyze & compare different IoT applications in smart cities, buildings, transportation, and energy management. • Examine real-world case studies of successful IoT implementations in smart infrastructure and extract lessons learned. Demonstrate an understanding of security and privacy considerations in IoT for smart infrastructure. • Discuss the impact of emerging technologies, such as artificial intelligence and 5G, on the future of IoT in smart infrastructure. Apply knowledge and critical thinking skills to propose IoT-based solutions for smart infrastructure challenges. • Work effectively in teams to analyze, design, and present IoT projects related to smart

infrastructure and communicate effectively and articulate the potential benefits and limitations of IoT for smart infrastructure.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous internal Examination (CIE)

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Web links and Video Lectures (e-Resources): makes.mindmatrix.io

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Sensor Deployment and Data Collection: Organize a hands-on activity where participants work in groups to deploy sensors in a simulated smart infrastructure environment.
2. Smart City Simulation Game: Develop a simulation game where participants take on different roles representing stakeholders in a smart city.
3. IoT Solution Design Challenge: Assign participants to design an IoT-based solution for a specific smart infrastructure problem. They can work individually or in teams to identify the problem, propose an IoT solution, outline the required components and technologies, and create a prototype or presentation.
4. Security and Privacy Risk Assessment: Conduct a group activity where participants analyse the security and privacy risks associated with IoT deployments in smart infrastructure.

Field Visit to Smart Infrastructure Project: Organize a field visit to a smart infrastructure project, such as a smart building, smart city district, or IoT-enabled transportation system.

SOCIAL CONNECT & RESPONSIBILITIES			
Course Code	**21SCR36**	**CIE Marks**	**50**
Teaching Hours week (L:T:P:S)	1: 0: 0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	03
Department	Management Studies / Engineering Department		
Offered for	3rd Semester		
Prerequisite	Nil		

Objectives: The Course will

- Enable the student to do a deep drive into societal challenges being addressed by NGO(s), social enterprises & The government and build solutions to alleviate these complex social problems through immersion, design & technology.
- Provide a formal platform for students to communicate and connect with their surroundings.
- Enable to create of a responsible connection with society.

Learning Outcomes: The students are expected to have the ability to :

1. Understand social responsibility
2. Practice sustainability and creativity
3. Showcase planning and organizational skills

Contents:

The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large. The course will engage studentsinr interactive sessions, open mic, reading groups, storytelling sessions, and semester-long activities conducted by faculty mentors. In the following a set of activities planned for the course have been listed :

Module-I

Plantation and adoption of a tree: Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Module-II

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

Module-III

Organic farming and waste management: usefulness of organic farming, wet waste managementin neighboring villages, and implementation in the campus.

Module-IV

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.

Module-V

Food Walk City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Activities

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. **Share the experience of Social Connect**. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

A total of 14-20 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into 10 groups of 35 each. Each group will be handled by two **faculty mentors**. Faculty mentors will design the activities (particularly Jammingsessions open mic ,and poetry)

Faculty mentors has to design the evaluation system.

Course Outcomes	Pos												PSOs		
	a	b	c	d	e	f	g	H	i	J	k	l	m	n	o
CO1: Understand social responsibility	-	-	-	-	-	-	2	1	3	3	-	3	-	-	-
CO2: Understand Indian culture and history	-	-	-	-	-	-	2	-	1	3	-	3	-	-	-
CO3: Understand smart agriculture	-	-	-	1	-	3	3	-	2	3	3	3	-	-	-
CO4: Practice sustainability and creativity	-	-	-	-	-	3	2	2	2	3	2	3	-	-	-
CO5: Showcase planning and organizational skills	-	-	-	-	-	1	1	-	2	3	-	3	-	-	-
Course Contribution to POs	**-**	**-**	**-**	**1**	**-**	**2.3**	**2**	**1.5**	**2**	**3**	**2.5**	**3**	**-**	**-**	**-**

Guideline forAssessment Process:

Continuous Internal Evaluation (CIE)

After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

Marks allotted for the diary are out of 50.

Planning and scheduling the social connect

Information/Data collected during the social connect

Analysis of the information/data and report writing

Considering all above points allotting the marks as mentioned below-

Excellent	80 to 100
Good	60 to 79
Satisfactory	40 to 59
Unsatisfactory and fail	<39

Semester End Examination (SEE)

This Jamming session will be conducted at the end of the course for **50 marks**

Jamming session includes -Platform to connect to others. Share the stories with others. **Share the experience of Social Connect**. Exhibit the talent like playing instruments, singing, one-act play, art painting, and fine art.

Faculty mentor has to design the evaluation system for the Jamming session.

Pedagogy (Guidelines) may differ depending on local resources available for the study

Module	Topic	Content	Group Size	Location	Magnitude	Activity	Reporting	Evaluation
I	Plantation and adoption ofa tree	Plantation of a tree that will be adopted for four years by a group of B.Tech. students. They will also make an excerpt either as a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.	03 – 05	Farmers Land or Road side or Community area or institution's campus, any one location to be selected.	One Students must monitor itfor three years	Site selection Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO/Industry and community to plant Tag the plant for continuous monitoring	Report shall be hand writtenn or blog with paintings, sketches, poster, video and/or photograph with Geo tag.	Each module is evaluated for 50 Marks and average of all the five modules will be the final marks. **CIE Rubrics for 50 M** Planning and scheduling the social connect – 15 M Information/Data collected during the social connect – 15 M Analysis of the information/data and report writing – 20 M **SEE 50 M:** Presentation, Jamming session, Open mic, Group
II	Heritage walk and crafts corner	Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.	03 - 05	Preferably Within the city where institution is located or home town of the student group	One or two One can be a structure or a heritage building theother can be heritage custom or practise	Survey in the form of questioner by connecting to the people and asking. No standard questioner to be given by faculty and has to be evolved involving students. Questions during survey can be asked in local language but report language is English.		
III	Waste management	Wet waste management in neighbouring villages, and implementation in the campus.	03 - 05 More than one group can be	Preferably in the nearby villages and within the campus.	One	Report on importance and benefits of Waste management. Report on segregation, collection, transportation and disposal.		

			assigne d one task based on magnitude of task.			Suggestion for composting. Visit nearby village/location to sensitize farmers andpublic about waste management and also document current practises.		discussion and debate.
III	Organic farming	Usefulness of organic farming in neighbouring villages, and implementationin the campus.	03 – 05	Visit to farming lands where organic farming is going on Campus Garden Roof top Garden or Vertical Garden or hydroponics if land is scarce.	One	Collect data on organic farming in the vicinity.Like types of crop, methodology etc.,. Suggestion for implementation at selected locations		
IV	Water Conservati on	Knowing the present practices in the surroundingvillages and implementationin the campus, documentaryor photo blog presenting thecurrent practices.	03 – 05	Rain water harvesting demonstration available in the campus or surroundings	One	Visit lakes/pond/river/dry well to involve on rejuvenation activity. Or Assessment of Water budget in the campus/village		

						Report on traditional water conservation practices (to minimize wastage)		
V	Food Walk	City's culinary practices, food lore, and indigenous materials of the region used in cooking.	03 - 05	Within the city where institution is located Food culture of student's resident region	One	Survey local food centres and identify the speciality Identify and study the food ingredients Report on the regional foods Report on Medicinals values of the local food grains, and plants.		

**Important recommendations requested; Special Appreciation from institution and university for students who take care of plants for three years.

IV Sem Syllabus

ELECTROMAGNETIC THEORY		Semester	**IV**
Course Code	**22UEC410C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	THEORY		

Course objectives:

This course will enable students to:

1. Study the different coordinate systems, Physical significance of Divergence, Curl and Gradient.
2. Understand the applications of Coulomb's law and Gauss law to different charge distributions and the applications of Laplace's and Poisson's Equations to solve real time problems on capacitance of different charge distributions.
3. Understand the physical significance of Biot-Savart's, Ampere's Law and Stokes' theorem for different current distributions.
4. Infer the effects of magnetic forces, materials and inductance.
5. Know the physical interpretation of Maxwell's equations and applications for Plane waves for their behavior in different media.
6. Acquire knowledge of Poynting theorem and its application of power flow

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

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1. Lecture method (L) does not mean only traditional lecture method, but different types of teaching methods may be adopted to develop the outcomes.
2. Encourage collaborative (Group) Learning in the class.
3. Ask at least three HOTS (Higher Order Thinking) questions in the class, which promotes critical thinking.
4. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, and develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
5. Topics will be introduced in a multiple representation.
6. Show the different ways to solve the same problem and encourage the students to come up with creative ways to solve them.
7. Discus show every concept can be applied to the real world and when that's possible, it helps improve the student's understanding.
8. Adopt the Flipped class technique by sharing the materials/Sample Videos before the class andhaving discussions on the topic in the succeeding classes.

Module-1

Revision of Vector Calculus – **(Text 1: Chapter 1)** **Coulomb's Law, Electric Field Intensity and Flux density**: Experimental law of Coulomb, Electric field intensity, Field due to continuous volume charge distribution, Field of a line charge, Field due to Sheet of charge, Electric flux density, Numerical Problems. **(Text: Chapter 2.1 to 2.5, 3.1)**
Module-2
Gauss's Law and Divergence: Gauss 'law, Application of Gauss' law to Point Charge, line charge, Surface charge and Volume Charge, Point (differential) form of Gauss law, Divergence. Maxwell's First Equation (Electrostatics), Vector Operator ▼and divergence theorem, Numerical Problems (**Text: Chapter 3.2 to 3.7).**Energy expended or work done in moving a point charge in an Electric field, The line integral (**(Text: Chapter 4.1 and 4.2)** Current and Current density, Continuity of current. **(Text: Chapter 5.1, 5.2)**
Module-3
Poisson's and Laplace's Equations: Derivation of Poisson's and Laplace's Equations, Examples of the solution of Laplace's equation, Numerical problems on Laplace's equation **(Text: Chapters 7.1 and 7.3)** **Steady Magnetic Field**: Biot-Savart Law, Ampere's circuital law, Curl, Stokes' theorem,Magnetic flux and magnetic flux density. (**Text: Chapters 8.1 to 8.5)**
Module-4
Magnetic Forces: Force on a moving charge, differential current elements, Force between differential current elements, Numerical problems **(Text: Chapter 9.1 to 9.3).** **Magnetic Materials**: Magnetization and permeability, Magnetic boundary conditions, the magnetic circuit, problems **(Text: Chapter 9.6 to 9.8)**
Module-5
Faraday's law of Electromagnetic Induction –Integral form and Point form, Numerical problems. Inconsistency of Ampere's law with continuity equation, displacement current, Conduction current, Derivation of Maxwell's equations in point form, and integral form, Maxwell's equations for different media, Numerical problems **(Text: Chapter 10.1 to 10.4)** **Uniform Plane Wave**: Wave propagation in free space, Uniform plane wave, Derivation of plane wave equations from Maxwell's equations, Poynting's Theorem and wave power, Skin effect or Depth of penetration, Numerical problems. **(Text: Chapter 12.1, 12.3, 12.4)**

Course outcome (Course Skill Set)

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

1. Evaluate problems on electrostatic force, electric field due to point, linear, volume charges by applying conventional methods and charge in a volume.
2. Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.
3. Determine potential and energy with respect to point charge and capacitance using Laplace equation and Apply Biot-Savart's and Ampere's laws for evaluating Magnetic field for different current configurations
4. Calculate magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.
5. Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves using Poynting theorem

ssessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
2. Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project based then only one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
4. The final CIE marks of the course out of 50 will be the sum of the scale down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Book:

1. W.H. Hayt and J.A. Buck, —Engineering Electromagnetics, 8th Edition, Tata McGraw- Hill, 2014, ISBN-978-93-392-0327-6.

Reference Books:

1. Elements of Electromagnetics – Matthew N.O., Sadiku, Oxford University press, 4thEdn.
2. Electromagnetic Waves and Radiating systems – E. C. Jordan and K.G. Balman, PHI, 2ndEdn.
3. Electromagnetics- Joseph Edminister, Schaum Outline Series, McGraw Hill.
4. N. Narayana Rao, —Fundamentals of Electromagnetics for Engineering, Pearson

Web links and Video Lectures (e-Resources):

- NPTEL Video lectures: https://youtu.be/pGdr9WLto4A
- NPTEL Video lectures: https://youtu.be/xn2IpxI991M

ActivityBasedLearning(SuggestedActivitiesinClass)/Practical-Based Learning

- Group Discussion/Quiz
- Demonstration of Electromagnetic concepts.
- Case Study on Medical Imaging devices.

-Course Outcomes	Pos												PSOs		
	a	**B**	**c**	**d**	**E**	**f**	**g**	**h**	**i**	**J**	**k**	**l**	**m**	**n**	**O**
CO1: Develop a thorough understanding of different coordinate systems and Evaluate problems on electrostatic force and fields	2	2	3	2	2	-	-	-	-	-	-	2	2	-	-
CO2: Apply Gauss law to evaluate Electric fields due to different charge distributions and Volume Charge distribution by using Divergence Theorem.	2	3	2	2	2	1	-	-	-	-	-	2	3	-	-
CO3: Interpret the physical significance of Laplace's equation, Biot-Savart's law, Ampere's law, and Stokes' theorem for evaluating Magnetic field for different current configurations	3	2	3	3	2	1	-	-	-	-	-	2	3	-	-
CO4: Interpret magnetic force, potential energy and Magnetization with respect to magnetic materials and voltage induced in electric circuits.	2	3	2	2	3	1	-	-	-	-	-	2	3	-	-
CO5: Apply Maxwell's equations for time varying fields, EM waves in free space and conductors and Evaluate power associated with EM waves.	3	3	3	3	3	1	3	-	-	-	-	2	2	-	-
Course Contribution to POs	**2.4**	**2.6**	**2.6**	**2.4**	**2.4**	**1**	**3**	-	**-**	**-**	**-**	**2**	**2.6**	**-**	**-**

PRINCIPLES OF COMMUNICATION SYSTEMS		Semester	4
Course Code	**22UEC411C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

This course will enable students to

- Understand and analyze concepts of Analog Modulation schemes viz; AM, FM
- Design and analyze the electronic circuits for AM and FM modulation and demodulation.
- Understand the concepts of random variable and random process to model communication systems.
- Understand and analyze the concepts of digitization of signals.
- Evolve the concept of SNR in the presence of channel induced noise

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1

Random Variables and Processes: Introduction, Probability, Conditional Probability, Random variables. Statistical Averages: Function of a random variable, Moments, Random Processes, Mean, Correlation and Covariance function: Properties of autocorrelation function, Cross–correlation functions, Gaussian Process: Gaussian Distribution Function. **[Text 2: 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.9]**

MODULE-2
Amplitude Modulation Fundamentals: AM Concepts, Modulation index and Percentage of Modulation, Sidebands and the frequency domain, AM Power, Single Sideband Modulation. **AM Circuits:** Amplitude Modulators: Diode Modulator, Transistor Modulator, collector Modulator. Amplitude Demodulators: Diode Detector, Balanced Modulators: Lattice Modulators. **Frequency Division Multiplexing:** Transmitter-Multiplexer, Receiver-DE multiplexer. **[Text1: 3.1, 3.2, 3.3, 3.4, 3.5, 4.2, 4.3, 4.4, 10.2]**
MODULE-3
Fundamentals of Frequency Modulation: Basic Principles of Frequency Modulation, Principles of Phase Modulation, Modulation index and sidebands, Noise Suppression Effects of FM, Frequency Modulation versus Amplitude Modulation. **FM Circuits:** Frequency Modulators: Voltage Controlled Oscillators., Frequency Demodulators: Slope Detectors, Phase Locked Loops. **Communication Receiver:** Super heterodyne receiver, Frequency Conversion: Mixing Principles, JFET Mixer. **[Text1: 5.1, 5.2, 5.3, 5.4, 5.5, 6.1, 6.3, 9.2, 9.3]**
MODULE-4
Digital Representation of Analog Signals: Introduction, Why Digitize Analog Sources? The Sampling process, Pulse Amplitude Modulation, Time-Division Multiplexing, Pulse Position Modulation: Generation and Detection of PPM wave. The Quantization Process. Pulse Code Modulation: Sampling, Quantization, Encoding, line Codes, Differential encoding, Regeneration, Decoding, filtering, multiplexing. **[Text2: 7.1, 7.2, 7.3, 7.4, 7.5, 7.6, 7.8, 7.9]**
MODULE-5
Baseband Transmission of Digital signals: Introduction, Inter symbol Interference, Eye Pattern, Nyquist criterion for distortion less Transmission, Baseband M-array PAM Transmission. **[Text2: 8.1, 8.4, 8.5, 8.6, 8.7]** **Noise:** Signal to Noise Ratio, External Noise, Internal Noise, Semiconductor Noise, Expressing Noise Levels, Noise in Cascade Stages. **[Text1:9.5]**

PRACTICAL COMPONENT OF IPCC *(Experiments can be conducted using MATLAB/SCILAB/OCTAVE)*

Sl. NO.	Experiments
1	Basic Signals and Signal Graphing: a) unit Step, b) Rectangular, c) standard triangle d) sinusoidal and e) Exponential signal.
2	Illustration of signal representation in time and frequency domains for a rectangular pulse.
3	Amplitude Modulation and demodulation: Generation and display the relevant signals and its spectrums.
4	Frequency Modulation and demodulation: Generation and display the relevant signals and its spectrums.
5	Sampling and reconstruction of low pass signals. Display the signals and its spectrum.
6	Time Division Multiplexing and DE multiplexing.

7	PCM Illustration: Sampling, Quantization and Encoding
8	Generate a) NRZ, RZ and Raised cosine pulse, b) Generate and plot eye diagram
9	Generate the Probability density function of Gaussian distribution function.
10	Display the signal and its spectrum of an audio signal.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

1. Understand the principles of analog communication systems and noise modelling.
2. Identify the schemes for analog modulation and demodulation and compare their performance.
3. Design of PCM systems through the processes sampling, quantization and encoding.
4. Describe the ideal condition, practical considerations of the signal representation for baseband transmission of digital signals.
5. Identify and associate the random variables and random process in Communication system design.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

The IPCC means the practical portion integrated with the theory of the course. CIE marks for the theory componentare **25 marks** and that for the practical component is **25 marks**.

CIE for the theory component of the IPCC

1. 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
2. Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
3. The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

1. **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
2. On completion of every experiment/program in the laboratory, the students shall be evaluated including viva- voce and marks shall be awarded on the same day.
3. The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write- ups are added and scaled down to **15 marks**.
4. The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
5. Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
6. The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

a. The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 sub-questions are to be set from the practical component of IPCC, the total marks of all questions should not be more than 20 marks.
b. SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify for the SEE. Marks secured will be scaled down to 50.
c. The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken
d. together.

Suggested Learning Resources:

Books

1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-0-07-066755-6.
2. Simon Haykin & Michael Moher, Communication Systems, 5th Edition, John Wiley, India Pvt. Ltd, 2010, ISBN: 978-81-265-2151-7.

Reference Books

1. B P Lathi, Zhi Ding, "Modern Digital and Analog Communication Systems", Oxford University Press., 4th edition, 2010, ISBN: 97801980738002.
2. Herbert Taub, Donald L Schilling, Goutam Saha, "Principles of Communication systems", 4th Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-1-25-902985-1

Web links and Video Lectures (e-Resources):

1. Principles of Communication Systems **https://nptel.ac.in/courses/108104091**
2. Communication Engineering **https://nptel.ac.in/courses/117102059**

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Assignments and test – Knowledge level, Understand Level and Apply level
2. Experiential Learning by using free and open source software's SCILAB or OCTAVE
3. Open ended questions by faculty, Open ended questions from students

Control Systems			
Course Code	**22UEC412C**	CIE Marks	50
Teaching Hours/Week (L: T: P)	(3:0:2)	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 12 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives: This course will enable students to:

1. Understand basics of control systems and design mathematical models using block diagram reduction, SFG, etc.
2. Understand Time domain and Frequency domain analysis.
3. Analyze the stability of a system from the transfer function
4. Familiarize with the State Space Model of the system.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain the different concepts of Linear Algebra & Signal Processing.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in a multiple representation.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Adopt Flipped class technique by sharing the materials / Sample Videos prior to the class and have discussions on the that topic in the succeeding classes.
10. Give Programming Assignments.

Module-1

Introduction to Control Systems: Types of Control Systems, Effect of Feedback Systems, Differential equation of Physical Systems -Mechanical Systems, Electrical Systems, Analogous Systems. (Textbook 1: Chapter 1.1, 2.2)

Module-2
Block diagrams and signal flow graphs: Transfer functions, Block diagram algebra and Signal Flow graphs. (Textbook 1: Chapter 2.4, 2.5, 2.6)
Module-3
Time Response of feedback control systems: Standard test signals, Unit step response of First and Second Order Systems. Time response specifications, Time response specifications of second order systems, steady state errors and error constants. Introduction to PI, PD and PID Controllers (excluding design). (Textbook 1: Chapter 5.3, 5.4, 5.5)
Module-4
Stability analysis: Concepts of stability, Necessary conditions for Stability, Routh stability criterion, Relative stability analysis: more on the Routh stability criterion. **Introduction to Root-Locus Techniques**, The root locus concepts, Construction of root loci. (Textbook 1: Chapter 6.1, 6.2, 6.4, 6.5, 7.1, 7.2, 7.3)
Module-5
Frequency domain analysis and stability: Correlation between time and frequency response, Bode Plots, Experimental determination of transfer function. (Textbook 1: Chapter 4: 8.1, 8.2, 8.4) Mathematical preliminaries, Nyquist Stability criterion, (Stability criteria related to polar plots are excluded) (Textbook 1: 9.2, 9.3) **State Variable Analysis:** Introduction to state variable analysis: Concepts of state, state variable and state models. State model for Linear continuous –Time systems, solution of state equations. (Textbook 1: 12.2, 12.3, 12.6)

PRACTICAL COMPONENT OF IPCC

Using suitable simulation software (P-Spice/ MATLAB / Python / Scilab / OCTAVE / LabVIEW) demonstrate the operation of the following circuits:

Sl. No.	Experiments
1	Implement Block diagram reduction technique to obtain transfer function a control system.
2	Implement Signal Flow graph to obtain transfer function a control system.
3	Simulation of poles and zeros of a transfer function.
4	Implement time response specification of a second order Under damped System, for different damping factors.
5	Implement frequency response of a second order System.
6	Implement frequency response of a lead lag compensator.
7	Analyze the stability of the given system using Routh stability criterion.
8	Analyze the stability of the given system using Root locus.
9	Analyze the stability of the given system using Bode plots.
10	Analyze the stability of the given system using Nyquist plot.
11	Obtain the time response from state model of a system.
12	Implement PI and PD Controllers.
13	Implement a PID Controller and hence realize an Error Detector.
14	Demonstrate the effect of PI, PD and PID controller on the system response.

Course Outcomes

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

1. Deduce transfer function of a given physical system, from differential equationrepresentation or Block Diagram representation and SFG representation.
2. Calculate time response specifications and analyze the stability of the system.
3. Draw and analyze the effect of gain on system behavior using root loci.
4. Perform frequency response Analysis and find the stability of the system.
5. Represent State model of the system and find the time response of the system.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam(SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

- The question paper will have ten questions. Each question is set for 20 marks.
- There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under thatmodule.
- The students have to answer 5 full questions, selecting one full question from eachmodule.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component.

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.

SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured out of 100 shall be reduced proportionally to 50.

Suggested Learning Resources:

Text Books

1. Control Systems Engineering, I J Nagrath, M. Gopal, New age international Publishers, Fifthedition.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/108106098

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Programming Assignments / Mini Projects can be given to improve programming skills

Communication Laboratory		Semester	**4**
Course Code	**22UEC413C**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2	SEE Marks	50
Credits	01	Exam Hours	03
Examination type (SEE)	Practical		

Course objectives:

This laboratory course enables students to

1. Understand the basic concepts of AM and FM modulation and demodulation.
2. Design and analyze the electronic circuits used for AM and FM modulation and demodulation circuits.
3. Understand the sampling theory and design circuits which enable sampling and reconstruction of analog signals.
4. Design electronic circuits to perform pulse amplitude modulation, pulse position modulation and pulse width modulation.

	Experiments (Experiments to be conducted using hardware components)
1	Design and test a high-level collector Modulator circuit and Demodulation the signal using diode detector.
2	Test the Balanced Modulator / Lattice Modulator (Diode ring)
3	Design a Frequency modulator using VCO and FM demodulator using PLL (Use IC566 and IC565).
4	Design and plot the frequency response of Pre-emphasis and De-emphasis Circuits
5	Design and test BJT/FET Mixer
6	Design and test Pulse sampling, flat top sampling and reconstruction
7	Design and test Pulse amplitude modulation and demodulation.
8	Generation and Detection of Pulse position Modulation
9	Generation and Detection of Pulse Width Modulation
10	PLL Frequency Synthesizer
11	Data formatting and Line Code Generation
12	PCM Multiplexer and DE multiplexer

Course outcomes (Course Skill Set):

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

1. Illustrate the AM generation and detection using suitable electronic circuits.
2. Design of FM circuits for modulation, demodulation and noise suppression.
3. Design and test the sampling, Multiplexing and pulse modulation techniques using electronic hardware.
4. Design and Demonstrate the electronic circuits used for RF transmitters and receivers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to **30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability.
- The marks scored shall be scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

- SEE marks for the practical course are 50 Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.

- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% of Marks allotted to the procedure part are to be made zero.

The minimum duration of SEE is 02 hours

Suggested Learning Resources:

1. Louis E Frenzel, Principles of Electronic Communication Systems, 3rd Edition, Mc Graw Hill Education (India) Private Limited, 2016. ISBN: 978-0-07-066755-6.

MICROCONTROLLERS		Semester	4
Course Code	**22UEC414B**	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type(SEE)	Theory		

Course objectives:

This course will enable students to:

- Understand the difference between Microprocessor and Microcontroller and embedded microcontrollers.
- Analyze the basic architecture of 8051microcontroller.
- Program 8051 microcontroller using Assembly Language and C.
- Understand the operation and use of inbuilt Timers/Counters and Serial port of 8051
- Understand the interrupt structure of 8051 and Interfacing I/O devices using I/O ports of 8051.

Teaching-Learning Process (General Instructions)

The samples strategies, which the teacher can use to accelerate the attainment of the variouscourse outcomes are listed in the following:

1. Lecture method (L) does not mean only the traditional lecture method, but adifferent type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the functioning of various techniques.
3. Encourage collaborative(Group)Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical kills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world and when that's possible, it helps improve the students' understanding.
   Give Programming Assignments.

Module-1 (8 Hrs)

Microcontroller: Microprocessor Vs Microcontroller, Micro controller & Embedded Processors, Processor Architectures-Harvard Vs Princeton & RISC Vs CISC, 8051 Architecture- Registers, Pin diagram, I/Oports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing. (Text book 1-1.1,Text book 2-1.0,1.1,3.0,3.1,3.2,3.3 Textbook 3-Pg 5-9)

Module-2 (8 Hrs)

Instruction Set: 8051 Addressing Modes, Data Transfer Instructions, Arithmetic instructions, Logical Instructions, Jump & Call Instructions Stack & Subroutine Instructions of 8051 (with examples in assembly Language). (Text book 2- Chapter 5,6,7,8, **Additional reading Refer Textbook 3, Chapter 3 for complete understanding of instructions with flow diagrams)**

Module-3 (8 Hrs)

Timers/Counters & Serial port programming:
Basics of Timers & Counters, Data types & Time delay in the 8051 using C, Programming 8051 Timers, Mode 1 & Mode 2 Programming, Counter Programming (Assembly Language only). (Text book 2- 3.4, Text book 1- 7.1, 9.1,9.2)
Basics of Serial Communication, 8051 Connection to RS232, Programming the 8051 to transfer data serially & to receive data serially using C.(Text book 2- 3.5, Text book 1- 10.1,10.2,10.3 except assembly language programs, 10.5)

Module-4 (8 Hrs)

Interrupt Programming: Basics of Interrupts, 8051 Interrupts, Programming Timer Interrupts, Programming Serial Communication Interrupts, Interrupt Priority in 8051(Assembly Language only) (Text book 2- 3.6, Text book 1- 11.1,11.2,11.4, 11.5)

Module-5 (8 Hrs)

I/O Port Interfacing & Programming: I/O Programming in 8051 C, LCD interfacing, DAC 0808 Interfacing, ADC 0804 interfacing, Stepper motor interfacing, DC motor control & Pulse Width Modulation (PWM) using C only. (Text book 1- 7.2, 12.1, 13.1, 13.2, 17.2, 17.3)

Course outcome (Course Skill Set)

At the end of the course, students will be able to:

1. Describe the difference between Microprocessor and Microcontroller, Types of Processor Architectures and Architecture of 8051Microcontroller.
2. Discuss the types of 8051 Microcontroller Addressing modes & Instructions with Assembly Language Programs.
3. Explain the programming operation of Timers/Counters and Serial port of 8051 Microcontroller.
4. Illustrate the Interrupt Structure of 8051 Microcontroller & its programming.
5. Develop C programs to interface I/O devices with 8051 Microcontroller.

.**Continuous Internal Evaluation:**

There are 25marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

Each test shall be conducted for 25marks.The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks

1. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the courses hall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
2. The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's

taxonomy as per the outcome defined for the course.Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common questionpapers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20marks.
2. There will be 2questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to50 marks

Suggested Learning Resources:

TEXT BOOKS

1. The "8051 Microcontroller and Embedded Systems – Using Assembly and C", Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollind. Mckinlay; Phi, 2006 / Pearson, 2006.
2. "The 8051 Microcontroller", Kenneth j. Ayala, 3rd edition, Thomson/Cengage Learning.
3. "Programming And Customizing The 8051 Microcontroller".,Myke Predko Tata Mc Graw-Hill Edition 1999 (reprint 2003).

REFERENCEBOOKS:

1. "The 8051 Microcontroller Based Embedded Systems", Manish K Patel, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.

"Microcontrollers: Architecture, Programming, Interfacing and System Design", Raj Kamal, Pearson Education, 2005.

Web links and Video Lectures(e-Resources):

https://youtu.be/pA6K5NgWTow?si=zQqqgXQq50dVL_-s

Industrial Electronics		Semester	IV
Course Code	**22UEC414C**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	Theory		

Course objectives: This course will enable student to

- Explain broad types of industrial power devices, there structure, and its characteristics.
- Design and analyze the broad categories of power electronic circuits.
- Explain various types of MEMs devices, principle of operation and construction.
- Familiarize with soft core processors and computer architecture.
- Apply protective methods for devices and circuits.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Industrial Power Devices: General purpose power diodes, fast recovery power diodes, schottky power diodes, silicon carbide power diodes **(Text book 1: 2.5, 2.6)**, Power MOSFETs, Steady state characteristics, switching characteristics, silicon carbide MOSFETs, COOLMOS, Junction field effect transistors, operation and characteristics of JFETs, Silicon Carbide JFET structures, Bipolar Junction Transistors, Steady state characteristics, switching characteristics, silicon carbide BJTs, IGBT, silicon carbide IGBTs

(Text book 1: 4.3, 4.4, 4.6, 4.7

Module-2

Power Electronics Circuits:), Thyristor, Thyristor characteristics, two transistor model **(Text book 1: 9.2, 9.3, 9.4)**. Controlled Rectifiers – Single phase full converter with R and RL load, Single phase dual converters, and Three phase full converter with RL load **(Text book 1: 10.2,**

10.3, 10.4). Switching mode regulators – Buck Regulator, Boost regulator, Buck – Boost regulator, comparison of regulators.
(Text book 1: 5.9.1, 5.9.2, 5.9.3, 5.10)

Module-3

Inverters – Principle of operation, Single phase bridge inverter, Three phase inverter with 180 and 120 degree conduction, Current source inverter **(Text book 1: 6.3, 6.4, 6.5, 6.9)**.
AC voltage controllers – Single phase full wave controller with resistive load, single phase full wave controller with inductive load **(Text book 1: 11.3, 11.4)**.

Module-4

MEMS Devices: Sensing and Measuring Principles, Capacitive Sensing, Resistive Sensing, Piezoelectric Sensing, Thermal Transducers, Optical Sensors, Magnetic Sensors, MEMS Actuation Principles, Electrostatic Actuation, Thermal Actuation, Piezoelectric Actuation, Magnetic Actuation, MEMS Devices Inertial Sensors, Pressure Sensors, Radio Frequency MEMS: Capacitive Switches and Phase Shifters, Microfluidic Components, Optical Devices. **(Text book 2: 13.1, 13.3, 13.4)**
MEMS Applications: Introduction, Industrial, Automotive, Biomedical.
(**Text book 2:15.1, 15.2, 15.3, 15.4)**

Module-5

Protections of Devices and Circuits: Cooling and Heat sinks, Thermal Modeling of Power Switching Devices, Electrical Equivalent Thermal model, Mathematical Thermal Equivalent Circuit, Coupling of Electrical and Thermal Components, Snubber circuits, Voltage protection by Selenium Diodes and Metal oxide Varistors, Current protection, Fusing, Fault current with AC source, Fault current with DC source, Electromagnetic Interference, sources of EMI, Minimizing EMI Generation, EMI shielding, EMI standards.
(Text book 1: 17.2, 17.3, 17.4, 17.5, 17.6, 17.7, 17.8, 17.9).

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Explain different types of industrial power devices such as MOSFET, BJT, IGBT etc, therestructure, and its operating characteristics.
2. Design and analyze the power electronic circuits such as switch mode regulators, inverters,controlled rectifiers and ac voltage controllers.
3. Explain various types of MEMs devices used for sensing pressure, temperature, current,voltage, humidity, vibration etc...
4. Familiarize with soft core processors such as ASIC and FPGA.
5. Familiarize with computer hardware, software, architecture, instruction set, memory organization, multiprocessor architecture.
6. Apply protective methods for devices various industrial power devices based on thermal requirements and develop protective methods for the circuits against various electrical parameters.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based thenonly one assignment for the course shall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomyas per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers forthe course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximumof 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Text Books

1. Power Electronics: Devices, Circuits, and Applications, Muhammad H. Rashid, Pearson, 4th International edition.
2. Fundamentals of Industrial Electronics, Bogdan M. Wilamowski, J. David Irwin, CRC Press, 2011,

Reference Books

1. Thomas E. Kissell, Industrial Electronics: Applications for Programmable Controllers, Instrumentation and Process Control, and Electrical Machines and Motor Controls, 3rd edition, 2003, Prentice Hall.
2. Ned Mohan, T.M. Undeland and W.P. Robbins, "Power Electronics: Converters, Applications and Design", Wiley India Ltd, 2008.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/108/102/108102145/
- https://nptel.ac.in/courses/117105082
- https://www.youtube.com/channel/UCKg8GNii0Q-ieXE56AXosGg/featured
- https://www.ieee-ies.org/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quiz and Seminars

OPERATING SYSTEM		Semester	4
Course Code	**22UEC414D**	CIE Marks	50
Teaching Hours/Week(L:T:P)	3:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	3
Examination type(SEE)	Theory		

Course objectives:

This course will enable students to:

- Understand the services provided by an operating system.
- Explain how processes are synchronized and scheduled.
- Understand different approaches of memory management and virtual memory management. Describe the structure and organization of the file system
- Understand inter-process communication and deadlock situations.

Teaching-Learning Process (General Instructions)

The samples strategies, which the teacher can use to accelerate the attainment of the variouscourse outcomes are listed in the following:

1. Lecturer method (L) need not to be only traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction to Operating Systems: OS, Goals of an OS, Operation of an OS,Computational Structures, Resource allocation techniques, Efficiency, System Performance and User Convenience, Classes operating System, Batch processing, Multi programming, Time Sharing Systems, Real Time and distributed Operating Systems **(Topics from Sections 1.2, 1.3, 2.2 to 2.8 of Text).**

Module-2

Process Management: OS View of Processes, PCB, Fundamental State Transitions of aprocess, Threads, Kernel and User level Threads, Non-preemptive scheduling- FCFS andSRN, Preemptive Scheduling- RR and LCN, Scheduling in Unix and Scheduling in Linux**(Topics from Sections 3.3, 3.3.1 to 3.3.4, 3.4, 3.4.1, 3.4.2, Selected scheduling topics from 4.2 and 4.3 , 4.6, 4.7 of Text).**
Module-3
Memory Management: Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with paging, Virtual Memory Management, Demand Paging, VM handler, FIFO, LRU page replacement policies, Virtual memory in Unix and Linux. **(Topics from Sections 5.5 to 5.9, 6.1 to 6.3 except Optimal policy and 6.3.1, 6.7,6.8 of Text)**
Module-4
File Systems: File systems and IOCS, File Operations, File Organizations, Directory structures, File Protection, Interface between File system and IOCS, Allocation of disk space, Implementing file access. **(Topics from Sections 7.1 to 7.8 of Text).**
Module5
Message Passing and Deadlocks: Overview of Message Passing, implementing message passing, Mailboxes, Deadlocks, Deadlocks in resource allocation, Handling deadlocks, Deadlock detection algorithm, Deadlock Prevention **(Topics from Sections 10.1 to 10.3, 11.1 to 11.5 of Text).**

Course outcome (Course Skill Set)

At the end of the course, students will be able to:

1. Explain the goals, structure, operation and types of operating systems.
2. Apply scheduling techniques to find performance factors.
3. Explain organization of file systems and IOCS.
4. Apply suitable techniques for contiguous and non-contiguous memory allocation.
5. Describe message passing, deadlock detection and prevention methods.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE)is 50%.The minimum passing mark for the CIE is 40%of the maximum marks(20marks out of 50) and forthe SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

There are 25marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.

Each test shall be conducted for 25marks.The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of thesyllabus. The average of the two tests shall be scaled down to 25 marks

Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the courses hall be planned. The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the sum of the two assignments shall be scaled down to 25 marks) The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests andassignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20marks.
2. There will be 2questions from each module. Each of the two questions under a module (with amaximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

Marks scored shall be proportionally reduced to50 marks

Suggested Learning Resources:

TEXT BOOKS

Data Structures Using C		Semester	IV
Course Code	**22UEC414A**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	3:0:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03
Examination nature (SEE)	Theory		

COURSE OVERVIEW:

COURSE OBJECTIVES:

The objectives of this course are to:

1. Develop proficiency in designing and implementing fundamental data structures.
2. Learn various sorting and searching algorithms and analyze their time complexity.
3. Understand algorithmic problem-solving techniques, including recursion.
4. Explore advanced data structures like trees, graphs, and hash tables.
5. Apply data structures and algorithms knowledge to solve real-world programming challengesefficiently.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The lecturer's approach (L) does not have to be limited to traditional methods of teaching. It is possible to incorporate alternative and effective teaching methods to achieve the desired outcomes.
2. Utilize videos and animations to illustrate the functioning of different techniques used in themanufacturing of smart materials.
3. Foster collaborative learning exercises within the classroom to encourage group participationand engagement.
4. Pose a minimum of three Higher Order Thinking (HOT) questions during class discussions to stimulate critical thinking among students.
5. Implement Problem-Based Learning (PBL) as an approach that enhances students' analyticalskills and nurtures their ability to design, evaluate, generalize, and analyze information, rather than solely relying on rote memorization.

Module-1

Arrays:1D,2D and multidimensional. Pointers: Definition and Concepts, Array of pointers, Structures and unions. Array of structures, pointer arrays, pointer to structures. Passing pointer variable as parameter in functions Dynamic memory allocation: malloc (), calloc (), realloc () and free function.Introduction to data structures and algorithms Text book 1 -Chapter-1.1-1.3 except Rational Numbers. Text Book 2, chapter-2

Module-2
The Stack – Definition and examples, primitive operations, Example. Representing Stacks in C, Example: Infix, Postfix and Prefix, converting an Expression from Infix to Prefix and Program. Text Book -1-Chapter – 2.1-2.3 Recursion – Recursive Definition and Processes, Recursion in C, Writing Recursive Programs.Recursions - Text Book -1-Chapter – 3.1-3.3
Module-3
Queues and Lists – The Queue and its sequential representation, Linked Lists, Lists in C. Other Lists structures – Circular Lists, Stacks, Queues as circular list. The Josephus problem, doublylinked lists. Linked lists and Queues - Text Book -1-Chapter – 4.1-4.3, 4.5
Module-4
Trees – Binary Trees, binary tree representations, Huffman algorithm, Trees and their applications. Searching – Basic searching Techniques, Tree Searching. Trees - Text Book -1-Chapter – 5.1-5.3, 5.5, 7.1, 7.2
Module-5
Hashing – Introduction, Static Hashing, Dynamic HashingText Book 3 -8.1 – 8.3 Graphs - Graph representation, Elementary graph operations, Minimum cost spanning Trees –Kruskal’s Algorithm, Prim’s algorithm Text Book 3 - 6.1, 6.2, 6.3.1, 6.3.2

Course Outcomes (COs) (Course Skill Set)

At the end of the course, the student will be able to:

1. Master the implementation and application of key data structures in programming.
2. Demonstrate the ability to analyze algorithm efficiency and optimize code.
3. Solve complex problems by applying algorithmic strategies and techniques.
4. Design and implement algorithms for tasks involving searching, sorting, and graph traversal.
5. Utilize data structures and algorithms to enhance software performance and scalability

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal AssessmentTest component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and thesecond test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and othermethods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination (SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

Suggested Learning Resources:

TEXT BOOKS:

1. Data Structures using C and C++, Yedidyah, Augenstein, Tannenbaum, 2nd Edition, PearsonEducation, 2007.
2. Data Structures using C, Reema Thareja, 2nd Edition, Oxford University Press, 2011
3. Fundamentals of Data structures in C, 2nd Edition, Horowitz, Sahni, Anderson freedUniversities Press,2008

REFERENCEBOOKS:

1. Reema Thareja, Computer fundamentals and programming in C, second edition, OxfordUniversity Press.
2. Gilberg and Forouzan, Data Structures: A Pseudo-code approach with C, 2ndEd,CengageLearning,2014.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/102/106102064/
- https://archive.nptel.ac.in/courses/106/106/106106127/
- https://nptel.ac.in/courses/106102064
- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS43.html
- https://nptel.ac.in/courses/106/101/106101060/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Real world problem solving using group discussion.

- Back/Forward stacks on browsers.
- Undo/Redo stacks in Excel or Word.
- Linked list representation of real-world queues -Music player, image viewer
- Real world problem solving and puzzles using group discussion. E.g., Fake coin identification, Peasant,wolf, goat, cabbage puzzle, Konigsberg bridge puzzle etc.,

Demonstration of solution to a problem through programming.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation(CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling thelaboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-upon time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted

<table>
<tr><td colspan="2">Microcontrollers
Lab</td><td>Semester</td><td>4</td></tr>
<tr><td>Course Code</td><td>22UEC415D</td><td>CIE Marks</td><td>50</td></tr>
<tr><td>Teaching Hours/Week(L:T:P)</td><td>0:0:2</td><td>SEE Marks</td><td>50</td></tr>
<tr><td rowspan="2">Credits</td><td rowspan="2">01</td><td>Total Marks</td><td>100</td></tr>
<tr><td>Exam Hours</td><td>2</td></tr>
<tr><td>Examination type(SEE)</td><td colspan="3">Practical</td></tr>
</table>

Course objectives: This course will enable students to:

- Understand the basic programming of Microcontrollers.
- Developthe8051 Microcontroller-based programs for various applications using Assembly Language & CProgramming.
- Program8051MicrocontrollertocontrolanexternalhardwareusingsuitableI/Oports.

Note	Execute the following experiments by using Keil Microvision Simulator (any 8051 Microcontroller can be chosen as the target) and Hardware Interfacing Programs using 8051 Trainer Kit.
Sl.No	**I. Assembly Language Programming**
Data Transfer Programs:	
1	Write an ALP to move a block of n bytes of data from source (20h) to destination (40h) usingInternal-RAM.
2	Write an ALP to move a block of n bytes of data from source (2000h) to destination (2050h) using External RAM.
3	Write an ALP to exchange the source block starting with address 20h, (Internal RAM) containing N (05) bytes of data with destination block starting with address 40h (Internal RAM).
4	Write an ALP to exchange the source block starting with address 10h (Internal memory), containingn (06) bytes of data with destination block starting at location 00h (External memory).
Arithmetic & Logical Operation Programs:	
5	Write an ALP to add the byte in the RAM at 34h and 35h, store the result in the register R5 (LSB)and R6 (MSB), using Indirect Addressing Mode.
6	Write an ALP to subtract the bytes in Internal RAM 34h &35h store the result in register R5 (LSB) & R6 (MSB).
7	Write an ALP to multiply two 8-bit numbers stored at 30h and 31h and store16- bit result in 32h and 33h of Internal RAM.
8	Write an ALP to perform division operation on 8-bit number by 8-bit number.
9	Write an ALP to separate positive and negative in a given array.
10	Write an ALP to separate even or odd elements in a given array.
11	Write an ALP to arrange the numbers in Ascending & Descending order.

12	Write an ALP to find Largest & Smallest number from a given array starting from 20h & store it in Internal Memory location 40h.
Counter Operation Programs:	
13	Write an ALP for Decimal UP-Counter.
14	Write an ALP for Decimal DOWN-Counter.
15	Write an ALP for Hexadecimal UP-Counter.
16	Write an ALP for Hexadecimal DOWN-Counter.
II. C Programming	
1	Write an 8051 C program to find the sum of first 10 Integer Numbers.
2	Write an 8051 C program to find Factorial of a given number.
3	Write an 8051 C program to find the Square of a number (1 to 10) using Look-Up Table.
4	Write an 8051 C program to count the number of Ones and Zeros in two consecutive memory locations.
III. Hardware Interfacing Programs	
1	Write an 8051 C Program to rotate stepper motor in Clock & Anti-Clockwise direction.
2	Write an 8051 C program to Generate Sine & Square waveforms using DAC interface.

Course outcomes (Course Skill Set): At the end of the course the student will be able to:

1. Write a Assembly Language / C program using 8051for solving simple problems that manipulate input data using different instructions.
2. Develop Testing and experimental procedures on 8051 Microcontroller, Analyze their operationunder different cases.
3. Developprogramsfor8051Microcontrollertoimplementreal world problems.
4. DevelopMicrocontrollerapplicationsusingexternalhardwareinterface.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and forthe SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation(CIE):

CIEmarksforthepracticalcourseare**50Marks**.

The split-up of CIE marks for record/journalandtestareintheratio**60:40**.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up.Rubrics for the evaluation of the journal/write-up for hardware/software experiments are designed by the faculty who is handling the laboratory session and are made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10marks.
- Total marks scored by the students are scaled down to **30marks**(60%ofmaximummarks).
- Weightagetobegivenforneatnessandsubmissionofrecord/write-upontime.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write- up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student’s performance and learning ability.
- The marks scored shall be scaled down to **20marks** (40%ofthemaximummarks). The Sum of scaled-down marks scored in the report write-up /journal and marks of a test is the total CIE marks scored by the student.

Semester End Evaluation(SEE):

- SEE marks for the practical courseare50Marks.
- **SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the Head of the Institute**.
- The examination schedule and names of examiners are informed to the university before the conduction of the examination. These practical examinations are to be conducted between the schedule mentioned in the academic calendar of the University.
- All laboratory experiments are to be included for practical examination.
- (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.
- Students can pick one question (experiment) from the questions lot prepared by the examiners jointly.
- Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva- voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15%ofMarksallottedtotheprocedurepartaretobemadezero.The minimum duration of SEE is 02 hours

Suggested Learning Resources:

"The 8051 Microcontroller: Hardware, Software and Applications", V Udayashankara and M S Mallikarjuna Swamy, McGraw Hill Education,1st edition,2017.

PROGRAMMABLE LOGIC CONTROLLER (PLC)		Semester	IV
Course Code	**22UEC415B**	CIE Marks	50
Teaching Hours/Week (L: T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	14 to 16 hours	Total Marks	100
Credits	01	Exam Hours	01
Examination type (SEE)	Theory		

Course objectives: This course will enable student to

- To understand the need for automation in the industry with basic controller mechanisms involved.
- To study programming concepts to achieve the desired goal or to define the various steps involved in the automation.
- To understand programming involved with basic subroutine functions.
- To make use of the internal hardware circuits of automation circuit to control the devices during various states by monitoring the timers and counters.
- To handle the data of the I/O devices to interface the data with the controller and auxiliary devices.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only traditional lecture method, but different type of teaching methods may be adopted to develop the outcomes.
2. Show Video/animation films to explain evolution of communication technologies.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOTS (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
7. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Introduction: Programmable logic controller (PLC), role in automation (SCADA), advantages and disadvantages, hardware, internal architecture, sourcing and sinking **(Textbook 1: 1.1 to 1.4)**

I/O devices and Processing: list of input and output devices, examples of applications. I/O processing, input/output units, signal conditioning, remote connections, networks, processing inputs I/O addresses.

(TextBook1: 2.1 to 2.3 and 4.1 to 4.7).

Module-2

Programming: Ladder programming- ladder diagrams, logic functions, latching, multiple outputs, entering programs, functional blocks, program examples like location of stop and emergency switches. (**TextBook1: 5.1 to 5.7).**

Module-3

Programming Methods: Instruction Lists- Ladder programs and Instruction lists, Branch codes, Programming Examples- Signal lamp-valve operation task. Sequential Function Charts- Branching and convergence. **(TextBook1: 6.1 to 6.3).**

Module-4

Internal Relays: ladder programs, battery-backed relays, one-shot operation, set and reset, master control relay (**TextBook1: 7.1 to 7.6).**

Timers and counters: Types of timers, ON and OFF- delay timers, pulse timers, forms of counter, programming, up and down counters. **(TexBook1: 9.1 to 9.6).**

Module-5

Shift register and data handling: shift registers, ladder programs, registers and bits, data handling, arithmetic functions. **(TextBook1: 11.1 to 11.2 and 12.1 to 12.3)**

Course outcome (Course Skill Set)

At the end of the course, the student will be able to:

1. Describe the PLC and how to construct PLC ladder diagrams.
2. Illustrate an application with programming.
3. Describe characteristics of registers and conversion examples.
4. Apply PLC functions to timing and counting applications.
5. Analyze the analog operation of PLC and demonstrate the robot applications with PLC.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- There are 25 marks for the CIE's Assignment component and 25 for the Internal Assessment Test component.
- Each test shall be conducted for 25 marks. The first test will be administered after 40-50% of the coverage of the syllabus, and the second test will be administered after 85-90% of the coverage of the syllabus. The average of the two tests shall be scaled down to 25 marks
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned.
- The schedule for assignments shall be planned properly by the course teacher. The teacher should not conduct two assignments at the end of the semester if two assignments are planned. Each assignment shall be conducted for 25 marks. (If two assignments are conducted then the

sum of the two assignments shall be scaled down to 25 marks)
- The final CIE marks of the course out of 50 will be the sum of the scale-down marks of tests and assignment/s marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 01 hours).**

1. SEE paper shall be set for 50 questions, each of the 01 marks. The pattern of the question paper is MCQ (multiple choice questions).
2. The time allotted for SEE is 01 hour. The student has to secure a minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Textbooks:

1. Programmable Logic Controllers-W Bolton, 5th edition/6th edition, Elsevier- newness, 2009/2015.
2. Programmable logic controllers - principles and applications"-John W. Webb, Ronald A Reiss, Pearson education, 5th edition, 2007.

Reference Books:

1 Programmable Logic Controllers"- E. A Paar, 3rd Edition, An Engineers Guide. Newness, 2003.

2 "Introduction to Programmable Logic Controller"- Garry Dunning, 3rd Edition, Thomson Asia Pte Ltd. Publication, 2006

3 "PLCs & SCADA - Theory and Practice"- Rajesh Mehra, Vikrant Vij, 2nd Edition, Laxmi publication, 2017

4 "PLC Programming for Industrial Automation"- Kevin Collins, 1st Edition, Kindle, 2016

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning.

- Quiz and Seminars

Octave Programming			
Course Code	**22UEC415A**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	12 Sessions	Total	100
Credits	01	Exam Hours	02
**Additional One hour may be considered for instructions ifrequired*			

Course objectives:

- Apply theoretical knowledge of Octave programming to practical programming tasks.
- Gain hands-on experience in implementing and debugging octave Programming through codingexercises and projects.

Course Syllabus: Basic data structures in Octave – Vectors, Matrices, Cell Arrays. Special vecors. Linear sampling and logarithmic sampling. Accessing elements of vectors, matrices, and matrices. Mathematical operations on vectors and matrices. Addition, Multiplication, Subtraction, Division, Power, Square-Root, trigonometric operations. Dot Products and Cross Products of Vectors. Matrix multiplication, matrix inverse and matrixtranspose operations. Finding eigen values and vectors of a square matrix. Finding the solution of a system of linear equations. Linear programming and integer linear programming using glpk. Plotting in Octave. Subplots, Stem Plots, Semilog and Log-log plots. Packages in Matlab – symbolic, signal processing, control. Applications of Octave to solve problems in Electrical engineering, Electronics engineering,Control Systems, Signals and Systems/Signal Processing.

Sl..NO	Experiments
1	(a) Define the following matrices using Octave i. A 4x4 identity matrix ii. A 4x4 matrix of zeros iii. A 4x4 matrix of ones iv. The matrix U4 defined below. $\begin{matrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 1 & 4 \\ 1 & 3 & 2 & 4 \\ 4 & 3 & 1 & 2 \end{matrix}$ v. Matrix D4 defined below. It is also called the Hadamard matrix of dimension 4. $\begin{matrix} 1 & 1 & 1 & 1 \\ 1 & -1 & 1 & -1 \\ 1 & 1 & -1 & -1 \\ 1 & -1 & -1 & 1 \end{matrix}$ vi. Matrix H4 defined below $\mathbf{H}_4 = \frac{1}{\sqrt{4}} \begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & -1 \\ \sqrt{2} & -\sqrt{2} & 0 & 0 \\ 0 & 0 & \sqrt{2} & -\sqrt{2} \end{bmatrix}$ vii. A 4x4 magic square G4 viii. A 4x4 matrix of random numbers selected from the range {-1,0,1}. ix. A 4x4 matrix of random numbers in the range 0 to 1. (b) (i) How can you generate a 4x4 matrix of all 2's? (ii) Find the transpose of U4. (iii) Multiply D4 by its transpose and obtain the resulting matrix. How is

<table>
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related to the identify matrix?

(iv) Find the inverse of H4 and verify that it is the inverse.

(v) What is the determinant of D4?

(vi) Extract the diagonal elements of H4.

(vii) How can you reshape the elements of D4 into a 2x8 matrix?

(viii) What is the magic sum of a 4x4 matrix? How can you verify that G4 is indeed a magic square?

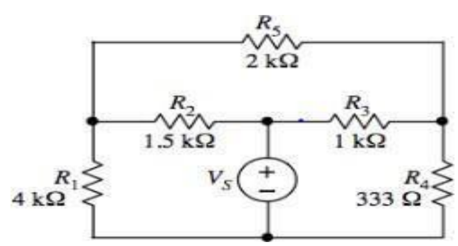
(ix) The matrix D4 mentioned above is a 4x4 matrix. We wish to extract the sub- matrix consisting of rows 1 and 4 and columns 1 and 4. [In other words, the four corners of D4.) Show Octave code for generating the submatrix SM.

(x) Check if the H4 and D4 are orthogonal matrices.

</td></tr>
<tr><td>2</td><td>

You will have learnt Kirchhoff's current and voltage laws to solve the voltages and currents in a DC circuit.Given a circuit with n loops, we can write down n equations in n unknowns (loop currents). Alternately, given a circuit with n nodes, we can write down n equations in n unknowns (node voltages). These linear equations can be solved using Octave.

(a) Write down the KCL and KVL for the following circuit and solve the node voltages and currents. Assume that Vs is 100V.



(b) Find the total power dissipated in the circuit.

(c) Find the total power supplied by the voltage source.

(d) Challenge – Instead of hardcoding the values of the resistors and the voltage source, can you allow the user to input R1, R2, R3, R4, R5, and Vs? Develop a complete Octave script which reads in the values of circuit parameters and prints the node voltages, node currents, and power dissipation.

(e) Variations of the above exercises can be given to the students. For example, a resistor can be included in series with Vs. Alternately, a different circuit from a text book can be given. You can also change the problem by specifying the current through one of the resistors and asking the user to solve for Vs.

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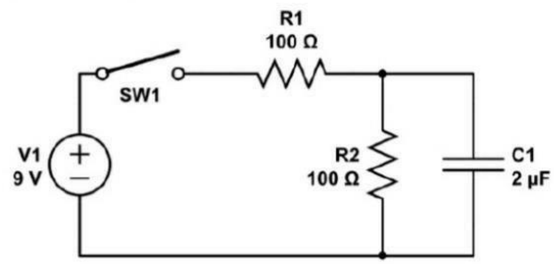
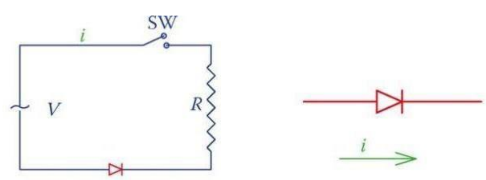
</table>

3	(a) Consider the RC circuit shown in the figure below. Plot the voltage across C and the charging current through C when the switch is turned on. (b) What is the rise time of the capacitor voltage?
	
4	 (a) The figure shows a diode-based rectifier. The diode conducts only when the input voltage is positive. Assume that it is an ideal diode. Plot the half-wave rectified waveform if the input to the rectifier is a 50-Hz sine wave of 200V RMS. Plot the output waveform for four cycles of the input. (b) Find the average of the Half wave-rectified output in Octave and verify your answerusing the formula for the average output. (c) Plot the output of a full-wave rectifier. (d) Find the RMS value of the Full wave-rectified output in Octave and verify youranswer using the formulafor the RMS value. (e) Assume that the input voltage is 2sin(500t) V and that the diode has a cut-in voltage of 0.6V. Plot thehalf-wave and full-wave rectified waveforms and find their average and RMS values.
5	(a) Given Z parameters, obtain the Y parameters using a function called Z2Y () Given Y parameters, obtain the Z parameters using afunction called Y2Z () (b) Find the Z and Y parameters for the T-network

	Assessment Details (both CIE and SEE) The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE). **Continuous Internal Evaluation(CIE):** CIE marks for the practical course is **50 Marks**. The split-up of CIE marks for record/journal and test are in the ratio **60:40**. • Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session. Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks. • Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks). • Weightage to be given for neatness and submission of record/write-upon time. • Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of the semester and these test shall be conducted after the 14^{th}week of the semester. • In each test, write-up, conduction of experiment, acceptable result, and procedural knowledge willcarry a weightage of 60% and the rest 40% for viva-voce. • The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book • The average of 02 tests is scaled down to **20 marks** (40%of the maximum marks). • The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the totalCIE marks scored by the student.
	Semester End Evaluation(SEE): SEE marks for the practical course is 50Marks. SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by theUniversity All laboratory experiments are to be included for practical examination. (Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly byexaminers. Students can pick one question (experiment) from the question slot prepared by the internal/external examinersjointly. Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, write up-20%, Conduction procedure and result -60%, Viva-voce 20%of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners) Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be madezero. The duration of SEE is 03hours Rubrics suggested in Annexure-II of Regulation book

	Suggested Learning Resources: Textbooks: Dr. P.J.G. Long, Department of Engineering University of Cambridge, "Introduction to Octave," can be downloaded from octavetut.pdf (cam.ac.uk)

Data Structures Lab using C			
Course Code	22UEC415C	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	0:0:2	SEE Marks	50
Total Hours of Pedagogy	15 Sessions	Total	100
Credits	01	Exam Hours	03
***Additional One hour may be considered for instructionsif required**			

Course objectives:

- Apply theoretical knowledge of data structures and algorithms to practical programming tasks.
- Gain hands-on experience in implementing and debugging data structures and algorithmsthrough coding exercises and projects.

Sl. NO.	**Experiments**
1	Write a C Program to create a Student record structure to store, N records, each record havingthe structure shown below: USN, Student Name and Semester. Write necessary functions a. To display all the records in the file. b. To search for a specific record based on the USN. In case the record is not found, suitable message should be displayed. Both the options in this case must be demonstrated. (Use pointer to structure for dynamic memory allocation)
2	Write a C Program to construct a stack of integers and to perform the following operations on it: a. Push b. Pop c. Display The program should print appropriate messages for stack overflow, stack underflow, and stack empty.
3	Write a C Program to convert and print a given valid parenthesized infix arithmetic expressionto postfix expression. The expression consists of single character operands and the binary operators + (plus), - (minus), * (multiply) and / (divide).
4	Write a C Program to simulate the working of a queue of integers using an array. Provide thefollowing operations: a. Insert b. Delete c. Display
5	Write a C Program using dynamic variables and pointers to construct a stack of integers usingsingly linked list and to perform the following operations: a. Push b. Pop c. Display The program should print appropriate messages for stack overflow and stack empty.
6	Write a C Program to support the following operations on a doubly linked list where each nodeconsists of integers: a. Create a doubly linked list by adding each node at the front. b. Insert a new node to the left of the node whose key value is read as an input c. Delete the node of a given data, if it is found, otherwise display appropriate message. d. Display the contents of the list. (Note: Only either (a, b and d) or (a, c and d) may be asked in the examination)
7	Write a C Program a. To construct a binary search tree of integers. b. To traverse the tree usingall the methods i.e., in order, preorder and post order. c. To display the elements in the tree.

8	Write recursive C Programs for a. Searching an element on a given list of integers using theBinary Search method. b. Solving the Towers of Hanoi problem.
9	Write a program to traverse a graph using BFS method. Write a program to check whether given graph is connected or not using DFS method.
10	Design and develop a program in C that uses Hash Function H:K->L as H(K)=K mod m(reminder method) and implement hashing technique to map a given key K to the addressspace L. Resolve the collision (if any) using linear probing
Note: The students must be encouraged to create Leet code account and work on Leetcode platform to improve the competency.	

Course outcomes (Course Skill Set):

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

- Develop proficiency in coding and debugging complex algorithms and data structures.
- Acquire practical problem-solving skills by applying data structures and algorithms to real-world programming challenges.
- Develop a C program to perform arithmetic operation using data structure and operators.
- Understand the concept of graph theory and develop a C program for searching an element.
- Develop a C program to check the given graph is connected using different algorithms.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination (SEE).

Continuous Internal Evaluation(CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record / journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling thelaboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up willbeevaluatedfor10marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-upon time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8^{th} week of thesemester and these test shall be conducted after the 14^{th}week of the semester.
- In each test, write-up, conduction of experiment, acceptable result, and procedural knowledge will carry aweightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40%of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marksscored by the student.

Semester End Evaluation(SEE):

SEE marks for the practical course is 50Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adheredto by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the question slot prepared by the internal/external examiners jointly.Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners. General rubrics suggested for SEE are mentioned here, write up-20%, Conduction procedure and result -60%, Viva-voce 20%of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero. Theduration of SEE is 03hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

Textbooks:

- Data Structures using C, Reema Thareja, 2nd Edition, Oxford University Press, 2011
- Introduction to the Design and Analysis of Algorithms, Anany Levitin: 2nd Edition, 2009.Pearson.

- Online Courses:
  - Coursera: "Algorithms" by Princeton University (taught by Robert Sedgewick and Kevin Wayne).
  - edX: "Algorithmic Design and Techniques" (offered by UC San Diego and Higher School of Economics).
- Websites and Online Resources:
  - Geeks for Geeks: Offers a wide range of tutorials, practice problems, and coding challenges related todata structures and algorithms.

    Leet Code: Provides coding challenges that are frequently asked in technical interviews and cover a variety of algorithmic concepts.
  - Hacker Rank: Offers coding challenges and competitions with a focus on algorithms and data structures.
  - Top Coder: Provides algorithmic challenges and competitions for practicing and improving problem-solving skills.
- YouTube Channels:
  - My code school: Offers video tutorials on various data structures and algorithms topics.
  - The Coding Train: Provides interactive coding tutorials on algorithms and data structures.
- Coding Platforms:
  - Code forces: Offers competitive programming challenges to improve algorithmic problem-solving skills. Hackerearth: Provides coding competitions and challenges along with tutorials and practice problems.

Syllabus for

B.E. I/II - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE136B	**Renewable Energy Sources**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To identify the parameters required for solar, wind, biomass, geothermal and ocean energy conversion systems.
- To apply and analyze concepts and theory related to solar, wind, biomass, geothermal and ocean energy conversion systems.
- To derive power output of solar and wind energy conversion systems based on the corresponding solar irradiation and wind speed respectively.
- To analyze pros and cons of solar, wind, biomass, geothermal and ocean energy conversion systems.

UNIT – I	(10 Hours)
Introduction to Energy Sources: 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, solar radiation data measuring instruments – Pyranometer and Pyrheliometer.	
UNIT – II	**(10 Hours)**
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. **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.	
UNIT – III	**(10 Hours)**
Wind Energy: Wind and its properties, history of wind energy, basic principles of Wind Energy Conversion Systems (WECS), wind data measuring instrument, classification of WECS, parts of a WECS, power in the wind; Vertical axis wind turbine generator - Savinous and Darrius types, advantages and limitations of WECS. **Biomass Energy:** Introduction, photosynthesis process, biomass conversion technologies, biomass gasification – principle and working of gasifiers; biogas - production of biogas, factors affecting biogas generation; types of biogas plants–KVIC and Janata model.	
UNIT – IV	**(10 Hours)**
Geothermal Energy: Introduction, classification, conversion technologies, applications, advantages and limitations of geothermal resources.	

Energy from Ocean:
Principle of tidal power, components of Tidal Power Plant (TPP), classification, advantages and limitations of TPP.
Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, types of OTEC power generation, block diagram, applications, advantages and limitations.

Reference Books:

1. B. H. Khan, "Conventional Energy Resources", Tata McGraw-Hill Education Private Limited, New Delhi, 3rd Edition, 2007.
2. G. D. Rai, "Non-conventional Energy sources", Khanna Publication, 4th Edition, 2015.
3. G. N. Tiwari and M K. Ghosal, "Fundamentals of Renewable Energy Resources", Alpha Science International Ltd, 1st Edition, 2007.
4. Shobh Nath Singh, "Non-Conventional Energy Resources", Pearson Education, 2nd Edition 2018.
5. Bent Sorensen, "Renewable Energy", Academic Press, 5th Edition, 2017 (e-book).
6. David Buchla, Thomas Kissell and Thomas Floyd, "Renewable Energy Systems", Pearson, 1st Edition, 2014 (e-book).
7. Roland Wengenmayr, Thomas Buhrke, "Renewable Energy: Sustainable Energy Concepts for the Future", Wiley-VCH, 2nd Edition, 2008 (e-book).

Course Outcomes:

After completion of the course the students will be able to,

1. Identify electrical and mechanical devices of solar, wind, biomass, geothermal and ocean energy conversion systems.
2. Measure performance parameters related to solar, wind, biomass, geothermal and ocean energy conversion systems.
3. Compute the power generation of wind and solar energy correspond to variable data.
4. Compare the features of solar, wind, biomass, geothermal and ocean energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE136B.1	3	1	1			1	1	1		1	1	1	3	1	
2	22UEE136B.2	3	1	1	1		1	1	1		1		1	2	3	
3	22UEE136B.3	3	2	3	1							1	1	1	1	
4	22UEE136B.4	3	3	3	2				1				1	1		1

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE115C	**Elements of Electrical Engineering**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To identify various components of Hydel, Thermal and Nuclear power plants and explain the overall operation of the power plants
- To make use of the basic concepts of magnetic circuits, electromagnetism, single phase & three phase circuits and apply them to analyse given electrical circuit.
- To make use of mesh current analysis and node voltage analysis to find the current and voltages of a given electric circuit.
- To calculate different parameters related to magnetic circuits, single phase & three phase AC circuits and energy consumption.
-

UNIT – I	(10 Hours)
Electrical Power Generation: Hydel plant, thermal plant, nuclear plant - working principle, site selection parameters, merits and demerits. **Electromagnetism:** Faraday's laws of electromagnetic induction, Lenz's law, Fleming's rules, statically and dynamically induced emf, concepts of self and mutual inductance, coefficient of coupling, energy stored in magnetic field.	
UNIT – II	**(10 Hours)**
DC Circuits: Ohm's law and Kirchhoff's laws, analysis of series, parallel and series-parallel circuits, current and voltage sources, source transformation and shifting, dependent and independent sources, mesh current analysis, node voltage analysis.	
UNIT – III	**(10 Hours)**
Single-Phase AC Circuits: Generation of sinusoidal voltage, average and rms values, form factor and peak factor, phasor representation of alternating quantities, analysis of R, L, C, R-L, R-C, R-L-C circuits with phasor diagrams, real power, reactive power, apparent power, power factor, series, parallel and series-parallel circuits. **Three-Phase AC Circuits:** Advantage of 3-phase system, generation of 3-phase power, relationship between line and phase values of balanced star and delta connections, power in balanced 3-phase circuits, measurement of 3-phase power by 2-wattmeter method.	
UNIT – IV	**(10 Hours)**
Domestic Wiring: Requirements, Types of wiring, Two way and three way control of loads. **Electrical Energy Calculation:** Power rating of household appliances, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Electrical Safety Measures:** Equipment: Types of equipment, voltage and current issues, safety. Human: Electric shock, effect of shock on body, factors affecting severity of shock, safety precautions.	
Reference Books: 1. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2014. 2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 10th Edition, 2019. 3. Edward Hughes, "Electrical and Electronic Technology", Pearson Publications, 10th Edition, 2010.	

4. Rajendra Prasad, "Fundamentals of Electrical Engineering", 2nd Edition, PHI Learning, 2009.
5. V.N.Mittle & A.Mittal, "Basic Electrical Engineering", Tata McGraw-Hill Education, 2005
6. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017.

Course outcomes:

After completion of the course the students will be able to,

1. Suggest suitable site for Hydro –electric, Thermal and Nuclear power plants by understanding the working principle and pros & cons
2. Apply the fundamental concepts of electromagnetism to assess the parameters of magnetic circuits
3. Apply electric circuit theorems to DC and AC (single phase and three phase) circuits to determine current, voltage, and power in various branches
4. Identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE115C.1	3											1	1		
2	22UEE115C.2	3	2	2	2								1	2		1
3	22UEE115C.3	3	3	2	2	1	1						1	1		
4	22UEE115C.4	3	3	1	3	1	1		1		1		2	1		1

Syllabus for B.E- I/II Semester for academic year 2023 – 2024

(For students admitted to I year in 2023-24)

22UEE116N	**Introduction to Electrical Engineering**	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Course Objectives:

- To understand the working of Hydro –electric, Thermal and Nuclear power plants
- To determine current, voltage, and power in various branches by applying electric circuit theorems to DC and AC (single phase and three phase) circuits
- To analyze the working principle and construction to identify the suitable applications of DC generators, motors and transformers by identifying the specifications
- To identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

UNIT – I	**(10 Hours)**
Introduction: General structure of electrical power systems using single line diagram approach. **Power Generation:** Hydel, thermal, nuclear power plants (block diagram approach). **DC Circuits:** Ohm's law and its limitations, KCL & KVL, series, parallel, series-parallel circuits. Simple Numerical.	
UNIT – II	**(10 Hours)**
AC. Fundamentals: Equation of AC voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor (only definitions), voltage and current relationship with phasor diagrams in R, L, and C circuits, concept of impedance, analysis of R-L, R-C, R-L-C series circuits, active power, reactive power and apparent power, concept of power factor. (Simple Numerical). **Three Phase Circuits:** Generation of three phase AC quantity, advantages and limitations, star and delta connection, relationship between line and phase quantities (excluding proof)	
UNIT – III	**(10 Hours)**
DC Generator, DC Motor, Transformers: Working principle, construction, equations, types and classifications, specifications, applications, cost. Simple numerical.	
UNIT – IV	**(10 Hours)**
Domestic Wiring: Requirements, Types of wiring, Two way and three way control of loads. **Electrical Energy Calculation:** Power rating of household appliances, two-part electricity tariff, calculation of electricity bill for domestic consumers. **Electrical Safety Measures:** Equipment: Types of equipment, voltage and current issues, safety. Human: Electric shock, effect of shock on body, factors affecting severity of shock, safety precautions.	
Reference books: 1. B.L Theraja, "Fundamentals of Electrical Engineering and Electronics", S. Chand Publications, 27th Edition, 2014 2. D C Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, 10th Edition, 2019.	

3. Edward Hughes, “Electrical and Electronic Technology”, Pearson Publications, 10th Edition, 2010
4. Rajendra Prasad, “Fundamentals of Electrical Engineering”, 2nd Edition, PHI Learning, 2009
5. V.N.Mittle & A.Mittal, “Basic Electrical Engineering”, Tata McGraw-Hill Education, 2005

Course Outcomes:

After completion of the course the students will be able to,

1. Understand the working of Hydro –electric, Thermal and Nuclear power plants
2. Apply the electric circuit theorems to DC and AC (single phase and three phase) circuits to determine current, voltage, and power in various branches
3. Analyze the working principle and construction to identify the suitable applications of DC generators, motors and transformers by identifying the specifications
4. Identify the safety aspects in different types of wiring mechanisms and evaluate the energy consumption in domestic loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE116N.1	3											1	1		
2	22UEE116N.2	3	1	1	1								1	2		1
3	22UEE116N.3	3	1	1	1								1	2		1
4	22UEE116N.4	3	1	1	1				1		1		1	1		1

Syllabus for

B.E. III - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UMA303C	**Computation Techniques for Electrical Systems - I**	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Definitions of signals and systems, Classification of signals, Elementary signals, Basic operations on signals, Properties of systems.	
UNIT – II	**10 Hours**
Time-domain representation for LTI systems: Convolution, Impulse response representation, Properties of impulse response representation, Block diagram representations	
UNIT – III	**10 Hours**
Z-Transforms: Introduction, Z transform, Properties of ROC, Properties of the Z - transform, Inverse Z - transform, Partial fraction expansion method, Transfer function, Causality and Stability	
UNIT – IV	**10 Hours**
Fourier Analysis of Continuous Time Periodic and Aperiodic signals: Introduction, Properties of continuous-time Fourier series (Excluding derivation of defining equations for CTFS), Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on properties of Fourier series and Fourier transform.	

References:

1. Simon Haykin and BaryVam 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. Michael Roberts, "Fundamentals of Signals & Systems", 2nd Edition, Tata McGraw-Hill, 2010
4. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia / PHI, 2nd Edition, 2013.
5. Ganesh Rao, Satish Tunga, "Signals and Systems", Sanguine Technical Publishers, 2nd Edition, 2020.

Course Outcomes:

After completion of the course the students will be able to,

1. Represent signals and perform the basic operations on signals and to identify systems properties on causality, stability, memory, linearity and time invariance
2. Illustrate- Continuous time systems and discrete time system by performing Convolution in LTI system with properties of impulse response
3. Analyze and Derive the Z transforms and properties of Z transform by using the concept of ROC
4. Determine Fourier series and properties of Fourier series in CTFS and CTFT signals

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UMA303C.1	2	3										1	1	2	1
2	22UMA303C.2	3	1	2	1								1	2	3	1
3	22UMA303C.3	3	3	1	1	1			1				1	1	2	1
4	22UMA303C.4	3	3	2	2	1			1				1		1	1

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE305C	Network Analysis	03 - Credits (2 : 1 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(7L-8T Hours)

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- Numerical Problems

Network Topology: Graph of network, concept of tree and co-tree, incidence matrix, Tie-set & cut-set schedules, Formulation of equilibrium equations in matrix form, solution of resistive network, Principles of duality- Numerical Problems

UNIT – II	(6L-6T Hours)

Network Theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Reciprocity theorem, Millman's theorem, Compensation theorem, Tellegan's theorem - Numerical Problems

UNIT – III	(7L-6T Hours)

Transient Behavior and Initial Conditions: Behavior 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- Numerical Problems

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- Numerical Problems

UNIT – IV	(6L-6T Hours)

Resonant Circuits: Series and parallel resonance, frequency-response of series and parallel circuits, Q-factor, Bandwidth-Numerical Problems

Two Port Network Parameters: Short Circuit admittance parameters, open circuit impedance parameters, transmission parameters, hybrid parameters, relationship between parameters sets- Numerical Problems

Reference Books:

1. William H, Jack E Kemmerly and Steve Durbin, "Engineering Circuit Analysis", 8th Edition, Tata McGraw Higher Education, 2014.
2. M. E. Van Valkenburg, "Network analysis", 3rd Edition, PHI Learning, 2014.
3. Roy Chowdhary, "Network and Systems", 2nd Edition, New age International Publications, 2010.
4. Charles K. Alexander, Matthew N. O. Sadiku "Fundamentals of Electric Circuits", 5th Edition, Tata McGraw Higher Education, 2013.
5. Abhijit Chakrabarti, "Circuit Theory-Analysis and Synthesis", 7th Edition, Dhanpat Rai Technical Publishers, 2016.

Course Outcomes:

After completion of the course the students will be able to,

1. Calculate current, voltage and power dissipated in various branches of the complex electric circuit having three or more meshes/nodes by applying electric circuit theorems
2. Solve and analyze the electrical circuits under transient conditions with the given initial conditions using Laplace transforms
3. Analyze series and parallel resonance circuits to determine the circuit parameters (L&C) for which the circuit will resonate at given frequency
4. Evaluate Admittance, Impedance, Hybrid and Transmission parameters for a given two port network by deriving the relation between different set of parameters.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE305C.1	3							1		1		1	3	1	1
2	22UEE305C.2	3	1						1		1		1	2	3	1
3	22UEE305C.3	3	3	2	2	1			1		1		1	1	1	1
4	22UEE305C.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE306C	Electronic Circuits	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Diode Circuits: Introduction, clipping circuits, Clipping at two independent levels, Clamping Circuits, Comparators, Full wave rectifier with C filter. **Transistor Biasing:** Introduction, Operating point, DC load line, Bias stability, voltage divider bias, Derivation of stability factors, Bias compensation.	
UNIT – II	**10 Hours**
BJT Low Frequency Analysis: 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:** 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:** Transfer characteristics of JFET, Important relationships, Depletion & Enhancement type MOSFETs.	
UNIT – III	**10 Hours**
Basics of Op-Amps: Block diagram and characteristics of 741 Op-amp, Op-amp as an inverting and non- inverting amplifier, voltage follower, adder, subtractor, integrator and differentiator. **Signal Processing circuits:** Precision half wave & full wave rectifiers, limiting circuits, clamping circuits, peak detectors, sample and hold circuits, Voltage regulators basics, voltage follower regulator, adjustable output regulator.	
UNIT – IV	**10 Hours**
Applications of Op-Amps: Zero crossing detectors, inverting Schmitt trigger circuit, non-inverting Schmitt circuit. Astable multivibrator and mono-stable multivibrator using 555 timer, Phase shift oscillator, oscillator amplitude stabilization and Wein bridge oscillator. **Active filters:** First and second order high pass and low pass filters, band stop and band pass filters.	

Reference Books:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. David A. Bell, "Operational Amplifier and Linear ICS", 3rd Edition, Oxford, 2012.
4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 9th Edition, Pearson/Prentice Hall, India, 2006.
5. Ramakanth A. Gayakwad, "Operational Amplifier and Linear ICS", 4th Edition, PHI, 2016.
6. Jacob Millman, Arvin Grabel, Microelectronics, 2nd Edition, Tata McGraw Hill, New Delhi, 2003

Course Outcomes:

After completion of the course the students will be able to,

1. Design and analyze diode clipping, limiting and clamping circuits

2. Examine various transistor biasing circuits
3. Analyse BJT, MOSFETs, and multistage amplifiers
4. Design and analyse op-amp based feedback circuits and various applications of op amps

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE306C.1	3	2	2									2	3	3	3
2	22UEE306C.2	3	2										2	2	3	3
3	22UEE306C.3	3		3		1			1		1		1	2	2	1
4	22UEE306C.4	3	3	3		1			1		1		2	2	2	1

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE307C	Electrical Machines-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Single Phase Transformer:
Constructional details and EMF equation, Phasor diagrams, Calculation of equivalent circuit parameters by OC and SC tests, Transformer ratings and per unit (p.u.) scaling, Losses & efficiency, all day efficiency, voltage regulation, polarity test and Sumpner's test.

UNIT – II	10 Hours

Three Phase Transformers:
Construction of three phase transformer and types, bank of single phase transformers for three phase operations and their connections: star-star, star-delta, delta-star, delta-delta, open delta, Labeling of terminals and vector groups, Single unit three phase transformer, Choice of connections:, Harmonics in transformer, Suppression of harmonics by tertiary winding, Scott connection and Phase conversion.
(Note: No analysis of Scott connection)
Parallel operation of Transformer
Need for parallel operation, conditions to be satisfied for parallel operation and load sharing.
Auto Transformer: Construction, working principle, saving of copper and applications.

UNIT – III	10 Hours

Three Phase Induction Motor:
Construction and types of motors, Principle of operation, production of rotating magnetic field, slip, rotor induced emf and its frequency, power losses in an induction motor, equivalent circuit, torque equation, torque-slip characteristics-motoring, generating and braking 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, Cogging and crawling, Introduction of circle diagram.
(Note: Drawing of circle diagram would be done from NL and BR test in the laboratory. No problems on circle diagram in theory papers)

UNIT – IV	10 Hours

Starting and Speed Control of Three Phase Induction Motors:
Need for starter, DOL, star delta, autotransformer and rotor resistance starters, Calculation of starting torque, double cage and deep bar motors, speed control by rotor resistance, voltage control, V/f control, NEMA classifications.
Introduction of Induction generator, Linear induction motor
Single Phase Induction Motors:
Construction, double field revolving theory, equivalent circuit, starting of single phase motors: Resistance split phase, capacitor start and capacitor run motors, shaded pole motors.

Reference Books:

1. I J Nagarath and DP Kothari, “Electrical machines”, 4th - Edition, TMH, New Delhi, 2020
2. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, “Electrical Machinery”, Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, “Generalized Theory of Electrical Machines”, Khanna publishers, 2014
5. M. G. Say, “Alternating Current Machines”, ELBS publishers, 1986
6. Alexander Langsdorf, “Theory of alternating current machines”, TMH, 1999

Course Outcomes:

After completion of the course the students will be able to,

1. Test the given transformers and induction motors by various methods and predetermine their performance such as losses, efficiency, and regulation.
2. Connect the given transformers in different configurations for different operations, like autotransformer, parallel operation and 3-phase connections.
3. Control the starting current and speed of 3-phase induction motors by suitable methods.
4. Select suitable induction motors for different industrial or domestic applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE307C.1	3	2	2									2	3		3
2	22UEE307C.2	3	2										2	3		3
3	22UEE307C.3	3		3		1			1		1		1	3		2
4	22UEE307C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE308C	**Electrical & Electronic Measurement**	**03 - Credits (2 : 0 : 2)**
Hours/Week : 2L + 2P		CIE Marks : 50
Total Hours :		SEE Marks : 50

UNIT – I	**7 Hours**
Measurement of Resistance Inductance and Capacitance: Measurement of medium resistance: Wheatstone bridge, Limitations; Measurement of low resistance: Kelvin's Double bridge; AC Bridges: General equilibrium equations of AC bridges; Measurement of Self Inductance – Types of bridges for measurement of self inductance, Maxwell's Inductance Capacitance Bridge, Measurement of Capacitance: Types of bridges for measurement of capacitance, De Sauty's bridge. Sources of errors in bridge circuits. Sources and Detectors	
UNIT – II	**6 Hours**
Measurement of Power and Related Parameters: Dynamometer Type Wattmeter; Induction Type Single Phase Energy meter – Construction, Theory; Dynamometer Type Single Phase Power Factor meter – Construction and Operation; Weston Frequency meter.	
UNIT – III	**7Hours**
Extension of Instrument ranges: Introduction; Shunts and Multipliers; Instrument Transformers: Advantages of Instrument Transformers, Ratios of Instrument Transformers, ratio Correction Factor, Burden on Instrument Transformer; Current Transformer(CT) – Theory of CT; Potential Transformer(PT) – Differences between CT and PT, Theory of PT.	
UNIT – IV	**6 Hours**
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. Advantages and Disadvantages of Electrical transducers. Principle, construction, working and application of: Resistive transducers - Resistance Temperature Detector (RTD), Light Dependent Resistor (LDR); Capacitive transducers; Inductive transducers: Linear variable differential transformer (LVDT). LM 35 sensor.	

List of Experiments

1. Measurement of low resistance using Kelvin's double bridge.
2. Measurements of inductance using Maxwell's L-C bridge.
3. Measurements of capacitance using De-sauty's bridge
4. Adjustment and calibration of l-Φ Energy meter.
5. Measurement of power in a balanced 3-phase circuit using two wattmeters 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.

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Reference Books:

1. A. K. Sawhney, "Electrical & Electronic Measurements and Instrumentation", 19th Edition, Dhanpat Rai & Son's, New Delhi, 2011.
2. Golding & Widdies, Pitman, "Electrical Measurements and Measuring Instruments", 5th Edition, D.R & Son's, New Delhi.
3. Ramon P. Areny, John G. Webster, "Sensors and Signal Conditioning", 2nd Edition, Wiley India Private Ltd.
4. Ian R. Sinclair, "Sensors and Transducers", 3rd Edition, Newgen Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Measure resistance, inductance and capacitance of a given specimen using DC and AC Bridges and validate the results analytically
2. Measure electrical power and related parameters using different types of measuring devices and validate the results analytically
3. Select Shunts & Multipliers, CT's & PT's to extend the range of ammeters & voltmeters
4. Select sensors & transducers for different electrical based applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE308C.1	3	2	2									2	3		3
2	22UEE308C.2	3	2										2	3		3
3	22UEE308C.3	3		3		1			1		1		1	3		2
4	22UEE308C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE310L	Electronic Circuits Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 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. Study of Op-Amp as
   - Inverting and non-inverting amplifier
   - Voltage follower
   - Adder and substractor
6. Study of Op-Amp as zero crossing detector
7. Study of Op-Amp as Schmitt trigger
8. Design and testing of Op-Amp based RC phase shift oscillator.
9. Study of rectifiers using Op-Amp.
10. Design and testing of first and second order filters using Op-Amp.
11. Study of astable multi vibrator using 555 timer

Reference Books:

1. Jacob Milliman, Christos C. Halkias, Chetan D. Parikh, Integrated Electronics-Analog and Digital Circuits and Systems, 2nd Edition, Tata McGraw Hill Education Private Limited, New Delhi, 2015.
2. G. K. Mithall, Electronic Devices and Circuits, Khanna Publishers, New Delhi, 1998.
3. David A. Bell, "Operational Amplifier and Linear ICS", 3rd Edition, Oxford, 2012.
4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 9th Edition, Pearson/Prentice Hall, India, 2006.

Course Outcomes:

After completion of the course the students will be able to:

1. Draw the circuit, write the procedure and select the required electronic components for a given experiment.
2. Rig up the circuit and conduct experiments using the electronic components to achieve desired results.
3. Analyze the results to write the inference and prepare a detailed report.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE310L.1	3				1	1					1	1	2	3	3
2	22UEE310L.2	3	1		1	2						1	2	3	3	3
3	22UEE310L.3	3	2	2	1	2	2					1	2	2	3	2

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE311L	Electrical Machines Laboratory - I	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

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. Polarity test
3. Sumpner's test to calculate no load loss and full load loss and predetermine efficiency.
4. Parallel operation of two single phase transformers and determine their load sharing
5. Connection of three single phase transformers: star-star, star-delta, delta-delta and delta-star.
6. Brake 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. Brake load test on single phase induction motor and performance evaluation (torque-speed, BHP- efficiency, slip -BHP, etc.)

Reference Books:

1. I J Nagarath and DP Kothari, “Electrical machines”, 4th Edition, TMH, New Delhi
2. Ashfaq Hussain, “Electrical Machines”, Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, “Electrical machinery”, Khanna publishers, 7th Edition 2018
4. Mohinder Singh Sejwal “Laboratory manual for Electro mechanics”, Curriculum Development Cell, Dept. of EE IIT Delhi, Wiley Eastern Ltd, ISBN 0852261438

Course Outcomes:

After completion of the course the students will be able to:

1. Test the given transformers and induction motors by various methods and predetermine their performance such as losses, efficiency and regulation.
2. Connect the given transformers in different configurations for different operations, like autotransformer, parallel operation and 3-phase connections.
3. Control the speed of 3-phase induction motors by stator voltage and rotor resistance method.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE311L.1	3	1	1		1	1					1	1	2	3	3
2	22UEE311L.2	3	1	1	1							1	1	3	3	3
3	22UEE311L.3	3	1	1	1							1	1	2	3	2

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE315C	**Sustainable Energy Technologies in Agriculture**	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**(10 Hours)**
Introduction to irrigation systems: Need for Irrigation and ill effects of irrigation, Type of irrigation methods, Micro irrigation systems – pros and cons, Energy saving potential in irrigation systems, Optimum sizing of pumps, Govt. initiatives in irrigation systems, Solar photovoltaic powered irrigation pumps, Different connection topologies of SPV pumps, pros and cons of SPV pumps.	
UNIT – II	**(10 Hours)**
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.	
UNIT – III	**(10 Hours)**
SPV based irrigation pumps: Solar photovoltaic basics, Issues in sizing the SPV based pumps, Govt. schemes for SPV irrigation systems, Selection of SPV array capacity & connection configuration, Economic analysis.	
UNIT – IV	**(10 Hours)**
Micro Irrigation Systems: Drip Irrigation Systems: Components used, Layout of drip irrigation, Selection of lateral pipelines, Sizing of pumping unit, Cost and Energy Analysis. Micro Sprinkler Irrigation Systems: Required resources and conditions, Layout, Selection of Sprinkler and spacing, Capacity of Sprinkler pumping unit, Cost and Energy Analysis.	

Reference Books:

1. A.M.Michael, “Irrigation Theory and Practice”, Vikas Publishers, Second Enlarged Edition, 2011.
2. Basanagouda F. Ronad, S H Jangamshetti, “Optimum Sizing of SPV Irrigation Systems based on Field Conditions”, LAP LAMBERT Academic Publishing, August 2018.
3. 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.

Course Outcomes:

After completion of the course, the students will be able to:

1. Identify the challenges faced by farmers in irrigation systems and be able to suggest probable solution
2. Assess the optimum size of the irrigation pumps by calculating the exact water requirement of the crops for the specific location for local climatic conditions
3. Analyze the working of solar photovoltaic powered irrigation system under the specified conditions
4. Suggest the type of micro irrigation scheme for specified agriculture land by analyzing field conditions

Syllabus for B.E III - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE315C.1	2	2										1	2		2
2	22UEE315C.2	2	1	1			1						1	1		2
3	22UEE315C.3	2	1	1			1	1	1				1	1		2
4	22UEE315C.4	2	2	1	1		1	1	1				1	1		1

Syllabus for

B.E. IV - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UMA403C	Computation Techniques for Electrical Systems -II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Fourier analysis of Discrete Time Periodic and Aperiodic signals: Introduction, Properties of Discrete - time Fourier series , Linearity, Time shift, Frequency shift, Scaling, Differentiation and Integration, Convolution and Modulation, Parseval's theorem and problems on Fourier series and Fourier transforms.	
UNIT – II	**10 Hours**
Numerical Analysis – I: 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 Method (without proof). Numerical differentiation using Newton's forward and backward formulae-problems. Numerical Integration: Trapezoidal rule, Simpson's one third rule.	
UNIT – III	**10 Hours**
Numerical Analysis - II: Numerical methods for solution of differential equations: Euler's and Modified Euler's method, Runge-Kutta 4^{th} order method. Step by step method(point by point method) **Statistics:** Curve fitting by the method of least squares: $y=a+bx$, $y=a+bx+cx^2$, $y=ab^x$.	
UNIT – IV	**10 Hours**
Basic Probability Theory: Probability concepts, Random variables probability distributions. Binomial distributions, Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.	

References:

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. "Signals and Systems", Ganesh Rao, Satish Tunga, Sanguine Technical Publishers, 2nd Edition, 2020.
5. Signals and Systems, Uday Kumar S.PRISM book publisher, 6th Edition, 2013
6. H P HSU, "Signals and Systems," Schaums Outline, TMH, 2nd Edition, 2011.
7. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt. ltd 2nd Edition 2012.
8. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).

Course Outcomes:

After completion of the course the students will be able to,

1. Apply the concepts of Fourier series and Fourier transforms to analyse Discrete Time Periodic and aperiodic signals.
2. Solve engineering problems using numerical techniques.
3. Obtain the numerical solution of ordinary differential equations.
4. Apply the concepts of Statistics and probability to solve problems in Engineering.

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UMA403C.1	2	3										1	1	2	1
2	22UMA403C.2	3	1	2	1								1	2	3	1
3	22UMA403C.3	3	3	1	1								1	1	2	1
4	22UMA403C.4	3	3	2	2	1	1						1		1	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE405C	Power System - I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
AC Transmission Systems: 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.	
UNIT – II	**10 Hours**
Electrical Parameters of Overhead Transmission Lines: Constants of Transmission line. Inductance of single phase two wire line, Capacitance of single phase two wire line. **Performance of Transmission Lines:** Classification of overhead Transmission line. Short Transmission line, Medium Transmission line – End condenser method, Nominal T method, Nominal π method, Long Transmission line. Generalized circuit constants (ABCD) of a transmission line.	
UNIT – III	**10 Hours**
Underground Cables: 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. **Distribution Systems:** Classification of distribution systems. Overhead Vs Underground distribution system. Connection schemes of distribution system. Requirements of a distribution system. Types of DC distributors, DC distributor fed at one end- Concentrated loading, Uniform loading. DC distributor fed at both ends - Concentrated loading. **Circuit Breakers:** Operating Principle of circuit breaking, Arc Phenomenon, Principle of Arc extinction, Methods of Arc extinction, Types of circuit breakers: Air blast circuit breaker, SF6 circuit breaker.	
UNIT – IV	**10 Hours**
Protective Relaying and Protective Schemes: 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, Distance relays: Impedance Relay, Reactance Relay, Mho Relay; and Buchholz Relay. **Static Relays:** 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.	

Reference Books:

1. Mehta V K and Rohit Mehta, "Principals of Power Systems", 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, "Power System Engineering", 5th Edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, "Switchgear and Protection and Power Systems", 13th Edition, Khanna Publishers, 2008.

4. J.B.Gupta, “Switchgear and Protection”, (2nd Edition), Katson Publisher, 2013.
5. Ravindarnath B, “Power System Protection and Switchgear”, 2nd Edition, New age International, 2008.

Course Outcomes:

After completion of the course the students will be able to,

1. Select various mechanical components for overhead transmission line based on the required electrical properties, mechanical properties and available budget
2. Estimate sag for equal, unequal supports with and without considering wind/ice loading
3. Assess performance of short, medium and long transmission lines in terms of efficiency and regulation
4. Select relevant method to implement protective schemes against different faults in electrical systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE405C.1	3											1	1	2	3
2	22UEE405C.2	3	1										1	1	1	2
3	22UEE405C.3	3	3	2	2	1	1						1	2	2	2
4	22UEE405C.4	3	3	3	3	1	1		1		1		2	1	1	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE406C	Logic Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Introduction: Introduction to Digital logic Design; Binary Systems and Codes: Binary Numbers, Octal and Hexadecimal Numbers; Number Base Conversions; Arithmetic Operation with different Bases; Complements. Signed Binary Numbers; Binary Codes and conversions: BCD, Gray, ASCII and EBCDIC. Binary Logic and Logic Gates: AND, OR and NOT.	
UNIT – II	**10 Hours**
Boolean Algebra and Logic Gates: Basic Definition. Basic Theorems. Boolean Functions; Standard Forms: Minterm and Maxterm. Simplification of Boolean Functions using SOP and POS; Logic Operations: NAND, NOR, Exclusive-OR and Equivalence. Integrated Circuits **Gate-Level Minimization:** The Map Method. Two- and Three-Variable Map. Four-Variable Map. Product of Sums Simplification. Don't-Care Conditions, logic gates implementation, determination and selection of Prime Implicants, Essential and Nonessential prime Implicants.	
UNIT – III	**10 Hours**
Analysis and Synthesis of Combinational Circuits: Combinational Circuits. Analysis and Design Procedure; Binary Adders-Subtractor; Decoders and Multiplexers, Sequential Circuits, Latches. **Flip-Flops:** RS, D, JK and T; Analysis of Clocked Sequential Circuits. Design Procedure, Registers and Counters: Registers. Shift Registers; Synchronous Counters. Ripple Counters.	
UNIT – IV	**10 Hours**
Sequential Circuits with Programmable Logic Devices: Introduction, Random-Access Memory, Memory Decoding, Read-Only Memory. Programmable Logic Array. **Verilog:** Introduction to Verilog, Verilog Structural and Behavioral Design, Verilog Time Dimension and Test Benches.	

Reference Books:

1. Morris Mano, Charles R. Kime, Logic and computer design fundamentals, Pearson Prentice Hall, 2004
2. Basavaraj,B., Digital fundamentals, New Delhi : Vikas Publishing House, 1999.
3. Kandel Langholz, Digital Logic Design, Prentice Hall, 1988.
4. Rafiq uzzaman& Chandra, Modern Computer Architecture, West Pub. Comp., 1988.
5. Zvi. Kohavi, Switching and Finite Automata Theory, Tata McGraw Hill, India, 2004.
6. C. V. S. Rao, Switching and Logic Design, 3rd Edition, Pearson Education, India, 2009.
7. Donald D. Givone, Digital Principles and Design, Tata McGraw Hill, India, 2002.

Course Outcomes:

After completion of the course the students will be able to,

1. Simplify Boolean functions using various reduction algorithms
2. Design and implement variety of logical circuits using combinational logic
3. Design and implement variety of logical circuits using sequential logic
4. Model various Verilog descriptions to test and verify digital systems

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE406C.1	3	2	2									2	1	3	1
2	22UEE406C.2	3	2	3									3	1	3	1
3	22UEE406C.3	3		3	1	1					1		3	1	3	1
4	22UEE406C.4	3	3	3	1	1			1		1		2	1	3	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE407C	Electrical Machines-II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
DC Generator: Construction of DC machines, introduction of armature windings, emf equation, types of excitations, no load and load characteristics (only separately excited and shunt field generator, no compound generator) Armature reaction and its effects, demagnetizing and cross magnetizing AT/pole, compensating winding, interpole, commutation **DC Motors:** Principle of Operation & concept of back EMF, torque equation, characteristics of D.C. motors (without compound motors), and applications, universal motor.	
UNIT – II	**10 Hours**
Starting, Speed control and Braking of DC Motors: Necessity of starters, resistance starters (excluding three point and four point starter), Speed control of shunt field, separately excited and series motors, Ward Leonard method of speed control, Braking of DC motors **Testing of D.C Motors:** Losses in DC Machine, Efficiency, direct load test, Swinburne's test, Field's test on DC series motors.	
UNIT – III	**10 Hours**
Synchronous Machines: Construction and types, types of field excitation, emf equation for generator, effect of distribution winding and chorded coils, effects of harmonics on emf generated, phasor diagram of a Synchronous generator with cylindrical rotor, voltage regulation, calculation of synchronous reactance by emf method **Salient pole synchronous machines:** Two-reaction model, slip test.	
UNIT – IV	**10 Hours**
Parallel operations of alternators: Synchronization, parallel operation, operation on infinite bus, operating characteristics, power flow equations of Alternators **Synchronous Motors:** Principle of operation, methods of starting, phasor diagram, effect of changing excitation, V and inverted V curves of synchronous machines, hunting in synchronous machines, effect of damper windings	

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition, TMH, New Delhi,2020
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, "Generalized theory of Electrical machines", Khanna publishers, 2014
5. M. G. Say, "Alternating Current Machines" ELBS publishers, 1986
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

After completion of the course the students will be able to,

1. Test the dc/ac generator and motor for losses and efficiency using various methods.
2. Analyse the effect of harmonics on ac generator and motor in emf generation.
3. Estimate the emf, number of poles/slots, losses, efficiency and power flow equations of dc/ac generator and motor
4. Select the suitable generator and motor for various engineering applications.

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE407C.1	3				1	1						1	1	3	2
2	22UEE407C.2	3	1										1	1	2	1
3	22UEE407C.3	3	3	2	2								1		2	1
4	22UEE407C.4	3	3	3	3	1		1					2	1	2	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE408C	Control Systems	04 - Credits (4 : 0 : 0)
Hours/Week : 04		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(13 Hours)
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.	
UNIT – II	**(13 Hours)**
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.	
UNIT – III	**(13 Hours)**
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.	
UNIT – IV	**(13 Hours)**
Frequency Domain Analysis: The concept of frequency response, Bode plots, procedure for constructing Bode plots, Gain margin, Phase margin, Frequency domain specifications, Nyquist stability criterion and examples. **Control system analysis in state-space:** State variable representation, conversion of state variable models to transfer functions and vice versa. Usage of MATLABcommand-line functions to verify the solution.	

Reference Books:

1. Benjamin C. Kuo, "Automatic Control System", 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop "Modern Control Systems", 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, "Control Systems Engineering", New Age International (P) Ltd.,1999
4. Norman S. Nise "Control System Engineering", McGraw Hill, 2010.
5. R. S. Allurkar, "Control Systems", EBPB, 2004

Course Outcomes:

After completion of the course the students will be able to,

1. Classify control systems based on a number of ways and select them for particular applications.
2. Develop mathematical modeling of LTI control systems via differential equation formation, transfer function, and state space analysis.

3. Employ time domain analysis to predict and diagnose transient performance parameters of LTI control systems for standard input function step.
4. Formulate different types of analysis in frequency domain to obtain the stability of the LTI control systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE408C.1	3	3	2	2	2							2	1	2	1
2	22UEE408C.2	3	3	3	2	3							2	1	3	1
3	22UEE408C.3	3	3	3	3	3							2	1	3	1
4	22UEE408C.4	3	3	3	3	3							2	1	2	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE410L	**Power System – I Laboratory**	**01 - Credits (0 : 0 : 1)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. ABCD parameters for short and medium network of transmission lines.
   a) Verification of Symmetry and Reciprocity of the network.
   b) Determination of regulation and efficiency.
2. Operating characteristics of static Under/Over Voltage relay.
3. Operating characteristics of Microcontroller over voltage relay (DMT and IDMT)
4. Operating characteristics of Electro-Mechanical over current relay.
5. Operating characteristics of Electro-Mechanical Earth fault relay.
6. Operating characteristics of Microcontroller over current 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)

Reference Books:

1. Mehta V K and Rohit Mehta, “Principals of Power Systems”, 4th Edition, S Chand and Company Ltd, Publishers, New Delhi, 2015.
2. Soni, Gupta and Bhatnagar, “Power System Engineering”, 5th Edition, Dhanapat Rai and Co.(P) Ltd. Publishers, New Delhi, 2016.
3. Sunil Rao, “Switchgear and Protection and Power Systems”, 13th Edition, Khanna Publishers, 2008.
4. J.B.Gupta, “Switchgear and Protection”, (2nd Edition), Katson Publisher, 2013.
5. Ravindarnath B, “Power System Protection and Switchgear”, 2nd Edition, New age International, 2008.

Course Outcomes:

After completion of the course the students will be able to:

1. Determine the electrical network parameters using electrical topology
2. Perform test to evaluate the breakdown strength of transformer oil.
3. Measure high AC and DC voltage using Sphere-gap test

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE410L.1	2	3										1	1	2	1
2	22UEE410L.2	3	1	2	1								1	2	3	1
3	22UEE410L.3	3	3	1	1	1			1				1	1	2	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE411L	Control System Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. To determine the characteristics of synchro-transmitter and receiver system and to study its application as remote position indicator.
2. To determine the time domain response of a second order system using RLC circuit for a step input.
3. To determine the frequency response of a second -order system.
4. To determine the frequency response of RC lag compensating network.
5. To determine the frequency response RC lead compensating network.
6. To draw the speed – torque characteristic of A.C. servomotor.
7. To sketch the root loci for the given control system for $K \geq 0$. Find the value of K at the breakaway point. Also write a MATLAB program to verify the same.
8. To sketch the Bode plot of the given open-loop transfer function and determine the gain cross-over frequency and phase cross-over frequency, GM, PM. Also write a MATLAB program to verify the same.
9. To sketch the Nyquist plot of the given feedback control system and examine the stability of the closed loop system using Nyquist criterion. Also write a MATLAB program to verify the same.
10. To Incorporate MATLAB program into a Simulation Model.

Reference Books:

1. Benjamin C. Kuo, “Automatic Control System”, 7th Edition, PHI, 2010.
2. Richard C. Dorf Robert H. Bishop “Modern Control Systems”, 8th Edition, Addison-Wesley,1999
3. I.J. Nagarath and M Gopal, “Control Systems Engineering”, New Age International (P) Ltd.,1999
4. Norman S. Nise “Control System Engineering”, McGraw Hill, 2010.
5. R. S. Allurkar, “Control Systems”, EBPB, 2004

Course Outcomes:

After completion of the course the students will be able to:

1. To realize and analyze lead and lag compensator networks.
2. Examine characteristics of control system components such as AC servomotor, and synchros.
3. To analyze stability of the system through Root Locus, Bode plot and Nyquist plot using MATLAB

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE411L.1	2	3										1	1	2	1
2	22UEE411L.2	3	1	2	1								1	1	3	1
3	22UEE411L.3	3	3	1	1	1			1				1	1	2	1

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UEE412L	Electrical Machines Laboratory-II	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. OCC characteristics of D.C. Shunt generator and determine critical resistance and critical speed.
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 to determine losses of a dc shunt motor and efficiency.
6. Ward Leonard method of speed control of D.C. motor.
7. Fields test on dc series motors to determine losses and efficiency.
8. Voltage regulation of alternator by EMF and MMF method.
9. Synchronization of Alternator with infinite bus.
10. V and Inverted V curves of a synchronous motor

Reference Books:

1. I J Nagarath and DP Kothari, "Electrical machines", 4th - Edition, TMH, New Delhi
2. Ashfaq Hussain, "Electrical Machines", Dhanpat Rai & Co. Publications, 3rd Edition, 2017
3. P.S. Bhimra, "Electrical machinery", Khanna publishers, 7th Edition 2018
4. P.S. Bhimra, "Generalized theory of Electrical machines", Khanna publishers, 2014
5. M. G. Say, Performance and design of AC machines, CBS publishers.
6. Alexander Langsdorf, "Theory of alternating current machines", TMH, 1999

Course Outcomes:

After completion of the course the students will be able to:

1. Test the parameters of synchronous machine and DC machines by various methods and predetermine their performance such as losses, efficiency and regulation
2. Analyse the performance of DC and synchronous machines and tabulate the readings by their characteristics.
3. Select the suitable ac/dc generator and motor for various engineering applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UEE412L.1	3	1	1		1	1					1	1			
2	22UEE412L.2	3	1	1	1							1	1			
3	22UEE412L.3	3	1	1	1							1	1			

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

22UHS424C	Universal Human Values-II	01 - Credits (1 : 0 : 0)
Hours/Week : 01		CIE Marks : 50
Total Hours :15		SEE Marks : 50

UNIT – I	(4 Hours)
Introduction to Value Education: Right Understanding; Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT – II	**(4 Hours)**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	
UNIT – III	**(4 Hours)**
Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' **–** as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature..	
UNIT – IV	**(3 Hours)**
Implications of the Holistic Understanding – a Look at Professional Ethics Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics; Holistic Technologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession	

Reference Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034- 53-2
3. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
4. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Explore holistic vision of life - themselves and their surroundings.
2. Develop competence and capabilities for maintaining Health and Hygiene.
3. Analyze various problems in life, family, Society and in handling problems with Sustainable Solutions.
4. Apply values to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions.

Syllabus for B.E IV - Semester for academic year 2023 – 2024

(For students admitted to I year in 2022-23)

Course Outcomes - Programme Outcomes Mapping Table

Sl	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	22UHS324C.1							3	2	3			1			
2	22UHS324C.2						3	3	1	1			1			
3	22UHS324C.3						3	3	2	1			1			
4	22UHS324C.4						2	2	3	2			1			

Syllabus for

B.E. V - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UMA503C	Computation Techniques for Electro-Magnetic Fields	03 - Credits (2 : 2: 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(7L-6T Hours)
Review of Vector Analysis: Introduction to scalars and vectors **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. **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	**(6L-7T 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 and system of charges, potential gradient, the dipole. **Conductors, Dielectrics and Capacitance:** Current and current density, Continuity of current, metallic conductors, Conductor properties and Boundary conditions, capacitance.	
UNIT – III	**(7L-6T Hours)**
The Steady Magnetic Field: Biot - Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density. **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	**(6L-7T Hours)**
Materials and Inductance: The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials. **Time Varying Fields and Maxwell's Equations:** Faraday's law, displacement current, Maxwell's equation in point and Integral form.	

References:

1. William H. Hayt Jr. And John A Buck, "Engineering Electromagnetics**",** 17th Edition, Tata McGraw Hill, 2012.
2. John Karuss and Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill, 1999.
3. Edward C. Jordan and Keith G Balmain, **"**Electromagnetic Waves and Radiating Systems," 2nd Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.
4. Dr. D. Ganesh Rao, "Field Theory", Sanguine Technical Publishers, 1st Edition, 2014.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify differential coordinate elements for the various electric and magnetic field applications
2. Estimate the flux density, field intensity of electric and magnetic fields for various charges
3. Analyse the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying Maxwell's equation for real-time application of electromagnetism.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UMA503C.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UMA503C.2	3	2	1	1				1		1		1	2	3	1
3	21UMA503C.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UMA503C.4	3	3	3	2	1			1	1	1	1	2		1	1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE505C	Power System -II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Power System Representation:
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.
Symmetrical Three Phase Faults:
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.

UNIT – II	(10 Hours)

Symmetrical Components:
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.
Sequence Networks:
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.

UNIT – III	(10 Hours)

Unsymmetrical Fault at the Terminals Unloaded Generator:
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.
Unsymmetrical Faults on Power Systems:
L-G, L-L, L-L-G faults on unloaded power systems, Open conductor faults in power system.

UNIT – IV	(10 Hours)

Transient Stability Analysis:
Classification of Power System Stability, Steady Rotor dynamics, Swing equation, Solution of swing equation by numerical techniques (Point by point method and Runge Kutta Method), Power angle equation for salient and non-salient pole synchronous machines.
Equal Area Criterion:
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.

Reference Books:

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. Hadi Saadat, "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 will be able to,

1. Represent power system networks as per unit reactance diagrams on the base of given MVA and KV values
2. Assess phase & line components of voltage/current and to draw the positive, negative & sequence networks using symmetrical components
3. Carry out analysis of unsymmetrical faults (LG,LL,LLG) to determine fault currents when fault occurs at generator terminals/in power systems networks
4. Assess stability of power system under different types of disturbances by applying equal area criterion/solving the swing equation

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE505C.1	3	1	1	1		1				1		1	2		1
2	21UEE505C.2	3	2	1	1						1		1	2		2
3	21UEE505C.3	3	2	2	2	1		1	1		1		1	2		2
4	21UEE505C.4	3	3	3	2	1			1	1	1	1	2	1	1	2

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE506C	Power Electronics	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

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.
Power Transistors:
Introduction to Power BJT's and MOSFETs static characteristics, switching characteristics, switching limits, di/dt and dv/dt protection, cooling, heat sinks and snubber circuits.
Thyristors:
Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.

UNIT – II	10 Hours

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 and RLE load. Performance evaluation of Rectifier.

UNIT – III	10 Hours

Commutation Techniques:
Introduction. Natural commutation, forced commutation: self-commutation, impulse commutation, resonant pulse commutation and complementary commutation.
DC–DC Converter
Introduction. Principle Operation of dc-dc converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Detailed analysis of Class-A chopper with numerical, Principle operations of Class-B, Class-C, Class-D and Class-E chopper. Flyback converters-Boost, Buck and Buck-Boost converters

UNIT – IV	10 Hours

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 configurations to operate with 120^0- and 180^0-degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation.
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.

Reference Books:

1. M. H. Rashid, "Power Electronics", 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, "Power Electronics" Wiley Edition, 2003
3. P. S. Bimbra, "Power Electronics", 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, 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

Course Outcomes:

After completion of the course the students will be able to,

1. Select suitable power switches, heat sinks and power converters for industrial applications.
2. Investigate performance of the power switches-based on switching characteristics, power converters based on performance indices
3. Compute power loss in power switches and power converters, average and rms voltage, average and rms currents, ripple factors and harmonic components of power converters
4. Design various components of power converters employed in industrial application

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE506C.1	3							1		1		1	2	1	2
2	21UEE506C.2	3	3						1		1		1		2	
3	21UEE506C.3	3	3	2	1	1			1		1		1		3	
4	21UEE506C.4	3	3	2	2	1			1		1		2	2	2	2

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE507C	Digital Signal Processing	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Discrete Fourier Transform:
Introduction, Definition, and derivation of DFT and IDFT, Properties-linearity, shift, Symmetry etc., circular convolution, use of tabular arrays, circular arrays, Stock Ham's methods (via DFT-IDFT), Linear convolution of long duration sequences: Overlap-save and overlap-add methods.

UNIT – II	10 Hours

Fast Fourier Transform Algorithms:
Introduction, redix-2, decimation in time algorithm (DIT-FFT, DIT-IFFT), First decomposition, Continuation of decomposition, number of computations, number of multiplications, Computational efficiency

Design of FIR Digital filters:
Introduction, Windowing, rectangular, Hamming window

UNIT – III	10 Hours

Design of IIR Digital Filters:
Introduction, all pole analog filters- Butterworth and Chebyshev-I, Design of analog filters, Bilinear Transformation, Design of digital Butterworth and Chebyshev-I filters, Frequency transformations

UNIT – IV	10 Hours

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

Reference Books:

1. Proakis and Manolakis, "Digital Signal Processing Principle, algorithms and applications", 5th Edition, Pearson Education, 2021.
2. Sanjith K. Mithra, "Digital Signal Processing", 4th Edition, 2013.
3. P.Ramesh Babu, "Digital Signal Processing", 7th Edition, Scitech, 2018.
4. Salivahanam, "Digital Signal Processing", 4th Edition, TMH 2019.
5. Emmanuel, "Digital Signal Processing", 2nd Edition Pearson, 2001.

Course Outcomes:
After completion of the course the students will be able to,
1. Derive DFT properties and determine output of systems using convolution approach and DFT properties.
2. Assess the output of systems by deriving and developing fast Fourier algorithms.
3. Evaluate transfer function, frequency response, and output of a system by designing FIR/ IIR filters for required filter specifications.
4. Realize the discrete LTI system in direct form I & II, cascade and parallel forms. FIR/ IIR filters for required filter specifications.

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE507C.1	3				1	1						1	1	3	2
2	21UEE507C.2	3	1										1	1	2	1
3	21UEE507C.3	3	3	2	2								1		2	1
4	21UEE507C.4	3	3	3	3	1		1					2	1	2	1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE510L		**01 - Credits (0 : 0 : 1)**
Hours/Week : 02	**Power Electronics Laboratory**	CIE Marks : 50
Total Hours : 26		SEE Marks : 50

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

Reference Books:

1. M. H. Rashid, “Power Electronics”, 3rd Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undel and, Robbins, “Power Electronics” Wiley Edition, 2003
3. P. S. Bimbra, “Power Electronics”, 4th Edition Khanna Publishers, 2009.
4. G. K. Dubey, S.R.Dorodla, A.Joshiand, R.M.K.Sinha, “Thyristorised Power Controllers”, New Age International Publishers, 2005.

Course Outcomes:

After completion of the course the students will be able to:

1. Explain the basic operation of various power semiconductor devices and passive components
2. Apply power electronic circuits for different loads
3. Demonstrate the ability to apply what they have learned theoretically in the field of Power electronics

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE510L.1	3							1		1		1	2	1	2
2	21UEE510L.2	3	3						1		1		1		2	
3	21UEE510L.3	3	3	2	1	1			1		1		1	3	3	3

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE511LC	Auto CAD Electrical Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Installation and Basic Commands of Auto CAD package
2. Drawing the basic diagrams for familiarization with Auto CAD
3. Drawing the cross sectional elevation of XLPE cable
4. Drawing the line diagram of DOL and Star – Delta starter
5. Drawing the half sectional elevation of pin insulator
6. Drawing the single line diagrams of a substations for the specified incoming and outgoing components
7. Drawing the layout of residential and workshop plans
8. Development and drawing of Simplex, Single layer Progressive Lap winding for DC machine with specified details
9. Development and drawing of Simplex, Single layer retrogressive Lap winding for DC machine with specified details
10. Development and drawing of Simplex, Double layer progressive Lap winding for DC machine with specified details
11. Development and drawing of Duplex, Single layer progressive Lap winding for DC machine with specified details
12. Development and drawing of Simplex, Single layer Progressive Wave winding for DC machine with specified details
13. Development and drawing of Simplex, Single layer retrogressive Wave winding for DC machine with specified details

Reference Books:

1. Devalapur, S F, "Textbook of Electrical Drafting", 7th Edition, Eastern Book Promoters, Belgaum, 2006
2. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
3. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.

Course Outcomes:

After completion of the course the students will be able to:

1. Identify the tools and commands in the AutoCAD software
2. Draw and develop the engineering diagrams of the specified electrical components as per the proposed scale
3. Analyze the constructional details of electrical devices and components

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE511L.1	3	1	1		3	1					1	1	2	1	3
2	21UEE511L.2	3	2	2	1	3	1					1	2	2	1	3
3	21UEE511L.3	3	2	2	1	3	2					1	2	2		3

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE515I	Summer Internship – II	02 - Credits (0 : 0 : 2)
Hours/Week :		CIE Marks : 50
Total Hours :		SEE Marks : 50

Activities under Internship-II
This internship is referred to as Innovation/Societal/ Entrepreneurship based Internship and to be taken-up during the intervening vacation of IV and V semesters for all students. During the intervening period of IV and V semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo an Internship involving Innovation / Entrepreneurship related activities. Students may choose to work on innovation or entrepreneurial activities or both resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case students want to undergo an internship at his/her family business, he /she shall be permitted provided, a declaration by a parent is submitted directly to the Principal of the institution. With the consent of the internship guide and Principal of the institution, students shall be allowed to carry out the internship at their hometown (within and outside the state), provided favorable facilities are available.

Course Outcomes:

After undergoing the internship, students will be able to

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze and engage themselves in the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE515I.1	1	1			2						2	3	2	1	2
2	21UEE515I.2	1	1			2	1		1		2	2	3	3	1	2
3	21UEE515I.3	1				1	1					2	3	2		1
4	21UEE515I.4	1							1	3	3	2	3	2		1

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course-I

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	Electric Vehicles	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to EV: Historical Background, Benefits of Using Evs, Overview of types of Evs and its Challenges, EV Motor Drive Technologies, EV Energy Source Technologies, EV Battery Charging Technologies, EV Vehicle to Grid **EV Subsystem**: EV Subsystems and Configurations, HEV Subsystems and Configurations. HEVSubsystems and Configurations, Motion and dynamic equations for vehicles	
UNIT – II	**10 Hours**
Energy Storage: Batteries-Overview of Batteries, Battery Parameters, Lead Acid Batteries, Lithium Batteries, Metal Air Batteries. Alternative and Novel Energy Sources-Solar Photovoltaics, Flywheels, Super Capacitors. Fuel Cells-Main issues in the fuel cell, Hydrogen Fuel Cells: Basic Principles, Fuel Cell Thermodynamics (Introduction)	
UNIT – III	**10 Hours**
Architecture of EV and HEV: Vehicle Power Plant and Transmission Characteristics- Introduction, Drive train Configuration, Vehicle power plant, Internal combustion engine, Electric Motor, The need for gearbox, Drive train tractive effort and vehicle speed, Vehicle performance. 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 ofHybrid Drivetrains, HEV Configurations, Series and parallel Hybrid System.	
UNIT – IV	**10 Hours**
Power Flow in HEVs: Introduction, Power Flow Control, Power Flow Control in Series Hybrid, Power Flow Control in Parallel Hybrid, Power Flow Control in series-Parallel Hybrid, Power Flow Control Complex HybridControl	

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.

Course Outcomes:

After completion of the course the students will be able to,

1. list and define all the terms associated with electric and hybrid electric vehicles
2. Explain the types of EVs, power flow topologies, Motors, EV & HEV Sub systems
3. solve simple numerical problems on battery cell voltage fuel cells and flywheels
4. Compare and contrast the types of EVs based on applications, battery requirements and HEV configurations.

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3	1	1	1		1				1		1			
2		3	2	1	1						1		1			
3		3	3					1	1		1		1			
4		3	3	3	2	1			1	1	1	1	2			

Syllabus for B.E V - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	Fundamentals of Wind Energy Conversion Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction: Historical Development (BC – 20th Century); Historical Development (20th Century – 1980s); Recent Developments (1980s – present); The Nature of the Wind, origin of wind; Wind Energy Potential; Offshore Wind Energy; Modern Wind Turbines; Wind Vs Conventional power generation.	
UNIT – II	**10 Hours**
Wind Resource Assessment: Introduction – Spatial variation, Time variation; Characteristics of steady wind; Weibull wind speed distribution function; Vertical profiles of steady wind; Wind rose; Energy content of wind; Resource assessment.	
UNIT – III	**10 Hours**
Aerodynamics: Introduction; Aerofoil – Two dimensional theory, Relative wind velocity, Stall control; Wind flow models – Wind flow pattern; Axial momentum theory; Momentum theory for rotating wake; Blade element theory, Strip theory; Tip losses and correction; Wind Machine Characteristics.	
UNIT – IV	**10 Hours**
Wind Turbines: Introduction; Classification of Wind Turbines; Wind Turbine Components; Basic principles of wind energy extraction; Extraction of wind turbine power (Numerical problems) - Weibull distribution-Wind power generation curve-Betz's Law-Modes of wind power generation.	

Reference Books:

1. Siraj Ahmed, "Wind Energy- Theory and Practice", Prentice Hall of India, New Delhi, 2010.
2. D. P. Kothari, S. Umashankar, Wind Energy Systems and Applications, Narosa publishers, 2017.
3. Khan B. H., Non-Conventional Energy Resources, Tata McGraw Hill, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. List and define various parameters and features of wind energy conversion systems.
2. Explain various concepts and theory related to wind energy conversion systems.
3. Evaluate/calculate various parameters related to wind energy conversion systems.
4. Relate/articulate the concepts and theories related to wind energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3	1	1				1	1		1		1			
2		3	1	1				2	1		1		1			
3		3	2	1				2	1	1	1		1			
4		3	3	3				2	1		1		2			

Syllabus for

B.E. VI - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE605C	Power System-III	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours
Network Topology: 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. Algorithm for formation of Bus Impedance Matrix, formation of Ybus by inspection method and singular transformation method.	
UNIT – II	**10 Hours**
Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses **Gauss-Seidel Method:** Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples. **Newton-Raphson Method:** Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.	
UNIT – III	**10 Hours**
Economic Operations of Power System: 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	**10 Hours**
Excitation Systems: Introduction, DC Excitation system, AC Excitation, static Excitation, Dynamic performance measures of Excitation system, control and protective functions: AC and DC regulators, excitation system stabilizing circuits, power system stabilizer, load compensation, under excitation limiter, over excitation limiter. Modeling of AVR, steady state and dynamic performance analysis of AVR.	

References:

1. Stag. G. W and El-Abaid, A. H., “Computer Methods in Power System Analysis”, 2019 MEDTECH, A Division of Scientific International 2019.
2. Olle I. Elgerd, “Electric Energy Systems Theory-An Introduction”, 2nd Edition McGraw-Hill Book Company.
3. Pai M.A., “Computer Techniques in Power System Analysis”, 2nd Edition, TMH, 2006.
4. K. Uma Rao, “Computer Techniques and Model in Power Systems”, 2nd Edition, I.K. International, 2014.
5. Singh L. P., “Advanced Power System Analysis and Dynamics”, 6th Edition, New Age International (P) Ltd, New Delhi, 2014.
6. Nagrath, I .J., and Kothari, D.P., “Modern Power System Analysis”, 4th Edition, TMH, 2011

Course Outcomes:

After completion of the course the students will be able to,

1. Apply suitable network topology, primitive network, types of power system buses for load flow studies and economic scheduling algorithms and excitation systems for power system operation.
2. Investigate performance of the power systems using load flow analysis, optimum scheduling of thermal generators and excitation systems.
3. Calculate YBUS matrix, real power, reactive power and power flow for a given power systems using load flow studies and optimum cost of generation of thermal power plants using economic scheduling study and components of excitation systems.
4. Formulate the load flow models, economic scheduling of thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE605C.1	3							1		1		1	2	1	
2	21UEE605C.2	3	1						1		1		1	1	2	1
3	21UEE605C.3	3	3	2	2	1			1		1		1	3	1	1
4	21UEE605C.4	3	3	3	3	1			1	1	1		2	3	1	

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE606C	Microcontrollers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Microprocessors and Microcontrollers:
Introduction of Microprocessors and Microcontrollers 8051, Features, Block diagram, pin diagram, program model, Architecture, PSW, PC, SP, Memory Organization
8051 Assembly Language Programming:
Introduction to assembly language programming, assembling and running a program, The program counter and ROM space, data types and directives.
Addressing Modes:
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	10 Hours

Logical and Arithmetic Operations:
Introduction, Arithmetic instructions, incrementing and decrementing, Addition, subtraction, multiplication and division, decimal arithmetic-Programs, Byte level Logical instructions, Bit level logical instructions, Rotate and swap instructions, Programs
Jump and Call Instructions:
The jump and call program range, jump and call instructions, machine cycle and time delays generation-Programs

UNIT – III	10 Hours

8051 I/O and Timer Programming:
Introduction, I/O programming, I/O Bit Manipulation Programming. Timers, programming timers 0 and 1 in 8051 assembly. Counter programming
8051 Serial Port Programming:
Basics of serial communication, 8051 connections to RS-232, Serial port programming in 8051 assembly.

UNIT – IV	10 Hours

8051 Interfacing and Applications:
Interfacing 8051 to LCD, parallel ADC0809, serial ADC MAX1112, DAC, Stepper motor
Programming in C for 8051:
Introduction, Programming in C for 8051: data types, Programs on time delays, I/O programming.

Reference Books:

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, 2013.
3. Ajay V. Deshmukh; “Microcontrollers-Theory and Applications”, TMH, 2017.
4. Dr.Ramani Kalpathi and Ganesh Raja; “Microcontroller and its applications”, 1st revised Edition Sanguine Technical publishers, Bangalore-2007.

5. Subrata Ghoshal ," 8051 Microcontrollers, 2/e: Internals, Instructions, Programming &Interfacing", 2nd Edition, Pearson, 2014.
6. K Uma Rao, "The 8051 Microcontroller", Pearson, 2010.

Course Outcomes:

After completion of the course the students will be able to,

1. Comprehend architecture of 8051 microcontrollers, instruction set, directives, addressing modes
2. Illustrate arithmetic, logical, jump and call instructions, formulate and develop assembly language programs.
3. Illustrate serial communication, assess program execution time by calculating number of machine cycles and develop programs for timers and serial port.
4. Interface peripheral devices and develop programms for given application using assembly language and 8051C.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE606C.1	3							1		1		1	3	1	1
2	21UEE606C.2	3	1						1		1		1	2	3	1
3	21UEE606C.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE606C.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE610L	**Power System-II Laboratory**	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. 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.
2. YBus formation of power systems with and without mutual coupling by singular transformation and inspection method.
3. Determination of power angle diagrams for salient and non-salient pole synchronous m/cs, reluctance power, excitation emf and regulation.
4. Determine stability of power system using Swing equation. To determine critical clearing time for SMIB system by varying inertia constant, line parameters/fault location.
5. Write a program to perform load flow study using Gauss-Seidel method (only pq Bus not exceeding 4-buses).
6. Formation of Jacobian matrix for a given power system not exceeding 4 buses in polar Coordinates (no PV buses).
7. Write a program to perform load flow study using Fast-Decouple Load Flow Method
8. Optimal Generator Scheduling for Thermal power plants connected to load dispatch center.

Reference Books:

1. K. Uma Rao, “Computer Techniques and Model in Power Systems”, 2nd Edition, I.K. International, 2014.
2. Singh L. P., “Advanced Power System Analysis and Dynamics”, 6th Edition, New Age International (P) Ltd, New Delhi, 2014.
3. Nagrath, I .J., and Kothari, D.P., “Modern Power System Analysis”, 4th Edition, TMH, 2011

Course Outcomes:

After completion of the course the students will be able to:

1. Identify and formulate the electrical network parameters for load flow analysis 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

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE610L.1	3	1	1		1	1					1	1	3		2
2	21UEE610L.2	3	1	1	1							1	1	3		2
3	21UEE610L.3	3	1	1	1							1	1	2		2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE611L	**Microcontrollers Laboratory**	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments
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. Subtraction 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 Conversion-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 smart phone 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.

Reference Books:

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. David Calcutt Fred Cowan, Hasan Parchizadeh Elsecier, "8051 Microcontrollers an application based introduction", 2004.

Course Outcomes:

After completion of the course the students will be able to:
1. Develop and verify Assembly Language Programes for the specified applications
2. Analyze and execute the Assembly Language Programes in Microcontroller kit
3. Interface and analyze the functioning of peripheral devices with microcontroller

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE611L.1	3	1	1		1	1					1	1		1	1
2	21UEE611L.2	3	1	1	1	2						1	1		2	2
3	21UEE611L.3	3	1	1	1	2						1	1		2	2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE612L	**Advanced Programming Laboratory**	**01 - Credits (0 : 0 : 2)**
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. Study on basic instructions of Python programming language, scripts, commands
2. Write a programme to find slicing of numbers and characters
3. Write a programme to store the pair of elements using dictionary
4. Write a programme to find the exponentiation of a number
5. Write a programme to find the maximum from a list of numbers
6. Write a programme to perform Linear Search of given sequence
7. Write a program to count the numbers of characters in the string and store them in a dictionary data structure
8. Write a program to find the sum of all the primes below two million
9. Write a program to find multiplication of matrices and command line arguments using function
10. Write a programme to plot average hourly data of solar radiation and wind velocity
11. Write a programme to load the data from file.
12. Write a programme to concatenate the given numbers
13. Write a program to call methods of a class with object
14. Write a program to perform the given tasks using list comprehension

Reference Books:

1. Svein Linge and Hans Petter Langtangen, "Introduction to Python for Computational Science and Engineering (A beginner's guide)", Springer Open, 1st Edition 31 May 2018.
2. Allen Downey, Jeffrey Elkner, "Learning with Python: How to Think Like a Computer Scientist Paperback", 2015.
3. Y. Daniel Liang, "Introduction to programming using Python", 1st Edition, Pearson Publications, 2017.
4. Sheetal Taneja, Python Programming A Modular Approach, 1st Edition Pearson Publications, 2017.

Course Outcomes:

After completion of the course the students will be able to:

1. Examine Python syntax and semantics and be fluent in the use of Python flow control and functions Student should be able to develop algorithmic solutions to simple computational problems.
2. Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions to interpret the concepts of Object-Oriented Programming as used in Python.
3. Implement exemplary applications related to Electrical Engineering in Python

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE612L.1	3	1	1		1	1					1	1		1	1
2	21UEE612L.2	3	1	1	1	2						1	1		2	2
3	21UEE612L.3	3	1	1	1	2						1	1		2	2

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Professional Elective Course – I

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE611E	Electrical Machine Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Principles of Electrical Machine Design: Introduction to design of electrical machines, limitations. Different types of materials and insulators used in electrical machines. **Design of DC Machines:** Output equation, choice of specific loadings and number of poles, design of main dimensions, armature slot dimensions and estimation of ampere turns.	
UNIT – II	**(10 Hours)**
Design of Transformers (Single phase and three phase): Output equation for single phase and three phase transformer, choice of specific loadings, expression tor 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 and Design of tank and cooling tubes.	
UNIT – III	**(10 Hours)**
Design of Induction Motors: 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, end ring current.	
UNIT – IV	**(10 Hours)**
Design of Synchronous Machines: 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 and rotor of non salient pole machine.	

Reference Books:

1. A.K. Sawhney, A Course in Electrical Machine Design, Dhanpat Rai & Co. (P) Limited (2017), ISBN-10: 8177001019, ISBN-13: 978-8177001013.
2. Mittle V.N., Arvind Mittal, Design of Electrical Machines, Standard Publishers Distributors (2009), ISBN-13: 978-81-8014-126-3, ISBN: 81-8014-126-8.
3. V. Rajini, V. S. Nagarajan Electrical Machine Design Pearson Education (May 2018) ISBN-10: 9332585571, ISBN-13: 978-9332585577
4. K. G. UpadhyayDesign of Electrical Machines (2010) Publisher: New Age International ISBN: 9788122422825, 8122422829.

Course Outcomes:

After completion of the course the students will be able to,

1. List and define different types of materials, parts, insulators, and the terms associated to electrical machines and its design terms.
2. Explain the specific loadings, design factors for electrical machines.
3. Calculate the design parameters of an electrical machine for a given set of specifications and necessary assumptions as per the Indian standards.
4. Derive the equations with respect to specific loadings, dimensions and other design aspects for electrical machines.

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE611E.1	3	2	2					1		1		1	3	1	1
2	21UEE611E.2	3	2	2					1		1		1	2	1	1
3	21UEE611E.3	3	3	3	3				1	2	1		1	1	1	1
4	21UEE611E.4	3	3	3	2				1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE612E	Electrical Engineering Materials	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to Electrical and Electronic Materials: Importance of materials, Classification of electrical and electronic materials, Scope of electrical and electronic materials, Requirement of Engineering materials, Operational requirements of electrical and electronic materials, Classification of solids on the basis of energy gap, Products – working principle and materials, Types of engineering materials, Levels of material structure. Spintronics and Spintronic materials, Ferromagnetic semiconductors, Left handed materials.	
UNIT – II	**(10 Hours)**
Conductors: Conductor materials, Factors affecting conductivity, Thermal conductivity, Heating effect of current, Thermoelectric effect, Seebeck effect, Thomson effect, Wiedemann – Franz law and Lorentz relation, Problems. **Conductive Materials and Applications:** Mechanically processed forms of electrical materials, Types of conducting materials, Low resistivity materials, High resistivity materials, Contact materials, Fusible materials, Filament materials, Carbon as filamentary and brush material, Material for conductors, cables, wires, solder, sheathing and sealing.	
UNIT – III	**(10 Hours)**
Dielectrics: Introduction to dielectric materials, classification of dielectric materials, Dielectric constant, Dielectric strength and Dielectric loss. Polarization, Mechanisms of polarization, Comparison of different polarization process, Factors affecting polarization, Spontaneous polarization, Behavior of polarization under impulse and frequency switching, Decay and build-up of polarization under ac field, Complex dielectric constant. **Insulating Materials:** Insulating materials and applications – Ceramic, Mica, Porcelain, Glass, Micanite and Glass bonded mica. Polymeric materials – Bakelite, Polyethylene. Natural and synthetic rubber. Paper. Choice of solid insulating material for different applications, Liquid insulating materials – Requirements, Transformer oil, Bubble theory, Aging of mineral insulating oils. Gaseous insulating Materials – Air, Nitrogen, Vacuum.	
UNIT – IV	**(10 Hours)**
Magnetic Materials: Origin of permanent magnetic dipole, Magnetic terminology, Relation between relative permeability and magnetic susceptibility. Classification of magnetic materials, Diamagnetic, Paramagnetism, Ferromagnetism, Antiferromagnetic and the corresponding materials. Ferrimagnetism and ferrites – properties and applications, Soft and hard ferrites. Curie temperature, Laws of magnetic materials. Magnetization curve, Initial, and maximum permeability. Hysteresis loop and loss, Eddy current loss. Types of magnetic materials, Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.	

Reference Books:

1. K.M. Gupta, Nishu Gupta, "Advanced Electrical and Electronics Materials; Processes and Applications", 1st Edition, Scrivener Publishing, 2015
2. R.K. Shukla, Archana Singh, "Electronic Engineering Materials", Tata McGraw Hill Education PVT Ltd, 2012.

3. L Solymar, D. Walsh, R. R. A. Syms, “Electrical Properties of Materials”, 10th Edition, Oxford Publishing, 2018.
4. A.J. Dekker, “Electrical Engineering Materials”, 1st Edition, Pearson, 2015.

Course Outcomes:

After completion of the course the students will be able to,

1. Classify solids on the basis of energy gap, Products – working principle and materials,
2. Select Material for conductors, cables, wires, solder, sheathing and sealing.
3. Choose solid and liquid insulating materials for different applications.
4. Select magnetic materials: Soft and hard magnetic materials, High energy magnetic materials, Commercial grade soft and hard magnetic materials.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE612E.1	3							1		1		1		1	1
2	21UEE612E.2	3	1						1		1		1	2		1
3	21UEE612E.3	3		2		1			1	1	1		1	1	1	1
4	21UEE612E.4	3	3	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE613E	Testing and Commissioning of Electrical Equipment	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Electrical Tools, accessories: Tools, Accessories and Instruments required for Installation, Maintenance and Repair Work, India Electricity Rules, Safely Codes Causes and Prevention of Accidents, Artificial Respiration, Workmen's Safety Devices. **Transformers**: Installation, Location Site Selection, Foundation Details, Code of Practice for Terminal Plates, Polarity and Phase Sequence, Oil Tanks, Drying of Winding sand General Inspection. Commissioning Tests As Per National and International Standards - Volts Ratio Earth Resistance, Oil Strength, Insulation Tests, Impulse Tests Polarizing Index, Load Temperature Rise Tests. Specific Tests for Determination of Performance Curves like Efficiencies, Regulation Etc., Determination Mechanical Stress Under Normal and Abnormal Conditions.	
UNIT – II	**(10 Hours)**
Synchronous Machines: 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 and Field Windings, Wave Form and Telephone Interference Tests, Line Charging Capacitance. Performance Tests -Various Tests to Estimate the Performance of Generator Operations, Slip Test, Maximum Lagging Current, Maximum Reluctance Power Tests, Sudden Short Circuit Tests, Transient Sub Transient Parameters, Measurement of Sequence Impedances, Capacitive Reactance, and Separation Of Losses, Temperature Rise Test, and Retardation Tests. Factory Tests -Gap Length, Magnetic Eccentricity, Balancing Vibrations, Bearing Performance	
UNIT – III	**(10 Hours)**
Induction Motor: Specifications. Installation- Location of Motors and its Control Apparatus, Shaft Alignment for Various Coupling, Fitting of Pulleys and Coupling, Drying of Windings. Commissioning Tests -Mechanical Tests For Alignment, Air Gap Symmetry, Tests for Bearings, Vibrations and Balancing. Specific Tests -Performance and Temperature Raise Tests, Stray Load Losses, Shaft Alignment, Re-Writing and Special Duty Capability, Site Tes	
UNIT – IV	**(10 Hours)**
Laying of Underground Cables: Inspection, Storage, Transportation and Handling of Cables, Cable Handing Equipment, Cable Laying Depths and Clearances from other Services such as Water Sewerage, Gas, Heating and other Mains, Series of Power and Telecommunication Cables and Coordination with these Services, Excavation of Trenches, Cable Jointing and Terminations Testing and Commissioning. Location of Faults using Megger, Effect of Open or Loose Neutral Connections, Provision of Proper Fuses on Service Lines and Their Effect on System, Causes and Dim, and Flickering Lights	

Reference Books:

1. Testing, Commissioning, Operation and Maintenance of Electrical Equipment S. Rao Khanna Publishers 6th Edition, 19th Reprint, 2015
2. Testing and Commissioning of Electrical Equipment R.L.Chakrasali Prism Books Pvt Ltd 1st Edition,2014

3. Preventive Maintenance of Electrical Apparatus S.K.Sharotri Katson Publishing House 1st Edition, 1980
4. Handbook of Switchgears BHEL McGraw Hill 1st Edition, 2005
5. Transformers BHEL McGraw Hill 1st Edition, 2003
6. The J&P Transformer Book Martin J. Heathcote Newnes, 12th Edition, 1998

Course Outcomes:

After completion of the course the students will be able to,

1. Describe the process to plan, control and implement commissioning of electrical equipment’s.
2. Differentiate the performance specifications of transformer and induction motor Synchronous machines and switchgear.
3. Demonstrate the routine tests for synchronous machine, induction motor, transformer & switchgears.
4. Describe corrective and preventive maintenance of electrical equipment’s. Such as isolators, circuit breakers, induction motor and synchronous machines.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE613E.1	3							1		1		1		1	1
2	21UEE613E.2	3	1						1		1		1	2		1
3	21UEE613E.3	3		2		1			1	1	1		1	1	1	1
4	21UEE613E.4	3	3	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE614E	Data Base Management Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Introduction to Data Base Systems:
Managing data, a historical perspective, File systems versus DBMS, Advantages of DBMS, Describing and Storing Data in DBMS, Queries in DBMS, Transaction management, Structure of DBMS, People who work with databases.
Entity – Relationship Model:
Using high-Level Conceptual Data Models for Database Design, An example of 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 the COMPANY database, ER Diagrams, Naming Conventions and Design Issues.

UNIT – II	(10 Hours)

Relational Model and Relational Algebra:
Relational model concepts, relational model constraints and relational database schemes, update operations 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, Schemes, Change statements in SQL, basic Queries in SQL, more complex SQL queries, Insert, Delete and Update statements in SQL, additional features of SQL, specifying general constraints as assertion, views (virtual tables) in SQL,

UNIT – III	(10 Hours)

Data Base Design:
Informal Design Guidelines for Relation Schemes, 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 Scheme Design, Multivalued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Inclusion Dependencies, Other Dependencies and Normal Forms.

UNIT – IV	(10 Hours)

Transaction Management:
The ACID properties, Transactions and Schedules, Concurrent Execution of transactions, Lock-based Concurrency control, performance of locking, Transaction support In SQL, Introduction to crash recovery; 2PL, ss for 4rializability and recoverability, Introduction to lock management, Lock Conversions, Dealing with Deadlocks, Specialized locking Techniques, Concurrency control without locking, Introduction to ARIES

Reference Books:

1. Silberschatz, Korth and Sudharahan, “Data Base System Concepts”, 5th Edition, Mc-Graw Hill, 2007
2. C.J. Date, A.Kannan, S.Swamynatham, “An Introduction to Database Systems”, 8th

Edition, Pearson Education, 2006.

3. Raghu Ramakrishnan and JohannesGehrke, “Database Management Systems”, 3^{rd} Edition, McGraw Hill, 2004.
4. Elmasri and Navathe**,** “Fundamentals of Database Systems”, 4^{th} Edition, Pearson Publication.

Course Outcomes:

After completion of the course the students will be able to,

1. Construct, manipulate and share data base, for various applications and Draw ER diagram.
2. Construct relational database schemes, perform relational algebra operations and ER-to Relational Mapping and queues from database using SQL.
3. Describe different normal forms and properties of relational decomposition.
4. Perform operations about Transaction Management and Crash recovery.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE614E.1	1							1		1		1	1	1	1
2	21UEE614E.2	1	1						1		1		1	1	1	1
3	21UEE614E.3	1		2		1			1	1	1		1	1	1	1
4	21UEE614E.4	1	1	2	2	1			1		1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE615E	Operation Research	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction: Definition, OR models characteristics and phase of OR. Modeling with linear Programming: Two variable LP model, Graphical LP solution, model in equation from graphical to algebraic solution. **Simplex Method:** Special cases in Simplex method Big M method.	
UNIT – II	**(10 Hours)**
Duality: Definition of the dual problem primal to dual relationships, economic interpretation of duality, additional simplex algorithms. **Transportation Model:** Definition of transportation model basic feasible solution by different methods, finding optimal solutions, stepping stone method, MODI method, the assignment model, traveling salesman problem.	
UNIT – III	**(10 Hours)**
Advanced Linear Programming: Revised simplex method, dual simplex method, Bounded variable algorithm, parametric linear programming. **Game Theory:** Formulation of two – person, zero sum games, solving simple games, Max–Min, Min–Max principles, graphical solution procedure, solving by linear programming.	
UNIT – IV	**(10 Hours)**
Pert and CPM Techniques: Network representation, critical path computation, construction of the time schedule, variation under probabilistic models, crossing of simple networks, PERT calculation.	

Reference Books:

1. Hamdy A Thoha, “Operation Research an Introduction”, 8th Edition, Pearson Education, 2008.
2. Fredrick S.Hillier and Lieverman “Operation Research Concept and Cases”, 8th Edition, TMH, 2009.
3. S.D. Sharma, “Operation Research” 16th revised Edition, KNRN New Delhi 2009.
4. S. S. Rao, “Optimization Techniques”, 3rd Edition, New age International Publishers, 2010.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify and develop operational research models from the algebraic linear equations for the real world problems.
2. Illustrate the mathematical tools that are needed to solve different optimization problems.
3. Find the feasible solution for real time algebraic equations.
4. Design the PERT network and obtain solution by CPM methods.

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE615E.1	3							1		1		1	3	1	1
2	21UEE615E.2	3	1						1		1		1	2	3	1
3	21UEE615E.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE615E.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE616E	Field Theory	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)

Review of Vector Analysis:
Introduction to scalars and vectors
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.
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	(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 and system of charges, potential gradient, the dipole.
Conductors, Dielectrics and Capacitance: Current and current density, Continuity of current, metallic conductors, Conductor properties and Boundary conditions, capacitance.

UNIT – III	(10 Hours)

The Steady Magnetic Field: Biot-Savart law, Ampere's circuital law, Curl, Stokes' theorem, magnetic flux and flux density.
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	(10 Hours)

Materials and Inductance:
The nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuit, Potential energy and forces on magnetic materials.
Time Varying Fields and Maxwell's Equations:
Faraday's law, displacement current, Maxwell's equation in point and Integral form.

Reference Books:

1. William H. Hayt Jr. and John A Buck, "Engineering Electromagnetics", 17th - Edition, Tata McGraw Hill, 2012.
2. John Karuss and Daniel A Fleisch, "Electromagnetics with Applications", 5th Edition McGraw-Hill,1999.
3. Edward C. Jordan and Keith G Balmain, "Electromagnetic Waves and Radiating Systems", 2nd Edition, Prentice Hall of India / Pearson Education, 1968. Reprint 2002.
4. Dr. D. Ganesh Rao, "Field Theory" Sanguine Technical Publishers, 1st Edition, 2014.

Course Outcomes:
After completion of the course the students will be able to,
1. Identify differential coordinate elements for the various electric and magnetic field applications
2. Estimate the flux density, field intensity of electric and magnetic fields for various charges

3. Analyze the time varying and static electric and magnetic fields for various charges
4. Select the suitable time varying maxwells equation for real-time application of electromagnetism.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	21UEE616E.1	3	1	1	1	3	1		1		1		1	1	2	1
2	21UEE616E.2	3	2	1	1				1		1		1	2	3	1
3	21UEE616E.3	3	2	2	2	1		1	1		1		1	1	2	1
4	21UEE616E.4	3	3	3	2	1			1	1	1	1	2		1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course – II

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	Electrical Safety for Engineers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to Electrical Safety, Electric Shocks and their Prevention: OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts. Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns	
UNIT – II	**10 Hours**
First Aid in Case of Electric Shock: First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management. **Equipment Earthing and System Neutral Earthing:** Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages	
UNIT – III	**10 Hours**
Safety in Residential, Commercial and Agricultural Installations: Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity. **Accident Investigation:** Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region	
UNIT – IV	**10 Hours**
Electrical System Safety: Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers Protective Relays: Fundamental requirements of relaying, classification of relays Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages	

Reference Books:

1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi, 2nd Edition, 2021
2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008.
4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf

Course Outcomes:

After successful completion of this course the student will be able to:

1. Identify the type of the electric shock and suggest probable electric safety & security measures in the given electric system
2. Analyze the safety & grounding requirements in Residential, Commercial, Agricultural installations and suggest best practices with use of electricity
3. Carry out detailed fault investigation and suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Analyze the need for safety devices and requirements in the electric systems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		2	1		1		1		1		1		1			
2		2	2	1	1				1		1		1			
3		2	2	2	2				1		1		1			
4		2	2	2	2				1	1	1	1	2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	Energy Storage Systems	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Energy storage systems overview - Scope of energy storage, needs and opportunities in energy storage, Technology overview and key disciplines, comparison of time scale of storages and applications, Energy storage in the power and transportation sectors. Importance of energy storage systems in electric vehicles, Current electric vehicle market. **Thermal storage system**-heat pumps, hot water storage tank, solar thermal collector, application of phase change materials for heat storage-organic and inorganic materials, efficiencies, and economic evaluation of thermal energy storage systems.	
UNIT – II	**10 Hours**
Chemical storage system- hydrogen, methane etc., concept of chemical storage of solar energy, application of chemical energy storage system, advantages and limitations of chemical energy storage, challenges, and future prospects of chemical storage systems **Electromagnetic storage systems** - double layer capacitors with electrostatically charge storage, superconducting magnetic energy storage (SMES), concepts, advantages and limitations of electromagnetic energy storage systems, and future prospects of electrochemical storage systems.	
UNIT – III	**10 Hours**
Electrochemical storage system **Batteries-**Working principle of battery, primary and secondary (flow) batteries, battery performance evaluation methods, major battery chemistries and their voltages- Li-ion battery& Metal hydride battery vs lead-acid battery. **Super capacitors-** Working principle of super capacitor, types of super capacitors, cycling and performance characteristics, difference between battery and super capacitors, Introduction to Hybrid electrochemical super capacitors **Fuel cell:** Operational principle of a fuel cell, types of fuel cells, hybrid fuel cell-battery systems, hybrid fuel cell-super capacitor systems.	
UNIT – IV	**10 Hours**
Battery design:- Battery design for transportation, Mechanical Design and Packaging of Battery Packs for Electric Vehicles, Advanced Battery-Assisted Quick Charger for Electric Vehicles, Charging Optimization Methods for Lithium-Ion Batteries, Thermal run-away for battery systems, Thermal management of battery systems, State of Charge and State of Health Estimation Over the Battery Lifespan, Recycling of Batteries from Electric Vehicles	

Reference Books:

1. Frank S. Barnes and Jonah G. Levine, Large Energy Storage Systems Handbook (Mechanical and Aerospace Engineering Series), CRC press (2011)
2. Ralph Zito, Energy storage: A new approach, Wiley (2010)
3. Pistoia, Gianfranco, and Boryann Liaw. Behaviour of Lithium-Ion Batteries in Electric Vehicles: Battery Health, Performance, Safety, and Cost. Springer International Publishing AG, 2018.
4. Robert A. Huggins, Energy storage, Springer Science & Business Media (2010)
5. Ibrahim Dincer and Mark A. Rosen, Thermal Energy Storage Systems and Applications,

John Wiley & Sons, 3rd Edition, 2021.

6. Ru-shi Liu, Lei Zhang and Xueliang sun, electrochemical technologies for energy storage and conversion, Wiley publications, 2nd Volume set, 2012.
7. James Larminie and Andrew Dicks, Fuel cell systems Explained, Wiley publications, 3rd Edition, 2018.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the requirement, current status and future prospectus of energy storage.
2. Describe and compare various thermal, chemical energy storage technologies on the basis of technical characteristics.
3. Verify various types of energy losses and the associated energy efficient technologies for the routinely used thermal, chemical and electrical energy systems.
4. Design and Model the battery storage system and its applications

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		2	2										1	2	1	
2		2	1	1	1								1	2	1	
3		3	2	3	2	2	1	1	1	1		1	2	3	1	1
4		3	2	3	2	2	1	1		1		1	2	3	1	1

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

Open Elective Course – III

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	Renewable Energy Sources	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	**10 Hours**
Introduction to Energy Sources: 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 Pyrheliometer. **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.	
UNIT – II	**10 Hours**
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. 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	**10 Hours**
Biomass Energy: Introduction, Photosynthesis process, Biomass conversion technologies; Biomass Gasification – Principle and Working of Gasifiers, 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.	
UNIT – IV	**10 Hours**
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 and Limitation of OTEC. **Emerging Technologies:** Fuel Cell, Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations).	

Reference Books:

1. A 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 successful completion of this course the student will be able to:

1. List 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. Evaluate/calculate various parameters related to solar and wind energy conversion systems.
4. Relate/articulate the concepts and theories related to solar, wind, biomass, geothermal and ocean energy conversion systems.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		3	1	1				1	1		1		1			
2		3	1	1				2	1		1		1			
3		3	2	1				2	1	1	1		1			
4		3	3	3				2	1		1		2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

	MATLAB for Engineers	**03 - Credits (3 : 0 : 0)**
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hours

Fundamental Engineering Computing

- Engineering Problem Solving, MATLAB Environment, MATLAB Functions and Linear Algebra and Matrices

UNIT – II	10 Hours

Numerical Techniques

- Solution in System of Linear Equation
- Interpolation and Curve Fitting
- Numerical Integration and Differentiation
- Ordinary Differential Equation

UNIT – III	10 Hours

Special Topics

- Symbolic Mathematics
- Signal Processing
- Control System

UNIT – IV	10 Hours

Simulink Programming

- Introduction
- Usage of Simulink function blocks
- Handling of input and output data
- Development of Simulink model for solving of Engineering problems

Reference Books:

1. Holly Moore, “MATLAB for Engineers”, 4th Edition Pearson publisher 2015
2. David Alferdo, “MATLAB Handbook with the Applications to Mathematics, Engineering, Science and Finance” CRC Press Taylor and Francis group 2015

Course Outcomes:

After completion of the course the students will be able to,

1. Write Matlab program to solve system of linear Equation, Interpolation and Curve Fitting, Numerical Integration and Differentiation, Ordinary Differential Equation
2. Analyze the solution of engineering problems obtained from Matlab/ Simulink programs
3. Develop Matlab/Simulink model related signal processing and control system engineering.
4. Formulate and create new model to solve complex engineering problems

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1		1	1	1		3							1			
2		1	1	1	1	3							1			
3		1	1	1	2	3	1	1	1	1	1	1	2			
4		1	1	1	2	3	1	1	1	1	1	1	2			

Syllabus for B.E VI - Semester for academic year 2023 – 2024

(For students admitted to I year in 2021-22)

21UEE618P	**Mini Project**	**02- Credits (0 : 0 : 4)**
Hours/Week : 0L+4P		CIE Marks : 50
Total Hours : 48		SEE Marks : 50

Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. 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.

Mini Project helps students to explore and strengthen the understanding of fundamentals through practical application of theoretical concepts. Mini Project will boost student's skills and widen their horizon of thinking. It acts like a beginners guide to do larger projects later in their career.

Course Outcomes

After undergoing the internship, students will be able to:

1. Identify engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Analyze Data and interpret contemporary tools & resources to analyze / validate the solutions for engineering problems.
3. Communicate effectively and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of the executed work.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	**21UEE618P.1**	**3**			**3**					**3**			**3**	**2**	**3**	**1**
2	**21UEE618P.2**		**3**	**3**		**3**	**3**						**3**	**1**	**1**	**2**
3	**21UEE618P.3**	**3**	**3**	**3**	**2**	**2**	**1**				**3**		**3**	**2**	**2**	**3**
4	**21UEE618P.4**	**2**	**1**								**3**		**3**	**2**	**1**	**2**

Syllabus for

B.E. VII - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE751C	Computer Application to Power System	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)

Network Topology: 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

Primitive Network: General primitive element, Impedance and Admittance form of the primitive element, Primitive network matrices

Network Matrices: Introduction, Derivation of $Y_{bus} = [A][y][A]^T$, Formation of Y_{bus} by inspection method. Modeling: Transmission lines, Transformers, Loads and generator internal impedance. Examples

UNIT – II	(10 Hours)

Load Flow Studies: Introduction, Power Flow Equation, Classification of Buses, Operating Constraints, Data for Load Flow: System data, Generator bus data, Load Data.

Gauss-SeidalMethod: Algorithm for GS method, Modification of algorithm to include PV buses, Q- limit violations, Acceleration of convergence and examples.

Newton-Raphson Method: Introduction, Algorithm for NR method in polar coordinates and rectangular coordinates. Fast Decoupled Load Flow and examples.

UNIT – III	(10 Hours)

Economic Operations of Power System: 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	(10 Hours)

Transient Stability Studies: Introduction, swing equation, machine equations. Power system equations

Modeling: 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

Reference Books:

1. Stag.G.W., and El-Abaid,A.H.,"Computer Methodsin Power System Analysis", (2019 Edition), MEDTECH, A Division of Scientific International 2019.
2. K.UmaRao, "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, NewDelhi, 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. Recall/define network topology concepts, primitive network, types of buses, load flow studies, economic scheduling and transient studies in power systems.
2. Illustrate/describe need for network topology, primitive network, Y_{bus}, types of buses, load flow studies, optimal scheduling of thermal power plants, transient stability of power systems and computer model of DC excitation systems.
3. Derive Y_{bus}, Z_{bus}, load flow algorithms by different methods, necessary condition of economic scheduling of thermal generators and swing equations for transient stability of power systems.
4. Determine power system parameters using network topology, real and reactive power flow, optimal scheduling of thermal generators, solve swing equations and decide the suitable methods for economic scheduling for thermal generators.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE751C.1	3							1		1		1	2	1	
2	UEE751C.2	3	1						1		1		1	1	2	1
3	UEE751C.3	3	3	2	2	1			1		1		1	3	1	1
4	UEE751C.4	3	3	3	3	1			1	1	1		2		1	

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE752C	High Voltage, Switchgear & Protection	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)

Generation of HV AC 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	(10 Hours)

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	(10 Hours)

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	(10 Hours)

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.

Reference Books:

1. Sunil S. Rao "Switchgear and Protection and Power Systems", (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:

After completion of the course the students will be able to,

1. Select suitable generating and measuring instrument for testing high voltage equipment's.
2. Estimate the ripple factor, maximum voltage and relay timing for different high voltage instruments.
3. Compare the different insulating material, protection equipment's for high voltage applications
4. Apply the suitable protection equipments for selected rating of current and voltage ratings

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE752C.1	3	1		1	3	1		1		1		1	1	2	1
2	UEE752C.2	3	2	1	1				1		1		1	1	2	1
3	UEE752C.3	3	3	2	2	1			1		1		1	1	2	2
4	UEE752C.4	3	3	3	2	1			1	1	1	1	2	1	1	3

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UHS753C	Intellectual Property Rights	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction to IPRS: Importance of human creativity and its recognition and protection. Concepts of Property and Rights. Different forms of IPRs. Role of IPRs in R&D. **Patents**: Meaning of Patent, Objectives and Value of Patent. Criteria for Patentability. Software and Business Methods Patents. Govt. use of inventions, infringement of Patent and remedies for infringement. Compulsory license.	
UNIT – II	**(10 Hours)**
Prior art Searching: Prior art- Tangible versus Intangible prior art. Search strategy: key words, structures, sequences, use of operators, database for searching- free and paid, disclosed versus claimed matters. **Patent Drafting:** Types of specification, descriptions, drawing, claim drafting. **Filing Requirement of patent**: Work flow chart in obtaining Patents, Forms to be submitted, filing mechanism through Individual patent office and PCT route. Request for re - examination and revocation. Term of Patent and Patent renewal.	
UNIT – III	**(10 Hours)**
Trade-Marks: 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 and Trade Names. **Industrial Design**: Definition of a design. Inclusive and Exclusive Designs; Industrial Design registration in India. Infringement of Design and remedies for infringement.	
UNIT – IV	**(10 Hours)**
Copyright: Nature of Copyright, Subject-matter, Requirements to protect Copyright under the Law, Neighboring/Related Rights. Authorship rights. Copyright in the Digital Context. Transfer of Copyright and Infringement and remedies. Fair dealing and online streaming. **Confidential Information and Trade Secrets**: Introduction, Conditions of protection. Essentials for an action for breach of confidence.	

Reference Books:

1. P. Naryan, “Intellectual Property Law”, 3rd Ed, Eastern Law House, 2007.
2. Dr. S. R. Myneni, “Law of Intellectual Property”, 9th edition, Asia law House, 2019.
3. Dr. G. B Reddy, “Intellectual Property Rights and Law”, Gogia Law Agency. Hydrabad, Reprint edition 2020.
4. N.R. Subbaram., S.Viswanathan, “Hand book Indian Patent Law and, Practice” Printers and publishers Pvt., Ltd, 2008.
5. Cornish, “Intellectual Property Rights”, Universal publications.
6. Dr. B. L. Wadehra, “Law Relating to Intellectual Property” 5th edition, Universal Law publishing Co, Dehli.
7. SWAYAM / NPTL/ MOOCS/ We blinks/ Internet sources/ YouTube videos and other materials / notes

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

Course Outcomes:

After successful completion of this course the student should be able to:

1. Identify criteria to fit one’s own intellectual work in particular form of IPRs.
2. Apply statutory provisions and procedure to protect different forms of IPRs at national and international level.
3. Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial design etc.
4. Develop skill of making search using modern tools and techniques.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UHS753C.1						3									
2	UHS753C.2			2		1	2	2	2		2		2			
3	UHS753C.3						3	2	2		2		1			
4	UHS753C.4					2				1	1		2			

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE754E	Solar Photovoltaic System Design	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)

Chapter-01: Solar Energy – Introduction and its scenario of India and global; Solar Radiation – solar radiation spectrum, diffuse & beam radiation and solar radiation measurement.

Chapter-02: Solar Cells – I-V & P-V characteristics; Technologies; Parameters; Factors affecting electricity generated; series, parallel and series & parallel connections; Numerical problems.

UNIT – II	(10 Hours)

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.

Chapter-04: Balance of System (BoS) - Batteries; Charge Controllers; MPPT; Inverters. (BoS to cover functions, working, types, features, typical specifications and cost). Numerical problems.

UNIT – III	(10 Hours)

Chapter-05: Wires – Introduction, basics of current conduction, types of wires, measurement of wire dimensions, wire sizing; junction box;

Chapter-06: Introduction – stand-alone, grid connected & hybrid solar PV power systems; Installation, Maintenance, Troubleshooting and Safety of SPV power plants; Solar PV plant installation check list. Islanding – Definition, Causes. Types and Protection. Field visits within campus to study installations.

UNIT – IV	(10 Hours)

Chapter-07: Introduction – Configurations of SPV systems, SPV system design and integration – Design Methodology for Stand-alone SPV systems.

Chapter-08: Grid connected Solar PV Power Systems (GCSPVPS) – Introduction, Configurations & Components of GCSPVPS, GCSPVPS Design for small applications and for power plants.

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. 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

Course Outcomes:

After successful completion of this course the student will be able to:

1. Define parameters, components & features of solar cell, module, panel, array and SPV systems. They should be able to describe installation, O&M, troubleshooting and safety aspects of SPV systems,
2. Compute/estimate performance of SPV systems for different loads and applications

based on numerical problems.

3. Compare and analyze output of different solar PV systems.
4. Operate, test, design & discuss a solar PV system – stand alone or grid connected – based on typical loads

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE754E.1	3	1		1	3	1		1		1		1	1	2	1
2	UEE754E.2	3	2	1	1				1		1		1	1	1	3
3	UEE754E.3	3	3	2	2	1			1		1		1	1	1	1
4	UEE754E.4	3	3	3	2	1			1	1	1	1	2	1	3	1

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE732N	Electrical Safety for Engineers	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)

Introduction to Electrical Safety, Electric Shocks and their Prevention:
OSHA standards on electrical safety, objectives of safety and security measures, hazards associated with electric current and voltage, principles of electrical safety, approaches to prevent accidents, review of IE rules & acts.
Primary and secondary electrical shocks, possibilities of getting electrical shock and its severity, medical analysis of electric shocks and its effects, shocks due to flash/ Spark over's, prevention of shocks, safety precautions against contact shocks, flash shocks, burns

UNIT – II	(10 Hours)

First Aid in Case of Electric Shock:
First principles of actions after electric shock, first aid-artificial respiration methods, Cardiac Pulmonary Resuscitation, accident management and safety management.
Equipment Earthing and System Neutral Earthing:
Earthing, need for earthing, types of earthing, distinction between system grounding and equipment grounding, functional requirement of earthing system, technical consideration of station earthing system, step and touch potential, neutral grounding and its advantages

UNIT – III	(10 Hours)

Safety in Residential, Commercial and Agricultural Installations:
Domestic wiring methods and installations, safety requirements, shocks from domestic equipment-water taps- wet walls-agricultural pumps, types of cables and specifications, underground cables, best practices with use of electricity.
Accident Investigation:
Why and how to investigate, investigation report writing. Case studies of accidents in HESCOM/GESCOM region

UNIT – IV	(10 Hours)

Electrical System Safety:
Safety devices and their characteristics, safety clearances and creepage distances in electrical plants, line supports, insulators
Circuit Breakers: Arc phenomenon, principles of arc extinction, oil & air blast breakers
Protective Relays: Fundamental requirements of relaying, classification of relays
Protection of Alternators, Transformers, Bus bars and Lines, protection against over voltages

Reference Books:

1. S. Rao., R. K. Jain., H.L. Saluja., "Electrical safety, fire safety Engineering and safety management", Khanna Publishers New Delhi,2nd Edition, 2021
2. Pradeep Chaturvedi, "Energy management policy, planning and utilization", Concept Publishing company, New Delhi, 1997.
3. V. K.Mehta, Rohit Mehta, "Principles of Power Systems", S Chand Publications, 4th Edition, 2008.
4. The Electricity Act, 2003, https://cercind.gov.in/Act-with-amendment.pdf

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

Course Outcomes:

After successful completion of this course the student will be able to:

1. List and explain the objectives and security measures in electrical safety systems
2. Illustrate approaches to prevent accidents in electrical systems and describe the operation of safety devices
3. Suggest the methods to rescue & first aid approaches in case of electrical accidents
4. Assess & provide solutions to a practical case study and write an investigation report with independent conclusions.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE732N.1	2	1		1		1		1		1		1			
2	UEE732N.2	2	2	1	1				1		1		1			
3	UEE732N.3	2	2	2	2				1		1		1			
4	UEE732N.4	2	2	2	2				1	1	1	1	2			

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE761L	Power System Simulation Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

List of Experiments

1. ABCD parameters for short and medium network of transmission lines.
   a. Verification of Symmetry and Reciprocity of the network.
   b. 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. YBus 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/cs, 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 pq 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.

Reference Books:

1. Stag.G.W., and El-Abaid,A.H., “Computer Methods in Power System Analysis”, (2019 Edition), MEDTECH, A Division of Scientific International 2019.
2. K.UmaRao, “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.

Course Outcomes:

After completion of the course the students shall be able to:

1. Identify and formulate the electrical network parameters for load flow analysis 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

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE761L.1	3	1	1		1	1					1	1	3		2
2	UEE761L.2	3	1	1	1							1	1	3		2
3	UEE761L.3	3	1	1	1							1	1	2		2

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE762L	High Voltage and Relay Laboratory	01 - Credits (0 : 0 : 1)
Hours/Week : 02		CIE Marks : 50
Total Hours : 26		SEE Marks : 50

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

Reference Books:

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:

After completion of the course the students shall be able to:

1. Test the breakdown strength of various insulating material by different methods.
2. Select the appropriate relays for different current ratings based on their characteristics.
3. Estimate the flash over characteristics for uniform and non-uniform fields for high voltage applications.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE762L.1	3	1	1		1	1					1	1	1	2	1
2	UEE762L.2	3	1	1	1							1	1	1	1	1
3	UEE762L.3	3	1	1	1							1	1	1	2	3

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE764I	**Internship**	**02 - Credits (0 : 0 : 2)**
Hours/Week :		CIE Marks : 70
Total Hours :		SEE Marks : 30

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 6^{th} and 7^{th}semester. The duration of the training program should be for period of 4 weeks. A report on the training is to be submitted. The supervisor/ guide from industry shall allot 70 marks of the CIE and the other 30 by the internal evaluation committee. SEE evaluation will be made by a committee comprising of HoD as Chairman/his nominee, internship coordinator and a senior faculty. The SEE will be a Technical Seminar on the industrial training.

Course Outcomes

After undergoing the internship, students shall be able to:

1. Test the theoretical learning in practical situations by accomplishing the tasks assigned during the internship period.
2. Operate the systems/ devices independently and tabulate the experimental results in consultation with supervisor.
3. Apply various soft skills such as time management, positive attitude and communication skills during performance of the tasks assigned in internship organization.
4. Analyze the real time functioning of internship organization.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE764I.1	1	1			2						2		2	1	2
2	UEE764I.2	1	1			2	1		1		2	2		3	1	2
3	UEE764I.3	1				1	1					2		2		1
4	UEE764I.4	1							1	3	3	2		2		1

Syllabus for B.E VII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE765S	Technical Seminar	01 - Credits (0 : 0 : 2)
Hours/Week : 08		CIE Marks : 50
Total Hours :		SEE Marks : 50

Technical seminar is an important integral part of BE (E&EE) program. Seminar is outcome of 4 years of engineering program and is expected to test the learning skills of a student. It reflects quality of teaching-learning process in the department. Seminar work will remain as an epitome of your entire professional career.

Seminar should be based on thrust areas in state of art technologies. Students should identify the topic of seminar and finalize in consultation with coordinator. Students should understand the topic and compile the report in standard format and present in front of Panel of Examiners respective Programme.

Course Outcomes

At the end of this course, students will be able to

1. Enhance the knowledge on engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Data analysis and interpretation of contemporary tools & resources to analyze / validate the solutions of engineering problems
3. Communicate effectively to meet the technical seminar requirements and present the work to technical audience.
4. Prepare quality technical report with detailed analysis and representation of selected topic.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE765S.1	3	3						3	3	3	1	3	1	1	1
2	UEE765S.2	3	3		2		2		3	3	3	2	2	1	1	2
3	UEE765S.3	3	3	3	3	3	3	1	3	3	3	3	3	2	1	1
4	UEE765S.4	1	1	2					3	3	3	1	2	2	2	3

Syllabus for

B.E. VIII - Semester

for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

Syllabus for B.E VIII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE851E	Power System Operation and Control	03 - Credits (3 :0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Automatic Generation Control: Introduction, Control loops of power systems, Modeling of Automatic Voltage Regulator (AVR), performance AVR, modeling of Automatic Load Frequency Control (ALFC) of single area systems, performance of AVR, ALFC of two area systems, expression for tie-line flow and frequency deviation, tie-line bias-control, area control error and parallel operation of generators	
UNIT – II	**(10 Hours)**
Control of Voltage and Reactive Power: Introduction, generation and absorption of reactive power, relation between voltage, power and reactive power at nodes, methods of voltage control: Shunt reactor, shunt capacitor, series capacitor, tap changing transformer and booster transformer Compensating Devices-Characteristics of SVC, TCR, TSC and STATCOM. voltage stability, PV and QV curves, voltage collapse, prevention of voltage collapse	
UNIT – III	**(10 Hours)**
Unit Commitment: Statement of the problem, need and importance of unit, constraints in unit commitment, spinning reserve, Thermal Unit Constraints, Other constraints, Hydro constraints, Must Run, Fuel constraints, Unit commitment Solution methods: Priority-List methods, Dynamic Programming solution. Reliability Considerations, Patton's Security Function, Security constrained Optimal Unit Commitment, Start-up considerations, Optimal Generation Scheduling reliability in Unit commitment	
UNIT – IV	**(10 Hours)**
Power System Security: Introduction, factors affecting power system security, power system contingency analysis, detection of network problems, network sensitivity methods, calculation of network sensitivity factor, contingency ranking **Power System State Estimation:** Introduction, power system state estimation, maximum likeli-hood weighted least-square estimation, maximum likeli- hood concept with example, matrix formulations, Detection and Identification of bad measurements	

Reference Books:

1. Woodand BAJF Wallenberg, "Power Generation, Operation and Control", 2nd Edition, John Wiley and Sons, 2007.
2. G.L. Kusic, "Computer Aided Power System Analysis", 2nd edition, PHI, 1992.
3. T.J.E Miler, "Reactive Power Control in Electric Power Systems", John Wiely and Sons NY,1982.
4. Nagrath,I.J., and Kothari,D.P, "Modern Power System Analysis", (4th edition),TMH,2014.
5. Prabha Kundur, "Power System Stability and Control", 9th reprint, TMH, 2009.

Course Outcomes:

After completion of the course the students will be able to,

1. Develop the model of AVR and ALFC applied to the thermal generators in-order to regulate the frequency and terminal voltage.
2. Asses the performance of compensating devices, AVR, ALFC and summarize in terms

of stability issues.

3. Identify various compensating device and design the compensating devices applied to power systems.
4. Develop the unit commitment table and find the optimum combination of thermal generators for supplying the demand.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE851E.1	3							1		1		1	1	2	1
2	UEE851E.2	3	1						1		1		1	2	1	
3	UEE851E.3	3	3	2	2	1			1		1		1	1	3	1
4	UEE851E.4	3	3	3	3	1			1	1	1		2	1	1	

Syllabus for B.E VIII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE852E	Energy Conservation, Audit and Demand Side Management	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10 Hours)
Energy Scenario: Introduction to Energy; 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 Energy:** 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; 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**).**	
UNIT – II	**(10 Hours)**
Motors: Introduction, Motor Characteristics - Speed, Slip & Efficiency, Motor Selection; Determination of energy saving, Energy saving options in oversized motors, Effect of variation of voltage on performance of motor, Effect on efficiency due to variation in load; Energy Efficient Motors, Choice of energy efficient motor, Factors Affecting Energy Efficiency, Rewinding Effects on Energy Efficiency, Standards and Star Labeling of Energy Efficient Induction Motors. **Lighting:** Introduction, Terms and definitions – Lumen, Lux, Load efficacy, Lamp circuit efficacy, Color rendering index (**CRI**); Characteristic of different types of lamps. Energy saving opportunities in lighting. Criteria for Energy Efficient Lighting. Designing Lighting system – Indoor and Outdoor. Effect of reduction in supply voltage on energy consumption. Timers and occupancy sensors.	
UNIT – III	**(10 Hours)**
Energy Management and Audit: Energy management; Developing energy use profiles; Sankey Diagram; Process flow diagrams; Material and energy balance; Energy auditing instruments. Energy audit – Need for energy audit, Scope of energy audit, Types of energy audit – Preliminary energy audit, Detailed energy audit;	
UNIT – IV	**(10 Hours)**
Energy Conservation: 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. **Demand Side Management:** Introduction to DSM – Definition, Evolution, Benefits and Scope; Role of Energy Companies, Load Management, Application of Load Control, DSM Implementation Issues, Strategies to implement and Promote DSM, Customer acceptance of DSM, Environment & DSM, International experience with DSM, DSM in India.	

Reference Books:

1. Suresh Kumar Soni and Manoj Nair, Energy Conservation and Audit, Satya Prakashan, New Delhi, 2010
2. Rajiv Shankar, Energy Auditing in Electrical Utilities, Viva Books, New Delhi 2010
3. Larry C. White, Philip S. Schmidt, David R. Brown, "Industrial Energy Management Systems", Hemisphere Publishing Corp, New York.
4. Albert Thumann, "Fundamentals of Energy Engineering", Prentice Hall Inc, Englewood Cliffs, New Jersey.

Course Outcomes:

After completion of the course the students will be able to,

1. Define/list different energy resources, energy management/audits, energy efficient motors, lighting terminologies and demand side management terminologies.
2. Describe/explain energy economic methods, energy audit methods, lighting criteria and DSM techniques
3. Compute/determine numerical problems and compare & contrast on selection of energy economic techniques, lighting criterion, energy efficient motors and energy alternative from DSM techniques
4. Evaluate various methods of energy conservation & DSM in different sectors like agriculture, commercial, transpiration and domestic and design & develop methods/techniques for energy conservation, audit & management

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE852E.1	3							1		1		1	1	1	1
2	UEE852E.2	3	1						1		1		1	1	1	1
3	UEE852E.3	3	3	2	2	1			1		1		1	1	2	3
4	UEE852E.4	3	3	3	3	1			1	1	1		2	1	1	3

Syllabus for B.E VIII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE853E	Smart Grid	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours :40		SEE Marks : 50

UNIT – I	(10LHours)
Smart Grid Architectural Designs: Introduction, Today's Grid versus the Smart Grid, Energy Independence and Security Act of 2007: Rationale for the Smart Grid, Computational Intelligence, Power System Enhancement, Communication and Standards, Environment and Economics, General View of the Smart Grid Market Drivers, Stakeholder Roles and Function, Working Definition of the Smart Grid Based on Performance Measures, Representative Architecture, Functions of Smart Grid Components. **Smart Grid Communications and Measurement Technology:** Communication and Measurement, Monitoring, PMU, Smart Meters, and Measurements Technologies, GIS and Google Mapping Tools, Multiagent Systems (MAS) Technology, Microgrid and Smart Grid Comparison. **Performance Analysis Tools for Smart Grid Design:** Introduction to Load Flow Studies, Challenges to Load Flow in Smart Grid and Weaknesses of the Present Load Flow Methods, Load, Flow State of the Art: Classical, Extended Formulations, and Algorithms, Congestion Management, Effect, Load Flow for Smart Grid Design, DSOPF Application to the Smart Grid.	
UNIT – II	**(10L Hours)**
Network Theorems: Introduction to Stability, Strengths and Weaknesses of Existing Voltage Stability Analysis Tools, Voltage Stability Assessment, Voltage Stability Assessment Techniques, Voltage Stability Indexing, Analysis Techniques for Steady-State Voltage Stability Studies, Application and Implementation Plan of Voltage Stability, Optimizing Stability Constraint through Preventive Control of Voltage Stability, Angle Stability Assessment. **Computation Tools for Smart Grid:** Introduction to Computational Tools, Decision Support Tools, Optimization Techniques, Classical Optimization Method, Heuristic Optimization, Evolutionary Computational Techniques, Pareto Method.	
UNIT – III	**(10L Hours)**
Pathway for Designing Smart Grid:: Introduction to Smart Grid Pathway Design, Barriers and Solutions to Smart Grid Development, Solution Pathways for Designing Smart Grid Using Advanced Optimization and Control Techniques for Selection Functions, General Level Automation, Bulk Power Systems Automation of the Smart Grid at Transmission Level, Distribution System, Automation Requirement of the Power Grid, End User/Appliance Level of the Smart Grid, Applications for Adaptive Control and Optimization. **Renewable Energy and Storage:** Renewable Energy Resources, Sustainable Energy Options for the Smart Grid, Penetration and Variability Issues Associated with Sustainable Energy Technology, Demand Response Issues, Electric Vehicles and Plug-in Hybrids, PHEV Technology, Environmental Implications, Storage Technologies, Tax Credits.	
UNIT – IV	**(10L Hours)**
Interoperability, Standards, and Cyber Security: Introduction, Interoperability, Standards, Smart Grid Cyber Security, Cyber Security and Possible Operation for Improving Methodology for Other Users.	

Research, Education, and Training for the Smart Grid: Introduction, Research Areas for Smart Grid Development, Research Activities in the Smart Grid, Multidisciplinary Research Activities, Smart Grid Education, Training and Professional Development.

Case Studies and Test beds for the Smart Grid:

Introduction, Demonstration Projects, Advanced Metering, Microgrid with Renewable Energy, Power System Unit Commitment (UC) Problem, ADP for Optimal Network Reconfiguration in Distribution Automation, Case Study of RER Integration, Testbeds and Benchmark Systems, Challenges of Smart Transmission, Benefits of Smart Transmission.

Reference Books:

1. James Momoh., "Smart Grid, Fundamentals of Design and Analysis", (1st Edition), Wiley, 2012.
2. Clark W Gellings, "The Smart Grid, Enabling Energy Efficiency and Demand Side Response"- CRC Press, 2009.
3. Yokoyama, Nick Jenkins, "Smart Grid: Technology and Applications"- Wiley, 2012.

Course Outcomes:

After completion of the course the students will be able to,

1. Identify the smart measuring instruments for two way communication of each components in grid.
2. Apply the suitable load flow analysis technique for exiting distribution system.
3. Evaluate the optimal value for distribution system including renewable energy and storage systems.
4. Formulate the existing distribution for the conversion to smartgrid using standards as for the case studies.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE853E.1	3	1		1	3	1		1		2		1	1	3	1
2	UEE853E.2	3	2	1	1				1		1		1	1	2	3
3	UEE853E.3	3	3	2	2	1			1		1		1	1	2	1
4	UEE853E.4	3	2	3	2	1			1	1	1	1	2	1	3	2

Syllabus for B.E VIII - Semester for academic year 2023 – 2024

(For students admitted to I year in 2020-21)

UEE871P	Project Work	13 - Credits (0 : 0 : 26)
Hours/Week : 26		CIE Marks : 50
Total Hours : 260		SEE Marks : 50

	(0L-0T-26P Hours)

Students have to take up Design methodology and planning of project work, Description of Concepts and Technical Details, Incorporation of Suggestions made by examiners during CIE and prepare the project implementation schedule. A certified report with project demonstration and a seminar is to be presented by the students. The seminar should highlight – Broad project area of their project work carried out. CIE of 50 marks will be allotted by the examiners as per the rubrics. For SEE, student has to make a presentation of the work carried out to Project Evaluation Committee (PEC- Project coordinator, Internal Examiner, External Examiner). PEC will allot SEE marks for 50.

Course Outcomes

At the end of this course, students will be able to:

1. Identify, formulate & analyze the engineering problems associated with electrical & electronics engineering and interdisciplinary research.
2. Design & implement proposed solutions for complex engineering problems to meet specified objectives by analyzing / validating the design / solutions of engineering problems using contemporary tools & resources.
3. Prepare engineering documents and make effective presentation to communicate effectively and collaboratively with detailed analysis and interpretation of results to yield valid conclusions.
4. Demonstrate social, ethical cultural & engineering professional responsibilities.

Course Outcomes - Programme Outcomes Mapping Table

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	UEE871P.1	3	3						3	3	3	1	3	3	3	3
2	UEE871P.2	3	3		2		2		3	3	3	2	2	3	3	3
3	UEE871P.3	3	3	3	3	3	3	1	3	3	3	3	3	3	3	3
4	UEE871P.4	1	1	2					3	3	3	1	2	3	3	3

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

III Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	21UMA302C	Numerical Techniques and Fourier Series	3	3	0	0	50	50	100
2	21UIP341C	Mechanics of Materials	3	2	2	0	50	50	100
3	21UIP342C	Fundamentals of Material Science and Engineering	3	3	0	0	50	50	100
4	21UIP343C	Manufacturing Processes	3	3	0	0	50	50	100
5	21UIP344C	Engineering Thermodynamics and Fluid Mechanics	3	3	0	0	50	50	100
6	21UIP351L	Material Science and Testing Laboratory	1	0	0	2	50	50	100
7	21UIP352L	Manufacturing ProcessesLaboratory	1	0	0	2	50	50	100
8	21UIP353C	Report writing and Presentation skills	1	0	0	2	50	50	100
9	21UHS324C	Universal Human Values-II	1	1	0	0	50	50	100
10	21UMA300M	Bridge Course Mathematics-I	0	3	0	0	50	50	100
11	21UHS322C/ 21UHS323C	Samskruthika Kannada/ Balike Kannada	1	1	0	0	50	50	100
		Total	20	20	2	4	650	650	1100

21UIP341C	MECHANICS OF MATERIALS	Credits: 03
L:T:P -3: 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Simplestressandstrain -Mechanicalproperties of materials, stress, strain, stress-strainrelation, 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 superposition, thermal stresses, volumetricstrain, and elasticconstants.	
UNIT - II	**10 Hrs.**
Compound stress -Introduction, plane stress system, sign convention, stresses on an inclined plane, Principal stresses. **Bendingofbeams-**Shearforcesandbendingmoments,typesofbeams,loadsandreactions, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams fordifferent beams subjected to concentrated loads, uniform distributed load (UDL)and couple for different types of beams	
UNIT - III	**10 Hrs.**
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 beamsforpointload,UDL,UVL and couple,Macaulay'smethod.	
UNIT - IV	**10 Hrs.**
Thickandthincylinders-Stresses inthin cylinders, changes in dimensions of cylinder, thick cylinders subjected to internal and external pressures (Lame's equation). **Torsionofcircularshafts** -Puretorsion,assumptions,derivationoftensionalequations,polarmodulus,torsionalrigidity/stiffnessofshafts, powertransmittedbysolidandhollowcircularshafts. **Elasticstabilityofcolumns- -**Introduction tocolumns, Euler's theory for axially loaded elastic long columns, derivation of Euler's load for various end conditions, limitations of Euler's theory and Rankin'sformula.	
Reference Books *	

1. S.S.Bhavikatti, 2006, StrengthofMaterials, VikasPublicationsHouse-Pvt.Ltd.,2nd Ed.
2. W. A. Nash, StrengthofMaterials,TataMcGrawHill,4th edition
3. K.V.Rao,G.C.Raju,2007, MechanicsofMaterials,FirstEdition.
4. Ferdinand Beer, Jr.Johnston, E.Russell, ohnDeWolf, David Mazurek, 2011, McGraw -HillEducation.

Course Outcomes**
After completion of the course student will be able to: 1. Know the physical properties of the materials such as stresses, strains, stress-strain relationship, elastic constants etc andstudy the behavior of one-dimensional simple component of varied shapes under varied load conditions. 2. Analyze the concept of principal stresses through compound stresses in1D/2D elements. 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. 4. Analyze the cylinders exposed to internal and external pressures from the view point of stresses developedand change in dimensions. 5. Know the stresses developed and the rigidity of the mechanical elements transmitting tensional power. 6. Simulate the mechanical elements receiving axial compressive loads under different end conditions and determine their columnarstability.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	1					1	1			1		
CO2	3	3	1	1					1	1			1		
CO3	3	3	1	1					1	1			1		
CO4	3	3	1	1					1	1			1		
CO5	3	3	1	1					1	1			1		
CO6	3	3	1	1					1	1			1		

21UIP342C	FUNDAMENTAL OF MATERIAL SCIENCE AND ENGINEERING	Credits: 03
L:T:P -3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
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 twining of slip and twining.	
UNIT - II	**10 Hrs.**
Mechanical properties of metals - Concepts of stress and strain, tensile test, compression test, notch impact test and hardness test. **Fatigue -** Fatigue test, fatigue loadings, S-N diagram and fatigue properties. **Fracture -** Types, mechanisms of ductile fracture, Griffith's theory of brittle fracture. **Creep -** Creep curve, mechanism of creep, creep resistant materials.	
UNIT - III	**10 Hrs.**
Solidification - Mechanism of solidification, homogeneous and heterogeneous nucleation, crystal growth, cast metal structures. **Solid solutions -** Types, Hume Rothary rules governing the formation of solids solutions. **Phase diagrams -** Basic terms, Gibbs phase rule, construction of phase diagram involving, lever rule, different types of invariants reactions. **Iron carbon equilibrium diagram -** Salient features of iron and carbon, allotropic forms of iron, Fe-C diagram and phases in the Fe-C system, TTT curves.	
UNIT - IV	**10 Hrs.**
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 andclassification 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.	

Reference Books *

1. William. D. Callister, 2006,Materials Science and Engineering - An introduction Jr Wiley India Pvt. Ltd. 7th Edition,New Delhi.
2. George E. Dieter, Adapted by David Bacon, Mechanical Metallurgy, (SI Metric Edition), McGraw-Hill Book Company.
3. K. Srinivasan, Composites Materials - Production, Properties, Testing and Applications, Narosa Publishing House, New Delhi.
4. James F. Shackel Ford, 2006, Introduction to Material Science for Engineering, 6th Edition,

Pearson, Prentice Hall, New Jersy.

5. V. Raghavan, 2007,Materials Science and Engineering, 5thEdition, Prentice Hall, India.
6. O. P. Khanna,A Text Book on Material Science and Metallurgy, Dhanpat Rai Publications (P) Ltd, New Delhi.
7. Van Vlack,Elements of Material Science and Engineering, 6th Edition, Addison Wesley Publishing Company.
8. Smith,1997, Foundation of Material Science and Engineering, 3rd Edition, Mc Graw Hill.

Course Outcomes**

After completion of the course student will be able to:

1. Analyze different class of materials their properties and structures and present in them and to understand crystal structures, impacts of defects at the atomic and microstructure scales, atomic diffusion and mechanisms.
2. Describe various testing procedure to evaluate mechanical properties of materials and their use in the design of materials for engineering applications.
3. Elucidate 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.
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.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											3	1	2
CO2	3	2											3	1	2
CO3	3	2											3	1	2
CO4	3	2											3	1	2

21UIP343C	MANUFACTURING PROCESS	Credits: 03
L:T:P -3: 0: 0		CIEMarks:50
Total Hours/ Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction - Concept of manufacturing process, its importance, classification of manufacturing processes, introduction to hot and cold working, forging, rolling, extrusion process and drawing operation. **Patterns -** Introduction to casting process, steps involved advantages and limitations of casting process, definition, classification of patterns, pattern materials and various pattern allowances.	
UNIT - II	**10 Hrs.**
Sand moulding and methods - Types of base sand, requirement of base sand, types of sand moulds, properties, Ingredient of moulding sands, core sands, ingredients and properties and method used for sand moulding. **Special moulding process -** Study of important moulding processes, green sand, dry sand, sweep mould, CO_2 sand, shell mould, investment casting, metal moulds, gravity die-casting, pressure die casting. **Welding process -** Definition, principles, classification, application, advantages and limitations of welding process. **Arc welding-** Principle and classifications. **Gas welding-** Principle, oxy-acetylene welding, reaction in gas welding, flame and its characteristics.	
UNIT - III	**10 Hrs.**
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. **Turning, shaping and planning machines -** Classification, constructional features of turret and capstan lathe, tool layout and machining time. **Shaping and planning machine -** Classification, constructional features, driving mechanisms, shaping and planning operations, machining time. **Drilling machines -** Classification, constructional features, drilling and related operations, types of drilling tools, drill bit nomenclature.	
UNIT - IV	**10 Hrs.**
Milling machines - Classification, constructional features, milling cutters, nomenclature, milling operations, up milling and down milling, Indexing - Simple and compound indexing. **Grinding machines -** Types of abrasives, grain size, bonding process, grade and structure of grinding wheels, grinding wheel types, classification,and constructional features. Selection of grinding wheel. **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.	

Reference Books *

1. Hazara Choudhry, 2004,Workshop Technology, Vol-II, Media Promoters and Publishers Pvt. Ltd.
2. R.K.Jain, 2003,Production Technology, Khanna Publications.
3. HMT, Production Technology, Tata Mc Graw Hill,
4. Amitabha Ghosh and Mallik,2003, Manufacturing Science, affiliated East West Press.
5. G. Boothroyd,2000, Fundamentals of Metal Machining and Machine Tools, McGraw Hill.

Course Outcomes**

After completion of the course student will be able to:

1. Students able to describe and compare different manufacturing methods.
2. Ability to select different patterns and identify appropriate different types of moulds.
3. Student’s able to select different special castingprocess for types of products.
4. Realize the influence of operating parameters in different machining operations.
5. Recognize the operating principle, control parameters and applications in special machining processes.
6. Solve numerical related to various machining operations.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	2		2	2						1	1	1	1
CO2	3	2	2		2	2			2			1	1	1	1
CO3	2	2	2		2	1			1			1		1	1
CO4	3	3			2							1	3	2	3
CO5	3	3			2							1	3	2	3
CO6	3	2	2		3							2	3	2	3

21UIP344C	ENGINEERING THERMODYNAMICS AND FLUID MECHANICS	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Basic concepts of thermodynamics -Basic definition, thermodynamic systems, macroscopic v/s microscopic point of view, pure substance, thermodynamic equilibrium, thermodynamic properties, path and point functions, quasi static, reversible and irreversible processes. **Energy,workand heat -** Definition, sign convention, similarities and dissimilarities of heat and work. **Zeroth law of thermodynamics** -Concept of temperature and thermal equilibrium. **First law of thermodynamics-** Internal energy,Law of conservation of energy, statement of first law, application of first law to a process,perpetual motion machine of the first kind - PMM 1, application of first law of thermodynamics to closed system and steady state steady flow energy equation	
UNIT – II	**10 Hrs.**
Second law of thermodynamics -Heat reservoir, source and sink, heat engine, refrigerator, heat pump, reversed heat engine, statement of second law of thermodynamics - Kelvin-Planck statement and Clausius statement, equivalence of Clausius statement to the Kelvin-Planck statement, perpetual motion machine of second kind - PMM-II. **Entropy-**Definition,Clausius inequality proof, Carnot theorem, principal of increase of entropy, entropy as a quantitative test for irreversibility.	
UNIT – III	**10 Hrs.**
Properties of fluids - Introduction to fluid mechanics and its applications, properties of fluids, 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	
UNIT – IV	**10 Hrs.**
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** -Venturimeter, 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.	

Reference Books *

1) P. K. Nag, 2017, Basic and Applied Thermodynamics 6th Edition,Tata McGraw Hill.
2) R. K. Hegde and Niranjan Murty,2005, Basic and Applied Thermodynamics by, Sapna Book House, Bengaluru.
3) R. K. Bansal,2009, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications Pvt. Ltd.
4) Dr, Jagadish Lal (SI unit and MKS unit),1995, Fluid Mechanics and Hydraulics - 9thEdition,

Metropolitan Book Co Pvt. Ltd., New Delhi.

5) K. Subramanya 1000 Solved Problems in Fluid Mechanics (Includes Hydraulic Machines), 2005, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2005.
6) Dr. P. N. Modi, Dr. S. M. Seth, (SI Unit), 2005, Hydraulics and Fluid Mechanics including Hydraulic Machines by Standard Book House, 5th Edition, New Delhi.

Course Outcomes**

After completion of the course student will be able to:

1. To analyze 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.
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. Identify and obtain fundamental aspects of fluid flow behavior, analyze and understand the various fluid flow principles and governing equations and understand the principles of continuity, momentum, and energy as applied to fluid motions.
4. To develop and apply the fluid flow equations for various flow instruments and flow problems. Estimate pressure drop in fluid flow systems.

***Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											3	1	2
CO2	3	2											3	1	2
CO3	3	2											3	1	2
CO4	3	2											3	1	2

21UIP351L	MATERIAL SCIENCE AND TESTING LABORATORY	Credits: 01
L:T:P -0: 0: 2		CIEMarks:50
Total Hours/Week: 02		SEEMarks:50

PART-A	10 Hrs.
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	**20 Hrs.**
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 marks : 50 Marks --	
Course Outcomes**	

After completion of the course student will be able to:

1. Analyze the microstructure and characteristics of specimen and have heat treatment studies on various materials
2. Evaluate the values of yield stress, breaking stress and ultimate stress of the given specimen under tension test
3. To utilize UTM for shear, compression and bending tests on mild steel and wooden specimens
4. To conduct impact tests and find the impact value of test specimens
5. Justify the Rockwell hardness test over with Brinell and Vickers hardness and measure the hardness of the given specimen
6. Conduct the torsion test to determine the modulus of rigidity of given specimen and
7. To demonstrate the wear and fatigue test.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2											3	1	2
CO2	3	2											3	1	2
CO3	3	2											3	1	2
CO4	3	2											3	1	2

21UIP352L	MANUFACTURING PROCESSES LABORATORY	Credits: 01
L:T:P -0: 0: 2		CIEMarks:50
Total Hours/Week: 02		SEEMarks:50

Part – A	**15Hrs.**
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 and mould hardness tests d. Grain fineness number test (Sieve analysis test) e. Clay content test f. Moisture content test. **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 - B	**15 Hrs.**
3. MACHINE SHOP PRACTICE **Minimum four jobs consisting of following machining operations** Plain Turning, Taper Turning. Step Turning, Thread Cutting, Facing, Knurling. Eccentric Turning using lathe **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. **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. One practical test for 20 marks. (5 write-up, 10 conduction, calculation, resultsetc.5 (viva voce). **Allocation of 50 marks for SEE** Part-A : 20 Marks Part-B : 20 Marks Viva -Voce :10 Marks **Total : 50 marks**	

Course Outcomes**
After completion of the course student will be able to: 1. To have understood various processes carried out in foundry. 2. Ability to prepare different types of mold cavities and different sand testing methods. 3. Apply skills to develop jobs on different machine. 4. Calculate machining time for different operations. 5. Aware of importance of manufacturing process in an industry and the applications.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2							2			1	1	1	1
CO2	3	2	2						1				1	1	1
CO3	3	2	2		2				2			2	1	1	1
CO4	3	2			2				2			2	1	1	1
CO5	3	2	2		2				2			1	1	1	1

21UIP353C	Report writing and Presentation skills	Credits: 01
L:T:P - 0: 0: 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

UNIT-I	04 Hrs.
Written forms of communication: Letters, memos, e-mails, reports, technical proposals, research papers, instruction manualsand technical descriptions.	
UNIT - II	**04Hrs.**
Word processing packages: Introduction to different word processing packages, various techniques to create dynamic layouts, format documents effectively using Microsoft word styles, create and manage table layouts, perform mail merges to create mailing labels and form letters, manage templates, prepare documents for printing and exporting, control page formatting and flow with sections and page breaks, work with tab stops to align content properly, build and deliver word forms, track and accept/ reject changes to a document.	
UNIT – III	**04 Hrs.**
Spreadsheet packages: Introduction to different spreadsheet packages, build a solid understanding of the basics of spreadsheet, learn the most common spreadsheet functions used in the office, maintain large sets of spreadsheet data in a list or table, Wow your boss by unlocking dynamic formulas with IF, VLOOKUP, INDEX, MATCH functions and many more, harness the full power of spreadsheet by automating your day to day tasks through macros and VBA, create dynamic reports by mastering one of the most popular tools, pivot tables.	
UNIT – IV	**04 Hrs.**
Presentation packages: Introduction to different presentation packages, master the basic features of power point, build effective power point presentations, enhance power point presentations with graphical elements, leverage advanced text editing operations with power point, prepare to deliver a power point presentation.	

Reference Books *

1. Lesikar and Fatley, "Basics Business Communication Skills for Empowering the Internet Generation" 10th edition, Tata McGraw Hill edition,ISBN: 978-0-07-059975-.
2. Meenakshi Raman and Sangeeta Sharma, "Technical Communication Principles and Practices" Oxford University Press, ISBN-13 978-0-19-566804-9.
3. Meenakshi Raman and Prakash Singh, "Business Communication", Oxford University Press, ISBN-13: 978-0-19-567695-2.

Software - Any Office packages

Course Outcomes**

After completion of the course student will be able to

1. Deign different forms of written communication like memo, report, technical report etc.
2. Design different written communication formats using word processing package.
3. Design different spread sheets for business applications usingany spreadsheet package.
4. Design different academic and business presentations using any presentation package.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1								2		3		3	1		2
CO2					3					3		3	1		1
CO3					3					3		3	1		1
CO4					3					3		3	1		1

21UHS3324C	UNIVERSAL HUMAN VALUES-II	Credits: 01
L:T:P -1: 0: 0		CIE Marks: 50
Total Hours/Week: 01		SEE Marks: 50

UNIT-I	04 Hrs.
Introduction to Value Education: Right Understanding; Relationship and Physical Facility; Understanding Value Education; Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.	
UNIT - II	**04 Hrs.**
Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body,Programme to ensure self-regulation and Health.	
UNIT – III	**04 Hrs.**
Harmony in the Family and Society and Nature: Harmony in the Family - the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect'-as the Right Evaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society;Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature.	
UNIT – IV	**03 Hrs.**
Implications of the Holistic Understanding -A Look at Professional Ethics Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order;Competence in Professional Ethics;Holistic Technologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession	

Reference Books *

1. R R Gaur, R Asthana, G P Bagaria, 2019, A Foundation Course in Human Values and Professional Ethics, 2nd Revised Edition, Excel Books, New Delhi, ISBN 978-93-87034-47-1.
2. R. R. Gaur, R Asthana, G. P. Bagaria, 2019, Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,2nd Revised Edition, Excel Books, New Delhi, ISBN 978-93- 87034- 53-2.
3. A Nagaraj, 199, JeevanVidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkan tak.
4. A.N. Tripathi, 2004, Human Values, New Age Intl. Publishers, New Delhi.
5. The Story of Stuff(Book).
6. Mohandas Karamchand Gandhi Story of My Experiments with Truth.
7. E. F Schumacher,Small is Beautiful.
8. Cecile Andrews, Slow is Beautiful
9. J. C. Kumarappa Economy of Permanence.
10. Pandit Sunderlal, Bharat Mein Angreji Raj.
11. R. Dharampale, Discovering India.
12. Mohandas K. Gandhi, Hind Swaraj or Indian Home Rule.
13. Maulana Abdul Kalam Azad, India Wins Freedom.

Course Outcomes**

After completion of the course student will be able to:

1. Explore holistic vision oflife - themselves and their surroundings.
2. Develop competence and capabilities for maintaining Health andHygiene.
3. Analyze various problems in life, family,society and in handling problems with Sustainable Solutions.
4. Apply values to their own self in different day-to-day settings in real life and in handling problems with sustainable solutions.
5. Adopt the value of appreciation and aspiration for excellence and gratitude for all.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1							3	2	3			1			
CO2						3	3	1	1			1			
CO3						3	3	2	1			1			
CO4						2	2	3	2			1			
CO5								3				1			

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

IV Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	21UMA402C	Partial differential equations and Statistics	3	3	0	0	50	50	100
2	21UIP441C	Industrial Engineering and Management	3	3	0	0	50	50	100
3	21UIP442C	Industrial Metrology and Quality Control	3	3	0	0	50	50	100
4	21UIP443C	Theory of machines	3	3	0	0	50	50	100
5	21UIP444C	Theory of Metal Cutting and Tool Design	3	3	0	0	50	50	100
6	21UIP451L	Industrial Engineering Laboratory	1	0	0	2	50	50	100
7	21UIP452L	Industrial Metrology and Quality Control Laboratory	1	0	0	2	50	50	100
8	21UIP453L	Computer aided Component Drawing Laboratory	1	0	0	2	50	50	100
9	21UHS424C	Constitution of India	1	2	0	0	50	50	100
10	21UIP454L	Summer Internship	2	--	-	-	50	50	100
11	21UMA400M	Bridge Course Mathematics-II	0	3	-	-	50	50	100
		Total	21	17	02	06	500	500	1000

21UIP441C	INDUSTRIAL ENGINEERING AND MANAGEMENT	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Introduction to Industrial Engineering -Definition, historical development of industrial engineering, present state of industrial engineering, activities and approach of industrial engineering, objectives and functions of industrial engineering. **Productivity –** Definition of productivity,factors affecting the productivity. **Workstudy -** Definition,objective and scope of work study. **Human factors in work study-**Work study and management,work study and supervision,work study and worker. **Method study -** Definition, objectiveand 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.	
UNIT - II	**10 Hrs.**
Work measurement: Definition, objective and benefit of work measurement, work measurement techniques. **Timestudy –**Time Study,definition,time study equipment,selection of job,steps in time study,breaking jobs into elements, rating and standard rating, standard performance, allowances and standard time determination, predetermined motion timestudy, method time measurement(MTM). **Ergonomics-**Introduction, areas of study under ergonomics, introduction to man-machine system, components of man-machine system and their functions- design of workplaces, influence of climate on human	
UNIT - III	**10 Hrs.**
Management-Definition of management: its nature and purpose, the systems approach to the management process, functions of a manager. **Planning-** The nature and purpose of planning, types of plans, steps in planning, planning process. **Decision making-**Introduction, importance and limitations of decision-making, decision making process, programmed and non-programmed decisions, decision making under certainty, uncertainty and risk. **Organizing -** 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.	
UNIT - IV	**10 Hrs.**
Staffing - Definition, systems approach to HRM, situational factors affecting staffing. **Selection -** matching the person with the job, matching qualifications with position requirements, system approach to selection. **Human factors and motivation-** Introduction, motivation and motivators, process of motivation, Maslow's hierarchy of needs, Hertzberg's motivation-hygiene theory, Vroom's expectancy theory, Equity theory, McClelland's needs theory. **Leadership -** Definition, ingredients of leadership, trait approach to leadership, leadership behavior and styles, managerial grid. **Controlling -** Basic control process, critical control points, control as a feedback system, real time information and control, preventive control, control of overall performance, requirements for effective controls, budget as a control.	

Reference Books *

1. ILO,Introduction to work study–ILO,III(Revised), Edition,2007,ISBN:81-204-0602-8
2. Harold Koontz, Heinz Weihrich and A Ramachandra Aryasril, "Principles of Management", Tata McGraw Hill Int. Book Company, ISBN-10:0-07-058192-4.
3. S.SandersandE.J.McCormick, Human Factors in Engineering Design - 6thEdition, McGraw Hill,

ISBN:0-07-100319-3

4. P.C.Tripathi and P.N.Reddy, "Principles of Management" 4 Edition, Tata McGraw Hill Int. Book Co, ISBN:0-07-022088-3.

Course Outcomes**

After completion of the course student will be able to:

1. Carryout systematic investigation of existing way of doing work to effect improvement.
2. Compare and analyze the existing methods of working for a particular job and develop an improved method through questioning technique and determine the standard time of a job using time study.
3. Assess and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.
4. Recognize the concepts, need and importance of management and application of the various principles of management and examine the process of management and the various components of management process (Planning, Organizing, Staffing, Directing, and Controlling.

***Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			2					1			2	3	2	2
CO2	1	3	2	2					1				3	1	2
CO3	2		1	1	1	1	2		2	1		1	2	3	3
CO4	2	1	2		1		1		1			1	3	2	2

21UIP442C	INDUSTRIAL METROLOGY AND QUALITY CONTROL	Credits: 03
L: T:P -3: 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Basic Principles of engineering metrology - Introduction, metrology, need for inspection, accuracy, and precision, objectives of metrology and measurements, general measurement concepts, errors in measurements and methods of measurement. **Limits, fits, and tolerances -** Introduction, principle of interchangeability, tolerances, maximum and minimum metal conditions, fits, system of limits and fits, plain plug gauges, snap gauges.**Linear measurement -** Introduction, design of linear measurement instruments, surface plate, V-blocks, graduated scales, scaled instruments, vernier instruments, micrometer instruments, slip gauges, numerical examples.	
UNIT - II	**10 Hrs.**
Angular measurement - Introduction, protractor, sine bar, angle gauges, spirit level, optical instruments for angular measurement. **Comparators -** Introduction, functional requirements, classification of comparators, mechanical comparators, mechanical optical comparator, electrical comparators, pneumatic comparators. **Metrology of surface finish -** Introduction, surface metrology concepts, terminology, analysis of surface traces, methods of measuring surface finish, stylus System of measurement, stylus probe instruments, wavelength, frequency and cut-off, other methods for measuring surface roughness.	
UNIT - III	**10 Hrs.**
Basic concepts of quality - The meaning of "quality", quality of design, quality of conformance, quality of performance, quality function, quality control, quality characteristics, cost of quality, optimum cost of performance, quality control and inspection, quality policy, SQC. **Basic statistical concepts-**The concept of variation, the distinction between variables and attributes data, the frequency distribution, graphical representation of frequency distribution, quantitative description of distribution and the normal curve.**Control chart for variables -** The general theory of control chart, definition of control chart, some possible objectives of control chart, the relationship between $\overline{X}$, σ', and the values of $\overline{X}$, relationship between σ' and σ, relationship between σ' and R, choice of variables, basics of subgrouping, size and frequency of subgroups, control limits, drawing preliminary conclusions from control charts, run sum test, control limits on σ chart, revising the control limits, process capability analysis, why does a capable manufacturing process give defects?	
UNIT - IV	**10 Hrs.**
Control charts for attributes: Practical limitations of the control chart for variables, comparison of X and R chart with P chart, control limits on P chart, choice between 'p' chart and 'np' chart, periodic review and revision of p', control charts for defects, comparison between attribute charts and variable chars. **Acceptance sampling -** Introduction, sampling methods, the operating characteristics (OC) curve, producer's risk and consumer's risk, quality indices for acceptance sampling plans, AOQL, steps in the design of an acceptance plan, types of sampling plans, design item by item sequential sampling plans, ATI curve.	
Reference Books *	

1. N.V. Raghavendra and L. Krishnamurthy, "Engineering Metrology and Measurements", Oxford University Press, ISBN-13: 978-0-19-808549-2, ISBN-10: 0-19-808549-4
2. R.K.Jain, "Engineering Metrology", Khanna Publishers, Twentieth Edition, ISBN:81-7409-153-X
3. M Mahajan "Statistical Quality Control" Dhanpat Rai and Company.

4. Douglas C. Montgomery, “Introduction to Quality Control”, John Wiley and Sons, Inc978-0-470-16992-6.
Course Outcomes**
After completion of the course, students will be able to: 1. Apply principles of metrology to real-life problems using linear measurement. 2. Evaluate different types of angular measurements, comparators, and surface finish measurements. 3. Design control charts for variables and attributes. 4. Design different sampling methods

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action words and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3											2	2	
CO2	2	2	2	3									3	3	
CO3	1	2	3	3	2								2	3	
CO4	1	2	3	3	1								3	2	

21UIP443C	THEORY OF MACHIES	Credits: 03

L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction-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 -** Quick return motion mechanisms -drag link mechanism, whitworth mechanism and crank and slotted lever mechanism, straight line motion mechanisms, Pantagraph- Peaucellier's mechanism and Robert's mechanism, intermittent motion mechanisms - Geneva mechanism and Ratchet and Pawl mechanism and Toggle mechanism.	
UNIT - II	**10 Hrs.**
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 without friction.**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	**10 Hrs.**
Governors - Types of governors, force analysis of Porter and Hartnell governors, controlling force, stability, sensitiveness, isochronism, effort and power.**Gyroscope -** 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	**10 Hrs.**
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 trains. **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, 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**	

Reference Books *

1. Rattan S. S, 2005, Theory of Machines, McGraw-Hill Education 2nd edition.
2. Sadhu Singh, 2006.Theory of Machines, 2nd edition, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi
3. Shigley. J. V. and Uickers, 2004, Theory of Machines and Mechanisms, J.J. OXFORD University press,3rd edition.
4. Robert L. Norton, 2006, Theory of Machines,3rd edition,McGraw-Hill Higher Education

Course Outcomes**

After completion of the course student will be able to:

1. Construct/Compose mechanisms to provide specific motion.
2. To understand forces acting on the mechanisms.
3. To analyze the effect of a gyroscopic couple on Ship, Aeroplan and an Automobile.
4. To understand gears and gear trains and construct cam profile for the specific follower motion.

*__Books to be listed as per the format with decreasing level of coverage of syllabus__

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	3	3	3		3	2		3			
CO2	3	3	3	3	3	2	3		3	2		3			
CO3	3	3	3	3	3	3	3		3			3			
CO4	3	3	3	3	3	3	2		2			3			

21UIP444C	THEORY OF METAL CUTTING AND TOOL DESIGN	Credits: 03
L:T:P - 3 : 0: 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT-I	10 Hrs.
Mechanics of metal cutting - Metal cutting process, mechanism of chip formation, orthogonal and oblique cutting, types of chips, determination of shear plane angle, forces and energy calculations (Merchant's circle analysis), velocity relationship	
UNIT- II	**10 Hrs.**
Heat generation - Sources of heat generation, regions of heat generation.**Tool wear and tool life-** Wear mechanisms, types of tool wear, tool life criteria and Taylor's tool life equation, factors affecting tool life and simple problems, 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.	
UNIT- III	**10 Hrs.**
Design of single point cutting tool - Design of single point cutting tool, dimensions of tool shank for single point tool and numerical problems related to shank design. **Design of multi point cutting tools -** Introduction to design of multipoint point cutting tools, geometry, nomenclature and design features of drill bit and milling cutter and numerical problems.	
UNIT – IV	**10 Hrs.**
Jigs and fixtures - Significance and purpose of jigs and fixtures and their functions in manufacturing processes, classifications of jigs and fixtures and elements of jigs and fixtures. **Design of jigs and fixtures -** General guidelines and procedures for design of jigs and fixtures, concept of modular fixtures and force measurement using dynamometers,tool presetting fixtures.	

Reference Books *

1. B. L. Juneja, G. S. Sekhon and Nitin Seth, 2008, Fundamentals of Metal Cutting and Machine Tools, second addition, ISBN: 81-224-1467-2, New Age International Publishers
2. P C. Sharma, Production Engineering, Khanna Publishers. ISBN: 81-219-0421-8.
3. P. C. Sharma, Machine tools and Tool Design ISBN: 81-219-2362-X.
4. P. N. Rao, 2013, Manufacturing Technology - Metal Cutting and Machine Tools 3rd edition, TMH, New Delhi.
5. Dr. B. J. Ranganath, Metal Cutting and Tool Design, Vikas Publishing House.
6. M. H. A. Kempster,Introduction to Jigs and fixtures Design, ISBN: 81-856-1785-6.
7. G. Boothroyd, 2000, Fundamentals of Metal Machining and Machine Tools, Tata McGraw Hill.
8. Bhattacharya, 2007, Metal Cutting: Theory and Practice, New Central Book Agency, Kolkata,

Course Outcomes**

After completion of the course student will be able to:

1. Apply the fundamentals principles of metal cutting, mechanism of chip formation, mechanics of orthogonal cutting, concept of shear deformation and velocity relationship in machining operations.
2. Describe inter-relationship between cutting parameters and machining performance measures like tool life, tool wear, machining economics and optimization and select cutting

fluids for improving machinability.

3. Explain and identify cutting tool geometry of single and multipoint cutting tool and to develop the relations for forces in multipoint machining.
4. Identify appropriate combination of tools, jigs and fixture, suitable for a particular machining operation and design assembly of jigs and fixtures on simple work-piece.

*Books to be listed as per the format with decreasing level of coverage of syllabus

** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	2	2					1			3	1	2
CO2	3	2	1	3	2					1			3	1	2
CO3	3	2	1	3	2					1			3	1	2
CO4	3	2	1	3	2					1			3	1	2

21UIP451L	INDUSTRIAL ENGINEERING LABORATORY	Credits: 01
L:T:P - 0 : 0: 1		CIEMarks:50
Total Hours/Week: 02		SEEMarks:50

PART-A	10 Hrs.

Methodstudy

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	10 Hrs.

Workmeasurement

1. Rating practice through pin board assembly,deck of cards,marble collection and walking.
2. Determining the standard time for simple operations using stopwatch timestudy.

PART- C	10 Hrs.

Ergonomics

1. Measurement of parameters(heart beatrate, Blood Pressure)using walking simulator.
2. Measurement of parameters(heartbeat rate, Blood pressure)using Ergometer.
3. Effect of Noise, Light on human efficiency in work environments.

Reference Books *

1. Ralphand BarnesWork Study
2. ILO Introduction to WorkStudy

Course Outcomes**

After completion of the course student will be able to:

1. Carry out systematic investigation of existing way of doing work to effect improvement.
2. Select appropriate recording technique for a given activity and also understands fundamental hand motions involved in the process in order to eliminate unnecessary.
3. Determine the standard time of a job using time study.
4. Apply the knowledge of ergonomics to identify ergonomically related injuries that occur in workplace, and be able to find and assure that the workplace fits the worker and also able to put ergonomic assessments and solutions to practical use in the workplace.

*Books to be listed as per the format with decreasing level of coverage of syllabus
** Each CO to be written with proper action word and should be assessable and quantifiable

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1			2					1			2	3	2	2
CO2	1	3	2	2					1				3	1	2
CO3	2		1	1	1	1	2		2	1		1	2	3	3
CO4	2	1	2		1		1		1			1	3	2	2

21UIP452L	INDUSTRIAL METROLOGY AND QUALITY CONTROL LABORATORY	Credits: 01
L:T:P - 0 : 0 : 1		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

PART-A	15 Hrs.

Metrology Lab

1. Measurements of angle using Sine Center/ Sine Bar/Bevel Protractor.
2. Measurements of the taper angle of given Taper Plug using roller sets.
3. Measurements of Screw thread parameters using two wire or three- wire method
4. Study on Snap, Plug, Ring, Taper and Adjustable Gauges.
5. Calibration of Micrometer, Vernier caliper and Vernier Height Gauge.
6. Measurement of Gear tooth profile using Gear tooth Vernier.
7. Studies on Mechanical/Electronic/Pneumatic Comparator

PART-B	15 Hrs.

Statistical quality control (SQC) Lab

1. Analyze the fault in given batch of specimens by using seven quality control tools for engineering application.
2. Determination of process capability from given components and plot variable control chart and attribute chart.

SCHEME OF EXAMINATION:

One question from part - A	: 20 Marks
One question from part - B	: 20 Marks
Viva- Voce	: 10 Marks
TOTALS	**: 50 Marks**

Course Outcomes**

1. The student shall be measuring the various parameters like length, height, angle, displacement, flatness etc., by using various instruments like Verniercallipers, micrometer, dial indicator, etc.
2. The student shall be able to measure the threads, gear tooth profiles and surface roughness using appropriate instruments and analyze the data.
3. The student shall be able to recognize various types of governors and gyroscopes, and improve their performance as per requirement.
4. The student shall be able to identifying and analyze the cause for variation and recommend suitable corrective actions for quality improvement in real life problems.

***Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	3	1				3				3	2	1
CO2	1	2	3	3	1								2	2	1
CO3	3	2	2	1	1				3				2	2	1
CO4	2	3	3	2	1				1				3	2	1

21UIP453L	COMPUTER AIDED COMPONENT DRAWING LABORATORY	Credits: 01
L:T:P - 1 : 0: 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

PART-A	15 Hrs.

Introduction - Review of graphic interface of the software. Review of basic sketching commands and navigational commands. Starting a new drawing sheet. Sheet sizes. Naming a drawing. Drawing UNITs, grid and snap.

Orthographic views - 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). Hidden line conventions. Precedence of lines. **Few examples**

Part Modeling:

Fasteners: At least ONE from- Hexagonal headed bolt and nut with washer (assembly), square headed bolt and nut with washer (assembly) simple assembly using stud bolts with nut and lock nut.

Joints: At least ONE from- Cotter joint (socket and spigot), knuckle joint (pin joint) for two rods.

PART-B	15 Hrs.

Assembly Drawings (At least TWO)

1. Plummer block (Pedestal Bearing)
2. Petrol Engine piston
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Tailstock of lathe
6. Machine vice

Note:

All the sheets should be drawn in the class using software. Sheet sizes should be A4. All sheets must be submitted at the end of the class by taking printouts.

Two questions to be set from Part-A and Part-B.

PART-A : 20 Marks

PART-B : 30 Marks

Total= : 50 Marks

Reference Books *

1. N.D.Bhat and V.M.Panchal, Machine Drawing.
2. N. Siddeshwar, P. Kanniah, V.V.S. Sastri,2006, Machine Drawing, published by Tata Mc GrawHill.
3. K.R. Gopala Krishna, Machine Drawing with Auto CAD', Subhash Publication.
4. Sham Tickoo, 2011, Solid Edge V18,for engineers and designers. Dream tech.

Course Outcomes**

After completion of the course student will be able to

1. Apply the principles for constructing design of machine components using isometric, orthographic/ sectional views of drawings and conversion of drawing from isometric to orthographic and vice versa.

2. Apply the concepts of Computer aided modeling on a software to create models of mechanical components.
3. Analyze the issues related with the assembly of machine parts through three dimensional models.
4. Develop the skill to convert the Model/Assembly to the industrial drawings.

*Books to be listed as per the format with decreasing level of coverage of syllabus
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Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	1	1	1	1	1	2	1	1	1	1	1	2	1	2
CO2	2	1	2	2	3	2	3	1	1	1	1	2	3	2	3
CO3	2	2	3	2	3	3	3	2	1	2	2	2	3	2	3
CO4	3	3	3	2	3	3	3	3	2	2	2	2	3	3	3

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

V Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UIP541C	Design of Machine Elements	3	2	2	-	50	50	100
2	UIP526C	Industrial Engineering and Management	4	4	-	-	50	50	100
3	UIP513C	Quality Assurance & Reliability Engineering	4	4	-	-	50	50	100
4	UIP523C	Theory of Metal Cutting and Tool Design	3	3	-	-	50	50	100
5	UIP533N	Open Elective: Marketing Management	3	3	-	-	50	50	100
6	UHS002N	Advanced Quantitative Aptitude and Soft Skills	1	1	-	-	50	50	100
7	UIP542L	Metal Cutting and Product Assembly Lab	1	-	-	2	50	50	100
8	UCS559L	Advanced C Programming Laboratory	2	-	-	4	50	50	100
9	UIP532L	Industrial Engineering Laboratory	1	-	-	2	50	50	100
		Total	22	17	2	8	450	450	900

UIP541C	DESIGN OF MACHINE ELEMENTS	Credits: 04
L : T : P - 3 : 2: 0		CIE Marks: 50
Total Hours / Week: 05		SEE Marks: 50

UNIT - I	10 Hrs.
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 and combined loading.	
UNIT – II	**10 Hrs.**
Design of shafts - Design of shaft for pure torsion, pure bending, combined loading, design for strength and rigidity, shafts under fluctuating loads. **Design of Keys -** Types of keys, strength of rectangular and square keys. **Design of Coupling –** Coupling design, rigid flange coupling and bushed pin type flexible coupling.	
UNIT – III	**10 Hrs.**
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.	
UNIT – IV	**10 Hrs.**
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.	

Reference Books *

1. V. B. Bandhari, 200, Design of Machine Elements, Tata McGraw Hill Publishing Co. Ltd., New - Delhi.
2. Robert. L, 2001, Machine Design- Norton - Pearson Education Asia, New Delhi.
3. N. C. Pandey and C. S. Shah, 2002, Elements of Machine Design, Chorotar Publishing House.
4. R. K. Jain, Machine Design- Khanna Publications, New Delhi.
5. William Orthwan, Machine Component & Design Jaico Publishing Co.
6. K. Mahadevan and Balaveera Reddy, Design Data Hand Book, CBS Publication.

Course Outcomes**

After completion of the course student will be able to:

1. Analyze the influence of stress concentration, material type, mode of failure, fluctuating loads etc. over the basic mechanical components.
2. Know the basics of mechanical components such as shafts, keys, couplings etc and develop the skill to design them based on their strength and rigidity following standard design procedures.
3. Comprehend the different methods of fastening such as riveting, welding, screw and other mechanical means following the procedure adopted in designing such components.

4. Get the knowledge about the basics of gears and practice the standard procedure adopted in the design of gearing systems.
5. Gain the knowledge about the functioning of different types of bearings and study all the issues related with the design and selection of bearings.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	3	1					1				3		
CO2	3	3	3	1					1				3		
CO3	3	3	3	1					1				3		
CO4	3	3	3	1					1				3		
CO5	3	3	3	1					1				3		

UIP526C	INDUSTRIAL ENGINEERING AND MANAGEMENT	Credits: 04
L : T : P - 4 : 0: 0		CIE Marks: 50
Total Hours / Week: 04		SEE Marks: 50

UNIT - I	12 Hrs.
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, **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). **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.	
UNIT - II	**13 Hrs.**
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). **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.	
UNIT - III	**13 Hrs.**
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. **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.	
UNIT - IV	**13 Hrs.**
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. **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. **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 v/s services.	
Reference Books *	

1. Introduction to work study III (Revised) Edition, 2007, ISBN:81-204- 0602-8, ILO.
2. Ralph M. Barnes, 1985, Motion and Time study, 8th Edition, John Wiley.

3. Wledon, 1991, Engineering work Measurement ELBS, 1991 Marvin E. Mundel- Motion and Time study 1st edition, PHI.
4. S. Sanders and E. J. McCormick, Human Factors in Engineering Design, 6th Edition, McGraw Hill, ISBN:0-07-100319-3
5. S. Dalela and Sourabh, Work Study and Ergonomics, 3rd Edition, Chand Publishers, New Delhi.
6. Maynard, Industrial Engineering Hand book.

Course Outcomes**

After completion of the course student will be able to:

1. Importance of quality, emphasizing on the statistical methods/tools used for improving quality trying to minimize the quality costs, periodic/chronic quality problems and plan, and perform the quality audit activities to analyze quality assurance.
2. To recognize the causes of variation in quality of products for understanding sample size, sampling frequency, rational sub grouping, analyzing the patterns of control for decisions on acceptance or rejection.
3. To understand and differentiate, to draw, interpret, analyze and decide the various types control charts used in SQC based on variable/ attributes.
4. To analyze the concept and economics of acceptance sampling; to be able to use various kinds of acceptance sampling plans; to construct the operating characteristic curves; to determine the average out going quality level and the production/consumer risks
5. To identify the different modes failure of components, understanding the concept of reliability and life testing; analyze the various kinds of failures, failure rate; evaluate the reliability of components in series and parallel

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	2					1		1	1	3	2	2
CO2	2	2	1	2					1		1	1	3	2	2
CO3	1	3	1	2					1		1	1	2	2	2
CO4	1	3	1	2					1		1	1	3	2	2
CO5	2	2	1	2					1		1	1	3	2	2

UIP513C	QUALITY ASSURANCE and RELIABILITY ENGINEERING	Credits: 04
L : T : P - 4 : 0: 0		CIE Marks: 50
Total Hours / Week: 04		SEE Marks: 50

UNIT - I	13 Hrs.
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). **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.	
UNIT - II	**13 Hrs.**
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. **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.	
UNIT - III	**07 Hrs.**
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.	
UNIT - IV	**17 Hrs.**
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. **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. **Assignments:** Students have to use the software packages like MS Excel, SPSS, Origin to solve the assignment problems.	

Reference Books *

1. D. C. Montgomery, Introduction to statistical Quality Control, 4th Edition.SBN:0- 471-31648-2 John Wiley and Sons.
2. Grant and Leavenworth, Statistical Quality Control, 7th Edition.ISBN:00-70-435-553, McGraw Hill.
3. J. M. Juran, Frank M. Gryna, Quality Planning and Analysis, 3rdEdn, Tata McGraw Hill, ISBN:978-007-462- 1790.
4. Charles E. Ebeling, Reliability and Maintainability Engineering, International Edition, MLM1004, ISBN007115248, McGraw Hill.
5. Dale H. Besterfield, 2003, Quality Control, 7th Edition, ISBN-10: 0131131273, Prentice Hall.
6. Amitava Mitra, Fundamentals of Quality Control and Improvement, 2nd Edition, 1998, ISBN -10: 0136450863, Prentice Hall.

Course Outcomes**

After completion of the course student will be able to:

1. Analyze the concept, dimensions, terminology, and importance of quality, emphasizing on the statistical methods/tools used for improving quality trying to minimize the quality costs, periodic/chronic quality problems and plan, and perform the quality audit activities to analyze quality assurance.
2. To recognize the causes of variation in quality of products for understanding sample size, sampling frequency, rational sub grouping, analyzing the patterns of control for decisions on acceptance or rejection.
3. Explain and differentiate, to draw, interpret, analyze anddecide the various types control charts used in SQC based on variable/ attributes.
4. To analyze the concept and economics of acceptance sampling; to be able to use various kinds of acceptance sampling plans; toconstruct the operating characteristic curves; to determine the average out going quality level and the production/consumer risks
5. To identify the different modes failure of components, understanding the concept of reliability and life testing; analyze the various kinds of failures, failure rate; evaluate the reliability of components in series and parallel

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	1	2					1		1	1	3	2	2
CO2	2	2	1	2					1		1	1	3	2	2
CO3	1	3	1	2					1		1	1	2	2	2
CO4	1	3	1	2					1		1	1	3	2	2
CO5	2	2	1	2					1		1	1	3	2	2

UIP523C	THEORY OF METAL CUTTING AND TOOL DESIGN	Credits: 03
L : T : P - 3 : 0: 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

UNIT - I	10 Hrs.
Mechanics of metal cutting - Metal cutting process, mechanism of chip formation, orthogonal and oblique cutting, types of chips, determination of shear plane angle, forces and energy calculations (Merchant's circle analysis), velocity relationship and force measurement using dynamometers. **Geometry of cutting tools -** Introduction to single and multi point cutting tools.	
UNIT - II	**10 Hrs.**
Heat generation - Sources of heat generation, regions of heat generation. **Tool wear and tool life -** Wear mechanisms, types of tool wear, tool life criteria and Taylor's tool life equation, factors affecting tool life and simple problems, 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.	
UNIT - III	**10 Hrs.**
Design of single point cutting tool - Design of single point cutting tools, dimensions of tool shank for single point tool, problems related to shank design. **Design of multi point cutting tools -** Introduction to design of multipoint point cutting tools, drill geometry, nomenclature, design features of drill bit, milling cutter, nomenclature, design features and problems related to cutting tools.	
UNIT - IV	**10 Hrs.**
Jigs and fixtures - Significance and purpose of jigs and fixtures and their functions in manufacturing processes, classifications of jigs and fixtures, main elements of jigs and fixtures. **Design of jigs and fixtures -** General guidelines and procedures for design of jigs and fixtures, concept of modular fixtures and tool presetting fixtures.	

Reference Books *

1. B. L. Juneja, G. S. Sekhon and Nitin Seth, Fundamentals of Metal Cutting and Machine Tools, New Age International Publishers, second addition, 2008. ISBN: 81-224-1467-2.
2. P C. Sharma, Production Engineering, Khanna Publishers. ISBN: 81-219-0421-8.
3. P. C. Sharma, Machine tools and Tool Design, ISBN: 81-219-2362-X.
4. P. N. Rao, 2013, Manufacturing Technology - Metal Cutting and Machine Tools - 3/e, TMH, New Delhi.
5. T- Donaldson, LeGain, Goold, Tool Design, New Central Book Agency.
6. Dr. B. J. Ranganath, Metal Cutting and Tool Design, Vikas Publishing House.
7. G. Boothroyd, 2000, Fundamentals of Metal Machining and Machine Tools, McGraw Hill.
8. Bhattacharya A, 2007, Metal Cutting: Theory and Practice - New Central Book Agency, Kolkata.

Course Outcomes**

After completion of the course student will be able to:

1. Analyze and evaluate metal cutting principles and mechanism, valves of various forces involved in machining operations and tool geometry.
2. Explain the inter-relationship between cutting parameters and machining performance measures like tool life, tool wear, thermal aspects, economics of machining operations and

select cutting fluids for improving machinability.
3. Explain and identify cutting tool geometry of single and multipoint cutting tool and to develop the relations for forces in multipoint machining.
4. Identify appropriate combination of tools, jigs and fixture, suitable for a particular machining operation and design assembly of jigs and fixtures on simple work-piece.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	**3**	**2**	**1**	**2**	**2**					**1**			**3**	**1**	**2**
CO2	**3**	**2**	**1**	**3**	**2**					**1**			**3**	**1**	**2**
CO3	**3**	**2**	**1**	**3**	**2**					**1**			**3**	**1**	**2**
CO4	**3**	**2**	**1**	**3**	**2**					**1**			**3**	**1**	**2**

UIP533N	MARKETING MANAGEMENT	Credits: 03
L : T : P - 3 : 0: 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.
Defining marketing for the new realities: The value of marketing, the Scope of Marketing, Core marketing concepts, the new marketing realities, and Company Orientation towards the marketplace. **Collecting Information:** Components of modern marketing information system, Internal records, marketing intelligence, Analyzing the macro environment **Conducting Marketing Research:** The scope of Marketing research, The Marketing research process, the Seven Characteristics of good marketing research	
UNIT–II	**10 Hrs.**
Analyzing Consumer Markets: What influences consumer behavior? Key psychological processes, the buying decision process: Five stage model, Behavioral Decision Theory and Behavioral Economics **Identifying Market Segments and Targets:** Basis for segmenting consumer markets, How should business markets be segmented? Market targeting, Effective segmentation criteria. **Analyzing Business Markets:** What is organizational buying? Participants in the business buying process, the purchasing/procurement process, Stages in the buying process, Developing Effective-business-to- business marketing programs, Managing business-to-business customer relationships, and Institutional and Government markets.	
UNIT–III	**10 Hrs.**
Setting Product Strategy: Product characteristics and classifications, Differentiation, Environmental issues Product and brand relationships, Packaging, Labelling, warranties, and guarantees **Designing and Managing services**: The nature of services, the realities of the new service, Achieving excellence in services marketing **Managing retailing, Wholesaling, and Logistics:** Retailing, private labels, wholesaling, market logistics.	
UNIT–IV	**10 Hrs.**
Developing Pricing strategies and programs: Understanding pricing, setting the price, Adapting the price, Initiating and responding to price changes **Designing and Managing Integrated marketing communications:** The role of marketing communications, Marketing communications mix, How do marketing communications work, Developing effective communications, Selecting the marketing communications mix, Developing and managing an advertising programme	

Reference Books *

1. Philip Koteler, Kevin Lane Keller **“**Marketing Management” 15 edition, Pearson India Education Services Pvt.Ltd. ISBN 978-93-325-5718-5.
2. Philip Koteler, Kevin lane Keller, Abraham Koshy and Mithileshwar Jha "Marketing Management A South Asian Perspective". 13 Edition, 2012, Pearson Prentice – Hall of India private limited, ISBN-978-81-317-1683-0
3. Philip Koteler "Principles of Marketing", Prentice - Hall.
4. Michael R Czinkota, Marketing Management, 2nd Edition. Vikas Publishing House, ISBN 981-240-366-3

5. Wiliam J Stannon, "Fundamentals of Marketing", McGraw HIll
6. R.SS. Pillia and Mrs. Bagavathi "Marketing" S. Chand & Co. Ltd
7. S.A Sherlaker, "Marketing Management", 13 Edition.
8. 7. Rajagopal, Marketing Management Text & Cases, Vikas Publishing House.

MOOC Course: https://www.edx.org/course/marketing-management-iimbx-mk102x#!

NPTEL Course: http://nptel.ac.in/courses/110104068/3

Course Outcomes**

After completion of the course student will be able to

1. Discuss marketing for the new realities and design a market research program for products and services.
2. Identify market segments and analyze consumer markets and business markets.
3. Analyze the importance of product and service strategy in marketing
4. Demonstrate the need for retailing, wholesaling, and market logistics
5. Identify and adopt pricing strategy and mass communication program in marketing

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	3	3	3										
CO2			3	2	3										
CO3			3			2	2								
CO4				3		3									
CO5			3	3						3					

ADVANCED FQAS / BBC - II

OVERVIEW		
Semester	5^{th}	
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. 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.	
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

OVERVIEW			
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

UIP542L	METAL CUTTING AND PRODUCT ASSEMBLY LABORATORY	Credits: 01
L : T : P - 0 : 0: 2		CIE Marks: 50
Total Hours / Week: 02		SEE Marks: 50

UNIT - I	22 Hrs.

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 onmachines.
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	**:**	**25 Marks**
One question from part B	**:**	**15 Marks**
Viva-voice	**:**	**10 Marks**
TOTAL	**:**	**50 Marks**

Course Outcomes**
After completion of the course student will be able to: 1. Attain expertise in acceptance test on various machines by performing various operations on them. 2. Describe the formation of cutting tool parameters of single point cutting tool, to perform and assess the various forces using lathe tool dynamometer and analyze merchant's circle. 3. Perform various tests on milling machine using milling tool dynamometer. 4. Carry out test to determine the cutting tooltemperature using thermo-couples. 5. Determine chip-reduction co-efficient during metal cutting operation on machines. 6. Carry out tests for the surface measurement. 7. Understand and carry disassembly and assembly of the machine parts

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	1	2	2				3	1			2		1
CO2	2	2	1	2	2				3	1			2		1
CO3	2	2	1	2	2				3	1			2		1
CO4	2	2	1	2	2				3	1			2		1
CO5	2	2	1	2	2				3	1			2		1
CO6	2	2	1	2	2				3	1			2		1
CO7	2	2	1	2	2				3	1			2		1

UIP522L	INDUSTRIAL ENGINEERING LABORATORY	Credits: 01
L : T : P - 0 : 0: 2		CIE Marks: 50
Total Hours / Week: 02		SEE Marks: 50

PART - A	22 Hrs.

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
5. Measurement of parameters (heart beat rate) using walking simulator
6. Measurement of parameters (heart beat rate, calorie) using ergometer, effect of noise and light on human efficiency in work environments.

PART - C

Statistical Analysis

1. Operating characteristic curve of single sampling Attributes plan
2. Test for normality of sample means(normal distribution)
3. Test for normality of sample means(universal distribution)

Reference Books:

1. Work Study - Ralph and Barnes.
2. 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**

Course Outcomes**

After completion of the course student will be able to:

1. Do systematic investigation of existing way of doing work to effect improvement
2. Do selection of appropriate recording technique for a given activity and also understands fundamental hand motions involved in the process in order to eliminate unnecessary motions
3. Able to determine the standard time of a job using time study.
4. Explain an expended view of ergonomics, able to identify ergonomically related injuries that occur in workplace, able to find and assure that the workplace fits the worker and also able to put ergonomic assessments and solutions to practical use in the workplace.
5. Make use of statistical tools for minimizing inspection in acceptance control and understand different distributions to fit and analyze the data

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	3	2			2	1	1	3				3	2	2
CO2	2	3	2			2	1	1	3				3	3	2
CO3	3	3	2	1		2	1	1	3				3	3	2
CO4	2	3	3			2	1	1	3				3	2	2
CO5	2	3	2			2	1	1	3				3	2	2

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

VI Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UIP601C	Operations Research	4	3	2	0	50	50	100
2	UIP630C	Finite Element Methods	4	3	2	0	50	50	100
3	UIP640C	Digital Design and Manufacturing	3	3	0	0	50	50	100
4	UIP022E	Elective I Non-Conventional Machining Processes	3	3	0	0	50	50	100
5		OpenElective1	3	3	0	0	50	50	100
6	UHS003N	Career Planning and Professional kills	1	1	0	0	50	50	100
	UHS004M	Universal Human ValueS-II	0	0	0	0	50	50	100
7	UIP643P	Mini Project	3	0	0	6	50	50	100
8.	UIP642L	Digital Manufacturing Laboratory	1	0	0	3	50	50	100
9.	UIP641L	Finite Element Analysis Laboratory	1	0	0	2	50	50	100
		Total	23	16	4	11	500	500	500

UIP601C	OPERATIONS RESEARCH	Credits: 04
L:T:P - 3: 2: 0		CIEMarks:50
Total Hours/Week: 05		SEEMarks:50

UNIT-I	13 Hrs.
Introduction – Definition of OR, application of OR to engineering and managerial problems, features of OR models, limitation of OR and models of OR. **Linear Programming –** Definition mathematical formulation, standardform, solutionspace, solution-feasible, basicfeasible, optimal, infeasible, multiple, optimal, redundancy, degeneracy. graphical method, simplex method, variants of simple x algorithm- Artificial basis techniques, duality, solution of LPP using duality concept.	
UNIT - II	**13 Hrs.**
Transportation problem - Formulation of transportation model, Basic feasible solution using different methods(North-West corner, Least Cost, Vogel's Approximation Method) Optimality Methods. Unbalanced transportationproblem, Degeneracy in transportation problems, Variantsin Transportation Problems. **Assignmentproblem –** Formulation of the assignmen tproblem,unbalanced assignment problem,traveling salesman problem.	
UNIT – III	**13 Hrs.**
Queuingtheory: Queuing system and their characteristics,TheM/M/I queuing system, steady state performance, analysing of M/M/1 queuing model.M/M/K/model. **Projectmanagement-usingnetworkanalysis:** Network construction, determination of critical path and duration, floats. PERT-estimationofprojectdurationandvariance.	
UNIT – IV	**13 Hrs.**
Replacementanalysis: Introduction, reasons for replacement, Individual replacement of machinery or equipment with/without value of money, group replacement policies, problems. **Gametheory:** Formulations of games, two-person zero sum game, games with and without saddle point, graphical solutions(2xn,mx2game),and dominanceproperty.	

Assignments – Students have to submit their assignments using OR software packages.

Reference Books *

1. TahaH.A.,Operation Research and Introduction-, Prentice Hall of India, 6thEdition, 1999.ISBN-81-203-1222-8.
2. Philips, Ravindram and Soleberg, Principles of Operations Research – Theory and Practice,PHI,2ndEdition,2007.ISBN:978-81-265-1256-0.
3. Hiller and Libermann, 2009, Introduction to Operation Research, McGraw Hill 6thEdition, ISBN-13:978-0-7-060092-8.
4. S.D.Sharma,Kedarnath,Ramnath and Co, 2009, OperationsResearch,6thEdition, ISBN-978-81-907011-0-5.
5. J.K.Sharma,Operations Research Theory and Application, Pearson Education PvtLtd,4thEdn,ISBN-10:0230-63885-6

6. Kanthi Swarup and others, 2009, Operations Research ,Sultan Chand and Sons.14th Edition, ISBN978-81-8854-719-5

Course Outcomes**

After completion of the course student will be able to:

1. To have the knowledge of role of O.R. in solving industrial problems.
2. Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.)
3. Realize variety of problems such as assignment, transportation, travelling salesman etc
4. Analyze variety of replacement situations
5. Understand different queuing situations and find optimal solutions using models for different situations.
6. Identify the resources required for a project and generate a plan and use CPM and PERT techniques, to plan, schedule, and control project activities.
7. Apply software tools to obtain optimal solutions from a mathematical model.

*__Books to be listed as per the format with decreasing level of coverage of syllabus__

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3		3		1	1				1	1	2	2	3	2
CO2	2	3	2			1			3	1	2	2	2	2	2
CO3	2	3	2	3				1	2		2	2	2	2	
CO4	2			1	1	2			2		2		2	2	2
CO5	2	2	2	1	1				2			2	2	2	2
CO6	2	2	2	2	2		1		2		3	2	2	2	2
CO7	3	3	2	2	2	1				1	2		2	2	

UIP630C	FINITE ELEMENT METHODS	Credits: 04
L:T:P - 3 : 2: 0		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to FEM - Need for use of FEM - Advantages and disadvantages of FEM. Matrix algebra -Terminologies relating to matrices, methods of solution of linear algebraic equations. Eigen values and Eigen vectors, Simple numeric Gaussian Quadrature – 1 pt. 2pt and 3pt formula. **Basics of theory of elasticity -** Definition of stress and strain, stress-strain relations; Strain-displacement relations in 2D and 3D Cartesian and polar coordinates.	
UNIT - II	**13 Hrs.**
Continuum methods: Variational methods Rayleigh-Ritz methods applied to simple problems on axially loaded members cantilever. Simply supported and fixed beam with point loads and UDL. Galerkin method as applied to simple elasticity problem. **FEM -** Basicdefinitions:Displacement method Nodal degrees of freedom different coordinate systems shape functions. Lagrangian polynomial; complete Formulation of bar-truss beam-triangular-quadrilateral Tetrahedral hexahedral elements.	
UNIT - III	**13 Hrs.**
Boundary conditions - SPC and MPC. Methods of handling boundary conditions eliminating method-penalty method. Simple numericals, isoparametric, sub parametric, super parametric elements Convergence criteria - Requirements of convergence of a displacement model. **Higher order elementsbar-**Triangular-quadrilateral elements, tetrahedral and hexahedral elements (non-Formulation) - pascal triangle and pascal pyramid.	
UNIT - IV	**13 Hrs.**
Higher order elements - Introduction to axis symmetric problems-formulation of axis symmetric triangular element.**Dynamic analysis formulating-**Element mass matrix for 1D and 2D element, computation of Eigen value and vector for simple one-dimensional analysis.	

Reference Books *

1. Hutton, 2004, Fundamentals of Finite Element Method, Tata McGraw Hill.
2. Chandraupatla and Belegundu, 2002, Introduction to Finite Elements in Engineering, Pearson Edition.
3. J.N.Reddy, 2002, Finite Element Method, Tat McGraw Hill Edition.
4. A.Daryl. L. Logon, 2001,First course in Finite Element methods, Thomson Learning 3rd Edition.
5. Robert Cook, 2002, Concepts and applications of FEA, John willey and sons.
6. Chandrupatla, 2002, Finite Element Analysis, University press.
7. Bathe K. J, 2006, Finite Element Procedures, Prentice-Hall International Inc.

Course Outcomes**
After completion of the course student will be able to: 1. Get acquainted with the terminogies, preliminary concepts and matrix methods related to FEM and learn to express stress-strain, strain-displacement equations in metrix form. 2. Explain and apply variational approach to solve governing equations of axially loaded bars and beams. 3. Grasp the methods of handling boundary conditions and arrive at solutions using suitable convergence criteria. 4. Learn the formulation of higher order triangular and quadrilateral elements and get introduced to axi- symmetric problems. 5. Gain the knowledge of formulating element-mass matrix (dynamic analysis).

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1		2				1				3		
CO2	3	3	3		2								3		
CO3	3	3	3		2				1				3		
CO4	3	3	3		2				1				3		
CO5	3	3	3		2				1				3		

UIP640C	DIGITAL DESIGN AND MANUFACTURING	Credits: 03
L:T:P - 3 : 0: 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	13 Hrs.
Digital manufacturing - Development course of manufacturing and manufacturing science, definition of digital manufacturing, features and development of digital manufacturing **Architecture of digital manufacturing system –** Basic architecture, model of digital manufacturing system, the definition of digital manufacturing system , organization model of digital manufacturing system, function model of digital manufacturing system, information model of digital manufacturing system, operation and control model of digital manufacturing system. **CAD modeling** - Design process and role of CAD, types and applications of design models, three-dimensional modeling schemes, wireframes and surface representation schemes, solid modeling-Parametric modeling and assembly modeling.	
UNIT – II	**13 Hrs.**
CAD/CAM: Computers inindustrial manufacturing, design process, computer aided design (CAD), computer aided manufacturing(CAM), advantages and disadvantages CAD and CAM. **ComputercontrolinNC:** Introduction and basic components of an NC system, NC procedure, NC co-ordinate systems, NC motion control systems ,applications of numerical control and Economics of numerical control Introduction, problems with conventional NC, NC controller technology, CNC , DNC, combined CNC and DNC systems. **CNCprogramming -** Part programming fundamentals, manual part programming methods, Preparatory functions(G), miscellaneous functions (M), program number, tool length compensation, canned cycle, cutter radius, compensation, milling and drilling programming problems.	
UNIT – III	**13 Hrs.**
Reverseengineering: Introduction to reverse engineering, basic theory of reverse engineering, application of reverse engineering in digital manufacturing, applications of 3D scanner. **Digitalfactoryandvirtualmanufacturing:** Introduction, scope, methods and tools used in virtual manufacturing, benefits, virtual factory simulation. **Product lifecycle management** - Introduction, PLMsoftware's, outsourcingchain, PLM and concurrent engineering, other advantages of PLM, components of PLM software.	
UNIT- IV	**13 Hrs.**
InternetofThings: Introduction, applications, IoT data management requirements, architecture of IoT, technological challenges and issues in implementing IoT. **Additive manufacturing:** Introduction to additive manufacturing(AM), generic AM process, why use the term additive manufacturing? The benefits of AM, distinction between AM and CNC machining, development of AM technology and classification of AM processes.	
Reference Books *	
1. Ian Gibson, David W. Rosen, and Brent Stucker, 201, Additive Manufacturing Technologies:Rapid Prototyping to Direct Digital Manufacturing, Springer New York, ISBN: 978-1-4419-1119-3 e-ISBN: 978-1-4419-1120-9, DOI 10.1007/978-1-4419-1120-9. 2. Zude Zhou, Shane (Shengquan) Xie, Dejun Chen, Fundamentals of Digital Manufacturing Science, Springer, 1012, ISBN 978-0-85729-563-7 e-ISBN 978-0-85729-564-4, DOI 10.1007/978-0-85729- 564-4.	

3. P. Radhakrishnan, S. Subramanian, 2008, V. Raju, CAD/CAM/CIM, 3rd Edition, New Age International (P) Ltd., ISBN (13): 978-81-224-2711-0.
4. P.N. Rao, 2002, CAD / CAM Principles and Applications, TMH, New Delhi, 3rd Edition.
5. Ibrahim Zeid, CAD/CAM Theory and Practice. McGraw-Hill Higher Education, 1991.
6. Mikell P-groover, Emory W. Zimrners, 2003, CAD/CAM, Jr Pearson Education Inc.
7. N. Hopkinson, R.J.M. Hague and P.M. Dickens, 2006, Editors, Rapid Manufacturing: An Industrial Revolution for the Digital Age, 2006, John Wiley and Sons, Ltd, ISBN-13 978-0-470-01613-8.

Course Outcomes**

After completion of the course student will be able to:

1. Students will understand the concept, applications, architecture of digital manufacturing and the use of Computer Aided Design modeling that aids in the digital manufacturing
2. The students will be able to write and execute CNC part programmes understanding the difference between traditional, NC, CNC & DNC machining concepts, economic aspects and motion control systems
3. Students will be introduced to the concept and application of reverse engineering, 3D scanner/printer, digital/virtual manufacturing and the components & software used in Product Life Cycle Management
4. Students will be exposed to the emerging areas such as Internet of Things and additive manufacturing and will understand challenges, issues and benefits of the two.
5. Students will understand the concept, applications, architecture of digital manufacturing and the use of Computer Aided Design modeling that aids in the digital manufacturing

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1	1		1								1		1
CO2	3	3	3	3	3	2			2	2	1		2	3	2
CO3	3	2	1	2	3	2	2		1	2	2	1	2	2	2
CO4	3	2		2	3	2	2		3	2	2	2	2	2	3
CO5	3	1	1		1								1		1

UIP022E	NON-CONVENTIONAL MACHINING	Credits: 03

L:T:P - 3 : 0: 0	**PROCESSES**	CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT - I	**12 Hrs.**
Introduction to NCMP- Need for non-traditional machining methods, classification of modern machining processes, considerations in process selection, materials and applications.**Ultrasonic machining -** Elements of the process, mechanics of metal removal process parameters, economic considerations, working principles, equipment used, process parameters, metal removal rate, applications and limitations, recent developments.**Abrasive jet machining**, **Water jet machining and Abrasive water jet machining-** Basic principles, equipment, process variables, mechanics of metal removal, metal removal rate, application and limitations.	
UNIT - II	**08 Hrs.**
Electro chemical machining and chemical machining processes - Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate, tool design, surface finish and accuracy, economic aspects, simple problems for estimation of metal removal rate, fundamentals of chemical machining, advantages, disadvantages and applications.	
UNIT - III	**08 Hrs.**
Electric discharge machining- General Principle and applications of electric discharge machining, electric discharge, grinding and electric discharge wire cutting processes - Power circuits for electric discharge machining, mechanics of metal removal, process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, wire electric discharge machining, principle and applications.	
UNIT - IV	**12 Hrs.**
Electron beam, laser beam and plasma arc machining processes- Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - general principle and application of laser beam machining - thermal features, cutting speed and accuracy of cut, application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.	

Reference Books *

1. Pandey P.C. and Shan H.S, 1980, Modern Machining Processes, Tata McGraw-Hill, New Delhi.
2. Vijay.K. Jain, 2002,Advanced Machining Processes, Allied Publishers Pvt. Ltd., New Delhi, ISBN 81-7764-294-4.
3. Benedict. G.F. 1987, Nontraditional Manufacturing Processes, Marcel Dekker Inc., New York.
4. McGeough, 1988, Advanced Methods of Machining, Chapman and Hall, London.

Course Outcomes**

After completion of the course student will be able to:
1. Introduce and classify non-traditional machining processes, understand mechanical energy machining processes in context to mechanics of metal removal process, principles, advantages, disadvantages and application 2. Explain electrochemical and chemical advance machining processes like electro chemical machining and design the tool for ECM process 3. Explain thermoelectric advanced machining processes in context to working principal, process parameters, advantages, disadvantages and applications of electric discharge machining 4. Identify the principles, processes and applications of electron, laser and plasma arc machining processes

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2							2			1	1		1
CO2	2	3			2				2			1		1	1
CO3	2	2			2				1			1	1		1
CO4	2	2			2				1			1	1		1

UHS003N	CAREERPLANNINGANDPROFESSIONALSKILLS	Credits: 01

L:T:P - 1: 0: 0		CIE Marks: 50
Total Hours/Week: 01		SEE Marks: 50

UNIT-I	16 Hrs.

OVERVIEW		
Semester	**6th**	
CourseObjectives	The course objectives for the first 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	
CourseOutcome	After the course, the students will be able to do the following: 1. Answer multiple choicem questions from fundamental topics in the following domains: a. Quantitative aptitude, b. Verbal aptitude, and c. Reasoning aptitude. 2. Implement the toolsm and techniques learned inn the soft skill session to build confidence and self-esteem	
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**	**Topics**	**Hours**
UNITI- Quant and Reasoning Aptitude Training			
1	QA	**Number Properties**	2
2	QA	**Percentages**	2
3	RA	**Linear and Circular Arrangement**	2
4	RA	**Order and Rank**	2
UNITII-Verbal Aptitude Training			
5	VA	**Parts of Speech**	**2**
6	VA	**Reading Comprehension**	**2**
UNITIII- Career Skills Training			
7	**CS**	**Introduction to Interview Etiquette**	2
8	**CS**	**Introduction to GD Etiquette**	2
9	**CS**	**Introductionto Resumen Writing**	2
UNITIV-Soft Skills Training			
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 an Presentation**	2
15	SS	**Self-Motivation**	2

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Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1															
CO2															
CO3															
CO4															

UIP643P	MINI PROJECT	Credits: 03
L:T:P - 0 : 0: 6		CIE Marks: 50
Total Hours/Week: 06		SEE Marks: 50

UNIT-I	96 Hrs.

Number of students per batch:
Maximum 2 Evaluation

CIE :50Marks
SEE :50Marks

Evaluation -I: 15 Marks
Review : 15 Marks
Guide : 20 Marks

Evaluations will be done by a department committee consisting of

- HOD or his Nominee
- Guide
- Project Coordinator

SEE:
Students have to submit project diary.
The evaluation of the SEE will be based on write up (10marks) + Demo(15marks) + Presentation(15marks) and Viva- Voice(10marks)

EvaluationCommittee
- HOD or his nominee
- External Examiner
- Project Coordinator

UIP642L	DIGITALMANUFACTURINGLABORATORY	Credits: 01
L:T:P - 0 : 0: 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

PART A	10 Hrs.
1. Writing and execution of manual program mesusing ISO codes for machining of simple part in a. Turning (2exercises) b. Taperturning (2exercises) 2. Simplep art programmes and execution using tool radius compensation and canned cycles(4Exercises)	
PART B	**10 Hrs.**
1. Writing and execution of simple milling part programmes,with radius compensation and a. Curved cycles(4exercises) 2. Manual programming of the robot for pick and place operations (2exercises)	
PART C	**10 Hrs.**
1. Design, modelling and printing (additive manufacturing) of 3D objects and parts(DEMO) 2. Studyon3Dscanner 3. Simulation of Virtual real factory	

Reference Books *

1. P.N.Rao, 2002, CAD/CAM Principles and Applications-,TMH,NewDelhi.
2. AppuKuttan K.K, Robotics, IK International Publishing House Private Limited.
3. N.Hopkinson,R.J.M.HagueandP.M.Dickens,2006, Editors,Rapid Manufacturing: An Industrial Revolution for the Digital Age, John Wiley and Sons, Ltd, ISBN-13978-0-470-01613-8.
4. ZudeZhou,Shane(Shengquan)Xie,DejunChen,Fundamentals of Digital Manufacturing Science,Springer,1012,ISBN978-0-85729-563-7e-ISBN978-0-85729-564-4,DOI10.1007/978-0-85729-564-4.

Course Outcomes**

After completion of the course student will be able to

1. Apply the techniques of CNC programming and cutting tool path generation through CNC simulation software by using G-codes and M-codes and writing part program for simple machine parts for turning and milling operations.
2. Investigate the workflow of digital manufacturing: from scanning to modeling to printing.
3. Apply the principles of reverse engineering and 3D scanning to the digital manufacturing workflow.
4. Gain Hands on experience using CNC lathe, milling machines and robot.

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Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	2	2	2	2	1				1			1	2	2	2
CO2	3	2	3	2	2				1			1	3	2	3
CO3	3	2	3	2	1				1			1	3	2	2
CO4	3	2	2	2	1				1			1	2	2	2

UIP641L	FINITEELEMENTANALYSISLABORATORY	Credits: 01
L:T:P - 0 :0: 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

PART - A	15 Hrs.

Study of a FEApackage and modeling stress analysis of:

1. Bars of constant cross section area, tapered crosssection area and stepped bars.
2. Trusses–(Minimum2exercises).
3. Beams–Simplysupported,cantilever,beamswithUDL,beams with varying loadetc.

PART - B	15 Hrs.

1. Stress analysis of a rectangular plate with a circularhole.
2. Thermal Analysis- 2D problem with conduction and convection boundary conditions.
3. Fluid flow Analysis- Potential distribution in the 2–D bodies.
4. Dynamic Analysis.
    1) Fixed-fixed beam for natural frequency determination.
    2) Bar subjected to forcing function.
    3) Fixed-fixed beamsubjected to forcing function.

Course Outcomes**

After completion of the course student will be able to:

1. Realize the basic structure of commercially available FEM software package and learn the facilities available for solving engineering problems through graphical user interaction mode
2. Be trained in using FEM software for modeling, solving and interpreting structural, fluid flow and heat transfer basic problems
3. Get acquainted with the applications of FEM package and achieve proficiency in analyzing complex problems

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
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Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	1			3								1		
CO2	3	3	3		3								3		
CO3	3	3	3	3	3								3		
CO4															

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

VII Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	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	UIP019E	Elective - II Project Management	3	3	0	0	50	50	100
4	UIP027E	Elective - III Total Quality Management	3	3	0	0	50	50	100
5	UIP731N	Open Elective - II Project Management	3	3	0	0	50	50	100
6	UIP738I	Internship	2	0	0	4	50	50	100
7	UIP745P	Project Phase - I	5	0		10	50	50	100
		Total	24	15	4	14	350	350	700

SUBJECT CODE	OPERATIONS MANAGEMENT	Credits: 04
L : T : P - 3 : 2 : 0		CIE Marks: 50
Total Hours / Week: 05		SEE Marks: 50

UNIT - I	10 Hrs.
Operations management concepts - Introduction, historical developments, operations management, environment of operations and operations system decisions. **System design and capacity planning -** Introduction, manufacturing and service systems, design and system capacity and capacity planning. **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 of layouts. **(10 hours Teaching +7 hours Tutorial)**	
UNIT - II	**10 Hrs.**
Forecasting: Forecasting objectives and uses, forecasting variables, forecasting methodology, opinion and judgemental methods, time series methods, exponential smoothing, regression and correlation methods. **Aggregate planning -** Introduction, objective of aggregate planning, aggregate planning methods - policy guidelines, graphic and charting methods, transportation method of solving APP, master scheduling objective, master scheduling methods. **(10 hours Teaching +7 hours Tutorial)**	
UNIT - III	**10 Hrs.**
Material requirements planning - Introduction, underlying concepts, system parameters, MRP Logic, MRP implementation. **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 and service quality. **10 hours Teaching +7 hours Tutorial)**	
UNIT - IV	**10 Hrs.**
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. **Single machine scheduling -** Concept, measures of performance, SPT rules, weighted mean flow time, EDD rules, minimizing total tardiness. **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. **(10 hours Teaching +7 hours Tutorial)** **Total: 40 hours of Teaching + 28 hours of Tutorial**	
Reference Books *	
1. Buffa, Modern Production / Operations Management, Wiely Eastern Ltd., 4th Edition 2. Chary S. N, Production and Operations Management, Tata-McGraw Hill., 3rd Edition 3. James Dilworth, Operations management, PHI, 3rd Edition 4. Lee J. Karjewski and Larry P. Ritzman, Operations Management, strategy and Analysis, 6th Edition, Pearson Education Asia.	
Course Outcomes**	

1. Illustrate how operations management is important for an organization and analyse the facility location decisions, and the inventory systems.
2. Evaluate forecasting methods and apply them to real life situations and problems.
3. Analyse aggregate planning and MPS, also compare different aggregate planning methods.
4. Illustrate the importance of materials requirements planning and controlling and Analyse design of service systems.
5. Analyse the flow shop and job shop scheduling.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1		**2**	**2**	**2**							**2**		**2**	**3**	
CO2		**2**	**3**	**3**	**2**						**2**		**2**	**3**	
CO3		**2**	**3**	**3**	**2**						**2**		**2**	**2**	
CO4		**2**	**3**	**3**	**2**						**2**		**3**	**3**	
CO5		**2**	**3**	**3**	**2**						**1**		**2**	**2**	

UIP740C	THEORY OF METAL FORMING	Credits: 04
L : T : P - 3 : 2 : 0		CIE Marks: 50
Total Hours / Week: 05		SEE Marks: 50

UNIT - I	10 Hrs.
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. **(06 hours tutorials to be taken)**	
UNIT - II	**10 Hrs.**
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 and **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. **(08 hours tutorials to be taken)**	
UNIT - III	**10 Hrs.**
Extrusion - Classification of extrusion processes, hot extrusion, hydrostatic extrusion, analysis of extrusion process - extrusion of cylindrical rod and strip with friction and related problems and **Drawing of rods, wires -** Rod and wiredrawing process, analysis of drawing process - drawing of cylindrical rod and strip with friction and related problems. **(08 hours tutorials to be taken)**	
UNIT - IV	**10 Hrs.**
Tube drawing process - Introduction and analysis of tube drawing process and related problems and **High energy rate forming -** Introduction to HERF, explosive forming, electro hydraulic forming and electromagnetic forming. **(06 hours tutorials to be taken)** **Total: 40 hours of Teaching + 28 hours of Tutorial**	
Reference Books *	

1. Dr. Sadhu Singh, Theory of Plasticity and Metal Forming Processes, Khanna Publishers, New Delhi.
2. George E. Dieter, Adapted by David Bacon, Mechanical Metallurgy by, (SI Metric Edition), McGraw-Hill Book Company.
3. G. W. Rowe, Introduction to Industrial Mechanical Working.
4. ASM-Metals handbook.

Course Outcomes**
1. Attain proficiency in basic metal forming processes/techniques and analyse stress, strain, yielding of material according to different yield theory for a given state of stress 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. Analyze and evaluate process of excursion its analysis on the process mechanics and evaluate the variables affecting rod and wire drawing processes and 4. Describe the manufacturing of tube drawing process and its analysis and get well acquaintance with high energy rate forming processes.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	2	2					1			3	1	2
CO2	3	2	1	2	2					1			3	1	2
CO3	3	2	1	2	2					1			3	1	2
CO4	3	2	1	2	2					1			3	1	2

UIP019E	PROJECT MANAGEMENT	Credits: 03
L : T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

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 an 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 and 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.**
Co-ordination and control: Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance, control, schedule control, cost control. **Performance measures in project management**: Performance indicators, performance improvement for the CM and DM companies for better project management, project management and environment and Practitioners. **Project management institute:** Importance of the same for the Industry and **Case studies on project management**: Case studies covering project planning, scheduling, use of tools and techniques, performance measurement.	

Reference Books *

1. 4th Edition, 2002, ISBNO-07-462049-5.
2. Harold Kerzner, 2002, Project Management a System approach to Planning Scheduling and Controlling, CBS Publishers and Distributors.
3. Chaudhry S, 2002, Project Execution Plan: Plan for project Execution interaction.
4. Beningston Lawrence, 1970, Project Management - McGraw Hill.
5. Weist and Levy, 2002, A Management Guide to PERT and CPM, Eastern Economy of PH.
6. L. S. Srinnath, 2002, PERT and CPM Affiliated East West Press Pvt. Ltd.
7. Moder Joseph and Philips Cerel R, 1976, Project Management with PERT and CPM, New York VAN Norstrand, Reinhold, 2nd Edition.
8. Angus, Planning, Performing and Controlling Project, Person Education, 3rd Edition, ISBN:812970020.2001
9. James P. Lawis, 2001, Project planning scheduling and control, Meo Publishing Company.

10. Bhavesh M. Patel, ProjectManagement,Vikas Publishing House,2002,ISBN81-259-0777-7.
11. Jack Gido, Jampes P. Clements, Successful Project management,Vikas Publishing House ISBN:981-243-137-3.

Course Outcomes**

1. Students will understand the basics of project management, planning, analysis and various facets of PM
2. Develop skills of generation and screening of project ideas, organising, staffing, accounatbility, controlling and selection of contracters
3. Introduced to the use of various tools and techniques of PM, project scheduling, resources allocation methods and PLM
4. Knowledge of direction, coordination and control in PM, MIS, performance measures/improvement and project management institute with the help of important case studies

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	1									1			1	
CO2	2	2	1		1	1		1	1		2	1	2	2	1
CO3	3	2	2	1	2	1			1	2	3	1	2	3	2
CO4	3	3	2	2	2	2		2	2	2	3	2	2	3	2

UIP027E	TOTAL QUALITY MANAGEMENT	Credits: 03
L :T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

UNIT - I	10 Hrs.
Overview of total quality management - History of TQM quality, Walter Shewarts's concept of variation and control system, contribution of quality gurus - Deming's approach, Juran's quality trilogy, Crosby and quality treatment, Imai's Kaizen. Ishikawa's companywide quality control and Feigenbaum's theory of TQC. **Evolution of quality concepts and methods -** Quality concepts. Development of four finesses, evolution of methodology, evolution of company integration, quality of conformance versus quality of design, from deviations to weaknesses to opportunities. Future fitness. **Four revolutions in management thinking -** Customer focus, continuous improvement, total participation and societal networking, focus on customers: Change in work concept, market-in and customers.	
UNIT - II	**10 Hrs.**
Continuous improvement - Improvement as problem solving process - Management by process, WV model of continuous improvement, process control, process control and process improvement, process versus creativity. **Reactive improvement -** Identifying the problem, standard steps and tools, seven steps - case study, and seven QC tools, management diagnosis of seven steps reactive improvement, general guidelines for managers diagnosing a QI story. Case study for diagnosis of the seven steps.	
UNIT - III	**10 Hrs.**
Proactive improvement - Introduction to proactive improvement, standard steps for proactive improvement, semantics, example customer visitation, applying proactive improvement to develop new products - three stages and nine steps. **Total participation -** Teamwork skills, dual function of work, teams and team work, principles for activating teamwork, creativity in team processes, initiation strategies; CEO involvement, example strategies for TQM introduction, infrastructure for mobilization, goal setting (vision/mission), organization setting, training and education, promotional activities, diffusion of success stones, awards and incentives monitoring and diagnosis. Phase-in, orientation phase, alignment phase, evolution of parallel organization	
UNIT - IV	**10 Hrs.**
Hoshin management: Definition, phases in hoshin management - strategic planning (proactive), hoshin deployment, controlling with metrics(control), check and act (reactive), hoshin management versus management by objective, hoshin management and conventional business planning, an alternative hoshin deployment system, hoshin management as "Systems Engineering" for alignment.	

Reference Books *

1. N. Logothetis, Managing for Total Quality, Prentice Hall of India, New Delhi. (Chapter I - partly)
2. Shoji Shiba, David Walden, 2001, Four Practical Revolutions in Management: Systems for creating unique organizational Capability",2001, Productivity Press, ISBN 1-56327-217-2
3. Roger C. Swanson, The Quality Improvement Hand Book, Publisher Vanity Books International, New Delhi.
4. William. C. Johnson and Richard J. Chavla, Encyclopaedia of Total Quality Management, New Delhi.

Course Outcomes**
1. Appreciate the contributions of various management gurus to the field of TQM and analyze quality concepts and methods. 2. Demonstrate and evaluate the concepts of continuous improvement and reactive improvement. 3. Apply the concepts of proactive improvement for industry problems. 4. Evaluate the importance of team work and total participation in TQM. 5. Analyze the importance of hoshin management with reference to other management tools like business planning, systems engineering etc.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1									**2**	**2**			**2**	**2**	
CO2		**2**							**3**	**2**			**2**	**3**	**1**
CO3		**2**		**1**					**2**	**2**			**2**	**2**	**1**
CO4		**2**							**3**	**3**			**2**	**2**	**1**
CO5				**2**						**1**			**1**	**1**	

UIP731N	PROJECT MANAGEMENT	Credits: 03
L : T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

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 an 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 and 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.**
Co-ordination and control: Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance, control, schedule control, cost control. **Performance measures in project management**: Performance indicators, performance improvement for the CM and DM companies for better project management, project management and environment and Practitioners. **Project management institute:** Importance of the same for the Industry and **Case studies on project management**: Case studies covering project planning, scheduling, use of tools and techniques, performance measurement.	

Reference Books *

1. 4th Edition, 2002, ISBNO-07-462049-5.
2. Harold Kerzner, 2002, Project Management a System approach to Planning Scheduling and Controlling, CBS Publishers and Distributors.
3. Chaudhry S, 2002, Project Execution Plan: Plan for project Execution interaction.
4. Beningston Lawrence, 1970, Project Management - McGraw Hill.
5. Weist and Levy, 2002, A Management Guide to PERT and CPM, Eastern Economy of PH.
6. L. S. Srinnath, 2002, PERT and CPM Affiliated East West Press Pvt. Ltd.
7. Moder Joseph and Philips Cerel R, 1976, Project Management with PERT and CPM, New York VAN Norstrand, Reinhold, 2nd Edition.
8. Angus, Planning, Performing and Controlling Project, Person Education, 3rd Edition, ISBN:812970020.2001
9. James P. Lawis, 2001, Project planning scheduling and control, Meo Publishing Company.

10. Bhavesh M. Patel, Project Management, Vikas Publishing House,2002,ISBN81-259-0777-7.
11. Jack Gido, Jampes P. Clements, Successful Project management, Vikas Publishing House ISBN:981-243-137-3.

Course Outcomes**

1. Students will understand the basics of project management, planning, analysis and various facets of PM
2. Develop skills of generation and screening of project ideas, organizing, staffing, accountability, controlling and selection of contractors
3. Introduced to the use of various tools and techniques of PM, project scheduling, resources allocation methods and PLM
4. Knowledge of direction, coordination and control in PM, MIS, performance measures/improvement and project management institute with the help of important case studies

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12			
CO1	1	1									1				
CO2	2	2	1		1	1		1	1		2	1			
CO3	3	2	2	1	2	1			1	2	3	1			
CO4	3	3	2	2	2	2		2	2	2	3	2			

UIP738I	INTERNSHIP	Credits: 02
L : T : P - 0 : 0 : 4		CIE Marks: 50
Total Hours / Week: 04		SEE Marks: 50

The students have to undertake 6 weeks of Internship at a reputed industry after 6th semester.

The main objective of this internship is to provide practical exposure to students regarding the Industry.

Evaluation of Internship - Grading Rubric(Industry)

Evaluation Dimensions	Performance Rating			Maximum Score
	Needs Improvement	Meets Expectations	Excellent	
	0-4	5-7	8-10	
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

	0-1	2-3	4-5	
Character Traits	Regularly exhibited a negativeattitude; 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	5

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	5
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	5
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	5

Evaluation of Internship – Grading Rubric (Department Evaluation Committee/Faculty)				
Evaluation Dimensions	**Performance Rating**			Maximum **Score**
	Needs Improvement	**Meets Expectations**	**Excellent**	50
	0-8	**9-14**	**15-20**	
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.	20
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.	Hasbeencarefullyeditedand is free or nearly free of any grammatical ortypographical 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.	20
	0-4	**5-7**	**8-10**	**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	05
Dependability	05
Organizational Fit	05
Response to Supervision	05
	50
Internship Guide	
Demonstration of experience	20
Report	20
Presentation	10
	50
Total Score	**100**

UIP731N	PROJECT PHASE-I	Credits: 05
L : T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours / Week: 10		SEE Marks: 50

	160 Hrs.

Continuous Internal Evaluation (CIE): 50 marks
The CIE will be based on a project diary and two evaluations of 15 marks each .

Continuous Evaluation by guide: 20 marks

Evaluation 1 will include (along with CIE -I):15 marks

- **Motivation and Rationale behind the work**
- **Literature review**
- **Presentation**

Evaluation 2 will include (along with CIE -II):15 marks

- **Proposed design methodology**
- **Preliminary/Conceptual Design work**
- **Presentation and Report**

Evaluation by Guide will include:

- **Objectives and Feasibility study**
- **Survey and Problem identification**
- **Involvement in the work and ability to work in team**
- **Individual Contribution and Peer/Guide interaction**

All three evaluation are done by

- **HOD or his Nominee**
- **Guide**
- **Project Coordinator**

Semester End Examination (SEE):50 marks
The evaluation will be based on **project paper, project presentation, viva-voce and report submitted by project associates**. Evaluation committee consists of

- **HOD or his nominee**
- **External Examiner**
- **Project Coordinator**

Rubrics for Project Phase-I &II (VII + VIII Semester)

SEMESTER VII

Rubrics for	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before the end of first month in VII 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 VII semester of BE Program	R2	15	
	Evaluation by guide	In the last week of working days of VII semester	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of VII 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 the end of first month in VIII 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 VIII semester of BE Program	R6	15	
	Evaluation by guide	In the last week of working days of VIII semester	R7	20	Guide(s)
SEE	Semester End Examination	During SEE of VIII 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 the end of first month in VII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (Needs Improvement) (1)	**Average (Acceptable) (3)**	**Very good (Proficient) (5)**		
Motivation and Rationale behind the work	• 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	• 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	• 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	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Literature review	• Less technical papers are reviewed and less relevant	• Few technical papers are reviewed and moderately relevant	• At least 3 technical papers from reputed journals are made and reviews are quite relevant to the project work		
Presentation	• Slides contain some errors, Not legible, flow is okay, body language is minimal, Response to the audience questions and comments are not good	• Slides are error free, flow is good, body language is acceptable, Responds to the audience questions and comments	• Slides are error free, quite legible, flow is good, body language is good, Responds accurately to the audience questions and comments		

R2. Internal Evaluation (Before 15 days from the last working day of VII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (Needs Improvement) (1)	Average (Acceptable) (3)	Very good (Proficient) (5)		
Proposed design methodology	• Division of problem into modules but improper selection of design approaches and design methodology and not properly justified	• Division of problem into modules with proper selection of design approaches and design methodology but not properly justified	• Division of problem into modules and good selection of design approaches, appropriate design methodology with proper justification	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Preliminary/Conceptual Design work	• Very less efforts are made towards preliminary and conceptual design works to accomplish the work	• Efforts are made towards preliminary and conceptual design works to accomplish the work but some are not clear	• Preliminary and conceptual design works are carried and are in proper direction to accomplish the project work		
Presentation and Report	• Slides are not organized, and Question-answer is poor, report has errors and not systematic	• Slides are good but not neatly arranged, delivery is good, Question-answer is average • Report is not organized systematically	• 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		

R3. Evaluation by the guide (In the last week of working days of VII semester): Total Marks of 20

<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
(1)</th><th>Average
(3)</th><th>Excellent
(5)</th></tr>
<tr><td>Objectives and Feasibility study</td><td>• Many possible objectives are left out and very few are stated
• Design steps are not feasible to accomplish all the objectives</td><td>• Some objectives are stated clearly and some possible objectives are left out
• Design steps are less feasible to accomplish all the objectives</td><td>• 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</td><td rowspan="4">20</td><td rowspan="4">Guide(s)</td></tr>
<tr><td>Survey and Problem identification</td><td>• Topics are surveyed randomly and less relevant to societal and environmental problem</td><td>• Topics are surveyed and not fully relevant to society and environment problem</td><td>• Extensive survey is made and socially and environmentally relevant problem is identified</td></tr>
<tr><td>Involvement in the work and ability to work in team</td><td>• Less involved in the work</td><td>• Would have involved still more</td><td>• Sincerely involved in the work and very hard working and has good interest</td></tr>
<tr><td>Individual Contribution and Peer/Guide interaction</td><td>• Lesser involvement and contribution
• Rarely met the guide and met on guide’s call</td><td>• Contributed to the work to some extent
• Met the guide for interaction and sincere and obedient to the guide’s call and suggestions</td><td>• 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</td></tr>
</table>

R4: SEE Evaluation for Project Phase-I (During SEE of VII semester of BE Program): 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 • Design methodology not defined properly	• Division of problem into modules but inappropriate selection of computing framework • Design methodology not defined properly	• 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 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 not appropriate and not well arranged • Very less eye contact 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		

R5: Project work progress review-I (Before the end of first month in VIII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Design methodology and planning of project work	• Division of problem into modules and improper selection of computing framework • Design methodology not properly justified • Time schedule is not clear	• Division of problem into modules and improper selection of computing framework • Design methodology not properly justified • Time schedule is specified	• Division of problem into modules and good selection of computing framework • Design methodology not properly justified, • Time schedule is specified	• Division of problem into modules and good selection of computing framework, • Appropriate design methodology and proper justification • Time frame properly specified	15	HOD (or nomination) + Project coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Description of Concepts and Technical Details	• Inappropriate explanation of the key concepts and poor description of the technical requirements of the project	• Incomplete explanation of the key concepts and in-sufficient description of the technical requirements of the project	• Complete explanation of the key concepts but in-sufficient description of the technical requirements of the project	• Complete explanation of the key concepts and strong description of the technical requirements of the project		
Demonstration and presentation	• Contents of presentations are not appropriate and Demonstration not satisfactory	• 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	• Good demonstration of work so far carried-out, Contents of presentations are appropriate and well arranged, Proper eye contact with audience and clear voice with good spoken language		

R6: Project work progress review -II (Before 15 days from the last working day of VIII semester): Total Marks of 15

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Incorporation of Suggestions made in the previous review	• Some changes are made as per modifications suggested during previous evaluation	• All major changes are made as per modifications suggested during previous evaluation	• Changes are made as per modifications suggested during previous evaluation and good justification	• Changes are made as per modifications suggested during the previous evaluation and new innovations added	15	HOD (or nomination) + Project coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Discussion and Conclusion	• Results are not presented properly, Project work is not summarized and concluded • Future extensions in the project are not specified	• Results presented are not much satisfactory, Project work summary and conclusion not very appropriate • Future extensions in the project are not specified	• Results are presented in good manner, Project work summary and conclusion not very appropriate • Future extensions in the project are specified	• Results are presented in very appropriate manner, Project work is well summarized and concluded, • Future extensions in the project are well specified		
Demonstration and Presentation	• Modules are not in proper working form that further leads to failure of integrated system, Contents of presentations are not appropriate and not well delivered • Poor eye contact with audience and unclear voice	• Modules are working well in isolation and properly demonstrated, Modules of project are not properly integrated, Contents of presentations are appropriate but not well delivered • Eye contact with only few people and unclear voice	• Each module working well and properly demonstrated, Integration of all modules not done and system working is not very satisfactory, Contents of presentations are appropriate and well delivered, Clear voice with good spoken language but less eye contact with audience	• Each module working well and properly demonstrated, All modules of project are well integrated and system working is accurate, neatly presented with proper eye contact with audience and clear voice with good spoken language		

R7: Evaluation by the guide (In the last week of working days of VIII semester): Total Marks of 20

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	**Acceptable (Average) (3)**	**Satisfactory (Good) (4)**	**Proficient (Excellent) (5)**		
Technical Knowledge gained through project work	• Poor knowledge and no awareness related to project	• Lacks sufficient knowledge and Awareness	• Fair knowledge and awareness related to the project	• Extensive knowledge and awareness related to the project	20	Guide(s)
Regularity and Attendance	• Irregular and inconsistent in work	• Reports to the guide but lacks Consistency	• Reports to the guide very often but not very consistent	• Reports to the guide regularly and consistent in work		
Incorporation of Suggestions made in the previous review	• All major changes are made as per modifications suggested during previous evaluation	• All major changes are made as per modifications suggested during previous evaluation	• Changes are made as per modifications suggested during previous evaluation and good justification	• Changes are made as per modifications suggested during the previous evaluation and new innovations added		
Organization and structure of Project Report	• Project report not prepared according to the specified format, References and citations are not appropriate	• Project report is according to the specified format but some mistakes, Insufficient references and citations	• Project report is according to the specified format, References and citations are appropriate but not mentioned well	• Project report is according to the specified format, References and citations are appropriate and well mentioned		

R8: SEE Evaluation for Project Phase-II (During SEE of VIII semester of BE Program): Total Marks of 50

Evaluation Criteria	Score				Total Marks	Evaluation By
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Presentation	• Contents of presentations are not appropriate and not well delivered, Poor eye contact with audience and unclear voice	• Contents of presentations are appropriate but not well delivered, Eye contact with only few people and unclear voice	• Contents of presentations are appropriate and well delivered, Clear voice with good spoken language but less eye contact with audience	• Contents of presentations are appropriate and well delivered, Proper eye contact with audience and clear voice with good spoken language	50	HOD/ nomination + Project coordinator + External Examiner Each will evaluate for 50 marks and average of all three will be taken
Designs and implementation	• Proper design methodology is not followed resulting into poor design , No modern tools are used to implement, Work contributes very less to the world	• Proper design methodology is followed, Design lacks, very less modern tools are used to implement, the work contributes to the world in little way	• Proper design methodology is followed, Design is done but not perfect, few modern tools are used to implement, the work contributes to the world in some way	• Proper design methodology is followed, Design is perfect, Modern tools are used to implement, the work contributes to the world in greater way		
Results and Demonstration	• Some of the defined objectives are achieved • Modules are not in proper working form that further leads to failure of integrated system	• All defined objectives are achieved • Modules are working well in isolation and properly demonstrated • Modules of project are not properly integrated	• All defined objectives are achieved and working well and demonstrated • Integration of all modules not done and system working is not very satisfactory	• All defined objectives are achieved and evident from the results • Each module working well and properly demonstrated • All modules of project are well integrated and system working is accurate		
Project report	• Project report not prepared according to the specified format • References and citations are not appropriate	• Project report is according to the specified format but some mistakes • In-sufficient references and citations	• Project report is according to the specified format • References and citations not mentioned well	• Project report is according to the specified format • References and citations are appropriate and well mentioned		
Viva - Voce	• Answered few questions related to design, implementation and applications of project work	• Answered some questions related to design, implementation and applications of project work	• Answered 80% of the questions related to design, implementation and applications of project work	• Answered all the questions related to design, implementation and applications of project work		

Basaveshwar Engineering College, Bagalkote

Department of Industrial and Production Engineering

Scheme of Teaching and Evaluation
(Academic Year 2023 - 2024)

VIII Semester BE

Sl. No	SUBJECT CODE	SUBJECT	CREDITS	HOURS/ WEEK			EXAMINATION MARKS		
				L	T	P	CIE	SEE	TOTAL
1	UIP022E	Elective: Non-Conventional Machining Processes	3	3	0	0	50	50	100
2	UIP006E	Elective: Materials Management	3	3	0	0	50	50	100
3	UIP012E	Elective: Marketing Management	3	3	0	0	50	50	100
4	UIP804P	Project Phase-II	12	0	0	24	50	50	100
Total			21	9	0	24	200	200	400

UIP022E	NON-CONVENTIONAL MACHINING PROCESSES	Credits: 03
L : T : P - 3 : 0 : 0		CIEMarks:50
Total Hours/Week: 03		SEEMarks:50

UNIT - I	12 Hrs.
Introduction to NCMP- Need for non-traditional machining methods, classification of modern machining processes, considerations in process selection, materials and applications. **Ultrasonic machining -** Elements of the process, mechanics of metal removal process parameters, economic considerations, working principles, equipment used, process parameters, metal removal rate, applications and limitations, recent developments. **Abrasive jet machining**, **Water jet machining and Abrasive water jet machining -** Basic principles, equipment, process variables, mechanics of metal removal, metal remov al rate, application and limitations.	
UNIT - II	**08 Hrs.**
Electro chemical machining and chemical machining processes - Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing and deburring process, metal removal rate, tool design, surface finish and accuracy, economic aspects, simple problems for estimation of metal removal rate, fundamentals of chemical machining, advantages, disadvantages and applications.	
UNIT - III	**08 Hrs.**
Electric discharge machining- General Principle and applications of electric discharge machining, electric discharge, grinding and electric discharge wire cutting processes - Power circuits for electric discharge machining, mechanics of metal removal, process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy, characteristics of spark eroded surface and machine tool selection, wire electric discharge machining, principle and applications.	
UNIT - IV	**12 Hrs.**
Electron beam, laser beam and plasma arc machining processes- Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - general principle and application of laser beam machining - thermal features, cutting speed and accuracy of cut, application of plasma for machining, metal removal mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.	

Reference Books *

1. Pandey P.C. and Shan H.S, 1980, Modern Machining Processes, Tata McGraw-Hill, New Delhi.
2. Vijay K. Jain, 2002, Advanced Machining Processes, Allied Publishers Pvt. Ltd., New Delhi, ISBN 81-7764-294-4.
3. Benedict. G.F. 1987, Nontraditional Manufacturing Processes, Marcel Dekker Inc., New York.
4. McGeough, 1988, Advanced Methods of Machining, Chapman and Hall, London.

Course Outcomes**
After completion of the course student will be able to: 1. Introduce and classify non-traditional machining processes, understand mechanical energy machining processes in context to mechanics of metal removal process, principles, advantages, disadvantages and application 2. Explain electrochemical and chemical advance machining processes like electro chemical machining and design the tool for ECM process 3. Explain thermoelectric advanced machining processes in context to working principal, process parameters, advantages, disadvantages and applications of electric discharge machining 4. Identify the principles, processes and applications of electron, laser and plasma arc machining processes

***Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2							2			1	1		1
CO2	2	3			2				2			1		1	1
CO3	2	2			2				1			1	1		1
CO4	2	2			2				1			1	1		1

UIP006E	MATERIALS MANAGEMENT	Credits: 03
L : T: P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT- I	10 Hrs.
Integrated materials management - Importance, need for integrated concept, definition and scope, advantages, advantages of integrated materials management concept. **Corporate policy and materials management -** General corporate policy, scope, make or buy, quality requirements, quantity requirements, materials research - need and importance, definition and scope, organization for materials research, techniques and reporting. **ABC analysis -** What is ABC analysis-advantages of ABC analysis, mechanics of ABC analysis, purpose of ABC analysis, objective of ABC analysis and limitations of ABC analysis.	
UNIT- II	**10 Hrs.**
Codification and standardization - Nature of codification, process of codification, Kodak system, Brisch system, advantages of codification, need for standardization, standardization in India, Importance of standardization, definition of simplification and benefits of standardization. **Purchasing management -** Creative purchasing, purchase systems, price forecasting, buying seasonal commodities, purchasing under uncertainty, purchasing of capital equipment, international purchasing import substitution: Prospects and retrospect, public buying insurance buying.	
UNIT - III	**10 Hrs.**
Warehousing and stores management: Stores management, stores systems and procedures, incoming materials control, stores accounting and stock verification, obsolete, surplus and scrap management, value analysis, material handling, transportation and traffic management.	
UNIT- IV	**10 Hrs.**
Inventory management: Inventory management in India, economical ordering quantity, practical inventory systems, computers in materials management and evaluation of materials management.	

Reference Books *

1. Gopal Krishna P and M. Sundaresan, 2007, Materials Management: An Integrated Approach, Prentice-Hall of India Private limited, New Delhi, ISBN -978-81-203-0027-9.
2. Datta. A. K, 2000, Materials Management, Procedures, Text and Cases. Prentice-Hall of India Private limited, New Delhi.
3. Chtale, Materials Management.
4. Arnold. Materials Management.

Course Outcomes**

1. Analyze and demonstrate the role of materials management and research, integrated with corporate policy and able to analysis materials on the basis of ABC classification.
2. Acquire knowledge of codification and standardization.
3. Analyze and apply different purchasing policies and procedures used in the purchasing function
4. Apply and integrate warehousing and Stores Management skills to ensure an optimum supply chain performance.
5. Demonstrate knowledge and an understanding of the terminology relating to Inventory and materials Management.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1			1		1	2	2	1	2	1	1		2	2	2
CO2			2		2		2	1	1				2	1	1
CO3			1			1	2	2	1	1			1	2	1
CO4						2	1	1	2	2		1	2	1	2
CO5			2	1		1	1	1	2				2	2	2

UIP012E	MARKETING MANAGEMENT	Credits: 03
L : T : P - 3 : 0 : 0		CIE Marks: 50
Total Hours / Week: 03		SEE Marks: 50

UNIT - I	10 Hrs.
Defining marketing for the new realities - The value of marketing, the scope of marketing, core marketing concepts, the new marketing realities, and company orientation towards the marketplace. **Collecting information -** Components of modern marketing information system, Internal records, marketing intelligence, analyzing the macro environment**. Conducting marketing research -** The scope of marketing research, marketing research process, seven characteristics of good marketing research.	
UNIT - II	**10 Hrs.**
Analyzing consumer markets - What influences consumer behavior? Key psychological processes, the buying decision process: Five stage model, behavioral decision theory and behavioral economics. **Identifying market segments and targets -** Basis for segmenting consumer markets, how should business markets be segmented? Market targeting, effective segmentation criteria. **Analyzing business markets -** What is organizational buying? Participants in the business buying process, the purchasing / procurement process, stages in the buying process, developing effective-business-to-business marketing programs, managing business-to-business customer relationships, and institutional and government markets.	
UNIT - III	**10 Hrs.**
Setting product strategy - Product characteristics and classifications, differentiation, environmental issues product and brand relationships, packaging, labelling, warranties, and guarantees. **Designing and managing services** - The nature of services, the realities of the new service, achieving excellence in services marketing. **Managing retailing, wholesaling and logistics -** Retailing, private labels, wholesaling and market logistics.	
UNIT - IV	**10 Hrs.**
Developing pricing strategies and programs: Understanding pricing, setting the price, adapting the price, initiating and responding to price changes. **Designing and managing integrated marketing communications -** The role of marketing communications, marketing communications mix, how do marketing communications work, developing effective communications, selecting the marketing communications mix, developing and managing an advertising programme.	

Reference Books *

1. Philip Koteler, Kevin Lane Keller**,** Marketing Management, 15 Edition, Pearson India Education Services Pvt. Ltd. ISBN 978-93-325-5718-5.
2. Philip Koteler, Kevin lane Keller, Abraham Koshy and Mithileshwar Jha, 2012, Marketing Management a South Asian Perspective, 13th Edition, Pearson Prentice - Hall of India private limited, ISBN-978-81-317-1683-0.
3. Philip Koteler, Principles of Marketing, Prentice - Hall.
4. Michael R. Czinkota, Marketing Management, 2nd Edition, Vikas Publishing House, ISBN 981-240-366-3.
5. William J. Stannon, Fundamentals of Marketing, McGraw Hill.
6. R .S. S. Pillia and Mrs. Bagavathi, Marketing, S. Chand and Company. Ltd.
7. S. A. Sherlaker, Marketing Management, 13th Edition.
8. Rajagopal, Marketing Management Text and Cases, Vikas Publishing House.

MOOC Course: https://www.edx.org/course/marketing-management-iimbx-mk102x#!
NPTEL Course: http://nptel.ac.in/courses/110104068/3

Course Outcomes**

1. Discuss marketing for the new realities and design a market research program for products and services.
2. Identify market segments and analyze consumer markets and business markets.
3. Analyze the importance of product and service strategy in marketing.
4. Demonstrate the need for retailing, wholesaling, and market logistics.
5. Identify and adopt pricing strategy and mass communication programme in marketing.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1		3	3	3	3								3	3	
CO2			3	2	3								2		
CO3			3			2	2						3		
CO4				3		3							2		
CO5						1		1	2	2		2	2	2	

UIP804P	PROJECT PHASE-II	Credits: 03
L : T : P - 0 : 0 : 24		CIE Marks: 50
Total Hours / Week: 24		SEE Marks: 50

UNIT - I	384 Hrs.

Continuous Internal Evaluation (CIE): 50 marks
The CIE will be based on a project diary and two evaluations of 15 marks each .
Continuous Evaluation by guide: 20 marks

Evaluation 1 will include (along with CIE -I):15 marks

- **Design methodology and planning of project work**
- **Description of Concepts and Technical Details**
- **Demonstration and presentation**

Evaluation 2 will include (along with CIE -II):15 marks

- **Incorporation of Suggestions made in the previous review**
- **Discussion and Conclusion**
- **Demonstration and Presentation**

Evaluation by Guide will include:

- **Technical Knowledge gained through project work**
- **Regularity and Attendance**
- **Incorporation of Suggestions made in the previous review**
- **Organization and structure of Project Report**

All three evaluation are done by

- **HOD or his Nominee**
- **Guide**
- **Project Coordinator**

Semester End Examination (SEE):50 marks
The evaluation will be based on **project paper, project presentation, viva-voce and report submitted by project associates**. Evaluation committee consists of

- **HOD or his nominee**
- **External Examiner**
- **Project Coordinator**

Rubrics for Project Phase-I &II (VII + VIII Semester)

SEMESTER VII

Rubrics for	Phase	Period (Duration)	Rubric #	Marks	Evaluation by
CIE	Evaluation-I	Before the end of first month in VII 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 VII semester of BE Program	R2	15	
	Evaluation by guide	In the last week of working days of VII semester	R3	20	Guide(s)
SEE	Semester End Examination	During SEE of VII 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 the end of first month in VIII 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 VIII semester of BE Program	R6	15	
	Evaluation by guide	In the last week of working days of VIII semester	R7	20	Guide(s)
SEE	Semester End Examination	During SEE of VIII 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 the end of first month in VII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (Needs Improvement) (1)	Average (Acceptable) (3)	Very good (Proficient) (5)		
Motivation and Rationale behind the work	• 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	• 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	• 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	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Literature review	• Less technical papers are reviewed and less relevant	• Few technical papers are reviewed and moderately relevant	• At least 3 technical papers from reputed journals are made and reviews are quite relevant to the project work		
Presentation	• Slides contain some errors, Not legible, flow is okay, body language is minimal, Response to the audience questions and comments are not good	• Slides are error free, flow is good, body language is acceptable, Responds to the audience questions and comments	• Slides are error free, quite legible, flow is good, body language is good, Responds accurately to the audience questions and comments		

R2. Internal Evaluation (Before 15 days from the last working day of VII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks			Total Marks	Evaluation By
	Poor (Needs Improvement) (1)	**Average (Acceptable) (3)**	**Very good (Proficient) (5)**		
Proposed design methodology	• Division of problem into modules but improper selection of design approaches and design methodology and not properly justified	• Division of problem into modules with proper selection of design approaches and design methodology but not properly justified	• Division of problem into modules and good selection of design approaches, appropriate design methodology with proper justification	15	Committee consisting of HOD/Nominee + Project Coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Preliminary/Conceptual Design work	Very less efforts are made towards preliminary and conceptual design works to accomplish the work	Efforts are made towards preliminary and conceptual design works to accomplish the work but some are not clear	Preliminary and conceptual design works are carried and are in proper direction to accomplish the project work		
Presentation and Report	Slides are not organized, and Question-answer is poor, report has errors and not systematic	Slides are good but not neatly arranged, delivery is good, Question-answer is average Report is not organized systematically	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		

R3. Evaluation by the guide (In the last week of working days of VII semester): 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 VII semester of BE Program): Total Marks of 50

Evaluation	Score/Marks	Total	Evaluated by

Criteria	Needs improvement (Poor) (4)	Acceptable (Average) (6)	Satisfactory (Good) (8)	Proficient (Excellent) (10)	Marks	
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 • Design methodology not defined properly	• Division of problem into modules but inappropriate selection of computing framework • Design methodology not defined properly	• 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 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 not appropriate and not well arranged • Very less eye contact 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		

R5: Project work progress review-I (Before the end of the first month in VIII semester of BE Program): Total Marks of 15

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Design methodology and planning of project work	• Division of problem into modules and improper selection of computing framework • Design methodology not properly justified • Time schedule is not clear	• Division of problem into modules and improper selection of computing framework • Design methodology not properly justified • Time schedule is specified	• Division of problem into modules and good selection of computing framework • Design methodology not properly justified, • Time schedule is specified	• Division of problem into modules and good selection of computing framework, • Appropriate design methodology and proper justification • Time frame properly specified	15	HOD (or nomination) + Project coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Description of Concepts and Technical Details	• Inappropriate explanation of the key concepts and poor description of the technical requirements of the project	• Incomplete explanation of the key concepts and in-sufficient description of the technical requirements of the project	• Complete explanation of the key concepts but in-sufficient description of the technical requirements of the project	• Complete explanation of the key concepts and strong description of the technical requirements of the project		
Demonstration and presentation	• Contents of presentations are not appropriate and Demonstration not satisfactory	• 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	• Good demonstration of work so far carried-out, Contents of presentations are appropriate and well arranged, Proper eye contact with audience and clear voice with good spoken language		

R6: Project work progress review -II (Before 15 days from the last working day of VIII semester): Total Marks of 15

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Incorporation of Suggestions made in the previous review	• Some changes are made as per modifications suggested during previous evaluation	• All major changes are made as per modifications suggested during previous evaluation	• Changes are made as per modifications suggested during previous evaluation and good justification	• Changes are made as per modifications suggested during the previous evaluation and new innovations added	15	HOD (or nomination) + Project coordinator + Guide(s) Each will evaluate for 15 marks and average of all three is the marks awarded
Discussion and Conclusion	• Results are not presented properly, Project work is not summarized and concluded • Future extensions in the project are not specified	• Results presented are not much satisfactory, Project work summary and conclusion not very appropriate • Future extensions in the project are not specified	• Results are presented in good manner, Project work summary and conclusion not very appropriate • Future extensions in the project are specified	• Results are presented in very appropriate manner, Project work is well summarized and concluded, • Future extensions in the project are well specified		
Demonstration and Presentation	• Modules are not in proper working form that further leads to failure of integrated system, Contents of presentations are not appropriate and not well delivered • Poor eye contact with audience and unclear voice	• Modules are working well in isolation and properly demonstrated, Modules of project are not properly integrated, Contents of presentations are appropriate but not well delivered • Eye contact with only few people and unclear voice	• Each module working well and properly demonstrated, Integration of all modules not done and system working is not very satisfactory, Contents of presentations are appropriate and well delivered, Clear voice with good spoken language but less eye contact with audience	• Each module working well and properly demonstrated, All modules of project are well integrated and system working is accurate, neatly presented with proper eye contact with audience and clear voice with good spoken language		

R7: Evaluation by the guide (In the last week of working days of VIII semester): Total Marks of 20

Evaluation Criteria	Score/Marks				Total Marks	Evaluated by
	Needs improvement (Poor) (2)	**Acceptable (Average) (3)**	**Satisfactory (Good) (4)**	**Proficient (Excellent) (5)**		
Technical Knowledge gained through project work	• Poor knowledge and no awareness related to project	• Lacks sufficient knowledge and Awareness	• Fair knowledge and awareness related to the project	• Extensive knowledge and awareness related to the project	20	Guide(s)
Regularity and Attendance	• Irregular and inconsistent in work	• Reports to the guide but lacks Consistency	• Reports to the guide very often but not very consistent	• Reports to the guide regularly and consistent in work		
Incorporation of Suggestions made in the previous review	• All major changes are made as per modifications suggested during previous evaluation	• All major changes are made as per modifications suggested during previous evaluation	• Changes are made as per modifications suggested during previous evaluation and good justification	• Changes are made as per modifications suggested during the previous evaluation and new innovations added		
Organization and structure of Project Report	• Project report not prepared according to the specified format, References and citations are not appropriate	• Project report is according to the specified format but some mistakes, Insufficient references and citations	• Project report is according to the specified format, References and citations are appropriate but not mentioned well	• Project report is according to the specified format, References and citations are appropriate and well mentioned		

R8: SEE Evaluation for Project Phase-II (During SEE of VIII semester of BE Program): Total Marks of 50

Evaluation Criteria	Score				Total Marks	Evaluation By
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Presentation	• Contents of presentations are not appropriate and not well delivered, Poor eye contact with audience and unclear voice	• Contents of presentations are appropriate but not well delivered, Eye contact with only few people and unclear voice	• Contents of presentations are appropriate and well delivered, Clear voice with good spoken language but less eye contact with audience	• Contents of presentations are appropriate and well delivered, Proper eye contact with audience and clear voice with good spoken language	50	HOD/ nomination + Project coordinator + External Examiner Each will evaluate for 50 marks and average of all three will be taken
Designs and implementation	• Proper design methodology is not followed resulting into poor design , No modern tools are used to implement, Work contributes very less to the world	• Proper design methodology is followed, Design lacks, very less modern tools are used to implement, the work contributes to the world in little way	• Proper design methodology is followed, Design is done but not perfect, few modern tools are used to implement, the work contributes to the world in some way	• Proper design methodology is followed, Design is perfect, Modern tools are used to implement, the work contributes to the world in greater way		
Results and Demonstration	• Some of the defined objectives are achieved • Modules are not in proper working form that further leads to failure of integrated system	• All defined objectives are achieved • Modules are working well in isolation and properly demonstrated • Modules of project are not properly integrated	• All defined objectives are achieved and working well and demonstrated • Integration of all modules not done and system working is not very satisfactory	• All defined objectives are achieved and evident from the results • Each module working well and properly demonstrated • All modules of project are well integrated and system working is accurate		

Evaluation Criteria	Score				Total Marks	Evaluation By
	Needs improvement (Poor) (2)	Acceptable (Average) (3)	Satisfactory (Good) (4)	Proficient (Excellent) (5)		
Project report	• Project report not prepared according to the specified format • References and citations are not appropriate	• Project report is according to the specified format but some mistakes • In-sufficient references and citations	• Project report is according to the specified format • References and citations not mentioned well	• Project report is according to the specified format • References and citations are appropriate and well mentioned		
Viva - Voce	• Answered few questions related to design, implementation and applications of project work	• Answered some questions related to design, implementation and applications of project work	• Answered 80% of the questions related to design, implementation and applications of project work	• Answered all the questions related to design, implementation and applications of project work		

Department of Information Science and Engineering

B. E. I semester
Scheme of Teaching
and Examinations
(Effective from the academic year 2023-24)

I Semester (CSE Stream) **Branches: CS, IS, AIML and BT**
(Chemistry Group)

Applicable to students admitted in AY 23-24 to 1st sem and through lateral entry in

Sl. No.	Subject Code	Subject	Credits
1	22UMA103C	Mathematics for Computer Sciences - I	4
2	22UCH111C	Chemistry for Computer Sciences	4
3	22UCS119C	Principles of Programming using C	3
4	22UXXXXXE	Engineering Science Course-I	3
5	22USXXXXE	Emerging Technology Course-I	3
6	22UHS124C	Communicative English	1
7	22UHS126C/22UHS127C	Kannada – SK/Kannada - BK	1
8	22UHS129C	Innovation and Design Thinking	1
Total			**20**

B. E. II semester
Scheme of Teaching
and Examinations
(Effective from the academic year 2023-24)

Applicable to students admitted in AY 23-24 to 1st semester and through lateral entry in AY 24-25 to 3rd semester

(3rd NEP Batch)

II Semester (CSE Stream)

(Physics Group)

Sl. No.	Subject Code	Subject	Credits
1	22UMA203C	Mathematics for Computer Sciences - II	4
2	22UPH207C	Physics for Computer Sciences	4
3	22UME223C	CAED	3
4	22UXXXXE	Engineering Science Course-I	3
5	22USXXXXE	Programming Language Course-I	3
6	22UHS224C	Professional writing skills in English	1
7	22UHS225C	Indian Constitution	1
8	22UHS228C	Scientific Foundations of Health	1
Total			**20**

III Semester (2022-23-Entry Batch)

Sl. No.	Subject Code	Subject	Credits
1	22UMA301C	Numerical Techniques and Integral Transforms	**3**
2	22UIS305C	Advanced Web Programming (Integrated)	**4**
3	22UIS304C	Logic Design(integrated)	**4**
4	22UIS314C	Computer Organization	**4**
5	22UIS303C	Data Structures	**4**
6	22UIS381L	Data Structures Lab	**1**
7	22UMA300M	Bridge Course Mathematics - I	**0**
8	UHS002M	National Service Scheme	**0**
9	UHS003M	Physical Education(Sports and Athletics)	
Total			20

IV Semester (2022-23-Entry Batch)

Sl. No.	Subject Code	Subject	Credits
1	22UMA401C	Engineering Mathematics - IV	**3**
2	22UISXXXC	Universal Human Values - II	**1**
3	22UIS403C	Analysis and Design of Algorithms(Integrated)	**4**
4	22UIS412C	Object Oriented Modelling and Design (Integrated)	**4**
5	22UIS417C	Database Management Systems	**4**
6	22UIS413C	Software Engineering	**3**
7	22UIS421L	Database Application Laboratory	**1**
8	22UMA400M	Bridge course Mathematics - II	**0**
9	UHS002M	National Service Scheme	**0**
10	UHS003M	Physical Education(Sports and Athletics)	
11	UHS001M	Yoga	
Total			**20**

V Semester (2021-22-Entry Batch)

Sl. No.	Subject Code	Subject	Credits
1	21UIS519C	Discrete Mathematical Structures	3
2	21UIS513C	Web Programming(Integrated)	3
3	21UIS503C	Database Management System	3
4	21UIS047E	Data Science using Python **(Professional Elective Course- I)**	3
5	21UIS532N	Java Programming **(Professional Open Elective Course- I)**	3
6	21UIS511L	Database Application Laboratory	1
7	21UIS517I	Internship-II (4 weeks)	3
8	21UBT521C	Environmental Studies	1
9	21UHS521C	Qualitative Aptitude and Professional Soft Skills	2
Total			**22**

VI Semester

Sl. No.	Subject Code	Subject	Credits
1	21UIS615C	Theoretical Foundation of Computer Science	3
2	21UIS616C	Software Engineering	3
3	21UIS617C	Computer Network	3
4	21UISXXE	**(Professional Elective Course- II)**	3
5	21UIS631N	Data Science using Python **(Professional Open Elective Course- II)**	3
6	21UIS632N	Data Mining **(Professional Open Elective Course- III)**	3
7	21UHS600C	Indian Knowledge System	1
8	21UIS614P	Mini Project	2
Total			**21**

Sl.No	Sub-Code	Professional Elective Course- II(Offered)
01	21UIS019E	Data Mining
02	21UIS038E	Big Data Analytics
03	21UIS042E	Advanced Algorithm
04	21UIS050E	Distributed Cloud Computing

VII Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester, 2023-24 7th Semester)

Sl. No.	Subject Code	Subject	Credits
1	UIS720C	Object Oriented Modeling and Design	03
2	UISXXXE	**(Professional Elective – IV)**	03
3	UISXXXE	**(Professional Elective – V)**	03
4	UISXXXE	**(Professional Elective – VI)**	03
5	UISXXXN	**(Open Elective– III)**	03
6	UIS707L	Object Oriented System Design Lab	1.5
7	UIS716L	Software Testing Lab	1.5
8	UIS718I	Internship	02
9	UISXXXO	Online Certification Course registration	03
		Total	**23**

Sl.No	Sub-Code	**Professional Elective Course(Offered)**
01	UIS045E	Internet of Things
02	UIS038E	Big Data and Analytics
03	UIS049E	Cyber Security

Sl.No	Sub-Code	**Open Elective(Offered)**
01	UIS731N	Data Mining

VIII Semester

(Applicable students admitted during AY 2020-21 to 1st semester and Lateral Entry AY 2021-22 to 3rd semester, 2023-24 8th Semester)

Sl. No.	Subject Code	Subject	Credits
1	UIS801H	Management & Entrepreneurship (HSS)	03
2	UIS802C	NO SQL	03
3	UIS806P	Project	15
4	UIS807S	Seminar	01
		Total	**22**

22UMA301C	Numerical Techniques and Integral Transforms	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		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.

Reference 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, S. Chand & company Ltd Advanced Engineering Mathematics. Ram Nagar, New Delhi.
4. E Kreyszig, Advanced Engineering Mathematics

Course Outcomes**

After completion of the course student will be able to

1. The ability to solve engineering problems using non-linear equations and interpolation techniques.
2. The ability to solve problems using numerical differention and numerical integration.
3. Be capable to perform numerical 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 and z –transforms, to solve ode, pde and difference equations.

Subject Title	:	**Advanced Web Programming(Integrated)**
Subject code	:	**22UIS305C**
Semester	:	**3**
Credits with LTP Structure	:	**04 Credits (3L-0T-2P)**
Lecture Hours per Week	:	**3**
Practical Hours per Week		**2**
Tutorial Hours per Week	:	**0**
Total Contact Hours/Week	:	**03 Teaching Hours + 02 Practical Hours = 05 Hours**

Course Objectives:

1. Understand the principles of World Wide Web and also to create an effective web page.
2. Use CSS to implement a variety of presentation effects in XHTML and XML documents.
3. Develop basic programming skills using JavaScript.
4. Implement interactive and dynamic web page(s) using XHTML, JavaScript,XML,PHP,etc
5. Understand how server-side programming works on the web using PHP technology and design responsive web pages using PHP.

Course Outcomes:

After completing the course the student will be able to:

1. Develop JavaScript scripts for basic problems.
2. Develop JavaScript scripts for event handling.
3. Build dynamic documents using JavaScript and XHTML.
4. Develop web pages using XML technology.
5. Implement web pages using PHP.

CO-PO Mapping:

Course Outcomes	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
Develop JavaScript scripts for basic problems.	3	2	3		1							1	1	2	1
Develop JavaScript scripts for event handling.	3	2	3		1							1	1	2	1
Build dynamic documents using JavaScript and XHTML.	3	2	3		1							1	1	2	1
Develop web pages using XML technology.	3	2	3		1							1	1	2	1
Implement web pages using PHP.	3	2	3		1							1	1	2	1

1: Low correlation 2: Moderate correlation 3: High correlation

UNIT - I	09 Hours	Teaching Hours	Tutorial 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.		**09**	**00**
UNIT - II	**09 Hours**	**Teaching Hours**	**Tutorial Hours**
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.		**09**	**00**
UNIT - III	**11 Hours**	**Teaching Hours**	**Tutorial 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. **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.		**11**	**00**
UNIT - IV	**11 Hours**	**Teaching Hours**	**Tutorial 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.		**11**	**00**
Reference Books:			
1. Programming the World Wide Web - Robert W. Sebesta, 4th Edition, Pearson Education, 2008			

Laboratory Assignments

1. Develop JavaScript scripts for the following:

i.to model a simple calculator using ‘switch’ statement

ii.to print the number of prime numbers in a given range L to R using functions

iii.to find whether the given number is an Armstrong number using functions

iv. to find the number of occurrences of a character in a string using functions.

2. Develop and demonstrate using Javascript an XHTML document to validate the USN (the valid format is: A digit from 1 to 4 followed by two upper-case characters followed by two 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 windows must be displayed when errors are detected.

3. Develop XHTML document with Java Script to handle events as follows:
   i) 'Blur' event to transform the input text to upper case.
   ii) 'focus' event to change the background color of a text box.
   iii) 'Change' event to display the preferred browser in an alert box when the user relocates the browser from a drop-down menu.
   iv) 'click' event to copy the contents of one text in to another.
4. Create and demonstrate an XHTML document using Java Script for event handling as follows:
   XHTML document should contain a set of radio buttons showing names of web programming tools. On clicking a particular button, event handler should be called to display a brief description about the related tool using an alert box.
5. Develop and demonstrate an XHTML document as follows:
   The XHTML document must contain four paragraphs stacked on the top of each other with only enough of each showing so that the mouse cursor when placed over the exposed part of any paragraph, it should rise to the top to become completely visible.
6. Develop an XHTML document to accept user details. Develop a PHP script to retrieve these and display them with appropriate messages.

7. Write XHTML code to create a table as follows and enter the quantity required.

Product Name	Price/item (Rs)	Quantity
A	20	
B	30	
C	40	

   Create a set of radio buttons to accept the payment method needed-cheque, cash or card. Develop a PHP script to display the results in a table, which should contain product name, price, quantity and total cost for each product. Below the table, display the total number of ordered items, the total cost and the payment method used.
8. Create an XHTML document to accept student data which contains student name, branch and college name. Write a PHP document to insert data into the MySQL database and retrieve the particular database on student name from the database and display.

22UIS304C	Logic Design	Credits: 04
L:T:P - 3 : 0 : 2		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	10 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

UNIT–II	10 Hrs.

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 functionsThe Quine-McCluskey method of generating Prime implicants and Prime implicates, Decimal method for obtaining prime implicants, Variable-Entered Karnaugh maps.

UNIT–III	10 Hrs.

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).

UNIT–IV	10 Hrs.

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.

List of assignments

1. Realization of a given Boolean Expression using MEV method.
2. Design and implementation of BCD to Excess-3 using 4-bit Adder Chip and Logic Gates.
3. Design and implement Full adder using 3:8 Decoder (74138).
4. Design and implement Full subtractor using 8:1 multiplexer (74154).
5. Design JK master/slave flip-flop using NAND gates.
6. Design and implementation of 3 bit Mod-n synchronous counter using JK flip-flops (7476) (where n<=8).
7. Design and implementation of Ring counter and Johnson counter using 4-bit shift register.
8. Design and implementation of an Asynchronous Counter using a Decade Counter IC to count up from 0 to n (n<9). Display the count value on 7-segment LED display using BCD to 7-segment code converter IC.

Text Books

1. Donald D. Givone, 2002, "Digital Principles and Design", McGraw Hill Edition
2. Leach and Malvino, 2002, "Digital Principles and Applications", TMH, New Delhi.
3. Yarbrough J. M, 2001, "Digital logic- Applications and Design, Thomson Learning, New Delhi.

22UIS314C	Computer Organization	Credits: 04
L:T:P - 4 : 0 : 0		CIE Marks: 50
Total Hours/Week: 04		SEE Marks: 50

UNIT-I	13 Hrs.

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.

UNIT–II	13 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, Buses, Interface circuits, Standard I/O interfaces-USB; Device characteristics, Architecture, Addressing.

UNIT–III	13 Hrs.

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.

UNIT–IV	13 Hrs.

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.

Reference Books *

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, 2002, Computer Organization, , 5th edition, TMH.
2. William Stallings, 2006, Computer Organization and Architecture, ,7th edition, PHI.

Course Outcomes**

After completion of the course student will be able to

1. Comprehend the fundamentals of a computing system and its functional units.
2. Write an Assembly Language Program using various types of instructions and addressing modes.
3. Comprehend and Compare the approaches to implement I/O i.e. programmed I/O, interrupt driven I/O and DMA.
4. Comprehend and design various memory organizations.
5. Understand the concepts of 2’s complement representation, addition and subtraction operations
6.
7. with this representation, multiplication (BOOTH) and division methods.

22UIS303C	Data Structures	Credits: 04
L:T:P - 3 : 1 : 0		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	16 Hrs.

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.

UNIT–II	16 Hrs.

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	17 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, 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**.**

UNIT–IV	17 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.

Reference Books *

1. Aaron M. Tennenbaum, Yedidyah Langsam and Moshe J. Augenstein, 2006, "Data structure using C", Pearson Education/PHI.
2. Behrouz A. Forouzan, Richard F. Gilberg, "A Structured Programming Approach Using C", Second Edition, Thomson Brooks/Cole.
3. Behrouz A. Forouzan and Richard F. Gilberg, Thomson, 2003, "Computer Science A structured Programming Approach using C", II edition.
4. Richard F. Gilberg and Behrouz, 2005, "Data structures A pseudo code approach with c", Thomson.
5. Robert Kruse and Breuse Leung, 2007, "Data structures and program Design in C", PEARSON Education.

22UIS381L	Data Structure Laboratory	Credits: 1
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 02		SEE Marks: 50

List of assignments

1. Process information of the students using array of structures.
2. Implement integer stack ADT using arrays.
3. Convert infix expression into postfix expression.
4. Solve Towers of Hanoi problem using recursion.
5. Implement integer queue ADT using arrays.
6. Construct singly linked list and implement insertion operation on it.
7. Construct singly linked list and implement deletion operation on it.
8. Implement integer queue ADT using singly linked list.
9. Construct circular linked list and perform insertion operation on it.
10. Construct circular linked list and perform deletion operation on it.
11. Construct binary tree and implement tree traversal methods.

22UMA300M	Bridge Course Mathematics-I	Mandatory - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Differential Equations-1	10 Hrs.

Introduction to Differential Equations: Ordinary differential equations of first order**:** Variable separable, Homogeneous. Exact form and reducible to exact differential equations- Integrating factors on $1/N\,(\partial M/\partial y - \partial N/\,)$ and $1/M\,(\partial N/\partial x - \partial M/\partial y)$. Linear and Bernoulli’s equation.

(RBT Levels: L1, L2 and L3)

Differential Equations-2	10 Hrs.

Introduction to Higher Order Differential Equations: 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.

(RBT Levels: L1, L2 and L3)

Partial differentiation	10 Hrs.

Introduction to function of several variables: Partial derivatives; Euler’s theorem - problems. Total derivatives-differentiation of composite functions. Jacobeans-problems.
(RBT Levels: L1, L2 and L3)

Integral Calculus and Beta, Gamma functions	10 Hrs.

Introduction to Multiple integrals: Evaluation of double and triple integrals. Area bounded by the curve.

Introduction to Beta and Gamma functions: Definitions, Relation between beta and gamma functions-problems.

(RBT Levels: L1, L2 and L3)

References:

1. Maurice D weir, Joel Hass and Frank R. Giordano, “Thomas calculus”, Pearson, eleventh edition, 2011
2. B.S. Grewal : Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
3. B. V. Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
4. Erwin Kreyszing’s Advanced Engineering Mathematics volume1 and volume1I,wiley India Pvt.Ltd.,2014

22UMA401C	Statistics and Probability Distributions	03 - Credits (3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I Statistics **10 Hrs.**

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.

(RBT Levels: L1, L2 and L3)

UNIT – II Probability **10 Hrs.**

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.

(RBT Levels: L1, L2 and L3)

UNIT – III Probability distributions **10 Hrs.**

Binomial distributions, Poisson distributions and Normal distributions. Concept of joint probability, Joint probability distributions.

(RBT Levels: L1, L2 and L3)

UNIT – IV Markov chains **10 Hrs.**

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.

(RBT Levels: L1, L2 and L3)

References:

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.
5. Probability and stochastic processes by Roy D. Yates and David J. Goodman, wiley India pvt.ltd 2nd edition 2012.
6. Theory and problems of probability by Seymour Lipschutz (Schaum's Series).

22UISXXXM	Universal Human Values-II	Credits: 1
L:T:P - 2 : 1 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	04 Hrs.

Introduction to Value Education: Right Understanding;Relationship and Physical Facility;UnderstandingValue Education;Self-exploration as the Process for Value Education,Continuous Happiness and Prosperity -the Basic Human Aspiration-Current Scenario and Method to Fulfill the Basic Human Aspirations.

UNIT–II	04Hrs.

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self,Understanding Harmony in the Self, Harmony of the Self with the Body,Programme to ensure self-regulation and Health.

UNIT–III	04Hrs.

Harmony in the Family and Society and Nature: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; 'Respect' – as the RightEvaluation: Other Feelings, Justice in Human-to-Human Relationship; Understanding Harmony in the Society;Vision for the Universal Human Order; Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature..

UNIT–IV	03Hrs.

Implications of the Holistic Understanding – a Look at Professional Ethics

Definitiveness of (Ethical) Human Conduct; A Basis for Humanistic Education, HumanisticConstitution and Universal Human Order;Competence in Professional Ethics;HolisticTechnologies, Production Systems and Management Models; Strategies for Transition towards Value-based Life and Profession

Reference Books *

1.*A Foundation Course in Human Values and Professional Ethics*, R R Gaur, R Asthana, G P Bagaria,2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. Teachers'Manualfor*AFoundationCourseinHumanValuesandProfessionalEthics*,RRGaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034- 53-2

3.JeevanVidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak,1999.

4.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi,2004.

5.The Story of Stuff(Book).

6.The Story of My Experiments with Truth - by Mohandas KaramchandGandhi

7.Small is Beautiful - E. F Schumacher.

8.Slow is Beautiful - CecileAndrews

9.Economy of Permanence - J CKumarappa

10. Bharat Mein Angreji Raj – PanditSunderlal

11.Rediscovering India - byDharampal

12.Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi

13.India Wins Freedom - Maulana Abdul KalamAzad

14.Vivekananda - Romain Rolland(English)

15.Gandhi - Romain Rolland(English

22IS403C	ANALYSIS AND DESIGN OF ALGORITHMS (Integrated)	Credits: 04
L:T:P - 3 : 0 : 2		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	10 Hrs.

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	10 Hrs.

Brute Force: Selection Sort and Bubble Sort, Sequential Search and Brute-Force String Matching, Exhaustive Search.

Divide-and-Conquer: Mergesort, Quicksort, Binary Search, Multiplication of Large Integers and Strassen'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	10 Hrs.

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	10 Hrs.

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.

Laboratory Assignments

All the assignments are implemented using Java

1. a.Perform linear search. Hence find the time required to search an element.

   b.Perform binary search. Hence find the time required to search an element.

2. Sort a given set of ***n*** integer elements using **Bubble Sort** method and compute its time complexity. Run the program for varied values of *n* and record the time taken to sort. Plot a graph of the time taken versus ***n*** on graph sheet. Demonstrate using Java how the Brute Force method works along with its time complexity analysis: worst case, average case and best case.

3. Write a Java program to implement **Brute Force** string matching algorithm.

4. Sort a given set of ***n*** integer elements using **Quick Sort** method and compute its time complexity. Run the program for varied values of *n* and record the time taken to sort. Plot a graph of the time taken versus ***n*** on graph sheet. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

5. Sort a given set of ***n*** integer elements using **Merge Sort** method and compute its time complexity. Run the program for varied values of *n* and record the time taken to sort. Plot a graph of the time taken versus ***n*** on graph sheet. Demonstrate using Java how the divide-and-conquer method works along with its time complexity analysis: worst case, average case and best case.

6. Implement **BottomUp Heap** construction algorithm using Java.

7. Implement in Java, the **0/1 Knapsack** problem using (a) Dynamic Programming method (b) Greedy method.

8. From a given vertex in a weighted connected graph, find shortest paths to other vertices using **Dijkstra's algorithm**. Write the program in Java.

9. Find Minimum Cost Spanning Tree of a given connected undirected graph using **Kruskal'salgorithm.**

10. Write Java programs to Implement All-Pairs Shortest Paths problem using **Floyd's algorithm**.

Reference Books *

5. 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, 4.1–4.3,4.5 5.1–5.4, 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.
6. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, “Introduction to Algorithms”, 2nd Edition, PHI, 2006.
7. Horowitz E., Sahni S., Rajasekaran S. “Computer Algorithms”, Galgotia Publications, 2001.

22IS412C	Object Oriented Modelling and Design (Integrated)	Credits: 04
L:T:P - 3 : 1 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT - I	10 Hours	Teaching Hours	Tutorial Hours
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**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**

Text Books:

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.

22UIS413C	Database Management Systems	Credits: 04
L:T:P - 3 : 1 : 0		CIE Marks: 50
Total Hours/Week: 05		SEE Marks: 50

UNIT-I	16 Hrs.

INTRODUCTION: Introduction; An example; Characteristics of database approach; Advantages of using DBMS approach; when not to use a 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; Relationship types of degree higher than two.

UNIT–II	16 Hrs.

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

UNIT–III	17 Hrs.

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; Inclusion Dependencies; Other Dependencies and Normal forms.

UNIT–IV	17 Hrs.

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; CONCURRENCY**CONTROL:** Two-phase locking techniques for concurrency control;

CRASH RECOVERY: Recovery concepts; Recovery techniques based on deferred update; recovery techniques based on immediate update; shadow paging; The ARIES recovery algorithm;

Reference Books *

1. Remez Elmasri & amp; Shamkant B. Navathe, Fundamentals of Database Systems 5th Edition, Pearson Education.
2. Ramakrishanan Gehrke, “ Database Management Systems”, 3 rd edition, McGraw-Hill Higher Education.
3. C. J. Date, “An Introduction to Data base systems”, Addision Wesley, 4 th edition.

22UIS417C	Software Engineering	Credits: 03
L:T:P - 3 : 0 : 0		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

UNIT-I	10 Hrs.

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.

UNIT–II	10 Hrs.

REQUIREMENTS ANALYSIS AND SPECIFICATION: Requirements gathering and analysis, software requirements specification (SRS).

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.

UNIT–III	10 Hrs.

FUNCTION-ORIENTED SOFTWARE DESIGN: Overview of SA/SD methodology, structured analysis, developing the DFD model of the system, structured design, detailed design, design review.

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

UNIT–IV	10 Hrs.

SOFTWARE RELIABILITY AND QUALITY MANAGEMENT: Software reliability, statistical testing, software quality, software quality management system, ISO 9000, SEI capability maturity model.

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.

Reference Books *

1. Rajib Mall, Fundamentals of software engineering, 4th edition, pHI.
2. Ian Somerville, Software Engineering, 7th edition, Pearson Education.
3. Pressman R.S, “Software Engineering- A Practitioners Approach”, MGH New Delhi.
4. Jalote P, Narosa, “An integral approach to software Engineering”, New Delhi.

22UIS421L	Database Application Laboratory	Credits: 1
L:T:P - 0 : 0 : 2		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

List of assignments

PART-A

1. Consider the following relations:

Student (snum:Integer, sname: char, subject: char,slevel: char, age:integer)

Class(cname:char, roomno: integer, fid:integer)

Enrolled(snum:integer, cname:char)

Faculty(fid: integer, fname:char, deptid: integer

Enrolled has one record per student-class pair such that the student is enrolled in the class. Write the following queries in SQL. No duplicates should be printed in any of the answers.

(i) Find the names of all juniors (level=JR) who are enrolled in a class taught by faculty name.

(ii) For each level, print the level and the average age of students for that level.

(iii) For all levels except JR, print the level and the average age of students for that level.

(iv) Foe each faculty member that has taught classes only in room_number-20, print the faculty member's name and the total number of classes she or he has taught.

(v) Find the names of students not enrolled in any class.

2. Consider the Insurance database given below. The primary keys are underlined and the data types are specified:

PERSON (<u>Driver – id #:</u> string, Name: string, Address: string)

CAR (<u>Regno:</u> string, Model: string, Year: int)

ACCIDENT (<u>Report-number</u>: int, Accd-Date: date, Location: string)

OWNS (<u>Driver-id</u> #: string, <u>Regno</u>:string)

PARTICIPATED (<u>Driver-id</u>: string, <u>Regno</u>:string, <u>Report-Number</u>: int, Damage

Amount: int)

(i) Create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Demonstrate how you

a. Update the damage amount to 25000 for the car with a specific Regno in the ACCIDENT table with report number 12.

b. Add a new accident to the database.

(iii) Find the total number of people who owned cars that were involved in accidents in 2008.

(iv) Find the number of accidents in which cars belonging to a specific model were involved.

3. Consider the following database of student enrollment in courses & books adopted for each course:

STUDENT (Regno: string, Name: string, Major: string, Bdate:date)

COURSE (Course #:int, Cname:string, Dept:string)

ENROLL (Regno:string, Course#:int, Sem:int, Marks:int)

BOOK _ ADOPTION (Course# :int, Sem:int, Book-ISBN:int)

TEXT (Book-ISBN:int, Book-Title:string, Publisher:string, Author:string)

(i) Create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Demonstrate how you add a new textbook to the database and make this book be adopted by some department.

(iii) Produce a list of textbooks (include Course #, Book-ISBN, Book-Title) in the alphabetical order for courses offered by the 'CS' department that use more than two books.

(iv) List any department that has *all* its adopted books published by a specific publisher.

4. A database management system is to be created for a study centre to keep track of the students and the assignments records of the students. The database records the date of submission of assignments, the date of evolution, the date of viva, the date of declaration of results, who evaluated the assignment, and the mark list description in which the assignment marks were sent to regional office. The database also maintains the details of the evaluators. Perform the following activities for the description as given above.

a) Design the database with suitable integrity constraints and create the database

b) Write the following queries using SQL:

(i) Find the list of the students who have not submitted even a single assignment
(ii) Find the details of the evaluators by whom average marks awarded are more than 70%
(iii) Find the students who have passed more than 5 assignments
(iv) Find the list of students who have not appeared in VIVA. Make and state suitable assumptions, if any.

5. Design a database for maintaining the details of shows and ticketing for the shows of multiples. New perform the following activities for the system:

a) Create the database

b) Write the following queries using SQL

(i) Find the details of the movies whose shows are not yet full
(ii) Find the details of the movies that had been screened at least one year earlier to
(iii) Find the names of those that have an overall state of 60% of capacity on all days of screening

6. Consider the following database for a banking enterprise:

BRANCH(<u>Branch-name</u>:string, Branch-City:string, Assets:real)

ACCOUNT(<u>Accno</u>:int, Branch-Name:string, Balance:real)

DEPOSITOR(<u>Customer-Name</u>:string, Accno:int)

CUSTOMER(<u>Customer-Name</u>:string, Customer-Street:string, Customercity:

string)

LOAN(<u>Loan-Number</u>:int, Branch-Name:string, Amount:real)

BORROWER(<u>Customer-Name</u>:string, <u>Loan-Number</u>:int)

(i) Create the above tables by properly specifying the primary keys and the foreign keys
(ii) Find all the customers who have at least two accounts at the Main branch.
(iii) Find all the customers who have an account at all the branches located in a specific city.
(iv) Demonstrate how you delete tuples in ACCOUNT relation at every branch located in a specific city.
(v) Find all loan numbers for loans made at the specific branch with loan amounts greater than Rs1200.
(vi) Find all loan numbers for loans with loan amounts between Rs 90,000 and Rs100000.

7. Demonstrate views using SQL

Part-B

1. Write a PL/SQL code to demonstrate nested block.
2. Write a PL/SQL code to retrieve a employee name form employee database.
3. Write a PL/SQL code to calculate tax for employee and display taxable amount.
4. Write a PL/SQL code to calculate total & percentage of marks of the students in four subjects.
5. Write a PL/SQL code to reverse a sting.
6. Write a PL/SQL code to find the factorial of a given number.
7. Demonstrate transactions in PL/SQL.

22UMA400C	Bridge Course Mathematics-II	Credits - Mandatory L-T-P:(3 : 0 : 0)
Hours / Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

Differential Calculus **10 Hrs.**

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 (without proof) problems

(RBT Levels: L1, L2 and L3)

Vector Differentiation **10 Hrs.**

Introduction, Scalar and vector fields**.** Gradient, directional derivative; curl and divergence-physical interpretation; solenoidal and irrotational vector fields- problems.

(RBT Levels: L1, L2 and L3)

Laplace Transform **10 Hrs.**

Introduction, Definition of Laplace Transform, Laplace Transform of standard functions, Properties: Shifting, differentiation, Integral and division by t. Periodic function, Heaviside's Unit step function.

(RBT Levels: L1, L2 and L3)

Inverse Laplace transforms **10 Hrs.**

Properties, Convolution theorem-problems, Solutions of linear differential equations.

(RBT Levels: L1, L2 and L3)

References:

1. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.
2. Erwin Kreyszing's Advanced Engineering Mathematics volume I and volume II, wiley India Pvt.Ltd., 2014.
3. Elementary Differential Equations by Earl D. Rainville and Phillip E, Bedient, Sixth Edition
4. Erwin Kreyszing's Advanced Engineering Mathematics, wiley India Pvt.Ltd.,2014.

Subject Title	:	**DISCRETE MATHEMATICAL STRUCTURES**
Subject code	:	**21UIS519C**
Semester	:	**5**
Credits with LTP Structure	:	**3 Credits (3L-0T-0P)**
Lecture Hours per Week	:	**3 Hours**
Practical Hours per Week	:	**00**
Tutorial Hours per Week	:	**00**
Total Contact Hours per Week	:	**03 (3 Teaching Hours + 00 Tutorial Hours)**

UNIT - I	**10 Hours**	**Teaching Hours**
Fundamentals Principles of Counting: The Rules of sum and product, permutations, combinations: the binomial theorem, combinations with repetition, mathematical induction. **Recurrence relation**: first order linear recurrence relation, the second order linear homogeneous recurrence relation with constant coefficient		**10**
UNIT - II	**10 Hours**	
Fundamentals of Logic: Basic connectives and truth tables, Logical equivalence: the laws of logic, logical implication: rules of inference, the use of quantifiers, definitions and the proofs of theorems. **Set Theory:** Sets and subsets, set operations and the laws of set theory.		**10**
UNIT - III	**10 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. **Semigroups and Groups**: Definition, example and elementary properties, Homomorphism, Isomorphism.		**10**
UNIT - IV	**10 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**

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

21IS513C	WEB PROGRAMMING (Integrated)	Credits: 03
L:T:P - 2 : 0 : 2		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Course Outcomes**

After completion of the course student will be able to

1. Develop web pages using technologies like XHTML and CSS.
2. Develop document using JavaScript.
3. Build dynamic documents using JavaScript and XHTML.
4. Implement web pages using PHP.

UNIT-I	07 Hrs.

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;

UNIT–II	08 Hrs.

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	08 Hrs.

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.

UNIT–IV	07 Hrs.

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.

Laboratory Assignments

1.
Design the following static web pages required for an online book store web site.

1) HOME PAGE: The static home page must contain three frames.

2) LOGIN PAGE

3) CATOLOGUE PAGE: The catalogue page should contain the details of all the books available in the web site in a table

2. Write JavaScript to validate the following fields of the Registration page.

1. First Name (Name should contains alphabets and the length should not be less than 6 characters).

2. Password (Password should not be less than 6 characters length).

3. E-mail id (should not contain any invalid and must follow the standard pattern name@domain.com)

4. Mobile Number (Phone number should contain 10 digits only).

3. Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems: a) Input: Click on Display Date button using onclick( ) function Output: Display date in the textbox

b) Input: A number n obtained using prompt Output: Factorial of n number using alert

c) Input: A number n obtained using prompt Output: A multiplication table of numbers from 1 to 10 of n using alert

d) Input: A number n obtained using prompt and add another number using confirm Output: Sum of the entire n numbers using alert.

4. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next in the list. Add CSS to customize the properties of the font of the capital (color,bold and font size).

a. Design an XHTML web page using CSS, which has two paragraphs as follows:
   i) First para – Arial font, 24 pt size, italic, bold, text color blue, background color yellow, underlined, aligned right
   ii) Second para – Courier font, 40pt size, small capital letters, over lined, background color white, text color red, aligned center.

   b) Develop an XHTML web page to include a background image on some text and then illustrate the properties 'background-repeat' and 'background-position' with different values for each.

6. Develop XHTML document with Java Script to handle events as follows:
   i) 'Blur' event to transform the input text to upper case.
   ii) 'focus' event to change the background color of a text box.
   iii) 'Change' event to display the preferred browser in an alert box when the user relocates the browser from a drop-down menu.
   iv) 'click' event to copy the contents of one text into another.

7. Crete and demonstrate an XHTML document using Java Script for event handling as follows: XHTML document should contain a set of radio buttons showing names of web programming tools. On clicking a particular button, event handler should be called to display a brief description about the related tool using an alert box.

8. Develop and demonstrate an XHTML document as follows:
   The XHTML document must contain four paragraphs stacked on the top of each other with only enough of each showing so that the mouse cursor can always be placed over the exposed part of any paragraph, it should rise to the top to become completely visible.

9. Write XHTML code to create a table as follows and enter the quantity required.

Product Name	Price/item (Rs)	Quantity
A	20	

B	30
C	40

Create a set of radio buttons to accept the payment method need-cheque, cash or card. Develop PHP script to display a result in table, which should contain product name, price, quantity and total cost for each product. Below the table display the total number of ordered items, the total cost and the payment method used.

10. Create an XHTML document to accept the student data which contains student name, branch and college name. Write a PHP document to insert data into the MySQL database and retrieve the particular databased on student name from the database and display.

Reference Books *

5. Programming the World Wide Web - Robert W. Sebesta, 4th Edition, Pearson Education, 2008.
6. Internet & World Wide Web How to program - M. Deitel, P.J.Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
7. Web Programming Building Internet Applications - Chris Bates,3rd Edition, Wiley India, 2006.
8. The Web Warrior Guide to Web Programming - Xue Bai et al,Thomson, 2003.
9. M.Srinivasan: Web Technology Theory and Practice, Pearson Education, 2012.
10. Jeffrey.C.Jackson: Web Technologies-A Computer Science Perspective, Pearson Education, Eleventh Impression, 2012

Subject Title	**:**	**Database Management System**
Subject code	**:**	**21UIS503C**
Semester	**:**	**V**
Credits with LTP Structure	**:**	**Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**3-Hours**
Tutorial Hours per Week	**:**	**0-Hours**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

Course Objectives:

1. Get an idea of defining, constructing, manipulating, and sharing databases among various users and applications
2. Learn about database design models, especially come to know about entity-relationship diagrams
3. Acquire knowledge about relational model, relational model constraint, and relational algebra.
4. Understand structured query language.
5. Know about different normal forms and properties of relational decompositions.
6. Learn about transaction management and crash recovery.

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
INTRODUCTION: Introduction; An example; Characteristics of database approach; Advantages of using DBMS approach; when not to use a DBMS. **Database System Concepts and Architecture:** 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; Relationship types of degree higher than two.			
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**

RELATIONAL MODEL AND RELATIONAL DATABASE CONSTRAINTS: Relational model concepts; Relational model constraints and Relational database schemas; Update operations, Transaction and dealing with constraint violations. **Relational Database Design Using ER-to-Relational Mapping** **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.			
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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; Multi-valued dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form; Inclusion Dependencies; Other Dependencies and Normal forms			
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
TRANSACTION MANAGEMENT : Introduction to transaction processing; Transaction & system concepts; Desirable properties of transactions; Characterizing schedules based on recoverability; Characterizing schedules basedon serializability; Transaction support in SQL; CONCURRENCY CONTROL: Two-phase locking techniques for concurrency control; **CRASH RECOVERY**: Recovery concepts; Recovery techniques based on deferred update; recovery techniques based on immediate update; shadow paging; The ARIES recovery algorithm;			
Text Book:			
"Fundamentals of Database Systems", Remez Elmasri & Shamkant B. Navathe, 7th 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.			

Subject Title	**:**	**Data Science using Python**
Subject code	**:**	**21UIS047E**
Semester	**:**	**05**
Credits with LTP Structure	**:**	**3 Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**3 Hours**
Tutorial Hours per Week	**:**	**0 Hours**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

UNIT – I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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 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.		10	00
UNIT – II	10 Hours	**Teaching Hours**	**Tutorial Hours**
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: Python: Introduction, Getting Access to Python, Download and Install Python, Running Python through Console, Using Python through Integrated Development Environment (IDE) , Basic Examples, Control Structures, Statistics Essentials, Importing Data, Plotting the Data, Correlation , Linear Regression, Multiple Linear Regression,		10	00
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Machine Learning Introduction and Regression: Introduction, Machine Learning, Regression, Gradient Descent Supervised Learning: Introduction, Logistic Regression, Classification with kNN, Naïve Bayes Tools for data science: Python: Introduction to Machine Learning, Classification (Supervised Learning)		10	00
UNIT – IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Unsupervised learning: Introduction, Agglomerative Clustering, Introduction to Reinforcement Learning Tools for data science: Python: Clustering (Unsupervised Learning) Data Collection, Experimentation, and Evaluation: Introduction, 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, Cross-Validation.		10	00
Text Book:			

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.

Subject Title	**:**	**Java Programming**
Subject code	**:**	**21UIS532N**
Semester	**:**	**V**
Credits with LTP Structure	**:**	**Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**03**
Tutorial Hours per Week	**:**	**0**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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.		**10**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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.		**10**	**00**
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.			
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Arrays, Classes **Arrays:** One-dimensional arrays, Multi-dimensional arrays. **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.		**10**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Inheritance and Threads **Inheritance:** Inheritance basics- Member access and inheritance, Using super, Multi-level inheritance, Method overriding; Dynamic method dispatch, abstract classes, using 'final' with inheritance.**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**	**00**

Text Book:
1. The Complete Reference -Java, Herbert Schildt, 7th edition, McGraw Hill Publication. 2. Programming with Java – A primer, E. Balaguruswamy, 4th edition, McGraw Hill Publication.
Reference Books:
1. Java for programmers, Paul J. Deitel and Harvey M. Deitel, Pearson Eduation. 2. Introduction to Java programming, Y. Daniel Liang, 7th edition, Pearson Eduation.

Subject Title	**:**	**THEORETICAL FOUNDATIONS OF COMPUTER SCIENCE**
Subject code	:	**21UIS615C**
Semester	**:**	**06**
Credits with LTP Structure	**:**	**3 Credits (03L-0T-0P)**
Lecture Hours per Week	**:**	**3 Hours**
Tutorial Hours per Week	**:**	**00**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

Course Objectives:

1.

Course Outcomes:

After completing 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. Analyse the closure properties of regular and context-free languages.
4. Design finite automata, pushdown automata, Turing machines for solving language pattern recognition patterns.
5. Apply mathematical and formal techniques for solving problems.

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**	**00**
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**	**00**
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.		**10**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Introduction To Turing Machine: The Turing Machine, Programming Techniques for Turing Machines, Extensions to the basic Turning Machines, Turing Machine and Computers.		**10**	**00**
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, 7.1, 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.
3. A. M., PadmaReddy, “Finite Automata and Formal Languages, Pearson Education,2012

Department Name	:	**Information Science and Engineering**
Semester	:	**6**
Subject	:	**SOFTWARE ENGINEERING**
Subject code	:	**21UIS616C**
Credits	:	**03 (L:03, T:03, P:03)**
Lecture Hours per week	:	**03**
Tutorial Hours per week	:	**00**
Contact Hours per week	:	**03**

UNIT - I **10 Hours**

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).

UNIT - II **10 Hours**

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 Modeling 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

UNIT - III **10 Hours**

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, CASEsupport in software life cycle, other characteristics of CASE tools **10 Hours**

UNIT - IV		10 Hours
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.

Subject Title	**:**	**Computer Networks**
Subject code	**:**	**21UIS617C**
Semester	**:**	**6**
Credits with LTP Structure	**:**	**3 (3-0-0)**
Lecture Hours per Week	**:**	**3 Hours**
Tutorial Hours per Week	**:**	**--**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

Course Objectives:

1. Understand fundamental concepts of data communication.
2. Familiar with various types of computer networks.
3. Understand the role of each layer in the OSI andTCP/IP Models.
4. Describe the role of the data link layer protocols.
5. Describe the IPv4 and IPv6 addressing structure there packet format and different routing protocols in network layer.
6. Familiarize students with different transport and application layer protocols.

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Introduction: Data Communications: Components, Data representations, Data flow, Networks: Distributed Processing, Network Criteria, And Physical structures, Categories of Networks [LAN, WAN, MAN]. **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.		**10 Hours**	--
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial 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.		**10 Hours**	--
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial 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].		**10 Hours**	--
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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: Remote Logging, Electronic Mail and File Transfer:** Remote logging: Telnet, Electronic mail: Architecture ,File Transfer: FTP		**10 Hours**	--

Text Books:

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]

Reference Books:

1) Communication Networks –Fundamental Concepts and Key Architectures Alberto LeonGarcia and IndraWidjaja, 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.

Subject Title	:	**INTERNET OF THINGS**
Subject Code	:	**21UIS045E**
Semester	:	**6**
Credits with LPT Structure	:	**03 (3-0-0)**
Lecture Hours Per Week	:	**03**
Total Lecture Hours	:	**40**

UNIT - I	Teaching Hours
Introduction to IoT: 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 Managementand Compute Stack.	**10**
UNIT - II	Teaching Hours
Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: Salient features of protocol stacks utilizing IEEE 802.15.4 (Intd.): Zigbee Protocol, LoRaWAN	**10**
UNIT – III	Teaching Hours

IP as the IoT Network Layer: The Business Case for IP, the need for Optimization,

Optimizing IP for IoT, Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods: CoAP, MQTT 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.	**10**
UNIT – IV	Teaching Hours
Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and 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, Installing Software, Fundamentals of Arduino Programming, Example Modules on Arduino: Blinking an LED,Toggle the state of LED using Switch, Traffic light simulation for pedestrians, Interfacing Sensors to the Arduino: Temperature Sensor, Light Sensor, Ultrasonic Sensor, Interfacing Displays to Arduino: 7 Segment Display.	**10**

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 Arshdeep Bahga, "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)

Subject Title	:	**Data Mining**
Subject code	:	**21UISXXXN**
Semester	:	**6**
Credits with LTP Structure	:	**3 Credits (4L-0P-0T)**
Lecture Hours per Week	:	**3 Hours**
Tutorial Hours per Week	:	**00**
Total Contact Hours	:	**40 (40 Teaching Hours + 00 Tutorial Hours)**
Pre-requisites:	:	**Nil**
Who can register	:	**Students from Any discipline**

Course Objectives:

- To introduce the concepts of Data mining.
- To learn the Data Preprocessing.
- To learn and apply various Data Mining algorithms.
- To know the advanced applications of Data Mining.

Course Outcomes:

After Completion of the course the student will be able to:

CO1: Display a comprehensive understanding of Data mining, its role and importance in present scenario.

CO2: Apply various data preprocessing techniques to prepare the given raw input data, assess it and provide suitable data for a range of data mining algorithms.

CO3: Discover useful and interesting associations between various types of items in transactional data using association mining algorithms.

CO4: Apply classification algorithms to real time data.

CO5: Find and evaluate clusters in given real time data and find useful patterns.

CO6: Select and apply the concepts of search engines for retrieving web pages

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Introduction to data mining: Definition of Data Mining, Motivating Challenges of DM, Data Mining Tasks. Data Preprocessing: Data Attributes, Types of Data, Quality of Data and Data Preprocessing, Measures of Similarity and Dissimilarity.		10	0
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Association Analysis: Definition of Association Analysis, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets. FP Growth Algorithms, Evaluation of Association Patterns		10	0
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Classification: Preliminaries, Decision Tree Based Classifier, Nearest Neighbor Classifier. Cluster Analysis: Overview, K-means, DBSCAN		10	0

UNIT - IV	10 Hours	Teaching Hours	Tutorial Hours
Applications: Data Mining Applications, Web Mining, Search Engines		10	0
Reference Books:			

1. Introduction to Data Mining with Case Studies, G K Gupta, 3rd Edition, PHI.
2. Data Mining – Concepts and Techniques, Jiawei Han and Michelins Kamber, Morgan Kaufman, 2006, 2nd Edition.
3. Introduction to Data Mining, Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Subject Title	:	Data Science using Python
Subject code	:	21UISXXXN
Semester	:	06
Credits with LTP Structure	:	3 Credits (3L-0T-0P)
Lecture Hours per Week	:	3 Hours
Tutorial Hours per Week	:	0 Hours
Total Contact Hours	:	40 (40 Teaching Hours + 00 Tutorial Hours)

UNIT – I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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 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.		10	00
UNIT – II	10 Hours	**Teaching Hours**	**Tutorial Hours**
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: Python: Introduction, Getting Access to Python, Download and Install Python, Running Python through Console, Using Python through Integrated Development Environment (IDE) , Basic Examples, Control Structures, Statistics Essentials, Importing Data, Plotting the Data, Correlation , Linear Regression, Multiple Linear Regression,		10	00
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Machine Learning Introduction and Regression: Introduction, Machine Learning, Regression, Gradient Descent Supervised Learning: Introduction, Logistic Regression, Classification with kNN, Naïve Bayes Tools for data science: Python: Introduction to Machine Learning, Classification (Supervised Learning)		10	00
UNIT – IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**

Unsupervised learning: Introduction, Agglomerative Clustering, Introduction to Reinforcement Learning Tools for data science: Python: Clustering (Unsupervised Learning) Data Collection, Experimentation, and Evaluation: Introduction, 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, Cross-Validation.	10	00
Text Book:		
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.		

Subject Title	**:**	**Object Oriented Modeling and Design**
Subject code	**:**	**UIS720C**
Semester	**:**	**7**
Credits with LTP Structure	**:**	**3 Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**3 Hours**
Tutorial Hours per Week	**:**	**0 Hours**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

Course Outcomes:
After completing the course the student will be able to:
1. Apply the Object Oriented approaches for modeling and design.
2. Analyze the structural and behavioral models using UML appropriate notations.
3. Design object oriented models for development of software applications.
4. Design suitable implementation methods for object oriented models.

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
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**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
SYSTEM DESIGN-2, CLASS DESIGN, IMPLEMENTATION MODELING, AND		**10**	**00**

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.		
Text Books:		
1. Michael. Blaha, James. Rumbaugh **“Object-Oriented Modeling and Design with UML”**, 2nd Edition, Pearson Education, 2005.		
Reference Books:		
4. **Ali. Bahrami, “Object Oriented Systems Development”,** McGraw-Hill, 2008. 5. Grady. Booch **“Object-Oriented Analysis and Design with Applications”,** 3rd Edition, Pearson, 2007. 6. Mark. Priestley, **“Practical Object-Oriented Design with UML”**, 2nd Edition, Tata McGraw-Hill, 2003.		

<table>
<tr><td>Subject Title</td><td>:</td><td colspan="3">Internet of Things</td></tr>
<tr><td>Subject Code</td><td>:</td><td colspan="3">UIS045E</td></tr>
<tr><td>Semester</td><td>:</td><td colspan="3">7</td></tr>
<tr><td>Credits with LTP Structure</td><td>:</td><td colspan="3">3 Credits (3L-0T-0P)</td></tr>
<tr><td>Lecture Hours per Week</td><td>:</td><td colspan="3">3 Hours</td></tr>
<tr><td>Tutorial Hours per Week</td><td>:</td><td colspan="3">0 Hours</td></tr>
<tr><td>Total Contact Hours</td><td>:</td><td colspan="3">40 (40 Teaching Hours + 00 Tutorial Hours)</td></tr>
<tr><td colspan="5">Course Outcomes:
After completing the course the student will be able to:
1. Comprehend the fundamentals of IoT.
2. Identify the challenges driving the architectures of IoT systems.
3. Identify design limitations and the role of IoT networks.
4. Analyze the data generated with IoT devices.
5. Use appropriate physical IoT devices to implement an application.
6. Design solutions to open ended problems using IoT.</td></tr>
<tr><td colspan="2">UNIT –I</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="3">Introduction to IoT: What is IoT? Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoTNetwork Architecture and Design: Drivers Behind New Network Architectures, Comparing IoTArchitectures, ASimplifiedIoTArchitecture,TheCoreIoTFunctionalStack,IoT Data Management and Compute Stack.</td><td>10</td><td>00</td></tr>
<tr><td colspan="2">UNIT –II</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="3">Smart Objects: The “Things” in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks,Connecting Smart Objects: Communications Criteria, IoT Access Technologies: Salient features ofprotocolstacksutilizingIEEE 802.15.4(Intd.): Zigbee Protocol, LoRaWAN</td><td>10</td><td>00</td></tr>
<tr><td colspan="2">UNIT -III</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="3">IP as the IoT Network Layer: The Business Case for IP, the need for Optimization, Optimizing IP for IoT, Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods: CoAP, MQTT
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.</td><td>10</td><td>00</td></tr>
<tr><td colspan="2">UNIT -IV</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="3">Securing IoT: A Brief History of OT Security, Common Challenges in OT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVEandFAIR, The Phased Application of Security in an Operational Environment. IoT Physical Devices and Endpoints-Arduino UNO: Introduction to Arduino, Installing Software, Fundamentals of Arduino Programming, Example Modules on Arduino: Blinking an LED, Toggle the state of LED using Switch, Traffic light simulation for pedestrians, Interfacing Sensors to the Arduino: Temperature Sensor, Light Sensor, Ultrasonic Sensor, Interfacing Displays to Arduino: 7 Segment Display.</td><td>10</td><td>00</td></tr>
<tr><td colspan="5">Text Book(s):</td></tr>
</table>

1) DavidHanes,GonzaloSalgueiro,PatrickGrossetete,RobertBarton,JeromeHenry,"IoTFundamentals:Networking Technologies, Protocols, and Use Cases for the Internet of Things", Edition, Pearson Education(CiscoPressIndian Reprint). (ISBN:978- 9386873743) 2) SrinivasaKG,"InternetofThings",CENGAGELeaningIndia,2017
Reference Books:
1. VijayMadisettiandArshdeepBahga,"InternetofThings(AHands-on- Approach)", 1st Edition, VPT, 2014. (ISBN:978-8173719547) 2. RajKamal,"InternetofThings:ArchitectureandDesignPrinciples",1stEdition,McGrawHillEducation,2017.(ISBN:978-9352605224)

Subject Title	**:**	**Big Data and Analytics**
Subject Code	**:**	**UIS038E**
Semester	**:**	**7**
Credits with LTP Structure	**:**	**3 Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**3 Hours**
Tutorial Hours per Week	**:**	**0 Hours**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

Course Outcomes:

After completing the course the student will be able to:

1. Analyze the characteristics of digital data and it's challenges in Big data environment.
2. Analyze the challenges of big data analytics and its terminalogies that prevent businesses from capitalizing.
3. Build meaningful conversations on Big Data and analytics using Hadoop.
4. Identify suitable types of NoSQL databases to solve complex engineering problems.
5. Apply Hive and Pig tools on structured data for processinng and analyzing.

UNIT –I	10 Hours	Teaching Hours	Tutorial Hours
Types of Digital Data: Classification of Digital Data – Structured Data, Semi-Structured Data, and Unstructured Data. **Introduction to Big Data:** Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, What is 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 Data Warehouse Environment, A Typical Hadoop Environment, What is New Today? 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, Greatest Challenges that Prevent Businesses from Capitalizing on Big Data, Top Challenges Facing Big Data, Why is Big Data Analytics Important? What Kind of Technologies are we looking Toward to Help 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.		**10**	**00**
UNIT –II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Big Data Technology Landscape - NoSQL (Not Only SQL) and Hadoop. **NoSQL (Not Only SQL)** - 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. Introducing Hadoop, Why Hadoop? Why not RDBMS?, RDBMS versus Hadoop, Distributed Computing Challenges, History of Hadoop, Hadoop Overview, Use Case of Hadoop, Hadoop Distributors, HDFS (Hadoop Distributed		**10**	**00**

<table>
<tr><td colspan="2">File System), Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator), Interacting with Hadoop Ecosystem.</td><td></td><td></td></tr>
<tr><td>UNIT -III</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="2">Introduction to MongoDB: What is MongoDB? Why MongoDB?, Terms Used in RDBMS and MongoDB, Data Types in MongoDB, MongoDB Query Language.- Insert, Save, Update, Remove, find methods, Dealing with NULL values, Count, Limit, Sort and Skip Methods
Introduction to Cassandra: An Introduction, Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections..</td><td>10</td><td>00</td></tr>
<tr><td>UNIT -IV</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="2">Hive: What is Hive?, Hive Architecture, Hive Data Types, Hive File Formats, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function (UDF).
Introduction to Pig: What is Pig?, 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, Relational Operators, Eval Function, Complex Data Types.</td><td>10</td><td>00</td></tr>
<tr><td colspan="4">Text Book(s):</td></tr>
<tr><td colspan="4">1. Seema. Acharya and Subhashini. C, “Big Data and Analytics”, 1^{st} Edition, Wiley India, 2015 (Chapters 1,2,3,4,5,6,7,9,10).</td></tr>
<tr><td colspan="4">Reference Books:</td></tr>
<tr><td colspan="4">1. Bart. Baesens, “Analytics in a Big Data World: The Essential Guide to Data Science and its Applications”, 1^{st} Edition, Wiley, 2014.
2. DT Editorial Services, “Big Data: Black Book, Comprehensive Problem Solver”, 1^{st} Edition, Dreamtech Press, 2016.
3. Tom. White, “Hadoop – The Definitive Guide”, 3^{rd} Edition, O’Reilly, 2012.
4. Alex Holmes, “Hadoop in Practice”, 2^{nd} Edition, Dreamtech Press India Pvt. Ltd, 2014.
5. Dayong. Du, “Apache Hive Essentials”, 2^{nd} Edition, Packt Publishing Limited, 2018.
6. Alan. Gates, “Programming Pig”, 2^{nd} Edition, Shroff/O’Reilly, 2016.
7. Alan. Gates, “Programming Pig: Dataflow Scripting with Hadoop”, 2^{nd} Edition, Shroff/O’Reilly, 2016.</td></tr>
</table>

UIS049E: CYBER SECURITY
3-0-0(L-T-P)

Credits	**:**	**03**	**Semester**	**:**	**07**
Total Teaching Hours	**:**	**40**	**No. of Lecture Hrs/Week**	**:**	**03**
Total Tutorial Hours	**:**	**00**	**No. Tutorial Hrs/Week**	:	**00**
SEE Marks	**:**	**50**	**CIE Marks**	:	**50**
Total Contact Hours	:	**50 (50L + 0T)**	**Exam Hours**	**:**	**03**
Prerequisite	:	There are no prerequisites for this course. However, a fundamental knowledge in computers is desirable to understand the terminology and concepts better.			
Course Objectives	**:**	1. To understand various types of cyber-attacks and cyber-crimes 2. To learn threats and risks within context of the cyber security 3. To have an overview of the cyber laws & concepts of cyber forensics 4. To study the defensive techniques against these attacks			

Unit –I	**10 Lecture + 00 Tutorials**

Introduction to Cyber Security: Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy. **Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

Unit –II	**10 Lecture + 00 Tutorials**

Cyber forensics: Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Organizational security Policies and Measures in Mobile Computing Era, Laptops.

Unit –III	**10 Lecture + 00 Tutorials**

Cyber Security: Organizational Implications: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations.

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Datalinking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc

Unit-IV	**10 Lecture + 00 Tutorials**

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Datalinking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains-medical, financial, etc

Cybercrime: Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. **Mini-Cases:** The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Book	**:**	1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes,Computer Forensics and Legal Perspectives,Wiley

		2. B.B.Gupta, D.P.Agrawal, HaoxiangWang, Computerand CyberSecurity: Principle s, Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335,2018
Reference Book(s)	**:**	1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRCPress. 2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&FGroup.

Subject Title	:	**Data Mining**
Subject code	:	**UIS430N**
Semester	:	**7**
Credits with LTP Structure	:	**3 Credits (4L-0P-0T)**
Lecture Hours per Week	:	**3 Hours**
Tutorial Hours per Week	:	**00**
Total Contact Hours	:	**40 (40 Teaching Hours + 00 Tutorial Hours)**
Pre-requisites:	:	**Nil**
Who can register	:	**Students from Any discipline**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Introduction to data mining: Definition of Data Mining, Motivating Challenges of DM, Data Mining Tasks. Data Preprocessing: Data Attributes, Types of Data, Quality of Data and Data Preprocessing, Measures of Similarity and Dissimilarity.		10	0
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Association Analysis: Definition of Association Analysis, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets. FP Growth Algorithms, Evaluation of Association Patterns		10	0
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Classification: Preliminaries, Decision Tree Based Classifier, Nearest Neighbor Classifier. Cluster Analysis: Overview, K-means, DBSCAN		10	0
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Applications: Data Mining Applications, Web Mining, Search Engines		10	0

Text Books:

1. "Introduction to Data Mining with Case Studies", G K Gupta, 3rd Edition, PHI. (Chapter 1,2,3,4,5, 6)

Reference Books:

1. Data Mining – Concepts and Techniques", Jiawei Han and Micheline Kamber, Morgan Kaufman, 2006, 2nd Edition.
2. "Introduction to Data Mining", Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.

Subject Title	**:**	**Management and Entrepreneurship**
Subject code	**:**	**UIS801H**
Semester	**:**	**8**
Credits with LTP Structure	**:**	**Credits (3L-0T-0P)**
Lecture Hours per Week	**:**	**03**
Tutorial Hours per Week	**:**	**0**
Total Contact Hours	**:**	**40 (40 Teaching Hours + 00 Tutorial Hours)**

UNIT - I	**10 Hours**	**Teaching Hours**	**Tutorial 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, Management and Society, Social Responsibility and Ethics **Planning:** Nature, importance and purpose of planning process objectives - Types of plans (meaning only), Strategies, Policies and Planning Premises, The strategic Planning Process, Effective Implementation of Strategies, Decision Making, Limitations of Rational Decision making, Types of Decision Making		**10**	**00**
UNIT - II	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Organizing: The Nature and Purpose of Organizing, Formal and Informal Organization, Organizational Division - The Department, Departmantation, Organization Levels and span of management, Authority and Power, Decentralization of Authority, Delegation of Authority, Centralization Vs decentralization of authority, Promoting an appropriate Organization Culture **Staffing:** Nature and importance of Staffing , Recruitment, Selection, Performance Appraisal and Career Strategy, Manager Development Process and Training		**10**	**00**
UNIT - III	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Directing: Communication: Communication in the Enterprise, Barriers and Breakdown to Communication, Towards Effective Communication, Leadership: Human Factors in Managing, Motivation, Theories, Motivational Techniques, Ingredients of Leadership, Leadership styles based on authority. **Controlling:** Process of Controlling, Control as a feedback system, Feed Forward Control, Essentials of a sound control system		**10**	**00**
UNIT - IV	**10 Hours**	**Teaching Hours**	**Tutorial Hours**
Entrepreneurship: Entrepreneur: Meaning of Entrepreneur, Entrepreneur and Intrapreneur, Functions of an Entrepreneur, Types of Entrepreneur, Stages in entrepreneurial process, Role of entrepreneurs in Economic Development, Entrepreneurship in India, Entrepreneurship - its Barriers. **Preparation of project:** Meaning of Project and, Project Identification/Project Selection, Project Report: Contents and Formulation **Small Scale Industries (SSI):** Definition, Characteristics, Objectives, Scope, role of SSI in Economic Development. Institutional support: Different Schemes-		**10**	**00**

TECKSOK, KIADB, DIC Single Window Agency, KSFC.		
Text Book:		
1. Principles of Management – P. C. Tripathi, P.N. Reddy – Tata McGraw Hill. 2. Entrepreneurship Development -Small Business Enterprises - Poornima M Charantimath Pearson Education – 2006.		
Reference Books:		
1. Dynamics of Entrepreneurial Development & Management-Vasant Desai, Himalaya Publishing House. 3. Managing engineering and Technology-Daniel L. Babcock and Lucy C. Moorse, Third edition, Prentice Hall of India Private Limited, 2005, New Delhi 4. Management - Stephen Robbins, Pearson Education/PHI - 17thEdition, 2003		

<table>
<tr><td>Subject Title</td><td>:</td><td colspan="4">NOSQL</td></tr>
<tr><td>Subject Code</td><td>:</td><td colspan="4">UIS802C</td></tr>
<tr><td>Semester</td><td>:</td><td colspan="4">8</td></tr>
<tr><td>Credits with LTP Structure</td><td>:</td><td colspan="4">3 Credits (3L-0T-0P)</td></tr>
<tr><td>Lecture Hours per Week</td><td>:</td><td colspan="4">3 Hours</td></tr>
<tr><td>Tutorial Hours per Week</td><td>:</td><td colspan="4">0 Hours</td></tr>
<tr><td>Total Contact Hours</td><td>:</td><td colspan="4">40 (40 Teaching Hours + 00 Tutorial Hours)</td></tr>
<tr><td colspan="6">Course Outcomes:
After completing the course the student will be able to:
1. Explain and compare different types of NoSQL Databases.
2. Compare and contrast RDBMS with different NoSQL databases.
3. Demonstrate the detailed architecture and performance tune of Document-oriented NoSQL databases.
4. Explain performance tune of Key-Value Pair NoSQL Databases.
5. Apply NoSQL development tools on different types of NoSQL Databases.</td></tr>
<tr><td colspan="3">UNIT –I</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="4">What is NoSQL? Where is it used? What is it? Features of NoSQL. Types of NoSQL Databases. Why NoSQL? Advantages of NoSQL. The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedence Mismatch, Application and Integration Databases, Attack of the Cluster, The Emergence of NoSQL, Comparison of relational databases to NoSQL , Application, RDBMS approach, Challenges.</td><td>10</td><td>00</td></tr>
<tr><td colspan="3">UNIT –II</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="4">NoSQL key/value databases using MongoDB, Document Databases, Document oriented Database features, Consistency, Transactions, Avalability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against varying Aggregate structure. MongoDB Query Language</td><td>10</td><td>00</td></tr>
<tr><td colspan="3">UNIT -III</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="4">Column-oriented NoSQL databases using Apache Cassandra, Column-Family Data store features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage. Cassaandra Query Language
Graph Databases. What is Graph Database. Features. Consistency, Transactions, Availability, Query Featur Dataes, Scaling. Suitable Use Cases.</td><td>10</td><td>00</td></tr>
<tr><td colspan="3">UNIT -IV</td><td>10 Hours</td><td>Teaching Hours</td><td>Tutorial Hours</td></tr>
<tr><td colspan="4">Schema Migrations:
Schema Changes, Schema Changes in RDMBS, Schema changes in a NoSQL Datastore, Polyglot Perstenence, Beyond NoSQL, Choosing Your Database</td><td>10</td><td>00</td></tr>
<tr><td colspan="6">Text Book(s):</td></tr>
</table>

1. Sadalage.P & Fowler, NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persitence, Wiley Publications, 1st Edition, 2019 2. Getting Started with NoSQL: Your Guide to the world and Technology of NoSQL- Gaurav Vaish, Packt Publishing
Reference Books:
1. Seema Acharya and Subhashini Chellappan – Big Data and Analytics, Wiley India Pvt Ltd 2. Dan Sullivan, "NoSQL For Mere Mortals", 1st Edition, Pearson Education India, 2015. (ISBN-13:978-9332557338) 3. Dan McCreary and Ann Kelly, "Making Sense of NoSQL: A Guide for Managers and the Rest of us", 1st Edition, Manning Publication/Dreamtech Press 2013. (ISBN-13:978-9351192022) 4. https://www.geeksforgeeks.org/introdution-to-nosql 5. https://www.javapoint.com/nosql-databa

B.V.V.SANGHA'S

BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE - 587103

DEPARTMENT OF MANAGEMENT STUDIES
MBA PROGRAMME

I & II YEAR SCHEME
AND
SYLLABUS 2023-25
(Students admitted to 2023-24 Academic year)

Credit Distribution | Scheme | Syllabus | Labs, Internship & Project | Societal Project

- •
- •
- •
- •
- •

CREDIT STRUCTURE
(For the students admitting to 2023-24 batch)

Type of course	Semester				Total credits
	1	2	3	4	
Core	23	26	03	03	55
Elective	-	-	16	16	32
Project	-	-	04	06	10
Internship	-	-	03	-	03
Societal Project	Mandatory Course without any Credits				
Total	23	26	26	25	100

Scheme of Teaching and Examination
(For the students admitting to 2023-24 batch)
MBA I Semester

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	SEE	Total
			L	T	P				
1	22PBA101C	Principles of Management and Organizational Behaviour	4	0	0	4	50	50	100
2	22PBA102C	Economics for Decision Making	4	0	0	4	50	50	100
3	22PBA103C	Managerial Accounting	3	2	0	4	50	50	100
4	22PBA104C	Essentials of Marketing	4	0	0	4	50	50	100
5	22PBA105C	Corporate Communication	4	0	0	4	50	50	100
6	22PBA106C	Information Technology for Managers	3	0	0	3	50	50	100
		Total	**22**	**2**	**0**	**23**	**300**	**300**	**600**

Scheme of Teaching and Examination
(For the students admitting to 2023-24 batch)
MBA II Semester

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	SEE	Total
			L	T	P				
1	22PBA201C	Quantitative Techniques for Managers	3	2	0	4	50	50	100
2	22PBA202C	Business and Legal Environment	3	0	0	3	50	50	100
3	22PBA203C	Human Resource Management	4	0	0	4	50	50	100
4	22PBA204C	Research Methodology and IPR	4	0	0	4	50	50	100
5	22PBA210C	Entrepreneurship Development	4	0	0	4	50	50	100
6	22PBA206C	Financial Management	3	2	0	4	50	50	100
7	22PBA207L	Business Analytics Lab	0	0	3	1.5	50	50	100
8	22PBA208L	Presentation Lab	0	0	3	1.5	50	50	100
9	22PBA209M	Societal Project	Mandatory Course without any Credits						
		Total	**20**	**4**	**6**	**26**	**400**	**400**	**800**

MBA III Semester

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	*SEE	Total
			L	T	P				
1	22PBA301C	Essentials of Supply Chain Management	3	0	0	3	50	50	100
2		ELECTIVE-1 MKT/FIN/HR	4	0	0	4	50	50	100
3		ELECTIVE-2 MKT/FIN/HR	4	0	0	4	50	50	100
4		ELECTIVE-3 MKT/FIN/HR	4	0	0	4	50	50	100
5		ELECTIVE-4 MKT/FIN/HR	4	0	0	4	50	50	100
6	22PBA314P	Project Phase- I	0	0	8	4	50	50	100
7	22PBA316I	Internship*	-	-	-	3	50	50	100
		Total	**19**	**0**	**8**	**26**	**350**	**350**	**700**

* Tutorials for Finance Specialisation subjects only (Elective 1 and 2)

List of III Semester Electives

1. Marketing	
22PBA302E	Sales and Distribution Management
22PBA303E	Consumer Behaviour
22PBA304E	Services Marketing
22PBA305E	International Marketing Management
2. Finance	
22PBA306E	Investment Analysis and Portfolio Management
22PBA307E	International Financial Management
22PBA308E	Investment Banking and Financial Services
22PBA309E	Cost Management
22PBA306E	Investment Analysis and Portfolio Management

3. Human Resource Management	
22PBA310E	Organization Design , Change and Development
22PBA311E	Industrial Relations and Legislations
22PBA312E	Talent Management
22PBA313E	Learning and Development

MBA IV Semester

Sl.No	Subject Code	Subjects	Hrs/Week			C	CIE	*SEE	Total
			L	T	P				
1	22PBA401C	Strategic Management	3	0	0	3	50	50	100
2		ELECTIVE –5 MKT/FIN/HR	4	0	0	4	50	50	100
3		ELECTIVE –6 MKT/FIN/HR	4	0	0	4	50	50	100
4		ELECTIVE -7 MKT/FIN/HR	4	0	0	4	50	50	100
5		ELECTIVE -8 MKT/FIN/HR	4	0	0	4	50	50	100
6	22PBA414P	Project Phase- II	0	0	12	6	50	50	100
		Total	**19**	**0**	**12**	**25**	**300**	**300**	**600**

List of IV Semester Electives

1. Marketing	
22PBA402E	Business Marketing
22PBA403E	Integrated Marketing Communication
22PBA404E	Strategic Brand Management
22PBA405E	Digital Marketing
2. Finance	
22PBA406E	Financial Derivatives
22PBA407E	Tax Management
22PBA408E	Micro Finance
22PBA409E	Risk Management and Insurance

3. Human Resource Management	
22PBA410E	International Human Resource Management
22PBA411E	Recruitment and Compensation Management
22PBA412E	Personality Growth and Interpersonal Effectiveness
22PBA413E	Organizational Leadership

I-SEMESTER

22PBA101C	Principles of Management and Organizational Behaviour	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	12 Hrs.

Introduction: Meaning and nature of management. Purpose and functions. Contribution of management thinkers: Taylor, Henry Fayol, Elton Mayo. Social Responsibility of Managers, Ethics in managing, institutionalizing ethics. Current issues and future challenges in Management.

Planning: Steps in Planning Process –Importance and Limitations, types of plans -Management by Objectives (MBO). **Decision making**: Meaning, Techniques, process, modern approaches to decision making.

UNIT–II	12 Hrs.

Organizing: Organization Structure and Design: Formal and informal, Line and staff, functional, product, matrix, geographical, customer, virtual. Centralized and decentralized, Delegation of authority.

Leadership- Meaning, theories of leadership, Blake and Mouton managerial grid, Likert's four systems of management.

Motivation theories: X&Y, Maslow hierarchy, hygiene theory. **Controlling:** Nature, importance, process, techniques

UNIT–III	14 Hrs.

Fundamentals Organizational behaviour: Meaning, importance, Models of OB, contributing disciplines.

Personality: Meaning, determinants, traits, types-Big5, Type A&B, trait. **Perception-** Meaning, nature, process, Common shortcuts in judging people.

Values and attitude: Meaning, importance, sources of our value systems. Types of attitudes – cognitive dissonance theory, Job satisfaction, determinants, effect of job satisfaction on employee performance.

UNIT–IV	14 Hrs.

Group Dynamics and team building: Meaning and classifying groups, stages of group development, types of groups, importance of team building.

Emotions: Affect, mood and emotion and their significance, basic emotions, emotional intelligence, self-awareness, self-management, social awareness, relationship management.

Reference Books *

1. Harold Koontz, Heinz Weihrich, Essentials for Management: 8e, 2014.
2. Stephen Robbins, Sangi, Judge, Organizational Behavior, Pearson Education, 14e, 2012.
3. K. Shridhar Bhat, Management and Behavioral Processes, Himalaya Publications, 2e, 2017
4. Udai Pareek, Understanding Organizational Behaviour, Oxford.4e, 2011.

Course Outcomes**

After completion of the course student will be able to

1. Understand the fundamental concepts of management and organizational behavior.
2. Apply the management and organizational behaviorknowledge in various practical situations.
3. Analyze and evaluate the management and organizationalbehavior theories and practices.

4. Plan and implement various strategies related to management and organizational behavior.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7							
CO1	1	3	1	1	1	-	-							
CO2	3	3	2	-	2	-	-							
CO3	3	-	2	-	2	-	-							
CO4	2	-	2	-	2	-	-							

22PBA102C	ECONOMICS FOR DECISION MAKING	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	12 Hrs.

Introduction to economics: Managerial Economics- Meaning, Nature, Scope, & significance. Uses of Managerial Economics. Role and responsibilities of managerial economist. The Basic process of decision making.

Fundamental Concepts of Managerial Economics: Opportunity Costs, Incremental Principle, Time perspective, Discounting and Equi-Marginal principles. Theory of the Firm: Firm and Industry, Objectives of the firm, alternate objectives of firm. Managerial theories: Baumol's Model, Williamson's Model

UNIT–II	14 Hrs.

Demand analysis: Law of Demand, Exceptions to the Law of Demand, Elasticity of demand – Classification of Price, Income & Cross elasticity, Advertising and promotional elasticity of demand. Uses of elasticity of demand for Managerial decision making.

Law of supply: Elasticity of supply.

Demand forecasting: Meaning & Significance, Methods of demand forecasting. (Problems on Price elasticity of demand, and demand forecasting using Time-series method).

National income accounting: National income estimates in India- trends in national income– methods of measurement – income method, product method and expenditure method, – difficulties in measuring national income .

UNIT–III	14 Hrs.

Production analysis: Concepts, production function with one variable input - Law of Variable Proportions. Production functions with 2 variable inputs and Laws of returns to scale. ISO-Quants & ISO-Cost line. Economies of scale, Diseconomies of scale. (**Theory only**)

Measuring GDP and GDP Growth rate: Components of GDP.

Market structure and pricing practices:

Perfect competition: Features, Determination of price under perfect competition.

Monopoly: Features, Pricing under monopoly, Price Discrimination

Oligopoly: Features, Kinked demand Curve,

Monopolistic Competition: Features, Pricing Under monopolistic competition, Product differentiation

UNIT–IV	12 Hrs.

Descriptive Pricing Approaches: Loss leader pricing, Peak Load pricing. Price discrimination.

Profits: Determinants of Short-term & Long-term profits. Classification, measurement of profit.

Break Even Analysis –Meaning, Assumptions, determination of BEA, Limitations – Uses of BEA in Managerial decisions (Theory and simple Problems).

Reference Books *

1. Geethika, Ghosh & Choudhury, Managerial Economics, McGraw Hill 2/e, 2011.
2. Managerial Economics Dominick Salvotore, Oxford Publishers 2e, 2016
3. D M Mithani, Managerial Economics, Himalaya Publication. 2016
4. D N Dwivedi, Managerial Economics, Vikas Publication.9e, 2021.
5. Petersen H Craig, Lewis Chris W. and Jain K Sudhir, Managerial Economics, Pearson Education

Course Outcomes**
After completion of the course student will be able to 1. Describe, define, explain, or exhibit a fair understanding of the fundamental concepts related to business economics. 2. Apply or demonstrate the application knowledge of business economics in various practical/business situations. 3. Analyze, Evaluate and Appraise the various Business Economics theories, strategies& business situations of different businesses. 4. Develop or implement suitable business solutions (or strategies or models) for various business economics (functionalities/ products/ services/ entities etc.) of a business or organization

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	2	-	1	3	-	-	-								
CO2	3	-	2	2	-	-	-								
CO3	2	2	2	3	-	-	-								
CO4	2	1	1	2	-	-	-								

22PBA103C	MANAGERIAL ACCOUNTING	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	16 Hrs.
Principle of double entry book keeping: Importance & scope of accounting, GAAPS & accounting standards, accounting equation, Users of accounting statements. Ethics in preparation of accounts. Preparation of books of original records**:** Journal, ledger, and subsidiary books.	
UNIT–II	**16 Hrs.**
Preparation of final accounts/statement: sole trading concern and companies, Provisions of the companies act 1956 affecting preparation, presentation & analysis of Audit reports & director's reports.	
UNIT–III	**16 Hrs.**
Cash Flow Statement: Problems on Cash flow Statement Only. **Depreciation:** Concepts & methods of depreciation, Problems on straight line & WDV methods.	
UNIT–IV	**18 Hrs.**
Analysis of financial performance of a firm: Different tools, Ratio analysis- Different types of ratios, Inter-relation between Ratios, Du-Pont analysis, comparative and common size statements. Window dressing, Determination of EBDIT, EBIT, EDT, EAT, EPS, DPS, PE Ratio, ROCE, RONW, BV & Entity Value	

Reference Books *

1. Accounting for Management-Text & Cases S.K.Bhattacharya & John Dearden Vikas Publishing House Pvt. Ltd. 3e, 2018
2. Financial Accounting S.N.Maheshwari, Suneel K. Maheshwari, Sharad K. Maheshwari Vikas Publishing House Pvt. Ltd. 6e, 2018
3. Narayanaswamy. R, Financial Accounting - A Managerial Prespective, Prentice Hall India.5e, 2014.
4. Jawaharlal, (2017), Accounting For Managers, Himalaya Publishing House, 4^{th} e.
5. Raman. B.S.,(2010), Accounting for Managers, United Publishers,1^{st} e.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the concepts of accounting.
2. Apply or demonstrate the practical applications of accounting.
3. Analyze, Evaluate, appraise or justify various accounting statements or problems and suggest appropriate solutions.
4. Develop or implement or solve a variety of accounting problems, case studies and make inferences.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)	Program Specific

													Outcomes (PSOs)		
	1	2	3	4	5	6	7								
CO1	3	-	-	-	-	-	-								
CO2	3	2	-	-	-	-	-								
CO3	3	3	-	-	-	-	-								
CO4	3	3	-	2	-	-	-								

22PBA104C	ESSENTIALS OF MARKETING	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction: Nature and scope of Marketing, Evolution, Various Marketing orientations, Marketing Vs Selling concept, Consumer Need, Wants and Demand concepts. Marketing Mix. **Understanding the market environment:** Assess the impact of micro and macro environment. **Buyer behavior:** Meaning, Factors influencing buying behavior/ Buying motives, Buying habits, Types of buying behavior. Stages in buying decision process, Organizational buying Vs House hold buying, Consumerism.	
UNIT–II	**13 Hrs.**
Market Segmentation, Targeting & Positioning **Segmentation:** Meaning, Factors influencing segmentation, Basis for segmentation, Segmentation of Consumer/ Industrial markets. **Targeting:** Basis for identifying target customers, Target Market Strategies. **Positioning:** Meaning, Product differentiation strategies, Errors in positioning. **Marketing Mix Decisions** **Product decisions:** Concept, levels of product, product hierarchy, Diffusion of Innovation - diffusion process & adoption process, New product development, Product Life cycle, Product mix strategies. Concept of Branding, Brand equity. **Packaging / Labeling:** Packaging as a marketing tool, requirement of good packaging, Role of labeling in packaging.	
UNIT–III	**13 Hrs.**
Pricing decisions: Pricing concepts for establishing value, Impact of Five "C"s on pricing, Pricing strategies-Value based, Cost based, Market based, Competitor based, New product pricing. **Distribution decisions:** Meaning, Purpose, Channel alternatives available to the marketing manager, Factors affecting channel choice, Channel design and Channel Management decision, Multilevel Marketing (Network Marketing). **Integrated Marketing communication:** Concept of communication mix, communication objectives. **Advertising**: Advertising Objectives, Advertising Budget, AIDA model. **Sales Promotion:** Promotion mix, kinds of promotion, Tools and Techniques of sales promotion, Push-pull strategies of promotion. **Publicity /Public relation:** Meaning, Objective, Merits and Demerits.	
UNIT–IV	**13 Hrs.**
Personal selling: Concept, Features, Functions, Steps/process involved in Personal Selling. **Direct Marketing**: Meaning, Features, Functions, and Merits/Demerits. **Digital Marketing**: Meaning of Web marketing, social media marketing (Facebook & LinkedIn), Mobile marketing, and Email marketing. **Marketing Planning:** Meaning, Concepts of Marketing plan, Steps involved in planning. **Rural Marketing**: Meaning, scope of rural marketing, components of rural markets, rural vs. urban markets. **Trends in Marketing**: Guerrilla Marketing, Green Marketing,	

Neuro Marketing.
Reference Books *
1. Kotler Philip, Keller Lane Kevin,(2022), Principles of Marketing, Pearson, 16^{th} e. 2. Dr. Karunakaran, K., (2010), Marketing Management (Text & Cases in Indian Context), HPH. 3. Panda Tapan, Marketing Management, Excel Publication, 2^{nd}e. 4. ArunKumar and Meenakshi (2016), Marketing Management, Vikas Publishing 3e.
Course Outcomes**
After completion of the course student will be able to 1. Define, describe, explain, exhibit a fair understanding of the concepts related to marketing management 2. Apply or demonstrate the approaches, strategies and applications related to marketing management in various practical situations. 3. Analyze and evaluate the various situations, market conditions, and strategies related to marketing management. 4. Plan and implement suitable strategies related to marketing management

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**							
CO1	3	3	-	1	-	3	-							
CO2	3	2	-	1	-	2	-							
CO3	3	3	-	2	-	2	-							
CO4	3	3	-	3	-	2	-							

22PBA105C	CORPORATE COMMUNICATION	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.

Communication: Meaning & Definition, Role, Classification – Purpose of communication - Communication Process – Characteristics of successful communication.
Importance of Communication in management– Communication structure in organization – Communication in conflict resolution - Communication in crisis. Communication and negotiation, Communication in a cross-cultural setting.
Oral communication: Meaning, Principles of successful oral communication – Barriers to communication – Conversation control. Modes of Oral Communication. Nonverbal communication.

UNIT–II	13 Hrs.

Written Communication: Purpose of writing – Clarity in writing – Principles of effective writing – Approaching the writing process systematically: The 3X3 writing process for business communication: Pre writing – Writing – Revising – Specific writing features electronic writing process, email writing.
Business Letters and Reports: Introduction to business letters – Types of Business Letters – Format and components. Purpose, Kinds and Objectives of reports – Organization & Preparing reports, short and long reports
Writing business letters – Positive and Negative messages Writing Reports, Writing memos.
Group Communication: Meetings – Planning meetings – objectives – participants – timing –venue of meetings.
Meeting Documentation Preparations: Notice, Agenda, and Resolution & Minutes

UNIT–III	13 Hrs.

Presentation skills: What is a presentation – Elements of presentation – Designing & Delivering Business presentation advanced visual support for manager.
Negotiation skills: What is negotiation – Nature and need for negotiation – Factors affecting negotiation – Stages of negotiation process – Negotiation strategies.

UNIT–IV	13 Hrs.

Employment Communication: Introduction, Composing Application - Writing CVs, video resumes. Writing applications, resumes.
Group discussions, purpose of conducting GD, do's and don'ts in GD. – Interview skills, different types of interviews.
Technological Advancement on Business Communication – Technology-enabled Communication - Communication networks – Intranet – Internet –– SMS – telephone etiquettes, Teleconferencing, videoconferencing , telephone etiquettes

Reference Books *

1. Communicating in Business Ober Newman Cengage 8 th Edition, 2018
2. Chaturvedi P. D, and Chaturvedi Mukesh (2011), Business Communication: Concepts, Cases and Applications, Pearson Education, 2nd e.
3. BCOM A South-Asian Perspective Lehman, Dufrene,Sinha Cengage Learning 2 nd Edition, 2012

4. Communicating in Business Williams,Krizan Logan,Merrier Cengage Learning 8 th Edition, 2017
5. Lesikar, Flatley, Rentz, and Pande,(2010), Business Communication, TMH, 11the
6. Sehgal M. K and Khetrapal V, Business Communication, Excel Books.
7. Krizan, Merrier, and Jones,(2012),Business Communication, Cengage Learning, 8the,

Course Outcomes**

After completion of the course student will be able to

1. Explain fundamentals of written and oral communication
2. Apply the knowledge of business letters, reports, notice, agenda, resume and other business documents in practical situations.
3. Analyze importance of proper communication skills at business situations.
4. Demonstrate communication skills of listening and writing through written assignments, business letters and in class exercises and plan and design an effective presentation by focusing on presentation skills, audience analysis and focusing on contents.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	3	-	3	1	-										
CO2	3	-	2	3	2										
CO3	3	-	2	1	1										
CO4	3	-	2	1	2										

22PBA106C	INFORMATION TECHNOLOGY FOR MANAGERS	Credits: 03
L: T: P - 3_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 03 Total (40)		SEE Marks: 50

UNIT-I	10 Hrs.
Information systems and organizations: Meaning of information technology, Information technology in business, Concept of MIS, Definition, Functions, Role. Changing business environment and the emerging digital firms, Organizations, management and IT, Data, information and its attributes, types of decisions and information, the levels of people and their information needs. Kinds of information systems: Transaction Processing System (TPS) - Office Automation System (OAS) - Management Information System (MIS) - Decision Support System (DSS) and Group Decision Support System (GDSS) - Expert System (ES) - Executive Support System (EIS or ESS).	
UNIT–II	**10 Hrs.**
Computer fundamentals, telecommunication and networks: Computer System – Introduction - Generation of Computers - Classification of Computers - Input and output devices - Software – System s/w and Application s/w - O/S – Functions and Features. Communication, Media, Modems & Channels - LAN, MAN & WAN -Network Topologies, Internet, Intranet and Extranet. Wireless technologies like Wi-Fi, Bluetooth, Wi-Max, 3G and 4G. **System analysis and development and models:** Need for System Analysis - Stages in System Analysis - Structured SAD and tools like DFD, Context Diagram Decision Table and Structured Diagram. System Development Models: Water Flow, Prototype, Spiral, RAD – Roles and responsibilities of System Analyst, Database Administrator and Database Designer	
UNIT–III	**10 Hrs.**
Manufacturing and service systems: Information systems for Accounting, Finance, Production and Manufacturing, Marketing and HRM functions. **Enterprise system:** Enterprise Resources Planning (ERP): Features, selection criteria, merits, issues and challenges in Implementation – Supply Chain Management (SCM): Features, Modules in SCM – Customer Relationship Management (CRM): Phases. Knowledge Management and e-governance.	
UNIT–IV	**10 Hrs.**
Choice of IT: Nature of IT decision - Strategic decision - Configuration design and evaluation Information technology implementation plan. **Security and ethical challenges**: Ethical responsibilities of Business Professionals – Business, technology. **Computer crime** - Hacking, cyber theft, unauthorized use at work. Piracy – software and intellectual property. Privacy – issues and the Internet Privacy, Cyber Act. Challenges – working condition, individuals. Health and social issues, Ergonomics and cyber terrorism.	
Reference Books *	
1. “Management Information Systems”, Kenneth J Laudon, Jane P. Laudon, PHI, 13e, 2014	

2. “Management Information Systems”, W. S. Jawadekar, TataMcGraw Hill Edition, 4/e,2011
3. MIS by Ralph Stair, 13e, 2017
4. Introduction to Information System”, James A. O’ Brien, Tata McGraw Hill, 12th Edition.
5. “Management Information Systems”, S.Sadagopan, PHI, 2/e, 2014

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate awareness towards various fundamental concepts of information technology and highlight the role of information technology in business.
2. Apply the knowledge of information technology in various practical situations.
3. Analyze and evaluate the information technology situations of different businesses.
4. Plan and implement information system solutions for various functionalities of a business or organization.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	2	-	-	3											
CO2	3	2	-	-											
CO3	3	-	-	2											
CO4	2	-	-	2											

II-SEMESTER

22PBA201C	QUANTITATIVE TECHNIQUES FOR MANAGERS	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	16 Hrs.
Introduction to operations research: Introduction to OR; Scope, Techniques, Characteristics and Limitations of Operation Research; Methodology and Models in OR (only theory) **Linear programming problem (LPP):** Application of LPP in Management, Advantages of LPP (only theory) Formulation of LPP, Solution of LPP by Graphical method: Infeasible and Unbounded Solution, Formulation of Dual of a LPP (theory only)	
UNIT–II	**18 Hrs.**
Transportation models: General Structure; Various methods for finding initial solution: Maximization and Minimization problems North West Corner Method, Least Cost Method, Vogel's Approximation Method; Finding Optimal Solution: Stepping Stone method and Modified Distribution method-Problems **Assignment problems**; General Structure; Finding Optimal Solution; Maximization problem, Restrictions on Assignments, Alternate Optimal solutions.	
UNIT–III	**16 Hrs.**
Theory of games: Terminology; Two-person zero sum game; Solution to games: Saddle point, dominance rule, Value of the Game, mixed strategy, Graphical method of solving a game – (2x n) and (m x 2) games. **Replacement analysis:** Introduction, reasons for Replacement**,** Individual Replacement of machinery or Equipment with/without value of money, Group Replacement Policies, Problems.	
UNIT–IV	**16 Hrs.**
Network analysis: Terminology; Networking Concepts; Rules for drawing network diagram; CPM Computations: CPM Terminology, Finding critical path - Different Floats; PERT Computations: Computation of earliest and latest allowable times, Probability of meeting the scheduled dates; difference between PERT and CPM. **Queuing models and Simulation of management systems:** Introduction; Characteristics of Queuing models, Models for Arrival and Service Times; Single Poisson arrival with Exponential Service Rate; Applications of Queuing models. **Simulation of management systems** Terminology, Process of Simulation, Monte Carlo Method, Waiting Line Simulation Method, Inventory Management Simulation, Marketing Management Simulation, Financial Management Simulation	
Reference Books *	

1. Sharma. K. J, Operations Research, McMillan India, 5e, 2012
2. Vohra. D. N. (2017), Quantitative Techniques in Management, Tata McGraw Hill Publications, 5e.
3. Quantitative Methods for Business, Anderson Williams et-al. 13th edition, 2022
4. P.C Tulisian and Vishal Pandey, Quantitative Techniques theory and problems, Pearson,1e,

2022.
5. Sharma. D. S., Operations Research, KedarNath and Ram Nath& Co. Ltd, 2002
6. C. R. Kothari, (2013), Quantitative Techniques, Vikas Publishing House, 3rd e.

Course Outcomes**

After completion of the course student will be able to

1. Understand the concepts of operations research and the practical applications of it.
2. Solve a variety of mathematical models and make inferences from the solutions.
3. Appreciate the use of operation research techniques in taking effective business decisions.
4. Analyze the problems and apply algorithms to derive the optimal solution for standard LPP, transportation and assignment and sequencing so as to formulate real world problems into operations research models

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7							
CO1	3	3	-	1										
CO2	3	2	-	1										
CO3	3	2	-	3										
CO4	3	2	-	2										

22PBA202C	BUSINESS & LEGAL ENVIRONMENT	Credits: 03
L: T: P - 3_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 03 Total (40)		SEE Marks: 50

UNIT-I	10 Hrs.
Globalization, Liberalization & Privatization and Business Environment: Meaning and Implications, Phases, Impact on Indian Economy across Sectors. GATT and WTO: Agreements and Implications. **Global environmental issues:** Sustainable Development-Concepts, relevance in modern Business, World Business Council for Sustainable Development (WBCSD) Report. **Indian Economy and Business environment:** Structure of the Business Environment – Internal and External environment. Socio Cultural factors affecting the Business.	
UNIT–II	**10 Hrs.**
Small Scale industries: Growth, problems and prospects**. Large scale industries**: Growth, problems and prospects**.** Public and Private Sector Enterprises, **Macroeconomic policies in India:** Monetary policy, Credit control tools. **Business cycle**- Features, phases of Business environment **Foreign Exchange Regulation Act** (**FERA**), **Foreign Exchange Management Act (FEMA).**	
UNIT–III	**10 Hrs.**
Indian Contract Act: Offer and Acceptance, Performance and Discharge of contract, quasi contract, Contract of Guarantee, Bailment (rights and duties of bailor and bailee), **Agency** : Various modes of creating agency, rights and duties of agents and principal. **Law of Sales:** Sale of Goods Act: Sale and Agreement to sell, Conditions and Warrantees, Transfer of property **Law of partnership 1932:** Definition, Essentials of Partnership, Formation of Partnerships, Dissolution of Partnership Firm. **Company Law:** Salient Features of Companies, Classification and Formation of Companies, Memorandum and Articles of Association, Doctrine of Indoor Management, Appointment of Directors. Meetings of Directors. Shareholders of companies, overview of different modes of Winding up of Companies.	
UNIT–IV	**10 Hrs.**
Business Ethics: Relation between ethics and business ethics, evolution of business ethics, unethical behavior, ethical decision making, some unethical issues, benefits from managing ethics at workplace, **Corporate Social responsibility:** Types and nature of social responsibilities, CSR principles and strategies, Best practices of CSR, Need of CSR, Arguments for and against CSR, CSR Indian perspective, Indian examples.	
Reference Books *	

1. Misra. K. S, Puri K. V., Economic Environment of Business, HHP, Revised 2017.
2. Justin Paul, Business Environment Text and Cases, McGraw – Hill Publishers. Suresh Bedi,

Business Environment, Excel Books, 3e, 2010.

3. Business Law for Managers, Goel P. K,biztantra, 2014..
4. Business Law- S.S. Gulshan 4th E, 2012.
5. Business Law-Kuchal, 8e, 2023

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate, describe, explain the understanding of the fundamental concepts related to business environment
2. Apply the application knowledge of business environment & legal in various practical / business situations.
3. Analyze & evaluate the various business environment theories & business situations of different businesses.
4. Implement suitable business solutions (or strategies or models) for various business environments (functionalities/ products/ services/ entities etc.) of a business or organization.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**							
CO1	1	-	-	-	-									
CO2	3	-	-	-	2									
CO3	3	2	-	1	-									
CO4	-		2	3	-									

22PBA203C	HUMAN RESOURCE MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	12 Hrs.
Nature and scope of HRM and HRP: Introduction – definition, human resource management, features of HRM – role of HRM – managerial functions and operative functions. Role of personnel manager and HR manager – qualities of HR / personnel manager. HR planning (HRP) – Introduction – objectives of HRP – definition and need for HRP – benefits of HRP – factors affecting HRP – process.	
UNIT–II	**12 Hrs.**
Talent Acquisition –Recruitment definition – objectives –Factors affecting recruitment policy – Centralized and Decentralized – Recruitment techniques – Recruitment process, e-recruitment, and employee referrals. **Selection, Placement and Induction**: Meaning – definition of selection – essentials of selection procedure – significance of selection process and selection as a source of competitive advantage. selection procedure – recruitment application form – written exams – preliminary interview – various types of tests (aptitude, achievement, situational, interest, personality) – different types of interviews and interview process – means to make interview effective – medical exams – reference checks – final decision – employment – placement and induction. **Human Resource Training and Development:** Meaning of T & D importance of training – benefits of training – need and objectives, on-the-job and off-the-job training methods –– training procedure – final evaluation, - how to make training effective.	
UNIT–III	**14 Hrs.**
Performance appraisal (PAS): Introduction – meaning – need – purpose – objectives – contents of PAS – appraisers and different methods of appraisal – uses of performance appraisal – limitations and problems of performance appraisal – 360° Appraisal. **Payroll and Benefits** – Introduction – definition – need for sound salary administration – objectives – factors affecting wages / Types of incentive plans – profit sharing – bonus concepts – ESOPs – pay for performance, employee benefits-continuing education opportunities, flexi time, insurance schemes.	
UNIT–IV	**14 Hrs.**
Career planning and Internal mobility: Career planning – meaning – need, career development actions – promotion – meaning – purpose – bases of merit – seniority – merit cum seniority – benefits – problems. Promotion, Demotion – meaning – need for demotion policy. **Industrial Relations:** Overview of industrial relations. Industrial disputes, preventive and settlement machinery, Employee Grievance procedure. Collective bargaining-Introduction, importance. Industrial relations scenario: current issues and future challenges	
Reference Books *	
1. VSP Rao, Human Resource Management Text and Cases, Excel Books, 2016. 2. Gary Desler, Human Resource Management, Pearson, 15e, 2017.	

3. John M Ivancevich, Human Resource Management, TMH, 11e, 2017.
4. Michael Armstrong, a Hand Book of Human Resource Management, Kogan Page India Ltd.15e, 2020
5. Robbins, D’ Cenzo, Human Resource Management, John Wiley & Co.12e, 2020.

Course Outcomes**

After completion of the course student will be able to

1. Define, Describe, explain, or exhibit a fair understanding of the concepts related to human resource management.
2. Apply or demonstrate the application of concepts of human resource management knowledge in various practical/business situations.
3. Analyze, Evaluate, appraise the various human resource management theories situations. Justify the human resource management decisions or strategies of different businesses.
4. Implement suitable strategies related to human resource management.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	1	1	1	1											
CO2	3	2													
CO3	3	2													
CO4	2	2													

22PBA204C	RESEARCH METHODOLOGY AND IPR	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	14 Hrs.

Introduction to Business Research: Meaning, types, process of research- management problem, defining the research problem, formulating the research Hypothesis, developing the research proposals, research design formulation, sampling design, planning and collecting the data for research, data analysis and interpretation. Research Application in business decisions, Ethical issues in business research. Features of a good research study.

Business Research Design: Meaning, types and significance of research design, errors affecting research design.

Exploratory Research: Meaning, purpose, methods, Literature search, experience survey, focus groups and comprehensive case methods.

Conclusive Research Design: Descriptive Research, Meaning, Types, Cross sectional studies and longitudinal studies.

Experimental Research Design: Meaning and classification of experimental designs, formal and informal, Pre experimental design, True experimental design, Quasi-experimental design, Statistical experimental design.

UNIT–II	14 Hrs.

Sampling: Concepts, Types of Sampling, **Probability Sampling**: simple random sampling, systematic sampling, stratified random sampling, cluster sampling,

Non Probability Sampling: convenience sampling- judgmental sampling, snowball sampling, quota sampling, Errors in sampling**.**

Data Collection: Meaning, types, **Data collection methods**: Observations, survey and interview techniques, **Questionnaire design**: Meaning, process of designing questionnaire. Qualitative Techniques of data collection Secondary data Sources: advantages and disadvantages.

Measurement and Scaling Techniques: Basic measurement scales-Nominal scale, Ordinal scale, Interval scale, Ratio scale. Attitude measurement scale - Likert Scale, Semantic Differential Scale, Thurston scale, **Multi-Dimensional Scaling**: Non comparative scaling techniques.

UNIT–III	12 Hrs.

Data Analysis and Report Writing: Editing, Coding, Classification, Tabulation, Validation. Analysis and Interpretation, Report writing and presentation of results, Importance of report writing, types of research reports, Report structure, Guidelines for effective documentation.

UNIT–IV	12 Hrs.

Ethics: definition, moral philosophy, nature of moral judgements and reactions.

Intellectual Property Rights: Meaning and Concepts of Intellectual Property, Nature and Characteristics of Intellectual Property, Origin and Development of Intellectual Property, Kinds of Intellectual Property, Intellectual Property System in India, IPRs- Invention and Creativity- Intellectual Property-Importance and Protection of Intellectual Property Rights (IPRs)- **A brief summary of**: Patents, Copyrights, Trademarks, TRIPS and TRIMS , Industrial Designs- Integrated Circuits-

Geographical Indications-Establishment of WIPO- Application and Procedures.

Reference Books *

1. Research Methodology: C R Kothari, Viswa Prakasam Publication, 2014.
2. Business Research Methods: Donald R. Cooper & Pamela s Schindler, TMH/9e/2007
3. Business Research Methods : S. N. Murthy & U. Bhojanna, Excel Books, 3e, 2016
4. Research Methods: M M Munshi & K Gayathri Reddy, HPH, 2015.
5. Intellectual Property Rights. India, IN: Neeraj, P., & Khusdeep, D. (2014). PHI learning Private Limited.
6. David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012.
7. Intellectual Property Rights: Protection and Management. India, IN: Nithyananda, K V Cengage Learning India Private Limited, 2019.
8. Principles of Intellectual Property N.S. Gopalakrishnan & T.G. Ajitha, , Eastern Book Company, 2nd Edition, 2014.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe, explain, exhibit a fair understanding of the concepts related to business research and IPR
2. Apply or demonstrate the research knowledge in various practical situations.
3. Analyze, Evaluate and interpret the data collected using statistical tools and charts.
4. Plan and implement various research designs, data collection tools and strategies to reach pertinent research objectives.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7							
CO1	1													
CO2	3													
CO3	2	3				2								
CO4	2	2				3	3							

22PBA210C	ENTREPRENEURSHIP DEVELOPMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 03 Total (52)		SEE Marks: 50

UNIT-I	11 Hrs.
Introduction to Entrepreneur: Meaning of entrepreneur - Evolution of the concept - Functions of an Entrepreneur - Types of Entrepreneur -Intrapreneur- an emerging class - Concept of Entrepreneurship -Entrepreneurial Culture - Stages in entrepreneurial process. **Creativity and Innovation**: The role of creativity – The innovation Process – Sources of New Ideas – Methods of Generating Ideas – Creative Problem Solving – Entrepreneurial Process	
UNIT–II	**15 Hrs.**
Business Planning Process: Meaning of business plan, Business plan process, Advantages of business planning, Marketing plan, Production/operations plan, Organization plan, financial plan, and final project report with feasibility study, preparing a model project report for starting a new venture. **Institutions Supporting entrepreneurs:** small industry financing developing countries, A brief overview of financial institutions in India, Central level and state level institutions, SIDBI, NABARD, IDBI, SIDCO, Indian Institute of Entrepreneurship, DIC, Single Window, Latest Industrial Policy of Government of India	
UNIT–III	**13 Hrs.**
Family Business: Importance of family business, Types, History, Responsibilities and rights of shareholders of a family business, Succession in family business, Pitfalls of the family business, strategies for improving the capability of family business, improving family business performance. **International Entrepreneurship Opportunities**: The nature of international entrepreneurship, Importance of international business to the firm, International versus domestic entrepreneurship, Stages of economic development, Entrepreneurship entry into international business, exporting, direct foreign investment, barriers to international trade	
UNIT–IV	**13 Hrs.**
Informal risk capital and venture capital: Informal risk capital market, venture capital, nature and overview, venture capital process, locating venture capitalists, approaching venture capitalists. **Social Entrepreneurship**: Social enterprise-need, types, characteristics and benefits of social enterprises-Social entrepreneurship, Rural entrepreneurship-need and problems of rural entrepreneurship, challenges and opportunities-Role of government.	
Reference Books *	

1. The Dynamics of Entrepreneurial Development and Management, Vasant Desai, Himalaya Publishing House, 2010.
2. Entrepreneurship, Donald F. Kuratko and Richard M. Hodgetts, South-Western, 2012.
3. Entrepreneurship Development, Gupta S.L., Arun Mittal, International Book House, 2012.
4. Management and Entrepreneurship Development, Sudha G. S, Indus Valley Publication, 2009

Course Outcomes**

After completion of the course student will be able to

1. Understand, remember and explain various concepts of Entrepreneurship.
2. Apply and relate the theoretical knowledge entrepreneurship.
3. Analyze and evaluate various business scenarios with the lens of entrepreneurship.
4. Plan and implement strategies of entrepreneurship in real time scenarios.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	1														
CO2		2													
CO3				1											
CO4					1										

22PBA206C	FINANCIAL MANAGEMENT	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	16Hrs.
Financial management: – Introduction to financial management, objectives of financial Management – profit maximization and wealth maximization. Changing role of finance Managers. Ethics in financial management. **Time value of money:** –Future value of single cash flow & annuity, present value of single cash flow, annuity & perpetuity. Capital recovery & loan amortization	
UNIT–II	**18 Hrs.**
Sources of long-term Financing: - Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture capital investing, Angel investing, private equity, Warrants and convertibles (Theory Only) **Cost of Capital:** Cost of capital – basic concepts. Cost of debenture capital, cost of preferential capital, cost of term loans, cost of equity capital (Dividend discounting and CAPM model). Cost of retained earnings. Determination of Weighted average cost of capital (WACC) and Marginal cost of capital.	
UNIT–III	**16 Hrs.**
Working capital management: – factors influencing working capital requirements. Current asset policy and current asset finance policy. Determination of operating cycle and cash cycle. Estimation of working capital requirements of a firm. **Capital structure and dividend decisions:** – Planning the capital structure. **Leverages** – Determination of operating leverage, financial leverage and total leverage	
UNIT–IV	**16 Hrs.**
Investment Decisions: – Investment evaluation techniques – Net present value, Internal rate of return, Modified internal rate of return, Profitability index, Payback period, discounted payback period, accounting rate of return. Estimation of cash flow for new project. **Dividend policy:** – Factors affecting the dividend policy – dividend policies- stable dividend, stable payout	

Reference Books *

1. Financial Management: Text, Problems & Cases M.Y. Khan & P.K. Jain, TMH,7/e, 2017
2. Financial Management: Theory and Practice, Prasanna Chandra, TMH, 10/e, 2019
3. Financial Management Dr. G. Nagarajan & Dr. Binoy Mathew, Jayvee Digital Publishing, 2/e, 2022
4. Financial Management, Prahlad Rathod, Babitha Thimmaiah and Harish Babu, HPH, 1/e, 2015.
5. Financial Management, I.M. Pandey, Vikas Publishing, 11/e

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the finance concepts
2. Apply or demonstrate the practical applications of finance concepts.
3. Analyze, Evaluate, appraise or justify financial statements or problems and suggest appropriate solutions to practical situations.

4. Implement or solve a variety of finance problems, case studies and make inferences

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**							
CO1	1	-	-	3										
CO2	3	1	-	-										
CO3	2	3	-	3										
CO4	2	2	-	-										

III-SEMESTER

22PBA301C	ESSENTIALS OF SUPPLY CHAIN MANAGEMENT	Credits: 03
L: T: P - 3_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 03 Total (40)		SEE Marks: 50

UNIT-I	10 Hrs.
Introduction to Supply Chain Management: Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing. **Designing the supply chain network:** Designing the distribution network – role of distribution – factors influencing distribution – design options – e-business and its impact – distribution networks in practice – network design in the supply chain – role of network – factors affecting the network design decisions – modeling for supply chain.	
UNIT–II	**10 Hrs.**
Designing and Planning Transportation Networks: Role of transportation - modes and their performance – transportation infrastructure and policies - design options and their trade-offs – Tailored transportation. **Sourcing and Pricing:** Sourcing – In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment, selection – design collaboration – procurement process – sourcing planning and analysis. **Pricing and revenue management** for multiple customers, perishable products, seasonal demand, bulk and spot contracts	
UNIT–III	**10 Hrs.**
Information Technology in the supply chain: IT Framework – customer relationship management – internal supply chain management – supplier relationship management –transaction management – future of IT. **Coordination in a Supply Chain:** Lack of supply chain coordination and the Bullwhip effect – obstacle to coordination – managerial levers – building partnerships and trust – continuous replenishment and vendor-managed inventories – collaborative planning, forecasting and replenishment.	
UNIT–IV	**10 Hrs.**
Recent issues in SCM: Role of computer/ IT in supply chain management, CRM Vs SCM, Benchmarking concept, features and implementation, outsourcing – basic concepts, value addition in SCM – concept of demand chain management. **Block chain Management:** Meaning, Structure Block, Decentralize. **Uses:** Crypto currency. Smart contacts. **Types:** Public block chain, Private block chain, Hybrid block chain.	
Reference Books *	
1. A Logistic approach to Supply Chain Management, Coyle, Bardi, Longley, Cengage Learning, Latest edition. 2. Supply Chain Management- Strategy, Planning and Operation, Sunil Chopra, Peter Meindl, D.V.Kalr,	

Pearson 6th edition, 2015.

3. Supply chain Logistics Management, Donald J Bowersox, Mc Graw Hill, 9th Edition.
4. Supply Chain Management by Janat Shah Pearson Publication 2e, 2016.
5. Wisner, Keong Leong and Keah-Choon Tan, Principles of Supply Chain Management A Balanced Approach, Thomson Press, 4th e, 2015.

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate, define, explain, the understanding of the fundamental concepts related to Supply chain management.
2. Apply the application knowledge of Supply chain management in various practical/business situations.
3. Analyze & evaluate the various Supply chain management theories & business situations of different businesses.
4. Develop and implement suitable business solutions (or strategies or models) for various Supply chain management (functionalities/ products/ services/ entities etc.) of a business or organization

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	3	1	-	2	-	-	-							
CO2	2	2	-	1	-	-	-							
CO3	2	1	-	3	-	-	-							
CO4	3	3	-	2	-	-	-							

MARKETING

22PBA302E	SALES AND DISTRIBUTION MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	15 Hrs.
Sales Management: Meaning, Evaluation, Importance, Personal Selling, Emerging Trends in Sales Management, elementary study of sales organizations, qualities and responsibilities of sales manager. Types of sales organizations. **Selling skills and selling strategies:** Selling and Business Styles, selling skills, situations, Buyer-Seller Dyads, selling process, sales presentation, Handling customer objections, Follow-up-action. **Theories of Selling**: " AIDAS" theory, " Right set of circumstances" theory, " Buying-formula" theory of selling and "Behavioural equation" theory.	
UNIT–II	**13 Hrs.**
Management of Sales Territory & Sales Quota: Sales territory, meaning, size, designing, sales quota, procedure for sales quota. Types of sales quota, Methods of setting sales Quota. Recruitment and selection of sales force, Training of sales force. **Sales force motivation and compensation:** Nature of motivation, Importance, Process and factors in the motivation, Compensation- Meaning, Types of compensation plans and evaluation of sales force by performance appraisal process	
UNIT–III	**12 Hrs.**
Distribution Management: Definition, Role, Types of Distribution Channels, Distribution channels for Industrial products, distribution channel for consumer goods, functions of intermediaries, logistics of distribution, distribution alternatives, choice of distribution system, distribution strategy, customer-driven distribution strategy, stages in designing a channel system, channel conflict and resolution. Five forms of motivation for channel members, selecting the channel, evaluating channels, instruments of control.	
UNIT–IV	**12 Hrs.**
Wholesaler: Characteristics, Categories of wholesalers, services to manufactures, services to retailers, services to consumers, strategic management of wholesalers. **Retail Management:** Introduction, meaning, Characteristics, Retail industry India, role of retailing Trends in Retailing, careers in Retailing. Types of Retail Formats. **Retail Pricing:** Factors affecting pricing, Retail pricing strategies, Retail promotion strategies, Retail sales promotion, publicity.	

Reference Books *

1. Sales & Distribution Management by Tapan K. Panda & Sunil Sahadev, 2019, Oxford University Press
2. Sales & Distribution Management by Hawldar, McGraw Hill Education Publications,3e, 2017.
3. Sales & Retail Management an Indian Perspective by Dr. S.L. Gupta, ,2020,
4. Salesmanship And Sales Management – P.K. Sahu & K.C. Raut,3/e,2003, Vikas Publishing House
5. Sales Management- Douglas J Dalrymple, William L Crowe- John Wiley & Co.
6. Retail Management by Rosemary Varley, Mohammed Rafiq- Palgrave Macmillan

Course Outcomes**
After completion of the course student will be able to 1. Define, describe, explain, exhibit a fair understanding of the concepts related to sales & distribution management 2. Apply or demonstrate the approaches, strategies and applications related to sales & distribution management. 3. Analyze and evaluate the various situations, market conditions, and strategies related to sales & distribution management. 4. Develop or implement suitable strategies related to sales & distribution management

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7						1	2	3
CO1	3	2	-	1	-	-	-								
CO2	3	3	-	1	-	-	-								
CO3	3	2	-	2	-	-	-								
CO4	3	3	-	3	-	-	-								

22PBA303E	CONSUMER BEHAVIOUR	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	12 Hrs.

Introduction to the study of Consumer Behavior: Meaning & Definition of CB, Difference between consumer & Customer, Development of the Marketing Concept, Implementing the Marketing Concept, Segmentation, Targeting, Positioning, The Marketing Mix, Marketing Ethics and Social Responsibility, Social and Societal Marketing Concepts,

Role of Research in understanding consumer behavior: Consumer Research: Consumer Research Paradigms (Qualitative & Quantitative Research Methods, Combining Qualitative and Quantitative Research Findings), The consumer research process, Input-Process-Output Model of Consumer Behavior - Internal & External Influences.

Levels of Consumer Decision Making - Complex Decision Making or Extensive Problem Solving Model, Low Involvement Decision Making or Limited Problem Solving Model, Routinised Response Behavior, Four views of consumer decision making.

Situational Influences- the Nature of Situational Influence, Situational Characteristics and consumption behavior.

UNIT–II	13 Hrs.

Individual Influences on Consumer Behavior:

A) Motivation: Basics of Motivation, Needs, Goals, Positive & Negative Motivation, Rational Vs Emotional motives, Motivation Process, Arousal of motives, Selection of goals, Motivation Theories and Marketing Strategy - Maslow’s Hierarchy of Needs, Critical evaluation of marketing hierarchy and marketing applications, Trio of Needs, McGuire’s Psychological Motives, Discovering Purchase Motives, Marketing Strategies Based on Multiple Motives, Marketing Strategies Based on Motivational Conflict Frustration & Strategies to overcome frustration

B) Personality: Basics of Personality, Theories of Personality and Marketing Strategy (Freudian Theory, Neo-Freudian Theory, Trait Theory), Applications of Personality concepts in Marketing, Personality and understanding consumer diversity, Brand Personality, Self and Self-Image.

C) Perception:

Basics of Perception & Marketing implications, Elements of Perception, Dynamics of Perception, Consumer Imagery, Product positioning and repositioning, Positioning of services, perceived price, perceived quality, price/quality relationship, retail store image, manufacturer’s image, Perceived Risk, Types of perceived risk, How consumers’ handle risk

Individual Influences on Consumer Behavior:

A) Learning

Elements of Consumer Learning, Marketing Applications of Behavioral Learning Theories, Classical Conditioning (Pavlovian Model, Neo-Pavlovian Model), Nicosia Model, Sociological Model, Strategic Marketing Applications of Classical Conditioning, Instrumental Conditioning, Strategic Marketing Applications of Instrumental Conditioning, Modeling or Observational Learning, Marketing Applications of Cognitive Learning Theory, Information Processing, Involvement Theory, Measures of Consumer Learning.

B) Attitude

Basics of attitude, The nature of attitude, Structural models of attitude and Marketing Implications, Attitude change strategies, Attitude change based on the tri-component model(Changing the Cognitive Component, Changing the Affective Component, Changing the Behavioral Component), Other attitude change strategies.

C) Persuasive Communication

Communications strategy, Media Strategy, Message strategies, Message structure and presentation.

UNIT–III	13 Hrs.

External Influences on Consumer Behavior:

A) Social Class

Social Class Basics, Social class & Social status, the dynamics of status consumption, Features of Social Class, Five Social-Class Categories in India, Measurement of social class, Social Class Mobility, Geo demographic Clustering, Social Stratification, Factors responsible for social stratification

B) Culture and Subculture - Major Focus on Indian Perspective Culture: Basics, Meaning, Characteristics, Factors affecting culture, Role of customs, values and beliefs in Consumer Behaviour, The measurement of culture.

Subculture: Meaning, Subculture division and consumption pattern in India, Types of subcultures (Nationality subcultures, Religious subcultures, geographic and regional subcultures, racial subcultures, age subcultures, sex as a subculture)

Cross-cultural consumer analysis: Similarities and differences among people, the growing global middle class; Acculturation is a needed marketing viewpoint, applying research techniques

Cross-cultural marketing strategy: Cross-cultural marketing problems in India, Deciding on strategies to overcome cross-cultural problems

External Influences on Consumer Behaviour: Family, Reference Groups,

Groups: Meaning and Nature of Groups, Types

Family: The changing structure of family, Family decision making and consumption related roles, Key family consumption roles, Dynamics of husband-wife decision making, The expanding role of children in family decision making, The family life cycle & marketing strategy, Traditional family life cycle & marketing implications, **Reference Groups:** Understanding the power & benefits of reference groups, A broadened perspective on reference groups, Factors that affect reference group influence, Types of reference groups (Friendship groups, Shopping groups, Work groups, Virtual groups, Consumer-action groups), Reference group appeals (Celebrities, the expert, the common man, the executive and employee spokesperson, Trade or spokes-characters, Other reference group appeals).

UNIT–IV	14 Hrs.

Consumer Influence and Diffusion of Innovations:

Opinion Leadership: Dynamics of opinion leadership process, Motivation behind opinion leaders (The needs of opinion leaders and opinion receivers, Purchase Pals, Surrogate buyers vs. opinion leaders), Market Mavens, Opinion Leadership & Marketing Strategy, Creation of Opinion Leaders

Diffusion of Innovations: Diffusion Process (Innovation, Communication channels, Social System, Time)

Adoption Process: Stages, categories of adopters

Post Purchase Processes: Post Purchase Processes, Customer Satisfaction, and customer commitment: Post purchase dissonance, Product use and non-use, Disposition, Product disposition and marketing strategy, Purchase evaluation and customer satisfaction, The evaluation process, Dissatisfaction responses, Marketing strategies and dissatisfied customers, Customer satisfaction, repeat purchases and customer commitment, Repeat purchasers, committed customers and profits, Repeat purchasers, committed customers and marketing strategy.

CRM & Online Decision Making

A) Customer Relationship Management

Meaning & Significance of CRM, Types of CRM (Operational, Collaborative, and Analytical), Strategies for building relationship marketing, CRM Process-Benefits, CRM process for marketing organizations, brand switching behavior, e-CRM, Meaning, Importance of e-CRM, Difference Between CRM & e- CRM

On-line Decision Making: Meaning & Steps (**Case Studies)**

Reference Books *

1. Consumer Behaviour, Schiffman Kanuk and S. Ramesh Kumar- Pearson, Latest Edition
2. Consumer Behaviour: A Managerial Perspective, Dr.Dheeraj Sharma, Jagdish N Sheth, Banwari Mittal, Cengage Learning, latest Edition
3. Consumer Behaviour, Sethna, Sage Publications, 4/e, 2018
4. Consumer Behaviour in Indian Perspective, Himalaya Publications-latest Edition.
5. Consumer Behavior, Blackwell and Engel, Cengage Publication, Indian Edition.
6. Indian Consumers S.C.Mehta – Tata McGraw Hill

Course Outcomes**

After completion of the course student will be able to

1. Explain the concepts and theories vital for understanding consumer behavior.
2. Understand the various factors which affect the behavior of the consumer in the field.
3. Analyze and interpret existing theories and models in consumer behavior field and identify their applications in the field.
4. Develop marketing strategies based on consumer behavior concepts.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	3	-	-	-	-	-	-							
CO2	2	-	-	2	-	-	-							
CO3	2	3	-	1	-	-	-							
CO4	2	3	-	3	-	-	-							

22PBA304E	SERVICES MARKETING	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to services: What are services, Why service marketing, Difference in goods and service in marketing, Concept of service marketing triangle, Service marketing mix, GAP models of service quality **Consumer behaviour in services:** Search, Experience and Credence property, Customer expectation of services, Two levels of expectation, Zone of tolerance, Factors influencing customer expectation of services **Customer perception of services-** Factors that influence customer perception of service, Service encounters, Customer satisfaction, Service quality, Strategies for influencing customer perception.	
UNIT–II	**13 Hrs.**
Understanding customer expectation through market research: Key reasons for Gap 1, Using marketing research to understand customer expectation, Types of service research, Building customer relationship through retention strategies, Market segmentation-Process & targeting in services, Service failure. Retention strategies- Monitoring relationship, 3 levels of retention strategies. **Customer defined service standards:** “Hard” & “Soft” standards, Process for developing customer defined standards. Key reasons for GAP 2- Service quality as profit strategy. **Service design and Positioning -** New service development – types, stages. Service blue print. Service positioning – positioning on the Five dimensions of service quality, Service Recovery.	
UNIT–III	**13 Hrs.**
Employee role in service designing: Importance of service employee, Boundary spanning roles, Source of conflict, Strategies for closing GAP 3 **Customers role in service delivery-** Importance of customer & customers role in service delivery, Strategies for enhancing- Customer participation, Delivery through intermediaries- Key intermediaries for service delivery, Intermediary control strategies. **Managing demand and capacity** – Lack of inventory capability, Understanding demand patterns, Strategies for matching capacity and demand, Waiting line strategies.	
UNIT–IV	**13 Hrs.**
Role of marketing communication – Key reasons for GAP 4 involving communication, Four categories of strategies to match service promises with delivery, Methodology to exceed customer expectation. **Pricing of services-** Price as an indicator of service quality Approaches to pricing services, pricing strategies. **Physical evidence in services:** Types of service scapes, Role of service scapes, Frame work for	

understanding service scapes & its effect on behaviour, Guidance for physical evidence strategies.
Reference Books *
1. Services Marketing, Valarie A Zeithmal & Mary Jo Bitner-TMH, 6/e,2018 2. Services Marketing, Christopher Lovelock, Pearson Education, 2014 3. Services Marketing, Rajendra Nargundkar- TMH,1/e,2004 4. Services Marketing, Parasuraman, Sage Publications 2018 5. Services Marketing, Kenneth E Clow & David L Kurtz, Biztantra, 2/e, 2007 6. Services Marketing, Govind Apte, Oxford, 2007 7. Handbook of Services Marketing & Management, Swartz & Iacobucci, Sage Publications, 2000 8. Services Marketing, Hoffman & Bateson, Thomson, 2009
Course Outcomes**
After completion of the course student will be able to 1. Define, describe, explain, exhibit a fair understanding of the concepts related to services marketing. 2. Apply or demonstrate the approaches, strategies and applications related to services marketing. 3. Analyse and evaluate the various situations, market conditions, and strategies related to services marketing. 4. Develop or implement suitable strategies related to services marketing..

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	3	2	-	-	-	-	-							
CO2	3	3	-	-	-	-	-							
CO3	3	2	-	-	-	-	-							
CO4	3	2	-	-	-	-	-							

22PBA305E	INTERNATIONAL MARKETING MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Framework of international marketing: Definition – scope and challenges – difference between international marketing and domestic marketing – the dynamic environment of international trade – transition from domestic to international markets – orientation of management and companies **Global e-marketing:** The Death of Distance, communications, Targeting the individual customers, relationship marketing, interactivity, Speed to market, living in an age of technical discontinuities, new technologies change the rules of competition, components of the electronic value chain. **Developing a global vision through marketing research:** Breadth and scope of international marketing research – problems in availability and use of secondary data – problems in gathering primary data – multicultural research – a special problem – research on internet – a new opportunity – estimating market demand – problems in analyzing and interpreting research information – responsibility for conducting marketing research – communicating with decision makers. Identifying foreign markets – classification based on demand – based on the stage of development – other bases for division of world markets **Social and Cultural Environment:** Basic aspects of society and culture, Approaches to cultural factors, Impact of Social and Cultural Environment on Marketing Industrial and Consumer Products	
UNIT–II	**13 Hrs.**
Global marketing management – planning and organization: Global perspective – global gateways – global marketing management – an old debate and a new view – planning for global markets – alternative market entry strategies – organizing for global competition **Products and services for consumers:** Quality – Green marketing and product development, products and culture – analyzing product components for adaptation– products for consumers in global markets, product development, product adaptation, product standardization, marketing consumer services globally – marketing of services, brands in international markets **Products and services for businesses** Demand in global business to business markets – quality and global standards – business services – trade shows' crucial part of business to business marketing – relationship markets in business to business context	
UNIT–III	**13 Hrs.**
Licensing, Strategic Alliances, FDI: Introduction, Licensing, Strategic Alliances, Manufacturing Subsidiaries, Entry Modes and Marketing Control, Optimal Entry Strategies. **Global Distribution:**	

Introduction, Distribution as Competitive advantage, Rationalizing Local Channels, Wholesaling, Retailing, Global Logistics, Parallel Distribution, Global Channel Design.

International retailing

International expansion of retailers – international retailing defined – retail format – variations in different markets – general merchandise: retailing – issues in international retailing.

Pricing decisions:

Global Pricing Framework, Pricing Basics, Marginal Cost Pricing and its importance, Transfer Pricing, Counter trade, Systems Pricing, Pricing and Positioning, price quotation – INCO terms – preparation of quotations.

Promotion Decisions

Promotions – international advertising – sales promotion in international markets – international advertising – direct mailing – personal selling – exhibition – generic promotions in international marketing.

UNIT–IV	13 Hrs.

Recent trends in India's foreign trade:

Institutional infrastructure for exports promotions in India – India's trade policy – exports assistance – exports documentation and procedures including different stages of documentation

Globalization in India, Opportunities, Constraints and Initiatives

India - A Hub for Globalization, Globalization in India - Post Liberalization, India's Strengths, Strategies for Sustainable Competitive Advantage, Potential for Made in India, Major Globalization Initiatives from Indian Companies, WTO Regulations and their implications for India, Undesirable effects of globalization, Government Initiatives needed to foster globalization

The future of global marketing: Six major changes in global marketing. **Case studies**

Reference Books *

1. International Marketing – Cateora, Graham – TMH 18/E, 2019
2. International Marketing – Varshney, Bhattacharya – S Chand, 2015.
3. International Marketing: Analysis And Strategy - Sak Onkvisit, Johnshaw – Biztantra, 4/e, 2007
4. International Marketing – Rakesh Mohan Joshi – Oxford, 2004 2/e, 2014.
5. International Marketing – R Srinivasan – PHI, 4/e, 2016.

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate awareness towards various fundamental concepts of International marketing.
2. Apply the knowledge of subject in various practical situations.
3. Analyze and evaluate the concepts for practical application in different businesses.
4. Plan and implement international marketing strategies for business or organization.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7						1	2	3
CO1	3	2	-	3	-	-	-								
CO2	3	3	-	3	-	-	-								

CO3	3	2	-	2	-	-	-								
CO4	3	2	-	1	-	-	-								

FINANCE

22PBA306E	INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT	Credits: 04
L: T: P - 3_L: 2_T: 5_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	16 Hrs.
Investment: concepts of Investment, Objectives of financial investment. Investment and speculation, Features Of a good investment, Investment Process, Various investment avenues – financial and non-financial forms of investment. Ethics followed in investment opportunities. **Securities Market:** Primary Market - Factors to be considered to enter the primary market, Modes of raising funds, listing of securities- merits & demerits, qualifications for listing. Secondary Market-Major Players in the secondary market, Functioning of Stock Exchanges, Stock Exchanges in India, Trading and Settlement Procedures at NSE & BSE. Stock Market Indicators-computation of stock index, Types of stock market Indices, and Indices of Indian Stock Exchanges.	
UNIT–II	**16 Hrs.**
Analysis & Valuation of Securities: Analysis of Debt Securities: Bond pricing theorems. Yield curve. Duration & immunization. Analysis of convertible bonds. Bond portfolio management. **Analysis of Equity Investments:** **Fundamental analysis**- EIC Frame Work, Economic analysis and forecasting, Industry Analysis. Company analysis –Financial Statement Analysis, Ratio Analysis & non-financial factors to be considered. Valuation of equity shares. Concept of intrinsic value Balance sheet based valuation. Dividend discount model. **Technical analysis** – basic concepts, Theories- Dow Theory, Eliot wave theory, contrary opinions theory. Charts-Types, Trends and Trend Reversal Patterns. Mathematical Indicators – Moving averages, ROC, RSI, and Moving Average Convergence & Divergence (MACD) etc	
UNIT–III	**16 Hrs.**
Behaviour of Stock Market Prices: Market efficiency – various forms of market efficiency. Testing the efficiency. Random walk hypothesis. Behavioral Finance – Interpretation, Biases and critiques. (Theory only) **Risk and Return Concepts:** Analysis of risk & return, concept of total risk, factors contributing to total risk, Types of Risk- Systematic risk, Unsystematic risk, Calculation of Risk and returns. Risk & risk aversion. Capital allocation between risky & risk free assets-Utility analysis. **Portfolio Management:** Diversification- Portfolio management process. **Portfolio Risk and Return:** Expected returns of a portfolio, Calculation of Portfolio Risk and Return, Portfolio with 2 assets, Portfolio with more than 2 assets	
UNIT–IV	**18 Hrs.**
Modern portfolio theory– Asset allocation decision, Dominant & Efficient portfolio – simple diversification, Markowitz Model -Portfolio Selection, Opportunity set, Efficient Frontier Beta Measurement and selecting an optimal portfolio–Sharpe Single Index Model, Determination of corner	

portfolio.
Capital Asset pricing model: Basic Assumptions, CAPM Equation, Security Market line, Extension of Capital Asset pricing Model - Capital market line, SML VS CML.
Arbitrage Pricing Theory: Arbitrage, Equation, Assumption, Equilibrium, APT and CAPM.
Portfolio Performance Evaluation:
Mutual Funds: different types, Exchange Traded Funds (ETF), Fixed Maturity Plans (FMP), Hedge Funds. Pros and
cons of investing in Mutual Funds (MF), Performance of Mutual Funds-NAV. Performance evaluation of Managed Portfolios- Treynor, Sharpe and Jensen Measures.
Portfolio Management Strategies: Active and Passive Portfolio Management strategy.
Portfolio Revision: – Formula Plans-Rupee Cost Averaging

Reference Books *

1. Investment Analysis and Portfolio management, Prasanna Chandra, Tata McGraw Hill, 3/e, 2010.
2. Security Analysis & Portfolio Management, S Kevin, Tata McGraw Hill, 2014.
3. Security Analysis & Portfolio Management, Punithavathy Pandian, Vikas Publications, 2/e, 2018.
4. Security Analysis & Portfolio Management – Fisher and Jordan, 6/e Pearson, PHI.
5. Investments –Zvi Bodie, Kane, Marcus & Mohanty, TMH, 8th Edition, 2010.
6. Investment management (Security Analysis and & Portfolio Management), Bhalla V.K., Vikas Publications, 19/e, 2018.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the fundamental concepts of investments
2. Apply or demonstrate the practical insight into functioning of stock markets.
3. Analyze accounting theories of portfolio management and also the tools and techniques for efficient portfolio management
4. Evaluate, appraise or justify various trends and patterns of stocks and develop or implement or solve performance of stocks and solve various problems of investment management.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	3	1	-	1	-	-	-							
CO2	3	2	-	1	-	-	-							
CO3	3	2	-	2	-	-	-							
CO4	3	-	-	3	-	-	-							

22PBA307E	INTERNATIONAL FINANCIAL MANAGEMENT	Credits: 04
L: T: P - 3_L: 2_T: 5_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	18 Hrs.
International financial Environment- The Importance, rewards & risk of international finance-Goals of MNC- International Business methods – Exposure to international risk- International Monetary system- Multilateral financial institution. Ethics in International financial management **International flow of funds and International Monetary system**: - International Flow of Funds: Balance of Payments (BOP), Fundamentals of BOP, Accounting components of BOP, Factors affecting International Trade and capital flows, Agencies that facilitate international flows. BOP, Equilibrium & Disequilibrium. Trade deficits. Capital account convertibility (problems on BOP) International Monetary System: Evolution, Gold Standard, Bretton Woods system, the flexible exchange rate regime, the current exchange rate arrangements, the Economic and Monetary Union (EMU).	
UNIT–II	**16 Hrs.**
Foreign Exchange Market: Function and Structure of the Forex markets, Foreign exchange market participants, Types of transactions and Settlements Dates, Exchange rate quotations, Nominal, Real and Effective exchange rates, Determination of Exchange rates in Spot markets. Exchange rates determinations in Forward markets. Exchange rate behavior-Cross Rates- - Arbitrage profit in foreign exchange markets, Swift Mechanism. Triangular and locational arbitrage. **International Financial Markets and Instruments**: - Foreign Portfolio Investment. International Bond & Equity market. GDR, ADR, Cross listing of shares Global registered shares. International Financial Instruments: Foreign Bonds & Eurobonds, Global Bonds. Floating rate Notes, Zero coupon Bonds, International Money Markets International Banking services –Correspondent Bank, Representative offices, Foreign Branches. Forward Rate Agreements	
UNIT–III	**16 Hrs.**
International Parity Relationships & Forecasting Foreign Exchange rate: - Measuring exchange rate movements-Exchange rate equilibrium – Factors effecting foreign exchange rate- Forecasting foreign exchange rates .Interest Rate Parity, Purchasing Power Parity & International Fisher effect. Covered Interest Arbitrage **Foreign Exchange exposure**: - Management of Transaction exposure- Management of Translation exposure- Management of Economic exposure- Management of political Exposure- Management of Interest rate exposure	
UNIT–IV	**16 Hrs.**
Foreign exchange risk Management: Hedging against foreign exchange exposure – Forward Market-Futures Market- Options Market- Currency Swaps-Interest Rate Swap-Hedging through currency of invoicing- Hedging through mixed currency invoicing –Country risk analysis. **International Capital Budgeting:** Concept, Evaluation of a project, Factors affecting, Risk Evaluation,	

Impact on Value, Adjusted Present Value Method.

Reference Books *

1. International Finance Management - Eun & Resnick, Tata McGraw Hill, 7/e,2014.
2. Multinational Business Finance – Eiteman, Moffett and Stonehill, 15/e, Pearson, 2020
3. International Financial Management – Siddaiah T, 3/e, Pearson, 2021.
4. International Finance – Imad Moosa, 3/e, Tata McGraw Hill, 2011.
5. International Finance – Shailaja G, 2/e, University Press, 2011.
6. International Financial Management – Apte P. G, 8/e, TMH, 2020.
7. International Finance – Maurice Levi, 5/e, Routledge, 2009.
8. International Financial Management – Jain, Peyrard & Yadav, Macmillan 2015.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit basic concepts of international financial management
2. Apply or demonstrate the practical problems on foreign exchange determination.
3. Analyze foreign exchange exposure measurement and management and analyze and evaluate risk and return in international foreign exchange.
4. Evaluate, appraise or justify the functioning of world financial markets and implement or solve the Swap arrangements and determine the costs and benefits of different Swaps.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	2	1	-	1	-	-	-								
CO2	3	2	-	1	-	-	-								
CO3	3	2	-	2	-	-	-								
CO4	3	1	-	3	-	-	-								

22PBA308E	INVESTMENT BANKING AND FINANCIAL SERVICES	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Investment Banking- Introduction-Functions of Investment Banks- Types of Investment Banks-Investment Banking Services- Merchant Banking Services-Issue Management-Pre issue and Post issue obligations-Changing landscape of Investment Banking Regulation of the Capital Market- SEBI regulations for merchant bankers, brokers and sub brokers, intermediaries and portfolio managers-SEBI issue and Listing of Debt securities Regulation 2008 **Depository System**: Objectives, activities, interacting systems, role of depositories and their services, Advantages of depository system -NSDL and CDSL. The process of clearing and settlement through Depositories, Depository Participants. Regulations relating to Depositories-SEBI (Depositories and Participants) Regulations 1996-Registration of depository and participant- Rights and Obligations of depositories and participants-Recent amendments Custodial services- The Stock Holding Corporation of India Limited.	
UNIT–II	**13 Hrs.**
Housing Finance: Role, Types of housing loans, Institutions and banks offering Housing Finance, Procedure and Interest rates. Income Tax Implication. Reverse mortgage loan **Non-Banking Finance Companies**: Types, Growth, Functions, RBI Guidelines, Prudential Norms. **Factoring**: Origin, Types, Factoring mechanism, advantages, factoring charges, International factoring, Factoring in India**(theory only)**. **Forfeiting:** Origin, characteristics, and benefits, difference between factoring and forfeiting, growth of forfeiting in India **Underwriting**: Concept – Devolvement - Business model - Underwriting in fixed price offers and book built offers	
UNIT–III	**13 Hrs.**
Microfinance: The paradigm - NGOs and SHGs - Microfinance delivery mechanisms – Future of micro finance **Leasing:** Concept, Steps in Leasing Transactions, Types of Lease, Legal frameworks, Advantages and disadvantages of Leasing, Contents of a Lease Agreement, Matters on Depreciation and Tax, Problems in leasing**(problems in case study only)**, Factors influencing Buy or Borrow or Lease Decision. **Hire Purchasing:** Concepts and features, Hire Purchase Agreement, Comparison of Hire Purchase with Credit sale, Instalment sale and Leasing. Banks and Hire Purchase. Problems related to outright purchase, Hire purchase and leasing **(Problems in Case Study Only)**.	
UNIT–IV	**13 Hrs.**
Venture Capital: Concept, features, Origin and the current Indian Scenario. Private equity-Investment banking perspectives in private equity **Credit rating**: Definition and meaning, Process of credit rating of financial instruments, Rating methodology, Rating agencies, Rating symbols of different companies. Rating agencies for SMEs	

Securitization of debt: Meaning, Features, Special Purpose Vehicle, Types of securitisable assets, Benefits of Securitization, Issues in Securitization.

Reference Books *

1. Investment Banking- Pratap G Subramanyam, Tata McGraw Hill, 2012.
2. Financial services - Khan M.Y, 10/e, McGraw Hill, 2019.
3. Indian Financial System – Machiraju, 4/e, Vikas, 2010
4. Indian Financial System—Khan M. Y, 11/e, TMH, 2019.
5. Dynamics of Financial Markets and Institutions in India Srivastava R. M, Excel Books,2010.
6. Banking and Financial Services, Dr. Mukund Sharma, HPH, 2nd edition, 2015

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate an understanding of Indian capital market and Investment Banking.
2. To know how financial services like factoring, venture capital, leasing, hire purchase and NBFCs are provided in the financial system.
3. Identify the developments happening in micro finance, credit rating and securitization system.
4. Analyze and evaluate a given relevant business context using basic knowledge of financial markets and financial services and solve problems on financial services like leasing and hire purchasing.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	3	1	-	2	-	-	-							
CO2	2	1	-	2	-	-	-							
CO3	2	1	-	3	-	-	-							
CO4	2	1	-	2	-	-	-							

22PBA309E	COST MANAGEMENT	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	18 Hrs.
Introduction to Cost Management- Cost Accounting to Cost Management- Elements of costs-Classification of costs-Methods of costing-Cost Management Tools- A Strategic View to Cost Management- Preparation of a cost sheet. **Overheads,** Classification and Collection, Difference between Cost Allocation and Cost Apportionment, (Full-fledged Problems on Primary and secondary distribution, Simultaneous equations, Absorption of Overhead, Theory on under and Over absorption of Overhead	
UNIT–II	**16 Hrs.**
Marginal Costing – Nature and Scope- Applications-Break even charts and Point, Decision Making (all types with full problems) Differential Cost Analysis, Advantages and Disadvantages of Marginal Costing. **Budgetary Control:-** Objectives of Budgetary control, Functional Budgets, Master Budgets, Key Factor Problems on Production Budgets and Flexible Budgets. **Standard Costing:-** Comparison with Budgetary control, analysis of Variances, Simple Problems on Material and Labour variances only .	
UNIT–III	**16 Hrs.**
Demerits of Traditional Costing, Activity Based Costing, Cost Drivers, Cost Analysis Under ABC (Unit level, Batch Level and Product Sustaining Activities), Benefits and weaknesses of ABC, Simple Problems under ABC. **Cost Audit**,-objectives,, Advantages, Areas and Scope of Cost Audit , Cost Audit in India -- Practical—Read the contents of the report of Cost Audit and the annexure to the Cost Audit report. Management Audit- Aims and the objectives, Scope of Management Audit.	
UNIT–IV	**16 Hrs.**
Reporting to Management – Purpose of reporting-Requisites of a good report,, Classifications of Report, Segment reporting, Applicability of Accounting Standard 17, Objectives, Users of Segment reporting. Cost Reduction, and Cost Control, Target Costing – its Principles, Balanced Scorecard as a performance measure- Features- Purpose, Reasons for use of Balanced scorecard.	

Reference Books *

1. Cost Accounting (2e) by M.Y. Khan and P.K. Jain (2017). McGraw Hill Education.
2. Management Control Systems (4e) by Kenneth Merchant and Wim Van Der Stede. Pearson Education (2019).
3. A Text book of Cost and Management Accounting: Arora M. N, 11th Edition, Vikas.
4. Managerial Accounting: James Jiambalvo, 4th Edition, Wiley India Pvt. Ltd.
5. Cost Accounting: Jawaharlal & Seema Srivastava, 4th Edition, TMH

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the cost concepts, cost behaviors, and cost accounting techniques
2. Apply or demonstrate the practical insight into the use of cost information in support of different strategies
3. Analyze costing methods and techniques appropriate to a variety of businesses
4. Evaluate, appraise or justify budgets and operating results through variance analysis and develop, or implement or solve a variety of cost accounting problems, case studies and make inferences

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	2	-	3	-	-	-								
CO2	2	1	-	2	-	-	-								
CO3	2	3	-	3	-	-	-								
CO4	3	3	-	3	-	-	-								

HUMAN RESOURCE

22PBA310E	ORGANIZATION DESIGN, CHANGE AND DEVELOPMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Organization: Nature & Scope – Definitions – overview of various components & structure, Organizational Effectiveness – Definition – importance & approaches to organizational Effectiveness – the goal attainment approach – the system approach – the strategic approach, Organizational Change- Definition, nature, types, forces, models of organizational change –Kurt Lewis, Systems, 7 Stage and Contemporary Activities **Organization Design**: Approaches to organizational design – Organizational designs for different excellences. - Competitive excellence – Institutionalized excellence - Rejuvenatory excellence - Missionary excellence – Versatile excellence - Creative excellence - External nurturance of organizational excellence	
UNIT–II	**13 Hrs.**
Structural Dimensions of Organization design: Organization Design - Components of Organization Design - Dynamic Balance – Organization structure, dimension - division of labour, standardization, horizontal Differentiation, Advantages & disadvantages of Departmentalization; Vertical Differentiation, Span of Control, Centralization, Formalization, Implication of High Formalization, Flexibility. **Contextual Dimensions & Structural Options**: Contextual Factors, types of structure, Influence of: Environment, Strategy, Size & Technology and Power & Politics on Structure, Flat structure	
UNIT–III	**13 Hrs.**
Organization Development : **Foundations of Organizational Development:** Conceptual frame work of OD, History of OD, First order and second order Change, Values, assumptions and believes in OD, characteristics of OD, Participation and Empowerment, Teams and teamwork, Parallel learning structures, A normative-re-educative strategy of changing, Applied Behavioral science, Action research. **Managing the OD Process:** Components of OD Process, Diagnosis, Action & Program Management; Diagnosis: Diagnosing the System, its subunits and Processes, Diagnosis using the Six-box Organizational Model, Third Wave Consulting: The Action Component: nature of OD intervention	
UNIT–IV	**13 Hrs.**
OD interventions: Definition, factors to be considered, choosing and sequencing intervention activities, classification of OD interventions, results of OD, typology of interventions based on target groups. **Human process interventions:** Individual based: coaching, counseling, training, Behavioral modeling, delegating, leading, morale boosting, mentoring, motivation, **Techno structural (Structures, technologies, positions etc.,) & Strategic interventions: Techno structural:** Balanced scorecard; business process reengineering; downsizing and outsourcing;	

The Future and OD: The changing environment, Fundamental strengths of OD, Implications of OD for the client, ethical standards in OD, OD's future, OD Consultant's role, issues in consultant-client relationship, Power, Politics & OD, Research on OD.

Reference Books *

1. Change Management and Organisational Development Ratan Raina SAGE Texts 2018
2. Organisational Change- An Action Oriented Toolkit Gene Deszca, Cynthia Ingols, Tupper F. Cawsey SAGE Publications, Inc 2019
3. Organisation Development: The process of Leading Organisational Change Donald L. Anderson Sage Publication India Pvt. Ltd. 2/e, 2012
4. Organisation Development Donald L. Anderson SAGE South Asia 2013
5. Toolkit for Organisational Change T. F. Cawsey, Gene Deszca SAGE Text 2007
6. Organisation Development and Organisational Change Donald L. Anderson and Tupper F. Cawsey SAGE Publications 1/e, 2014

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate the organizational design, change and development and OD intervention related concepts
2. Apply the various approaches and strategies related to organizational design, change and development
3. Analyze & evaluate organizational systems and design interventions.
4. Plan organization structures and management strategies based on organizational needs

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	-	-	3	-	-	-								
CO2	-	3	-	-	-	-	-								
CO3	2		2	2	-	-	-								
CO4	-	2	-	-	-	-	-								

<table>
<tr><td>22PBA311E</td><td rowspan="3">INDUSTRIAL RELATIONS AND LEGISLATIONS</td><td>Credits: 04</td></tr>
<tr><td>L: T: P - 4_L: 0_T: 0_P</td><td>CIE Marks: 50</td></tr>
<tr><td>Hours/Week: 04 Total (52)</td><td>SEE Marks: 50</td></tr>
</table>

UNIT-I	13 Hrs.

Introduction: Background of Industrial Relations – Definition, scope, objectives, factors affecting IR, participants of IR, importance of IR. Approaches to Industrial relations, Forms of Industrial relations, system of IR in India – Historical perspective & post-independence period, Code of Discipline and historical initiatives for harmonious IR, Government policies relating to labor, ILO and its influence on Legal enactments in India.

Management of Conflicts and Collective Bargaining: Definition, Meaning, Nature, types of conflicts, strategies for conflict resolution. Collective bargaining, meaning, nature of C.B. collective bargaining process, essential conditions for the success of collective bargaining, prerequisites for collective bargaining, emerging issues in C.B. Factors inhibiting C.B, Suggestions for effective implementation of C.B.

UNIT–II	13 Hrs.

Grievance procedure and Discipline management:

Grievance - Meaning and forms, sources of grievance, approaches to grievance machinery, Grievance procedures and model grievance procedure.

Discipline - Causes of Indiscipline - Maintenance of discipline. Principles of Natural Justice, Judicial approach to discipline, Domestic enquiries, Disciplinary procedures, approaches to manage discipline in Industry, Principles of Hot stove rule.

UNIT–III	13 Hrs.

Industrial disputes: Meaning, Causes and settlement of industrial disputes, Industrial dispute Act 1947: Objectives of the Act, main features, authorities under the Act, machinery for prevention of industrial disputes. Paradigm shift from industrial relations to employee relations – shift in focus, difference, employee relations management at work, culture and employee relations, future of employee relations.

UNIT–IV	13 Hrs.

- Factories Act 1948.
- Industrial Employment (Standing orders) Act, 1946.
- Employees' State Insurance (ESI) Act, 1948.
- Maternity Benefit Act, 1961.
- Minimum Wages Act, 1948.
- Payment of Wages Act, 1936.
- Payment of Gratuity Act 1972.
- Employees' Provident Fund and Miscellaneous Provisions Act 1952.
- Payment of Bonus Act, 1965.
- Employees Compensation Act 2013.

- Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act, 2013

Reference Books *

1. . Industrial relation, S. Venkata Ratam and Manoranjan Dhal, Oxford Publicatio, 2017 (2nd edition).
2. Essentials of HRM and Industrial Relation, Rao, P Subba, Himalaya Publishing House, 2013 (5th edition).
3. Industrial Relations, Trade Union and Labour Legislation. PRN Sinha, Indu Bala Sinha, Seema Shekhar, Pearson, 2017 (3rd edition).
4. Industrial Relations and Labour Laws-Emerging Paradigms, B.D.Singh, Excel Book, 2008.

Course Outcomes**

After completion of the course student will be able to

1. Define, Describe, explain, or exhibit a fair understanding of the concepts related to industrial relations and legislations.
2. Apply or demonstrate the application of concepts of industrial relations and legislations knowledge in various practical situations.
3. Analyze, evaluate, appraise the various industrial relations theories and situations of different businesses and justify the industrial relations decisions or strategies of different businesses.
4. Develop or implement suitable strategies related to industrial relations.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	1	-	-	1	-	-	-								
CO2	3	2	-	2	-	-	-								
CO3	2	3	-	3	-	-	-								
CO4	2	2	-	2	-	-	-								

22PBA312E	TALENT MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	12 Hrs.
Talent Management: Meaning and significance of talent management. Aligning HRM goals to business**,** attracting talent, retaining talent, becoming the best employer by employer branding activities, inculcating performance culture, right sizing the workforce, work life balance initiatives, providing HR leadership to business.	
UNIT–II	**14 Hrs.**
Competency Mapping: Features of competency methods, historical development, definitions, approaches to mapping and case studies in competency mapping. Competency mapping procedures and steps- business strategies, performance criteria, criteria sampling, tools for data collection, data analysis, validating the competency models, short cut method, mapping future jobs and single incumbent jobs, using competency profiles in HR decisions. **Methods of data collection for mapping**.-observation, repertory grid, critical incidence technique, expert panels, surveys, automated expert system, job task analysis, behavioral event interview. Developing competency models from raw data- data recording, analyzing the data, content analysis of verbal expression, validating the competency models.	
UNIT–III	**13 Hrs.**
Performance Management: Definition of performance Management, the performance management contribution, dangers of poorly implemented PM systems, aims and role of PM Systems, characteristics of an ideal PM systems, performance management process, performance management and strategic planning. Performance goal setting, performance coaching and support, performance monitoring, performance appraisal. Performance feedback. **Employee engagement**- meaning and significance, constituents of engagement, conceptual framework of engagement, behaviors associated with engaged employees, engaged, not engaged, actively disengaged, parameters to measure employee engagement, Q 12 model of Gallup, employee satisfaction survey.	
UNIT–IV	**13 Hrs.**
Career planning: Meaning, Stages of career, career anchors, features of career planning, career planning models, need and objectives of career planning, steps in career planning, how to manage the career planning in organization?, requirements of effective career planning, career planning process. Career planning tools and techniques, limitations of career planning. **Succession planning**: Meaning, elements in succession planning, relation between career and succession planning, challenges in succession planning.	
Reference Books *	
1. Talent Management – Gowri Joshi, Veena Vohra, Cengage Learning, 2018. 2. The Talent Management Hand Book – Lance A. Berger & Dorothy R. Berger, Tata McGraw Hill. 3. Competence at work – Lyle M. Spencer, Signe M. Spencer. John Wiley, 1993.	

4. A Handbook of Competency Mapping – Seema Sangi, Response BOOKS, 2004.

Course Outcomes**

After completion of the course student will be able to

1. Remember and understand the various concepts of talent management.
2. Apply and relate the theoretical knowledge of talent management subject to the practical aspects.
3. Analyze and evaluate the situations related to talent management practices.
4. Plan and implement models to solve problems or issues related to competency mapping, performance management, and succession planning and employee engagement.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	1	1	1	1	-	-	-							
CO2	3	2	-	-	-	-	-							
CO3	2	3	-	-	-	-	-							
CO4	2	2	-	-	-	-	-							

22PBA313E	LEARNING AND DEVELOPMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to Employee learning and Development, learning, learned, The Forces Influencing Working and Learning, classification of learned capabilities, learning theories- Reinforcement Theory, Social Learning Theory, Goal Theories, Need Theories, Need Theories, Need Theories, Expectancy Theory, Adult Learning Theory, Information Processing Theory; The basic principles of learning, The Learning Process , Mental and Physical Processes, The Learning Cycle, Age Influences on Learning Implications of the Learning Process for Instruction, Instructional Emphasis for Learning Outcomes **Training and Learning**: Introduction, Relationship, meaning, Designing Effective Training, Forces influencing working & learning, Training Practices. Strategic Training, Training Needs Assessment **Transfer of Training**: Introduction, Training Design, Work Environment Characteristics influencing transfer, organizational environments encouraging transfer; Implementation of the training programme	
UNIT–II	**13 Hrs.**
Traditional Training Methods: Presentation Methods, Hands-on Methods, GroupBuilding Methods. Choosing Training methods. E-Learning & Use of Technology in Training: Technology's Influence on Training, Technology & Multimedia, Computer-Based Training, Developing Effective Online Learning, Blended Learning, Simulations, Mobile Technology & Training Methods, Intelligent Tutoring Systems, Distance Learning, Technologies for Training Support, Technologies for Training Administration, Learning Management Systems (LMSs), Systems for Training Delivery, Support & Administration, Choosing New Technology Training Methods. **Training Evaluation**: Reasons for Evaluating Training, Overview of the Evaluation Process, Outcomes Used in the Evaluation of Training Programs, Determining Whether Outcomes Are Good, Evaluation Practices, Evaluation Designs, Threats to Validity, Types of Evaluation Designs, Considerations in Choosing an Evaluation Design, Determining Return on Investment, Determining Costs, Measuring Human Capital and Training Activity.	
UNIT–III	**13 Hrs.**
Employee Development: Introduction, Approaches to Employee Development, The Development Planning Process, Company Strategies for Providing Development, Special Issues in Training and Employee Development. **Careers and Career Management**: Introduction, Importance, Career: meaning, A Model of Career Development (Career Stages), Career Management Systems, Roles of Employees, Managers, Human Resource Managers, and Company in Career Management, Evaluating Career. Management Systems. Special Challenges in Career Management.	
UNIT–IV	**13 Hrs.**
The Future of Leaning and Development: Introduction, Increased Use of New Technologies for Learning, Increased Demand for Learning for Virtual Work Arrangements, Increased Emphasis on Speed in Design, Focus in Content & Use of Multiple Delivery Methods, Increased Emphasis on	

Capturing and Sharing Intellectual Capital, Increased Use of True Performance Support, Increased Emphasis on Performance Analysis and Learning for Business Enhancement, Increased Use of Training Partnerships & Outsourcing Training, Training and Development from a Change Model Perspective, Methods to Determine Whether Change is Necessary, Key Issues in Implementing Change

Reference Books *

1. G. Pandu Naik - HRD Solutions for excellence - T & D, Text Research & Cases, Excel Books 2012.
2. Noe A Raymond - Employee Training & Development, Mc. Graw Hill Publication 5E, 2017.
3. Effective training-Systems, strategies and practices, 2e, 2008, Blanchard, Pearson education
4. Training for organizational transformation – Rolf Lynton & Udai Pareek, Sage Publications, 2009
5. Effective HR Training Development Strategy – Dr. Ratan Reddy, HPH, 3e,2015
6. Training in organizations, Goldstein, 4th edition, 2002,Cengage

Course Outcomes**

After completion of the course student will be able to

To understand the concept of learning and theories of Learning
2. To learn the different methods of Training
3. To familiarize student with concept of Career Development
4. To understand the impact of IT on Learning

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	1	1	1	1	-	-	-							
CO2	3	2	-	-	-	-	-							
CO3	2	3	-	-	-	-	-							
CO4	2	2	-	-	-	-	-							

IV-SEMESTER

22PBA401C	STRATEGIC MANAGEMENT	Credits: 03
L: T: P - 3_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (40)		SEE Marks: 50

UNIT-I	10 Hrs.
Strategic Management: What is Strategy and Business Policy; What is Strategy, Why strategic Management; Strategic Management in multi SBU **Strategic Management elements and model:** Strategic intent ,Elements of Strategic Management – mission and objective – why, how are they formulated, why do they change, examples of mission /objective, . Factors influencing formation of objectives and mission, Policies, programs, budgets, and procedures	
UNIT–II	**10 Hrs.**
Mintzberg model of decision-making, Strategic decision making process, Corporate Governance and Social Responsibility **General environment:** identifying external environment variables; economic factors, technological factors, social factors, porter's approach to industry analysis; drawing an industry matrix / etop; global competition **Internal Analysis and Diagnosis, VRIO framework:** Competitive Advantage, Value-chain analysis, internal factors to be analyzed – Marketing and distribution factors; R&D factors; Production & Operations factors; Corp. Resources & Personnel factors; Finance factors, diagnosing strengths and weaknesses of an organization.	
UNIT–III	**10 Hrs.**
Developing a IFAS and strategic advantage profile.(IFAS+EFAS=SGAS Matrix). SWOT Analysis & TOWS Matrix **Generic Strategic Alternatives:** Basis-Porter's Generic Strategies; Direction: Expansion, Stability, Retrenchment, and combination strategies – when and how do companies choose them?; Timing tactics and market location tactics. **Strategy Variation** Internal and External alternatives to strategies ;(Concentric Strategies – vertical Integration, Diversification strategies) Related / Unrelated, Horizontal/ Vertical, Active / Methods: Passive alternatives.	
UNIT–IV	**10 Hrs.**
International Entry Strategies – Acquisitions, Mergers, and Joint Ventures – Factors which are important – legal and human considerations. **Corporate level Decision Making:** Strategic Choice and Implementation; Analytical Tools – BCG Matrix, GE Business Screen, International Portfolio analysis, Key Country Matrix.; Parenting Matrix	
Reference Books *	
1. Strategic Management Fred R. David Prentice Hall India Publication. 2. Crafting and Executing Strategy: The Quest for Competitive Advantage – Concepts and Cases Arthur A. Thompson Jr. Margaret A. Peteraf John E. Gamble, A. J. Strickland III, Arun K. Jain,	

McGraw Hill Education, 16/e 2016 3.

3. Contemporary Strategy Analysis, Robert M. Grant, Wiley India, 10e
4. Business Policy and Strategic Management by William J Glueck and Jauch. (G&J)
5. Strategic Management – competitiveness and Globalization by Michael A Hitt, R Duana Ireland & Robert E Hoskisson.(Hitt)
6. Business policy and strategic Management – By Gupta, Golekota& Srinivasan.PHI,2005(Gupta etal)
7. Strategic Management by Pearce and Robinson- T M H,2005(P&R)
8. Strategic Management-, The Indian context,- R.Srinivasan, Prentice Hall, 2005

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate & Explain various strategies in business organizations
2. Apply various strategy formulation skills in practical situations of the organization
3. Analyze and evaluate the different types of strategies adopted in the various business organizations.
4. Plan and implement various strategies and strategic management models

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	3	-	2	-	-	-	-							
CO2	2	-		2	-	-	-							
CO3	1	-	2	-	-	-	-							
CO4	3	3		-	-	-	-							

MARKETING

22PBA402E	BUSINESS MARKETING	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Dimensions of Industrial Marketing: Nature of Industrial Marketing, Industrial Marketing vs. Consumer Marketing, Economics of Industrial demand – The Resellers Market – The Industrial Marketing Concept, Understanding Industrial Markets, Types of Industrial Markets, Classifying Industrial Products, Organizational Procurement Characteristics – The Industrial Marketing Environment, Environmental effect on Industrial Market with special reference to Government rule. **Nature of Industrial buying:** Organizational buying Activity, Buying models and buying centre concept, Inter Personal Dynamics of Industrial Buying Behavior, Roles of Buying centre, Conflict Resolution in Decision Making Ethics in Purchasing.	
UNIT–II	**13 Hrs.**
Market Segmentation: Choosing Target Segments, Positioning, Differentiated and Un-Differentiated Markets, Concentrated and Niche Markets, Positioning Strategies, Difference between Industrial Market Research and Consumer Market Research **Formulating Product Planning:** Developing Product Strategy, Analyzing Industrial Product Life Cycle, Developing Strategies for new and existing products. **Business Service Marketing**: Special Challenges.	
UNIT–III	**13 Hrs.**
Formulating Channel Strategy: Industrial Distributor, Definition, Geographical Distribution, Size Characteristics, operating characteristics, Role of Sales Agent and their drawbacks, choice of the right Distributors, Participation of other Channel Members in Industrial Distribution- Channel Logistics-Relationship of Logistics & Physical Distribution, Total Cost approach customer service, assessing the customer service, Identifying the cost centers. **Pricing Strategies:** Price Determinants, Factors that Influence the Pricing Strategies, concept of learning curves, Pricing Strategies, Competitive Bidding, and Leasing	
UNIT–IV	**13 Hrs.**
The Promotional Strategies: Advertising in Industrial Markets, uses, Message Formulation, policies, media, budgetary support, evaluation of advertising- sales Promotion- Use of Sales Promotion in Industrial Markets, trade shows and exhibitions B 2 B Forms of E-Commerce. **Management of Sales Force:** Managing the Industrial Sales Force, Organizing and controlling the industrial sales force activity, planning for the sales force Deployment. Personal Selling: Selecting and Recruitment of Industrial sales person, sales training, Directing, Motivating. Task Assignment, Compensation, Measuring the Effectiveness of Sales Force. (**Case studies)**	
Reference Books *	

1. Business to Business Marketing, Ross Brennan, Louise Canning & Raymond McDowell Sage Publications, 3e - 2014.
2. B2B Marketing Strategy: Differentiate, Develop and Deliver Lasting Customer Engagement, Heidi Taylor Kogan Page, 1/e, 2017.

3. Innovative B2B Marketing: New Models, Processes and Theory, Simon Hall, Kogan Page, 1/e, 2017 Industrial Marketing, Robert R. Reeder & Reeder – PHI
4. Business Marketing Management, Michael D. Hutt, Thomas W. Speh, Cengage Learning, 9/e,2007
5. Industrial Marketing, Krishna Havaldar – TMH, 2/e,2005
6. Business Marketing, Frank G. Bingham Jr., et al; TMH, 3/e, 2005
7. Industrial Marketing, Prof. P. K. Ghosh, Oxford

Course Outcomes**

After completion of the course student will be able to

1. Define, describe, explain, exhibit a fair understanding of the concepts related to business marketing.
2. Apply or demonstrate the approaches, strategies and applications related to business marketing.
3. Analyze and evaluate the various situations, market conditions, and strategies related to business marketing.
4. Develop or implement suitable strategies related to business marketing.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**
** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	3	2	2	-	-	-	-							
CO2	3	3	1	-	-	-	-							
CO3	3	2	-	-	-	-	-							
CO4	3	2	-	-	-	-	-							

22PBA403E	INTEGRATED MARKETING COMMUNICATIONS	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.

Role of IMC in marketing process, IMC planning model, Marketing and promotion process model. Communication process, steps involved in developing IMC programme, Effectiveness of marketing communications

Advertising: Purpose, Role, Types, Advertising Vs Marketing mix, Advertising appeal in various stages of PLC,

Advertising Agency: Types of agencies, Services offered by various agencies, Criteria for selecting the agencies and evaluation.

UNIT–II	13 Hrs.

Advertising objectives and Budgeting: Goal setting – DAGMAR approach, Various budgeting methods used, AIDA Model

Media planning: Developing Media plan, Problems encountered, Media Evaluation-Print, Broadcast media, Support media in advertising.

Media strategy: Creativity, Elements of creative strategies and its implementation, Importance of Headline and body copy.

UNIT–III	13 Hrs.

Direct Marketing: Features, Elements, Role, Growth, Advantages/Disadvantages, And Direct Marketing Strategies.

Promotion: Meaning, tools used in promotion, Traditional & modern promotional mix,

Sales promotion: Importance, Types- consumer oriented & trade oriented, Co-operative advertising, Integration with advertising and publicity, push pull strategies, drawbacks of promotion.

Public relation/ Publicity:- Meaning, Objectives, tools of public relations, target audience for PR, Meaning & Goals of publicity, Corporate Advertising – Role, Types, Limitations, PR Vs Publicity.

Monitoring, Evaluation and control: Measurement in advertising, various methods used for evaluation- Pre-testing & Post testing.

UNIT–IV	13 Hrs.

International Advertising: Global environment in advertising, Forces in international environment, Decision areas in international advertising.

Internet advertising: Meaning, Components, Advantages and limitations, Types of Internet advertising. Digital Marketing.

Industrial advertising: B 2 B Communication, Special issues in Industrial selling.

Event Management: Introduction Purpose of organizing an Event, Different types of events, Concepts of promotion and pricing in events

Reference Books *

1. Advertising and Promotions IMC Perspectives: Belch and Belch Tata Mc Graw Hill, 7/e, 2009
2. Advertising 'An IMC Perspective' - S. N. Murthy/U.Bhojanna - Excel Books, 2010.
3. Advertising & Integrated Brand Promotion, O'Guinn, Allen, Semenik, 6/e, Thomson, 2011
4. Integrated Advertising, Promotion, and Marketing Communications, Clow, Baack, 7/e, Pearson Education,

2014

5. Foundations of Advertising, Chynawalla & Sethia, HPH, 2011
6. Advertising management Rajeev Batra, John G Myers & Aaker – PHI, 5/e, 2007

Course Outcomes**

After completion of the course student will be able to

1. Demonstrate the knowledge of various tools and techniques related to IMC.
2. Apply and relate the theoretical knowledge of IMC to the practical aspects.
3. Analyze and evaluate the marketing communication strategies of various companies.
4. Plan and implement integrated marketing communication solutions for different products or services.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7					1	2	3
CO1	3	-	-	-	-	-	-							
CO2	-	2	-	-	-	-	-							
CO3	-	2	-	3	-	-	-							
CO4	-	1	2	-	-	-	-							

22PBA404E	STRATEGIC BRAND MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.

Introduction to the concept of Brand Management:
Brand –Meaning, Definition, Evolution of Brands, Role & Advantages of Brand to consumers & manufacturers, Product Vs Brand.
Branding- Meaning, Creation of Brands through goods, services, people, Organization, Retail stores, places, online, entertainment, ideas, challenges to Brand builders.
Strategic Brand Management Process-Meaning, Steps in Brand Management Process, Strong Indian Brands.
Customer Based Brand Equity:
Customer Based Brand Equity-Meaning, Model of CBBE.
Brand Equity: Meaning, Sources, Steps in Building Brands, Brand building blocks, Brand Building Implications, David Aaker's Brand Equity Model.
Brand Identity & Positioning: Meaning of Brand identity, Need for Identity & Positioning, Dimensions of brand identity, Brand identity prism,
Brand positioning – Meaning, Point of parity & Point of difference, positioning guidelines
Brand Value: Definition, Core Brand values, Brand mantras, internal branding, brand audits.

UNIT–II	13 Hrs.

Choosing Brand Elements to Build Brand Equity:
Criteria for choosing brand elements, options & tactics for brand elements- Brand name, Naming guidelines, Naming procedures, Impact of Brand name on Brand Awareness & Brand Associations, Logos & Symbols & their benefits, Characters & Benefits, Slogans & Benefits, Packaging & Benefits.
Leveraging Brand Knowledge: Meaning of Brand Knowledge, Dimensions of Brand Knowledge, Meaning of Leveraging Secondary Brand Knowledge & Conceptualizing the leverage process.
Measuring & Interpreting brand performance: Brand Value chain- Designing Brand Tracking studies, Establishing brand Equity Management Systems, Brand equity charter

UNIT–III	13 Hrs.

Brand Strategies:
a) Brand Extension- Meaning, Types, Needs, Advantages & Disadvantages of Brand Extension, Brand-Product matrix, Brand Hierarchy, Building Brand Equity at different hierarchical levels, Brand hierarchy decision,
b) Brand Personality- Meaning & Definition, Types of Brand personalities, Elements of Brand personality
c) Brand Image- Meaning & Definition, Sources of Brand Image, Brand Image for Established and New Products, Brand Image & Celebrity
d) Brand Repositioning: Meaning, Types of repositioning strategies in Indian marketing

UNIT–IV	13 Hrs.

Brand Imitations: Meaning of Brand Imitation, Kinds of imitations, Factors affecting Brand Imitation, Imitation Vs Later market entry, First movers advantages, Free rider effects, Benefits for later entrants, Imitation Strategies.

Measuring Brand Equity: Methods for measuring Brand Equity**-** Quantitative Techniques & Quantitative Techniques, Comparative methods- Brand based comparisons, Marketing based comparisons, Conjoint Analysis, Holistic methods.

Luxury & Celebrity Brand Management: Luxury definition and relativity, role of celebrities in luxury brand management, luxury goods and luxury brands, basic psychological phenomena associated with luxury purchase, luxury marketing mix, luxury retail.

Reference Books *

1. Strategic Brand Management, Building Measuring & Managing Brand Equity – 5e, 2019 Phi / Pearson Education – Kevin Lane Keller
2. Brand Management -The Indian Context – Y L R Moorthi – Vikas Publication.
3. Brand Management- Harish V Verma, 5/e,2012, Excel Books
4. Compendium Brand Management – Chunnawalla – HPH, 1/e, 2011
5. Managing Indian Brands – S Ramesh Kumar – Vikas 2e, 2003
6. Strategic Brand Management- Richard Elliott & larry Perclu, Oxford Press, 4/e, 2018
7. Creating powerful brands – Chernatony, Elsevier Publication, 4/e, 2010

Course Outcomes**

After completion of the course student will be able to

1. Understand and remember various brand management concepts.
2. Apply and relate the theoretical knowledge of brand management subject to the practical aspects.
3. Analyze and evaluate branding strategies of various companies.
4. Plan and implement branding strategies for different products or services.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	3	2	-	1	-	-	-							
CO2	3	3	-	1	-	-	-							
CO3	3	2	-	1	-	-	-							
CO4	3	2	-	2	-	-	-							

22PBA405E	DIGITAL MARKETING	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to Digital Marketing: Concept of Digital Marketing, Origin, traditional versus Digital Marketing. Digital Marketing Strategy- The PO-E-M Framework, Segmenting and customising Messages, Digital Landscape. Digital advertising Market in India. Skills required in Digital Marketing, Digital Marketing Plan **Display Advertising**: Concept of Display Advertising, types of display ads, buying models, display plan Targeting- contextual targeting placement targeting, remarketing, interest categories, geographc and language tagging, demographics, mobile, other targeting methods. Programmatic digital advertising, You Tube Advertising.	
UNIT–II	**13 Hrs.**
Search Engine Advertising: Understanding Ad Placement, Understanding Ad Ranks, Creating First Ad Campaign, Performance Reports. Social Media Marketing: Building a successful Strategy Live Project: Create a digital marketing plan. Face Book Marketing: Facebook for business & facebook insights LinkedIn Marketing: LinkedIn Strategy, LinkedIn Analytics Twitter Marketing: Building Content Strategy, twitter usage , Twitter Analytics Instagram & Snanpchat: Objectives of Instagram, Hashtags. What is Snanpchat. Digital Public Relations	
UNIT–III	**16 Hrs.**
Mobile Usage, Mobile Advertising- Mobile Advertising Models, advantages of Mobile advertising, Mobile Marketing Toolkit, Mobile Marketing features- Location based services, Social marketing on mobile, QR Codes, Augmented Reality, Gamification.Tracking mobile campaigns- Mobile Analytics. Live Project: Create a mobile advertising project.	
UNIT–IV	**13 Hrs.**
Search Engine Optimization: How search engines work, concept of search engine optimisation (SEO), On Page Optimisation, Off Page Optimisation, Social media Reach, Maintenance- SEO tactics, Google Search Engine, Web Analytics- Key Metrics- concepts only	

Reference Books *

1. Digital Marketing by Seema Gupta, McGraw Hill Education, 2017
2. Markeing 4.0: Moving from Traditinal to Digital, Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Wiley, 2017
3. Fundamentals of Digital Marketing, Puneet Bhatia, Pearson, 2/e, 2014
4. Social Media Marketing Tracy L Tuten, Michael R Solomon, Sage Publications, 3/e, 2020

Course Outcomes**

After completion of the course student will be able to

1. Recognize appropriate e-marketing objectives.
2. Appreciate the e-commerce framework and technology.
3. Illustrate the use of search engine marketing, online advertising and marketing strategies.
4. Develop a social media strategy's to solve business problems.

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

** **Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	2	-	1	-	-	-								
CO2	3	3	-	1	-	-	-								
CO3	3	2	-	1	-	-	-								
CO4	3	2	-	2	-	-	-								

FINANCE

22PBA406E	FINANCIAL DERIVATIVES	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	18 Hrs.

Financial Derivatives: Introduction, meaning, economic benefits of derivatives - Types of financial derivatives - Features of derivatives market –functions of derivative markets, traders in derivatives markets in India. Ethics in derivatives market.

Forward contracts: Forward contracts – concept, types, forward rate, forward rate agreements (FRA), Valuation of forwards, forward markets.

UNIT–II	16 Hrs.

Futures Contracts: Concept, types. Participants, market quotes, differences, specifications of future contracts, mechanics of buying and selling futures, margins, marketing to market, valuation of futures, trading, clearing & settlement. Hedging strategies: Index futures, arbitrage opportunities.

Financial Swaps - Features and uses of swaps **–**types – SWAP designing of interest rate swaps-valuation- Basics of CDS & ABS.

UNIT–III	16 Hrs.

Options: Concept, types& classification, features, participants, option market quotes, mechanics of options, put-call parity, option pricing, factors affecting option pricing. Market indicators: put-call ratio, open interest, roll-over, concept of exotic option.

Valuation of option: Basic model, one step binomial model, Black and Scholes Model. Risk Analysis & Management: option Greeks, Delta, Gamma, Vega, Theta and Rho.

UNIT–IV	16 Hrs.

Option trading strategies: option spreads, straddles, strangles, strips & straps. Hedging with options, Arbitrage profits in options.

Commodity derivatives: Commodity futures market-exchanges for commodity derivative in India, commodities traded – trading and settlements, market quotes. Commodity futures pricing: Pricing by arbitrage, futures & spot price (carry & reverse cost carry). Hedging risk.

Reference Books *

1. Options Futures & Other Derivatives - John C. Hull, 10/e, 2018, Pearson Education.
2. Options & Futures- Vohra & Bagri, 2/e, TMH 2017
3. Derivatives- Valuation & Risk Management - Dubofsky & Miller, Oxford University Press, 2005.
4. Financial Derivatives- Bishnupriya Mishra and Sathya Swaroop Debashish, Excel BOOKS, 2007.
5. Derivatives, Principles and Practice, Sundaram & Das, Mc Graw Hill, 2017
6. Derivatives & Financial Innovations - Bansal, TMH.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit fundamentals and basic concepts of financial derivatives
2. Analyze, Apply or demonstrate risk management process using derivatives.
3. Evaluate, appraise or justify problems on financial derivatives using different models.
4. Develop or implement of fundamentals of credit risk management and Value at Risk

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	1	-	-	3	-	-	-								
CO2	3	3	-	3	-	-	-								
CO3	2	3	-	-	-	-	-								
CO4	2	3	-	-	-	-	-								

22PBA407E	TAX MANAGEMENT	Credits: 04
L: T: P - 3_L: 2_T: 0_P		CIE Marks: 50
Hours/Week: 05 Total (66)		SEE Marks: 50

UNIT-I	18 Hrs.
Basic concepts: assessment year, previous year, person, assessee, Income, charges on income, gross total income, capital and revenue receipts, residential status, receipt and accrual of income, connotation of income deemed to accrue or arise in India. Tax Planning, Tax Evasion and Tax Management. (Problems on residential Status of Individual assessee). Explanation under various heads of income. Income from salary (Basic problems), Income from House Property.	
UNIT–II	**16 Hrs.**
Income under the head Profit and Gains of Business or Professions and its computation- basis method of accounting- scheme of business deductions/ allowance- deemed profits- maintenance of books, Depreciation (Problems on computation of income from business/ profession of Individual assessee and Depreciation). Income under capital gain, basis of charge, transfer of capital asset, inclusion & exclusion from capital asset, capital gain, computation of capital gain(theory & problems), deductions from capital gains.	
UNIT–III	**16 Hrs.**
Income from Other Sources (Theory Only), Permissible deductions under section 80C to 80U. Setoff and carry forward of losses and clubbing of Incomes**.** Computation of tax liability of a firm and partners.	
UNIT–IV	**16 Hrs.**
Computation of taxable income of a company with special reference to MAT. Corporate dividend Tax. Ethics in tax management. **Introduction to GST** Levy and exemption, Time value of supply, Administration of GST, introduction to customs duty.	

Reference Books *

1. Direct Taxes – Vinod Singhania and Kapil Singhania, Taxmann Publications, Latest Edition.
2. Students Guide to Income Tax – Vinod Singhania, Taxman Publications. Latest Edition
3. Direct Tax – Mehrotra, Sahitya Bhavan. Latest Edition
4. Students Guide to Income Tax – Manoharan T. N, Snow White. Latest Edition

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the basic concepts of tax management. And solve problems of taxation and interpret the solutions.
2. Apply or demonstrate various deductions and exemptions of taxes. Analyze working of GST system in the country
3. Evaluate, appraise or justify tools and techniques of tax management to practical situations
4. Develop or implement or solve various tax reports.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	1	-	-	3	-	-	-								
CO2	3	3	-	3	-	-	-								
CO3	2	3	-	-	-	-	-								
CO4	2	2	-	-	-	-	-								

22PBA408E	MICRO FINANCE	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.

Microfinance: Meaning, Definition**,** Nature and Scope of Microfinance, Developments in Microfinance (India), Key features of Microfinance, Credit Market, Three classic problems in Credit Markets: Selection, Monitoring and Enforcement. The Rationale and genesis of micro credit/microfinance, the nature of microfinance: microcredit vs. microfinance,

Products and Services in Microfinance:

Financial Services: Credit Products – Microcredit, Micro-leasing, Micro-venture capital. Savings, Payment Services and Insurance Products, New frontiers in Microfinance Services**.**

UNIT–II	13 Hrs.

Institutional Structure of Microfinance in India

NABARD and Microfinance: strategy, Capacity Building Support to Government, Bankers, MFI's, NGOs, SHGs and Trainers Training. Microfinance Development and Equity Fund (MFDEF), SHG- Bank Linkages.

SIDBI and Microfinance: Approach, Capacity Building Support for Microfinance, on lending, Liquidity Management, Loan to Micro-enterprises, Rating of MFIs. Role of RMK in Microfinance Development in India. Role of Commercial banks, RRBs, Cooperative banks, Private Banks, NBFCs, and MFIs in the Development of Microfinance.

UNIT–III	13 Hrs.

Regulatory Frameworks for MFIs:

Principles of Regulation ,Regulations Vs Supervision ,Determinants for regulating microfinance ,Costs of regulation, Constraints to regulating ,Self –regulation in India: Concerns and Prospects, Objectives and benefits of self –regulation Need for microfinance regulation in India, **Microfinance Delivery Models In India:**

SHG –Bank Linkages Program: Role of NABARD under SHG-Bank Linkage Programme. Role of Commercial banks, RRBs, DCCBs, NGO and Farmer's clubs. Status and Progress of Self-Help Groups in the country

UNIT–IV	13 Hrs.

Accounting and Financial Aspects of Microfinance: Accounting for client transactions; Accrued loan interest revenue; Loan write-offs; Purchase, Depreciation, Sale or disposal of fixed assets; Grants and donations etc. Accounting procedures at SHGs/Clusters/Federations/MFIs, etc.

Credits Planning, Appraisal, Deployment, Monitoring and Follow up Credits: Meaning and types of credits proposals, Lending norms and policies of micro financial Institutions, Documentation, and Credit counseling and financial supervision.

Risk Management in Microfinance: Types of risk in microfinance-strategy for risk minimization, Credit rating Models-GIRAFE, PEARLS, CAMEL, and CRSIL. Non –performing assets –Classification of over dues, recovery management.

Reference Books *

1. Rural Credit and Self-help Groups: Microfinance Needs and Concepts in India, K.G Karmakar, Sage Publications, New Delhi, 2013
2. Indian Microfinance: The Challenges of rapid growth – Prabhu Ghate, Sage Publications, New

Delhi, 2013

3. Sustainable Banking with the Poor: Microfinance Handbook – An Institutional and Financial Perspectives – Jonna Ledgerwood (2010), the World Bank, Washington D.C., USA.
4. Credit Appraisal, Risk Analysis and Decision Making, by D.D. Mukherjee, Snow White Publications Private Limited, Mumbai, 10e, 2019
5. Management of Savings and Credit Programmes by NGOs: A Reference Book – R.C.Gupta(2012), Har-Anand Publications, New Delhi.
6. Microfinance in India: Banyan Tree and Bonsai, Mahajan, Vijay and Bharti Gupta Ramola (2013), Background paper prepared for World Bank, Washington DC: The World Bank.
7. Indian Microfinance: The Challenges of rapid growth – Prabhu Ghate, Sage Publications, New Delhi, 2010

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the basic concepts of Micro finance.
2. Apply tools and techniques of micro finance to practical situations.
3. Analyze evaluate and appraise the published reports, and the financial performance of micro financial institutions.
4. Develop or implement or solve financial performance problems of micro financial institutions

* **Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	3	2	-	3	-	-	-							
CO2	3	2	-	3	-	-	-							
CO3	3	2	-	2	-	-	-							
CO4	3	2	-	1	-	-	-							

22PBA409E	RISK MANAGEMENT AND INSURANCE	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	14 Hrs.
Introduction to Risk Management: Risk Identification: Risk-Risk and Uncertainty-Types of RiskBurden of Risk-Sources of Risk-Methods of handling Risk-Degree of Risk-Management of Risk. Risk Identification-Business Risk Exposures-Individual Exposures-Exposures of Physical Assets - Exposures of Financial Assets -Exposures of Human Assets - Exposures to Legal Liability – Exposure to Work-Related Injury. (Theory). Risk Measurement: Evaluating the Frequency and Severity of Losses-Risk Control-Risk Financing Techniques-Risk Management Decision Methods-Pooling Arrangements and Diversification of Risk. Advanced Issues in Risk Management: The Changing Scope of Risk Management-Insurance Market Dynamics-Loss Forecasting-Financial Analysis in Risk Management -- Decision Making Other Risk Management Tools. (Theory).	
UNIT–II	**14 Hrs.**
Introduction to Insurance – Introduction to Insurance: Risk and Insurance- Definition and Basic Characteristics of Insurance Requirements of an Insurable Risk-Adverse Selection and Insurance-Insurance vs. Gambling Insurance vs. Hedging Types of Insurance-Essentials of Insurance Contracts. Indian Insurance Industry -Historical Framework of Insurance, Insurance sector Reforms in India. IRDA-Duties and powers of IRDA-IRDA Act 1999. (Theory). **Life Insurance**: Basics of Life Insurance-Growth of Actuarial Science-Features of Life Insurance-Life Insurance Contract-Life Insurance Documents-Insurance Premium Calculations. Life Insurance Classification-Classification on the Basis –Duration-Premium Payment Participation in ProfitNumber of Persons Assured-Payment of Policy Amount-Money Back Policies-Module Linked Plans. Annuities-Need of Annuity Contracts, Annuity V/s Life Insurance, Classification of Annuities. (Theory).	
UNIT–III	**14 Hrs.**
General Insurance: Laws Related to General Insurance-General Insurance Contract-General Insurance Corporation (GIC). Health Insurance-Individual Medical Expense Insurance – Long Term Care Coverage – Disability Income Insurance – Medi-claim Policy – Group Medi-claim Policy – Personal Accident Policy – Child Welfare Policy-Employee Group Insurance – Features of Group Health Insurance – 01.02.2023 Group Availability Plan. Fire Insurance-Essentials of Fire Insurance Contracts, Types of Fire Insurance Policies, Fire Insurance Coverage. Marine Insurance-Types of Marine Insurance – Marine Insurance principles Important Clauses in Marine Insurance– Marine Insurance Policies –Marine Risks-Clauses in Marine Policy. Motor Vehicles Insurance-Need for Motor Insurance, Types of Motor Insurance, Factors to be considered for Premium Fixing. (Theory).	
UNIT–IV	**10 Hrs.**
Management of Insurance Companies: Functions and Organization of Insurers- Types of Insurance Organization, Organizational Structure of Insurance Companies-Functions of Insurers. Underwriting-Principles of Underwriting, Underwriting in Life Insurance, Underwriting in nonlife Insurance. Claims Management-Claim Settlement in General Insurance-Claim Settlement in Life Insurance. (Theory).	
Reference Books *	
1. Principles of Risk Management and Insurance, George E Rejda, Pearson, 12/e, 2009. 2. Insurance and Risk Management, P.K. Gupta, Himalaya, 1/e, 2010	

3. Introduction to Risk Management and Insurance, Dorfman, Mark S., Prentice Hall India, 10/e, 2008.
4. Risk Management and Insurance, Scott E. Harrington, Gregory R Niehaus, TMH, 2/e, 2007.

Course Outcomes**

After completion of the course student will be able to

1. Define, describe explain or exhibit the concept of Risk Management.
2. Apply or demonstrate about Insurance and its products.
3. Analyze and understand Legal framework of Life and General Insurance.
4. Evaluate, appraise or justify IRDA Roles and Responsibility and design, develop or implement or solve a variety treasury and risk management problems, case studies and make inferences

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	2	-	3	-	-	-								
CO2	2	1	-	2	-	-	-								
CO3	2	3	-	-	-	-	-								
CO4	3	3	-	-	-	-	-								

HUMAN RESOURCE

22PBA410E	INTERNATIONAL HUMAN RESOURCE MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to IHRM: Definition, reasons for going global, Approaches to IHRM, Difference between IHRM and Domestic HRM, Reasons for emergence of IHRM, Models of IHRM Matching model, Harvard Model, Contextual Model, 5P Model European Model, Models of SHRM in Multinational Companies, Internationalization of HRM: Socio-cultural context, Organizational dynamics and IHRM: Role of culture in International HRM, Culture and employee management issues, Cultural sensitivity, Hofstede's model of four cultural dimension, Organizational Processes in IHRM, Linking HR to International expansion strategies, The Challenges of International Human Resource Management	
UNIT–II	**13 Hrs.**
Recruitment, Selection and staffing in International context: International Managers parent country nationals, third country nationals, host country nationals, advantages and disadvantages of different selection methods, different approaches to multinational staffing decisions, recruitment methods-using head-hunters, cross-national advertising, e recruitment, international staffing issues. **Performance Management**: Basic component in performance management, performance management of international employees, expatriate performance management, PCN role conception, TCN role conception, Contextual model of expatriate performance management.	
UNIT–III	**13 Hrs.**
Training and development in international context: Context Backdrop of international training, Current scenario in international training and development, training & development of international staff, types of expatriate training, HCN training, Career Development, repatriate training, developing international staff and multinational teams, knowledge transfer in multinational companies. **International Compensation:** Forms of compensation and factors that influence compensation policy, key components of international compensation, Approaches to international compensation, compensation practices across the countries, social security systems across the countries.	
UNIT–IV	**13 Hrs.**
International Labour Relations: Key issues, response of labour unions to MNCs. HRM practices in different countries- Japan, USA, UK, Turkey, Middle East, India and China. Key issues in international industrial relations. **International business ethics and HRM, Mode of operation and IHRM**, Ownership issues, Case studies	
Reference Books *	

1. International Human Resource Management, Srinivas R. Kandula, Sage Publication India Pvt. Ltd., 2018
2. International Human Resource Management, Anne-Wil Harzing, Ashly H. Pinnington, Sage Publication
3. India Pvt. Ltd., 4/e, 2015
4. International Human Resource Management - Peter J. Dowling, Denice E. Welch, Cengage Learning.

Course Outcomes**
After completion of the course student will be able to 1. Understand the concepts and practices of International HRM. 2. Apply and relate key international HRM practices, such as global staffing, training and performance management and international labor relations 3. Analyze different cases of IHRM with respect to corporate world 4. Plan and implement different strategies of IHRM

*** Books to be listed as per the format with decreasing level of coverage of syllabus**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)											Program Specific Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	1	1	1	1	-	-	-							
CO2	3	2	-	2	-	-	-							
CO3	2	3	-	3	-	-	-							
CO4	2	2	-	2	-	-	-							

22PBA411E	RECRUITMENT AND COMPENSATION MANAGEMENT	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Job Analysis. Meaning, definition, and purpose. Methods of job analysis: job analysis interviews, job analysis questionnaire, task analysis inventory, position analysis questionnaire, subject expert workshops, critical incident technique. **Recruitment**- Meaning and Process; Sources of Recruitment, Internal and External Source, Modern Techniques of Recruitment, Sources- Internet Based, Placement Agencies. **E-Recruitment:** Role of the Internet and social networks in recruitment.	
UNIT–II	**13 Hrs.**
Selection - Meaning, Essentials of Selection Procedure, Selection Hurdles, Selection Procedure - Application Blank; Employment Tests- Utility and Validity. Employment **Interviews-** Principles and Techniques Biases and Errors in interviews, Medical Test, Reference Check, Appointment- Terms and conditions. **Induction** – Meaning. Importance, types, processes and practices in organizations.	
UNIT–III	**13 Hrs.**
Compensation – Definition – Classification – Types – incentives –fringe benefits. Theories of wages – wage structure – wage fixation – wage payment – salary administration.	
UNIT–IV	**13 Hrs.**
Rewards for sales personnel pay and commission – performance based pay system – incentives – Executives' compensation plan and packages. Boards – Pay Commissions – Compensation Management in Multi-National organizations	
Reference Books *	
1. Recruitment Management – Rashmi T.K- Hph, 1e, 2014 2. Recruiting, Interviewing, Selecting And Orienting New Employee, Arthur Diane, 5/E, 2012 Jico Publisher 3. Managing Human Resources - Bholander, Snell, Sherman-Thomson Learning 18th Edition, 2019. 4. Personal and Human Resource Management – P Subba Rao- Himalaya Publication, 5/E, 2015. 5. Richard Thorpe & Gill Homen: Strategic Reward System-Prentice-Hall, 2000 6. Human Resource Management- Cynthia Fisher, James B. Shaw Lyle F Scheoenfeldt- India Pvt.Ltd.	
Course Outcomes**	
After completion of the course student will be able to 1. Understand and remember various concepts of Recruitment and Compensation. 2. Apply and relate the theoretical knowledge of recruitment selection, and compensation subject to the practical aspects. 3. Understand and develop the techniques required for selection of employees. 4. Plan and implement the strategies of Recruitment and compensation management.	

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)	Program Specific

													Outcomes (PSOs)		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	1	1	1	1	-	-	--								
CO2	2	2	-	-	--	-	--								
CO3	3	3	-	-	-	--	--								
CO4	2	2	-	-	-	--	--								

22PBA412E	PERSONALITY GROWTH AND INTERPERSONAL EFFECTIVENESS	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Personality growth: Meaning of personality, nature and scope of personality growth. Self-awareness and self-esteem. Components of personality development, Ego states- Id, ego and super ego and defense mechanism. Developing a self-improvement plan. **Pedagogy and Andragogy**. Adult Learning Process; Learning styles, Kolb's learning cycle and its relatedness to personality development	
UNIT–II	**13 Hrs.**
Understanding human personality: Personality theories, Carl Jung's theory of personality types and Myers Briggs Type Indicator test (MBTI), Trait theories- Type A and B, Emotional intelligence. **Attitudes, beliefs, Values and their impact on behavior:** Definitions of attitude and value, work attitudes, organizational values and work values, seven habits of highly effective people.	
UNIT–III	**13 Hrs.**
Basic functions of mind: Creativity and innovation. Blocks to creativity. Creativity processes and tools- convergent and divergent thinking. Six thinking Hats, Neuro Linguistic Programming. **Interpersonal relations and personal growth:** Interpersonal needs for openness, inclusion and control. Discovering the interpersonal orientation through FIRO-B. Conflict resolution and negotiation, time management and honoring the commitments.	
UNIT–IV	**13 Hrs.**
Transactional Analysis: Ego states, Transaction Analysis, Structural Analysis, Interaction Analysis Life position Analysis, script Analysis. Lifestyle approach, Personal effectiveness, Johari Window, developing personal effectiveness.	

Reference Books *

1. Organizational Behaviour: Human Behavior at work – John W. Newstrom and Keith Davis, 11/e, Tata McGraw Hill, 2003.
2. Human Relations in organizations - Robert N. Lussier, 8/e, 2017, Mc-Graw Hill Education
3. Understanding OB - Udai Pareek, Oxford University Press, 4th Edition, 2018.
4. Theories of Personality- Calvin S Hall, 4/e, Wiley India Pvt. Ltd.
5. Seven habits of highly effective people, 2019 - Stephen R Covey, Pocket Books.
6. Training in interpersonal Skills- Stephen Robbins, 6th Edition, 2015, Pearson Education.
7. Development of Management Skills - Whetten & Cameron, 8/e, 2017, PHI.

Course Outcomes**

After completion of the course student will be able to

1. Understand and various concepts of personal growth.
2. Apply and relate the theoretical knowledge of strategies to the practical aspects.
3. Analyze and develop the tools and technique for development of employees.
4. Plan pedagogical and and ragogical teaching methodologies and interpersonal skills

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	-	-	-	-	-	-								
CO2	-	3	-	-	-	-	-								
CO3	-	-	2	2	-	-	-								
CO4	-	-	-	-	-	-	-								

22PBA413E	ORGANIZATIONAL LEADERSHIP	Credits: 04
L: T: P - 4_L: 0_T: 0_P		CIE Marks: 50
Hours/Week: 04 Total (52)		SEE Marks: 50

UNIT-I	13 Hrs.
Introduction to Leadership: Definition, Importance of leadership, Roles of a leader, Leadership theory paradigms, levels of analysis of leadership theory **Leadership traits and ethics:** Personality traits and leadership, traits of effective leaders, Leadership attitudes, ethical leadership, Achievement motivation theory.	
UNIT–II	**13 Hrs.**
Leadership behaviour and motivation, and contingency leadership: Leadership behaviour and styles, University of Michigan and Ohio studies, Leadership grid, Leadership and motivation, Content and process theories, Reinforcement theory, Contingency leadership theories and models, Leadership continuum theory, Normative leadership theory, Leadership substitute theory	
UNIT–III	**13 Hrs.**
Team Leadership: The use of teams in organizations, Types of teams, Decision making in teams, Leadership skills for effective team meetings, Ginnet's team effectiveness leadership model, virtual and self-managed teams, the changing role of leadership in self-managed teams **Leader follower relations:** Followers, Evolution of Dyadic theory, Leader member exchange theory, Fellowship, Delegation, Coaching, Managing conflict **Organizational Leadership:** Charismatic and transformational leadership, Stewardship and servant leadership, Leadership of culture and diversity, Creating high performance culture, Strategic leadership	
UNIT–IV	**13 Hrs.**
Leadership development and succession: Development through self-awareness and self-discipline, Development through education, experience, and mentoring, succession. Leadership development programs, Evaluation of leadership development efforts, Leadership **Indian cases on leadership**	

Reference Books *

1. Effective Leadership- Lussier/ Achus, Third edition, Thomson South Western, 2007
2. Leadership-Enhancing the Lessons of experience, Hughes, Ginnet, Curphy, Fifth edition, Tata McGraw Hill, 7^{th} e, 2011.
3. Leadership in Organizations, Gary Yukl, Pearson Education, 8^{th} Edition, 2017.
4. The Leadership Experience, Richard L Daft, Cengage Learning, 6^{th} Edition, 2015.
5. Dynamics of leadership, Craig Watson, Jaico Publication, 2005.
6. Leadership-Research findings, Practice, and skills, Andrew J Durbrin, 7^{th} Edition, 2012, Biztantra.

Course Outcomes**

After completion of the course student will be able to

1. Understand the concepts and practices of organizational leadership.
2. Apply and relate key international organizational leadership theories and practices.
3. Analyze different cases of organizational leadership with respect to corporate world.

4. Plan and implement different strategies of organizational leadership.

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**											**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**					**1**	**2**	**3**
CO1	2	1	2	2	-	-	-							
CO2	1	2	3	2	-	-	-							
CO3	2	2	3	2	-	-	-							
CO4	1	2	2	2	-	-	-							

Scheme of Evaluation:

(2023-24 Joining Batch)

SL NO	COURSE TITLE	COURSE CODE
1	BUSINESS ANALYTICS LAB	22PBA207L
2	PRESENTATION LAB	22PBA208L
3	INTERNSHIP	22PBA316I
4	PROJECT PHASE I	22PBA314P
5	PROJECT PHASE II	22PBA414P

22PBA207L	BUSINESS ANALYTICS LAB	Credits: 1.5
L:T:P - 0_L : 0_T: 3_P		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Course Structure

A). Excel for Managers:

1. **Introduction to Excel**-Getting started, Excel Environment, Menus and Dialog boxes.
2. **Basic functions**- Totaling, percentages, averages, maximums and minimums, numeric cells, discounts, if statements, nested if statements, sum if statements, count if statements etc.

B). SPSS (Business Statistical Analysis)

1. **Introduction to SPSS**: Getting started, SPSS Environment, Menus, Dialog boxes for Statistical procedures, saving files.
2. **Descriptive Statistics**: Frequency Distributions, Measures of Central Tendency, and Measures of Dispersion.
3. **Testing of Hypothesis**: t-test- one sample, independent sample, paired sample, ANOVA-one way and two-way.

Software packages used:

1. Microsoft Excel
2. SPSS (Statistical Package for Social Sciences).

Guidelines

- Business Analytics Lab is a passing head in the MBA programme.
- Every student has to complete all experiments/exercises prescribed in the course manual.
- Student shall submit a hard copy of lab journal report to the college. The lab journal should consist all prescribed exercises.
- Business Analytics Lab is evaluated for 100 marks (CIE-50 and SEE-50)
- Performance and journal write up consists 30 marks (Marks for each experiment = 30 marks / number of proposed experiments.

Scheme of Evaluation (CIE & SEE)

Examination	Marks
Continuous Internal Evaluation (CIE)	50
Semester End Examination (SEE)	50
Total Marks	**100**

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of course coordinator and another expert from the department. Performance and journal write up shall be evaluated by the course coordinator on a continuous basis. The internal evaluation will be conducted batch wise. A student shall obtain not less than **50%** of maximum marks prescribed for CIE.

Sl. No	Description	Max. Marks
1	Write-up Exam	20
2	Execution	20
3	Viva- Voce	10
	Total	50
	Total 50 marks is reduced to 20 marks	20*
4	Performance and journal write up	30
	Total	**(20+30) =50**

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee which comprises of internal examiner (from the department) & External examiner (Academician). The external examination will be conducted batch wise. A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % in the aggregate of CIE and SEE marks.

Sl.No	Description	Max. Marks
1	Write Up	20
2	Execution	20
3	Viva-Voce	10
	Total	**50**

*** CIE (50) + SEE (50) = 100 Marks**

Note:

- Lab report will be signed by course coordinator and HOD.
- Internal Marks will be entered by course coordinator
- Consolidated CIE Marks Sheets hard copy will be signed by course coordinator & HOD and same is submitted to COE.

Course Outcomes**

After completion of the course student will be able to

1. Understand and use the technology for decision making
2. Learn and adopt various tools to convert data into meaningful information
3. Select, Analyze and choose appropriate tools for various business situations.
4. Develop Application Analytical Skills for solving management problems

*** Books to be listed as per the format with decreasing level of coverage of syllabus**
**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)												Program Specific Outcomes (PSOs)		
	1	2	3	4	5	6	7								
CO1	-	1	-	-	-	3	-								
CO2	-	2	-	-	-	3	-								
CO3	-	3	-	-	-	3	-								
CO4	-	3	-	-	-	3	-								

22PBA208L	PRESENTATION LAB	Credits: 1.5
L: T:P - 0_L : 0_T: 3_P		CIE Marks: 50
Total Hours/Week: 03		SEE Marks: 50

Course Structure

Objectives:

It gives an opportunity for student to:

- Develop presentation ability
- Use effective visual aids
- Learn to prepare presentations by collecting, preparing and analyzing data
- Adopt several methods and tools for presentation
- Use positive presentation style behavior
- To remove stage fear and build confidence

Guidelines

- Presentation Lab is a passing head in the MBA programme.
- Every student has to complete all exercises/ presentations prescribed in the course manual.
- Student shall submit a hard copy of presentation lab journal report to the college. The lab journal should consist of all prescribed exercises/ presentations topics.
- Presentation exercises/ topics will be from various subjects/ domains, namely, Financial Management, Managing Human Resource, Research Methodology &Statistics, Strategic Management and Business and Legal Environment. Student shall collect relevant data on the given topic and make a presentation.
- Presentation Lab is evaluated for 100 marks (CIE-50 and SEE-50)
- Performance and journal write up consists 30 marks (Marks for each exercise = 30 marks / no of proposed exercises).

Scheme of Evaluation (CIE & SEE)

Examination	Marks
Continuous Internal Evaluation (CIE)	50
Semester End Examination (SEE)	50
Total Marks	**100**

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal examiner and another expert from the department. Performance and journal write up shall be evaluated by the concerned subject faculty who engages the presentation for the particular topic. The internal evaluation will be conducted batch wise. A student shall obtain not less than **50%** of maximum marks prescribed for CIE.

SL. No	Marks split	Max.Marks
1	Write-up Exam	**20**
2	Presentation	**20**
3	Interaction	**10**
	Total	**50**
Total 50 marks is reduced to 20 marks		**20***
4	Performance and journal write up	**30**
	Total	**(20+30)=50**

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee which comprises of internal examiner (from the department) & External examiner (Academician). The external examination will be conducted batch wise. A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % in the aggregate of CIE and SEE marks.

Sl. No	Marks split	Max Marks
1	Write-up	20
2	Presentation	20
3	Viva Voce	10
	Total	**50**

*** CIE (50) + SEE (50) = 100 Marks**

Note:

- Lab report will be signed by course coordinator and HOD.
- Internal Marks will be entered by course coordinator.
- Consolidated CIE Marks Sheets hard copy will be signed by course coordinator & HOD and same is submitted to COE.

Course Outcomes**

After completion of the course student will be able to

5. Understand and use the technology for decision making
6. Learn and adopt various tools to convert data into meaningful information
7. Select, Analyze and choose appropriate tools for various business situations.
8. Develop Application Analytical Skills for solving management problems

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**								
CO1	3		2	1			3								
CO2					3										
CO3	1	3	2				3								
CO4	2			1		2									

22PBA316I	Internship	Credits: 03
		CIE Marks: 50
		SEE Marks: 50

Guidelines

INTRODUCTION:

Internship is an integral part of the academic curriculum of MBA. It is an initiative to bridge the gap between knowledge and its application through a series of interventions that will enable students of MBA programme to gain insights and exposure to the industry. Internship carries 3 credits and is carried out by the student for 8 weeks after the completion of second semester. The internship evaluation and examination is carried out in the third semester.

OBJECTIVES:

The objectives of conducting Internship of MBA programme are:

- Internship is a passing head in the MBA programme.
- To provide an opportunity for students to apply theoretical concepts in real life situations at the work place;
- To sensitize students to the nuances of corporate culture and familiarize them with the corporate code of behavior;
- To enable students to manage resources, work under deadlines, identify and carry out specific goal-oriented tasks;
- To enable students discover their professional strengths and weaknesses and align them with the changing business environment;

To sharpen domain knowledge and provide cross functional skills.

General Guidelines:

A. Nature of Internship: The student will have to identify an Internship in a business enterprise. Students are expected to work in the organization/obtain professional knowledge and skills, apart from studying the organization structure and functioning of that organization.

B. Duration of Internship: The Internship shall be for a period of 8 weeks immediately after completion of second semester.

C. Guide: Internal guide of the Internship is a faculty member working in department. External guide is from the business organization where the student is carrying out his/her Internship. Internal guide is expected to be in continuous interaction with external guide during the course of the Internship.

D. Submission of Report: Students shall submit three hard copy of the report to the college and a soft copy in PDF file (Un-editable monolithic format).

E. Evaluation:

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal guide and another expert from the department. A student shall obtain not less than 50% of maximum marks prescribed for CIE.

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee which comprise of Internal examiner (from the department), & External examiner (Industry expert or Academician). A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % of marks in CIE and 50 % in the aggregate of CIE and SEE marks.

*** CIE (50) + SEE (50) = 100 Marks**

Contents of the Internship Report	
1	**Cover page**
2	Certificate from the guide, HOD and Head of the Institution indicating bonafied performance of Internship by the student.
3	Certificate from the Organization
4	Declaration by the student
5	Acknowledgement
6	Executive summary
7	Table of contents
8	List of tables and graphs
9	**Chapter 1:** Introduction about the industry.
1	**Chapter 2:** Organization Profile • Brief History • Profile of the organization • Vision, Mission & Quality policy of the organization • Organization Structure and functions of different departments. • Product / Service profile • Areas of operations • Infrastructure facilities • Competitors information
1	**Chapter 3:** SWOT Analysis
1	**Chapter 4:** Overview of the HR/ Marketing/Finance department: • Elaborative information of the department • Strategy of the department • No. of employees, their roles & responsibilities
1	**Chapter 5:** Learning experience and conclusion.
1	**Bibliography**
1	**Annexure** relevant to the Internship such as weekly reports, figures, graphs, photographs, financial statements etc.

Format of the Internship: Report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1" margin all sides (1.5" on left side due to binding) and 1.5line spacing.

Scheme of Evaluation

Examination	Marks
Continuous Internal Evaluation (CIE)	50 Marks
Semester End Examination (SEE)	50 Marks
Total Marks	**100 Marks**

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal guide and another expert from the department. The internal evaluation will be conducted batch wise. A student shall obtain not less than 50% of maximum marks prescribed for CIE.

Sl.No.	Split up of CIE Marks	Marks
1.	Report Evaluation	30
2.	Presentation	20
	Total	**50**

Sl.No.	Report Evaluation	Marks
1.	Introduction about the industry	05
2.	Organization Profile	10
3.	SWOT Analysis	05
4.	Overview of the department	05
5.	Learning Experience and conclusion	05
	Total	**30**

Sl.No.	Split up of Presentation Marks	Marks
1.	Professional skills learnt during the internship	05
2.	Domain skills learnt	05
3.	Preparation of power point slides	05
4.	Overall confidence gained during internship	05
	Total	**20**

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee comprises of internal examiner (from the department), & External examiner (Industry expert or Academician). The external examination will be conducted batch wise. A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % of marks in CIE and 50 % in the aggregate of CIE and SEE marks.

Sl.No.	Split up of SEE Marks	Marks
1.	Understanding of the industry	10
2.	Understanding the corporate functions and company profile	10
3.	SWOT Analysis justification	10
4.	Learning experience and conclusion	10
5.	Interaction	10
	Total	**50**

*** CIE (50) + SEE (50) = 100 Marks.**

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	**Programme Outcomes (POs)**												**Program Specific Outcomes (PSOs)**		
	1	**2**	**3**	**4**	**5**	**6**	**7**						**1**	**2**	**3**
CO1	3	1				2	1								
CO2	2	2				2	2								
CO3	2	2				3	3								
CO4	3	3				3	3								

22PBA314P & 22PBA414P	Project Phase I & II	Credits: 10 (4+6)
		CIE Marks: 50
		SEE Marks: 50

Guidelines

INTRODUCTION:

Project is an integral part of the academic curriculum of MBA Programme and is one of the head of passing. Each student shall carryout the project work independently as per the scheme of teaching and evaluation under the guidance of one of the departmental faculty members. The project work is spread across third and fourth semesters into Phase-I and Phase-II respectively. Project Phase-I (22PBA314P) carries 4 credits and Project Phase-II (22PBA414P) carries 6 credits. The total project work carries 10 credits.

Objectives:

A student can take up an in-depth study and work on them, there by gaining thorough knowledge in the field of the study. Student can choose theoretical/ fundamental/ conceptual/ application oriented/ organizational/ societal related issues as their research problem area and work on them. Student can take up inter domain/ interdisciplinary research problem for the study.

General Guidelines:

- Internship is a passing head in the MBA programme.
- The topic and title of the project work shall be chosen by the student in consultation with the guide during beginning of the third semester.
- Phase-I and Phase-II examinations will be conducted during third and fourth semester respectively.
- On completion of Project Phase-I & II, the report has to be prepared by the student and submitted to the department for evaluation.
- During Phase-I, one spiral bound report (hard copy) shall be submitted to the college.
- During Phase-II, student shall submit three hard copies of the entire project work report (including Phase-I & II) to the college and a soft copy in PDF file (un-editable monolithic format).
- Before submission of the final hard bound and soft copies during fourth semester, student has to submit a softcopy of the project thesis for plagiarism check by paying prescribed fees by the college.
- Fourth semester students having backlog courses are also permitted to submit the project thesis for plagiarism check and attend the SEE.
- The plagiarism check (similarity check) shall be done excluding the certificates, bibliography, index and references etc.
- Thesis sent for similarity check should have all the sections of the thesis from introduction page to conclusion.
- Percentage of similarity check ≤25%
- If the similarity check index is >25%, the modified thesis has to be resubmitted with the prescribed fees for resubmission.
- The third time resubmission shall be considered as the final one failing to which the same thesis shall not be accepted for similarity check.

Evaluation:

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal guide and another expert from the department. A student shall obtain not less than 50% of maximum marks prescribed for CIE.

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee comprises of Internal examiner (from the department), & External examiner (Industry expert or Academician). A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % of marks in CIE and 50 % in the aggregate of CIE and SEE marks.

*** CIE (50) + SEE (50) = 100 Marks.**

Schedule

Schedule to be followed during Project Phase-I

Activity	Internal evaluation
1) Organization study/ Introduction of the topic 2) Literature review 3) Problem statement 4) Objectives of the study	Student has to do first presentation covering these aspects.
5) Research design/ methodology i. Sampling design ii. Data collection methods iii. Data analysis tools 6) Scope of the study 7) Limitations of the study	Student has to present on these aspects during second presentation.
8) Questionnaire framing/Data collection	Student has to present and get approval of questionnaire/ data collection during third presentation.

Schedule to be followed during Project Phase-II

	Activity	Internal Evaluation
1.	Data processing: Data collected to be edited, coded, tabulated and presented to the guide.	Student has to do first presentation covering these aspects.
2.	Data Analysis and interpretation: Analysis and interpretation of results, findings and observations. Students must use appropriate tools and techniques for analyzing the data.	Student has to present on these aspects during second presentation.
3.	Suggestions/recommendations and conclusion. Finalization of report.	Student has to present and get approval of final report during third presentation.
4.	Submission of report	Final report should be submitted as per the stipulated time given by the college.

Scheme of Evaluation CIE and SEE – Project Phase - I

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal guide and another expert from the department. A student shall obtain not less than 50% of maximum marks prescribed for CIE.

Sl. No	Aspects	Marks
1	Project Progress Presentation I	10
2	Project Progress Presentation II	10
3	Project Progress Presentation III	10
4	Presentation and viva voce	20
	Total	**50**

Sl.No.	Split up of marks for Presentation and Viva voce	Marks
1	Identifying significant research problems	05
2	Quality of literature review	05
3	Identification of appropriate research design and tools	05
4	Interaction and justification	05
	Total	**20**

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee comprises of Internal examiner (from the department), & External examiner (Industry expert or Academician). A student shall obtain not less than 40% of maximum marks prescribed for SEE and 50 % of marks in CIE and 50 % in the aggregate of CIE and SEE marks.

Sl No	Split up of marks	Maximum Marks
1	Problem identification and objectives of the study	10
2	Literature review/scope of the study	10
3	Research design /methodology	10
4	Limitations of the study/questionnaire	10
5	Interaction and justification	10
	Total	**50**

***CIE (50) + SEE (50) = 100 Marks**

Scheme of Evaluation CIE and SEE – Project Phase - II

Continuous Internal Evaluation (CIE): Internal evaluation will be carried out by the Internal Department Committee which comprises of internal guide and another expert from the department. A student shall obtain not less than **50%** of maximum marks prescribed for CIE.

Sl. No	Split up of Marks	Marks
1	Project Progress Presentation I	10
2	Project Progress Presentation II	10

3	Project Progress Presentation III	10
4	Report Evaluation	20
	Total	**50**

Sl.No.	Report Evaluation	Marks
1.	Organization and presentation of work	10
2.	Emphasizing the contribution and results	10
	Total	**20**

Semester End Examination (SEE): External Evaluation will be carried by the SEE Examination Committee comprises of, Internal examiner / Guide (from the department), & External examiner (Industry expert or Academician). A student shall obtain not less than **40%** of maximum marks prescribed for SEE and 50 % of marks in CIE and 50 % in the aggregate of CIE and SEE marks.

Sl No	Split up of Marks	Marks
1	Report Evaluation	30
2	Viva- Voce	20
	Total	**50**

Report Evaluation:
The report shall be sent through Email for evaluation to Two examiners – One Internal Examiner (Guide) and One External Examiner. The evaluation of the project report / Dissertation shall be made independently by each examiner for 30 marks. The average of the marks awarded by the two examiners shall be the final evaluation marks for the project report / Dissertation and rounded to next higher digit.

Sl No	Split up of Marks	Maximum Marks
1	Introduction	05
2	Literature review	05
3	Research Methodology	05
4	Data analysis and interpretation	10
5	Findings, suggestions and conclusion	05
	Total	**30**

Viva- Voce:
Viva-voce examination for 20 Marks shall be jointly conducted by the external examiner and internal examiner (Guide).

Sl No	Split up of Marks for Viva-Voce	Maximum Marks
1	Organisation and Presentation of the work	05
2	Enterprising the contribution and results	05
3	Interaction	10
	Total	**20**

***CIE (50) + SEE (50) = 100 Marks.**

The final marks of project evaluation (Report evaluation + viva voce) shall be considered for 50 marks and handed over to examination section

Sl No	Contents of the Project Report
1	Cover page
2	Certificate from the guide, HOD and Head of the Institution
3	Declaration by the student
4	Acknowledgement
5	Executive summary
6	Table of contents
7	Chapter 1: Introduction
8	Chapter 2: Literature review
9	Chapter 3: Research Methodology
10	Chapter 4: Data analysis and interpretation
11	Chapter 5: Findings, suggestions and conclusion
12	References and bibliography
13	Annexure relevant to the Project such as questionnaire, financial statements etc.

Format of the Project Report:

Report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1” margin all sides (1.5” on left side due to binding) and 1.5line spacing.

**** Each CO to be written with proper action word and should be assessable and quantifiable**

Course Outcomes	Programme Outcomes (POs)										
	1	2	3	4	5	6	7				
CO1						1	1				
CO2						1	1				
CO3						2	2				
CO4						3	3				

22PBA209M	**Societal Project Audit Course** (Mandatory Course without any Credits)	**Credits: 00** CIE Marks: 50

Course Structure

Introduction:

Societal project shall be Audit course, the students should identify and study problems faced by the society. The students must submit a report to the respective guides. This shall be an audit course on the lines of ability enhancement courses and shall be undertaken after the first semester and before commencement of the second semester.

Societal Project (one week) is mandatory for all the students and this has to be carried out after the first semester during vacation and the report should be submitted by the students and should be assessed internally during the second semester and it is a non credit but mandatory course (Audit Course). Short term projects at villages, slums or urban areas can be under social project. The project will be more fruitful, if students work in teams. The teams can select one or more fields to do their best in the fields such as:

(i) Swachch Bharat: Swachh Bharat Mission, Swachh Bharat Abhiyan, or Clean India Mission is a country-wide campaign to eliminate open defecation and improve solid waste management.

(ii) Accessible India: Accessible India Campaign or Sugamya Bharat Abhiyan is a program to serve the differently-able community of the country.

(iii) Digital India: A campaign to ensure the Government's services are made available to citizens electronically by improved online infrastructure and by increasing Internet connectivity or making the country digitally empowered in the field of technology.

(iv) Beti-Bachao and Beti-Padhao: A campaign of the Government of India that aims to generate awareness and improve the efficiency of welfare services intended for girls in India.

(v) Environment and Energy Conservation and Education, legal aid, consumer protection and allied field including Indian Red Cross Society, National Cadet Corps, Bharat Scouts and Guides.

Objectives

1. To help students to realize the stark realities of the society.
2. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
3. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
4. To help students to initiate developmental activities in the community in coordination with public and government authorities

Guidelines

- Societal project is Audit Course without any Credits.
- Societal project can be carried out by an individual or a team of 2 to 5 members.
- Societal project shall be for a period of one week immediately after completion of first semester.
- Guide for the societal project is a faculty member working in department and is expected to be in continuous interaction with the student.
- Student shall submit a hard copy of Societal project to the college.

- Evaluation: CIE evaluation Committee consists of two internal examiners. There will not be Semester End Examination for the Societal project.

Scheme of Evaluation: Internal Evaluation – 100 Marks

Sl.No.	Split up of CIE Marks	Marks
1.	Report Evaluation	50
2.	Presentation	50
	Total	**100**

Sl.No.	Split up of Report Evaluation Marks	Marks
1.	Introduction	10
2.	Need for the study / Objectives	10
3.	Methodology	10
4.	Contribution	10
5.	Conclusion	10
	Total	**50**

Sl.No.	Split up of Presentation Marks	Marks
1.	Relevance of the theme or problem selected	10
2.	Involvement in the project chosen	10
3.	Presentation skills	10
4.	Overall contribution during project	10
5.	Learning	10
	Total	**50**

Sl. No.	Contents of the Report
1.	Introduction
2.	Need for the study / Objectives
3.	Methodology
4.	Contribution
5.	Conclusion

Format of the Report:

Report shall be prepared using the word processor viz., MS Word, Times New Roman font sized 12, on a page layout of A4 size with 1” margin all sides (1.5” on left side due to binding) and 1.5 line spacing.

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE-587 102

Department of Computer Applications (MCA)

MCA – I Semester Scheme of teaching and examinations for 2023-2024

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial	Practical	CIE	SEE	Total
1.	BSC	23PCA101C	Mathematical Foundations for Computer Applications	03	03	-	-	50	50	100
2.	PCC	23PCA102C	Python Programming	04	04	-	-	50	50	100
3.	PCC	23PCA103C	Web Programming	03	03	-	-	50	50	100
4.	PCC	23PCA104C	Operating Systems& Shell Programming	03	03	-	-	50	50	100
5.	IPCC	23PCA105C	Computer Networks	04	03		02	50	50	100
6.	MCC	23PCA106C	Research Methodology & IPR	03	03	-	-	50	50	100
7.	PCCL	23PCA107L	Python Programming Laboratory	02	-	-	04	50	50	100
8.	PCCL	23PCA108L	Web Programming Laboratory	02	-	-	04	50	50	100
9.	SEM	23PCA109S	Seminar	02	-	-	-	50	50	100
10.	BC	23PCA110M - BC*	Introduction to Programming Languages		03			100	--	100
			Total	**26**	**22**	**--**	**10**	**550**	**450**	**1000**

*** BSC-Basic Science Courses, PCC- Professional Core Course, PCCL- Professional Core Courses Lab, IPCC- Integrated Professional Core Course, MCC- Mandatory Core Course, *Only for non-computer science students**

Introduction to Programming Languages: Principles of Programming Languages course is a non-credit course introduced to the students who admits into MCA program from non-computer science background.

Integrated Professional Core Course: The theory part of the IPCC shall be evaluated both by CIE and SEE. The Practical part shall be evaluated by only CIE.

Seminar: The Head of the Department shall make an arrangement for conducting seminars through concerned faculty members of the Department. The committee, constituted for the purpose by the Head of the Department, shall award the CIE and SEE marks for the seminar. The committee comprising of Guide/Co-Guide, Senior faculty of the department and HoD/HoD nominee.

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE-587 102

Department of Computer Applications (MCA)

MCA - II Semester Scheme of teaching and examinations for 2023-2024

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial	Practical	CIE	SEE	Total
1.	PCC	23PCA201C	Data Structures and Algorithms	03	03	-	-	50	50	100
2.	PCC	23PCA202C	Java and J2EE	04	04	-	-	50	50	100
3.	IPCC	23PCA203C	Database Management Systems	04	03	-	02	50	50	100
4.	PCC	23PCA204C	Technical Communication	03	03	-	-	50	50	100
5.	PEC	23PCAXXXE	Professional Elective-I	03	03	-	-	50	50	100
6	PEC	23PCAXXXE	Professional Elective-II	03	03	-	-	50	50	100
7.	PCCL	23PCA205L	Data Structures Laboratory	02	-	-	04	50	50	100
8.	PCCL	23PCA206L	Java and J2EE Laboratory	02	-	-	04	50	50	100
9.	MP	23PCA207P	Mini Project	02	-	-	04	50	50	100
10	AUD/AEC	23PCA001O	ONLINE Courses	Classes & evaluation procedures are as per the policy of the online course providers and BOS						PP
			Total	**26**	**19**	**-**	**14**	**450**	**450**	**900**

PCC: Professional Core Course, IPCC-Integrated Professional Core Course, PCCL- Professional Core Courses Lab ,PEC-Professional Elective Courses, PP-Passing is Mandatory ,MP-Mini Project, AUD/AEC –Audit Course / Ability Enhancement Course

Mini Project: Students are expected to take up mini project with a team size not exceeding 3. The objective of this course is to develop real time mini projects using latest technologies. CIE marks shall be awarded by a committee comprising of Guide/Co-guide if any, Project Coordinator/Nominee of Project Cordinaor and HoD/ HoD nominee. The CIE marks awarded, shall be based on the Application Development and Project Presentation skill ,evaluation of Project Report and performance in the Question and Answer session in the ratio of 50:25:25. SEE marks shall be awarded by a committee comprising of Internal Examiner and External Examiner. The SEE marks awarded, shall be based on the Application Development and Project Presentation skill , evaluation of Project Report and performance in the Question and Answer session in the ratio of 50:25:25.

Online Certification Course: MOOC/NPTEL is the ONLINE course. Student must register and complete the online certification courses individually. Student shall take up any online certification courses which are chosen in the area of computer science. Duration may span from 8 – 12 weeks and should complete the courses during the MCA program. Students must produce the hardcopy of the registration details and confirmation details to the concerned faculty advisor without fail.

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE-587 102

Department of Computer Applications (MCA)

Professional Elective-I		Professional Elective-II	
Subject Code	**Subject**	**Subject Code**	**Subject**
23PCA208E	Data Mining	23PCA212E	Introduction to Artificial Intelligence
23PCA209E	Cloud Computing	23PCA213E	DevOps
23PCA210E	Mobile Application Development	23PCA214E	Android Programming Concepts
23PCA211E	Computer Vision	23PCA215E	Natural Language Processing

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE-587 102

Department of Computer Applications (MCA)

MCA – III Semester Scheme of teaching and examinations for 2023-2024

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial	Practical	CIE	SEE	Total
1.	PCC	23PCA301C	Software Engineering and Agile Practices	3	03	-	-	50	50	100
2.	IPCC	23PCA302C	Internet of Things	3	03	-	02	50	50	100
3.	PCC	23PCA303C	Web 2.0	4	03	-	-	50	50	100
4.	PEC	23PCAXXXE	Professional Elective-III	3	03	-	-	50	50	100
5.	PEC	23PCAXXXE	Professional Elective-IV	3	03	-	-	50	50	100
6.	PCCL	23PCA304L	OOMD Laboratory	2	-	-	04	50	50	100
7.	PCCL	23PCA305L	Web 2.0 Laboratory	2	-	-	04	50	50	100
8.	SP	23PCA306P	Societal Project	2	-	-	04	100	--	100
9.	INTR	23PCA307I	Internship	04	(08 weeks of Internship completed during the intervening vacation of II and III semesters)			100	--	100
			Total	**26**	**15**	**--**	**14**	**550**	**350**	**900**

PCC: Professional Core Course, IPCC - Integrated Professional Core Course, PEC - Professional Elective Courses, PCCL - Professional Core Courses Lab, MP-Mini Project, SP-Societal Project, INT-Internship

Societal Project: Students in consultation with the internal guide for applying technology to workout/proposing viable solutions for societal problems. Students are expected to take up project with a team size not exceeding 2. CIE marks shall be awarded by a committee comprising of Guide, a senior faculty of the department and HoD/ HoD nominee. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25. Those, who have not pursued /completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE for this course.

Internship: All the students shall have to undergo a mandatory internship of 08 weeks during the intervening vacation of II and III semesters. CIE marks shall be awarded by a committee comprising of Guide, a Senior faculty of the department and HoD/HoD nominee. The 100 CIE marks is awarded based on the evaluation of Report(50 marks) and Presentation skill(50 marks). Those, who have not pursued /completed the Internship, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Internship requirements.

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Department of Computer Applications (MCA)

Professional Elective-III		Professional Elective-IV	
Subject Code	**Subject**	**Subject Code**	**Subject**
23PCA308E	Big Data Analytics	23PCA312E	Introduction to Machine Learning
23PCA309E	Cyber Security	23PCA313E	Block Chain Technology
23PCA310E	Dart and Flutter Framework	23PCA314E	Modern Application Development
23PCA311E	Software Testing	23PCA315E	User Interface Design

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BASAVESHWAR ENGINEERING COLLEGE, BAGALKOTE-587 102

Department of Computer Applications (MCA)

MCA – IV Semester Scheme of teaching and examinations for 2023-2024

Sl. No.	Course	Subject Code	Subject	Credits	Hours/Week			Examination Marks		
					Lecture	Tutorial	Practical	CIE	SEE	Total
1.	PROJ	23PCA401P	Project Work	22	-	-	-	50	50	100
			Total	**22**	**-**	**-**	**-**	**50**	**50**	**100**

Project Work : The project work shall be carried out individually. CIE marks shall be awarded by a committee comprising of Guide/Co-guide and a senior faculty of the department and HoD/HoD Nominee. CIE evaluation shall be based on the Project Report, Project Presentation skill, and performance in the Question and Answersession in the ratio of 50:25:25. SEE shall be awarded by a committee comprising of Internal and External examiner. SEE evaluation shall be based on project report, live demo/source code analysis, question & answer session after satisfying the plagiarism check. Plagiarism checks shall be as per the University norms.

MCA I AND II SEMESTER SYLLABUS

2023-2024

MCA I Semester

23PCA101C	Mathematical Foundations for Computer Applications	Credits: 03
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Set Theory: Sets and Subsets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Principles of Inclusion and Exclusion, Permutations and Combinations with repetition. **Fundamentalsof Logic :**Basic Connectives and Truth Tables, Logic Equivalence- the laws of Logic, Logical Implications, Rules of Inference, The use of Quantifiers, Quantifier Definitions, Proofs of Theorems.	
UNIT–II	**10 Hrs.**
Functions: Cartesian products and Relations, Functions-Plain and One-to-One, Onto Functions, Stirling Numbers of the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions. **Relations :**Properties of Relations, Computer recognition-Zero One Matrices and Directed graphs, Posets and Hasse Diagrams	
UNIT–III	**10 Hrs.**
Linear Algebra: Introduction, types of matrices, elementary row operations, row echelon matrix, rank, consistency of a system of linear equations. Eigen values and eigen vectors. Largest eigen value using power method. Cayley-Hamilton theorem (without proof) – inverse of a matrix using Cayley-Hamiltonian theorem. **Algorithms to solve system of linear algebraic equations:** Gauss elimination, Gauss seidel and Jacobi iterative procedures.	
UNIT–IV	**10 Hrs.**
Statistics: Introduction**,** Measures of central tendency (Arithmetic mean,Geometric mean, Harmonic mean, Median,Quartiles, Mode). Measures of dispersion (Range, Quartile deviation, mean deviation and standard deviation).**Random variable and probability distribution** Concept of random variable, discrete probability distributions, continuous probability distributions, Mean, variance and co-variance and co-variance of random variables. Binomial and normal distribution, Exponential and normal distribution with mean and variables and problems.	

Reference Books *

1. Ralph P. Grimaldi, Discrete and Combinatorial Mathematics And Applied Introduction, 4th Edition, Pearson Education, 2003.

2. Richard A Johnson and C.B Gupta “Probability and statistics for engineers” Pearson Education.
3. Dr. K. S. Chandrashekhar, Engineering Mathematics- IV, Sudha Publications

Course Outcomes**

After completion of the course student will be able to

1. Apply the fundamentals of set theory and mathematical logic to perform various set operations and logic to the real world problems.
2. Apply the concept of relations and functions on sets to determine their types and compositions.
3. Acquire ability to work with matrices.
4. Acquire ability to represent the data and calculate the measures of central tendency and dispersion.
5. Identify and list the different applications of discrete mathematical concepts in computer science.

23PCA102C	**Python Programming**	**Credits: 04**
Hrs/Week: L:T:P:S **4:0:0:0**		CIEMarks:50
Total Hours/Week: 52 Hrs		SEEMarks:50

UNIT-I	**13 Hrs.**
Basics of Python Programming: Features of python, writing and executing first python program, Literal constants,variables and identifiers, data types,input operation, comments, reserved words, indentation, operators and expressions, operations on strings. Decision control statements. **Data Structures:** Creating, accessing, cloning, add, updating of lists, list methods. Introduction to Tuples. Dictionary &Set methods.	
UNIT–II	**13 Hrs.**
Functions: Introduction, Function Definition, Function Call, Variable scope and lifetime, the return statement, more on defining functions. Lambda functions .**Modules:** The from...import statement, Name of Module, Making your own Modules, The dir() function. **Regular Expressions:** The match()function, The search() function, The sub() function, The findall(), finditer() functions, Meta characters in regular expressions, groups.	
UNIT–III	**13 Hrs.**
Classes and Objects: Introduction, Classes and Objects, class method and self argument, The init method, Class Variables and Object Variables, The del() method, Other special methods, Public and Private data members, Private Methods, Calling a class method from another class methods, Staticmethods.**OperatorOverloading:**Introduction,ConceptofOperatorOverloading,Reverse adding.	
UNIT–IV	**13 Hrs.**
File Handling: Introduction, File Path, Types Of Files, Opening And Closing Files, Reading And Writing Files, File Positions, Renaming And Deleting Files, Directory Methods, Methods From OS Module. **Working with Database:** Connecting to a SQLite database, execute select statements, execute insert,update,and delete statements. Introduction to PySimpleGUI.	
Reference Books *	
1. ReemaThareja,"PythonProgrammingusingproblemsolvingapproach",OxfordUniversity Press,2017. 2. Paul Gries, Jennifer Campbell, Jason, Practical Programming, An introduction to Computer Science using Python3.6,3rdEdition, Pragmetic Book shelf.	

3. Charles Dierbach,"Introduction to Computer Science using Python", Wiley India Edition.
Course Outcomes**
After completion of the course student will be able to 1. Demonstrate core elements of Python Programming 2. Apply the knowledge of functions in building the python programs 3. Understand the basic concepts of object oriented programming 4. Demonstrate the concepts of file handling 5. Apply the knowledge in real time applications

23PCA103C	Web Programming	Credits: 03
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Fundamentals of Web and 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; Images; Hypertext Links; Lists; Tables; Forms; Frames; Syntactic differences between HTML4,HTML 5 and XHTML, Introduction to HTML5.0 form elements and validations.	
UNIT–II	**10 Hrs.**
CSS Introduction: Levels of style sheets; Style specification formats; Selector forms; Property value forms; Font properties; List properties; Color; Alignment of text; The Box model; Background images; The <span> and <div> tags; Conflict resolution. **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.	
UNIT–III	**10 Hrs.**
Dynamic Documents with JavaScript: 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. The DOM 2 event model. **Introduction to AJAX:** Overview of AJAX, The basics of AJAX, Rails with AJAX. **Introduction to PHP:** Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files.	
UNIT–IV	**10 Hrs.**
Session Handling with PHP: Tracking users, Cookies, Sessions.CRUD Operations using databaseand Handling XML. **Introduction to Ruby on Rails:** 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. **Introduction to Rails:** Overview of Rails, Document requests, Processing forms, Rails applications with Databases, Layouts.	

Reference Books *

1. Robert W. Sebesta, Programming the World Wide Web, 4th Edition, Pearson Education, 2008.
2. Chris Bates, Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2006.
3. Eric Ladd, Jim O' Donnel using HTML 4,XML and Java, Prentice Hall of India-QUE,1999.

Course Outcomes**

After completion of the course student will be able to

1. Illustrate the fundamentals of web programming.
2. Apply the mark-up and layout design to build web applications.
3. Analyze appropriate content and scripting language concepts.
4. Design and implement user interactive web applications.
5. Apply the knowledge of web and can give solutions to the real world problems.

23PCA104C	Operating Systems & Shell Programming	Credits: 03
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week:40Hrs		SEEMarks:50

UNIT-I	10 Hrs.

Introduction to Operating Systems: 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; Kernel data structures, Computing environments and Open source operating systems.

System Structures: Operating System Services; User - Operating System interface; System calls; Types of system calls; System programs; Operating System design and implementation; Operating System structure; Operating System debugging, Operating System generation; System boot.

UNIT–II	10 Hrs.

Process Management: Process concept; Process scheduling **Multi-Threaded Programming**: Overview; Multi-core programming, Multithreading models; Thread Libraries; Implicit threading, threading issues. **Process Scheduling:** Basic concepts; Scheduling criteria; Scheduling algorithms; Thread scheduling, Multiple-Processor scheduling; Real time CPU scheduling. **Process Synchronization**: The Critical section problem; Peterson's solution; Synchronization hardware; Mutex locks, Semaphores; Classical problems of synchronization; Monitors.

UNIT–III	10 Hrs.

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

Memory Management Strategies: Background; Swapping; Contiguous memory allocation; Segmentation, Paging; Structure of page table.**Virtual Memory Management:** Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.

UNIT–IV	10 Hrs.

Essential UNIX/LINUX commands: User Names and Groups, Logging In, Correcting Typing Mistakes, Format of Linux Commands, Changing Your Password.**Unix files:** Naming files,Basic file types/categories**,** Organization of files, Hidden files, Standard directories, Parent child relationship, The home directory and the HOME variable, Reaching required files- the PATH variable, manipulating the PATH, Relative and absolute pathnames.**Directory commands** – pwd, cd, mkdir, rmdir commands. The dot(.) and double dots (..) notations to represent presentand parent directories and their usage in relative path names. **File related commands** – cat, mv, rm, cp, wc and od commands, File attributes and permissions and knowing them, The ls command with options. **Changing file permissions**: the relative and absolute permissions changing methods, Recursively changing file permissions, Directory permissions.

Reference Books *

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Concepts, 9thedition, Wiley-India, 2016.
2. D.M Dhamdhere, Operating Systems: A Concept Based Approach 2ndEdition, Tata McGraw-Hill, 2002.
3. SumitabhaDas: Your UNIX The Ultimate Guide; TMH.

Course Outcomes**

After completion of the course student will be able to

1. Explore the core structure and functionality of the Operating Systems.
2. Interpret the various process management and synchronization mechanisms.
3. Analyze the knowledge of occurring deadlock concepts and apply wide range of problem solving methods to solve deadlocks.
4. Identify and analyze the performance of different memory management techniques, page replacement and disk scheduling algorithms.
5. Demonstrate the basic UNIX commands.

23PCA105C	Computer Networks	Credits: 04
Hrs/Week:L:T:P:S **3:0:2:0**		CIEMarks:50
Total Hours/Week:52 40Hrs + 12Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Introduction: Uses of Computer Networks, Network Hardware.**Network Software**: Protocol Hierarchies, Design Issues for the Layers.**Reference Models**: The OSI Reference Model, The TCP/IP Reference Model, A Comparison of the OSI and TCP/IP Reference Models.**Physical Layer**-Guided Transmission Media, Digital Modulation and Multiplexing.	
UNIT–II	**10 Hrs.**
Data Link Layer-Data link Layer Design issues, Framing, Flow Control and Error Correcting and Detection codes, Sliding Window Protocols (Stop and Wait, Go-Back-N (GBN) and Selective Repetitive (SR)), Medium Access Control-The Channel Allocation Problem, Multiple Access Protocols, and Ethernet.**Data Link Layer Switching:** Uses of bridges, repeaters, hubs, switches, routers and gateways.	
UNIT–III	**10 Hrs.**
The Network Layer: Network Layer Design issues, Routing algorithms- The Optimality Principal, Shortest Path Algorithm, Flooding, Distance Vector Routing, Link State Routing, Hierarchical routing, Congestion Control Algorithms, Quality of Service, Internetworking. **The Network Layer in the Internet:**The Network Layer in the internet- IP version 4 Protocol(IPv4), The Main IPv6 Header, Extension Headers, Internet Control Protocols: ICMP, ARP, DHCP.	
UNIT–IV	**10 Hrs.**
The Transport Layer -The Transport Service: Services Provided to the Upper Layers, Berkeley Sockets, Elements of Transport Protocols, Internet transport protocols- TCP: Introduction to TCP, The Service Model, Protocol, Segment Header, UDP. **The Application Layer**-The Domain Name System, Electronic Mail, The World-Wide-Web, Streaming Audio and Video.	
Reference Books *	

1. Andrew S. Tanenbaum, David J Wetherall, “Computer Networks”, Pearson Education, Pearson Publication, 5th Edition, 2012.

2. Behrouz A Forouzan, Firouz Mosharraf, “Computer Networks A Top-Down Approach”, Tata McGraw-Hill Education Pvt. Ltd, 2011.

3. William Stallings, "Data and Computer Communication" ,8th edition, Pearson Publications,2007.

LIST OF LABORATORY ASSIGNMENTS:

Simulate the following experiments using the NS2 simulators.

1. Three node point to point network with duplex link between them.
2. Four node point to point network using TCP/UDP.
3. Different types on internet traffic such as FTP, Telnet and Analyze throughput.
4. Transmission of ping messages over network topology consisting of six nodes.
5. Ethernet LAN using N nodes (6 to 10), change error rate and data rate and also compare throughput.

Implement the following programs using C/C++ language:

6. Error detection using CRC-CCITT(16-bits).
7. Bits stuffing and de-stuffing of Binary data.
8. Distance vector algorithm to find a suitable path for transmission.
9. Congestion control using leaky bucket algorithm.
10. Demonstrate converting normal text to cipher text using simple techniques.

Course Outcomes**

1. To comprehend basics of data communication system.
2. Enumerate the layers of the OSI, TCP/IP model and demonstrate functions of each layer and comprehend the concept of data link protocols.
3. To exhibit the ability to apply different error detection and correction technique to solve communication problem.
4. To exhibit the ability to understand issues related to transport layer and protocols.
5. Demonstrate the concept of internetworking, routing techniques of network layer.

23PCA106C	Research Methodology & IPR	Credits: 03
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Research Methodology: 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,Importance of Knowing How Research is Done,ResearchProcess,Criteria of Good Research, and 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–II	**10 Hrs.**
Reviewing the literature: Place of the literature review in research, bringing clarity and focus to your research problem, improving research methodology, Broadening knowledgebase in research area, enabling contextual findings, How to review the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.	
UNIT–III	**10 Hrs.**
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.Design of Sample Surveys: Introduction,Sample Design, Sampling and Non-sampling Errors, Sample Survey versus Census Survey,Types of Sampling Designs.	
UNIT–IV	**10 Hrs.**
Data Collection: Experimental and Surveys, Collection of Primary Data, Collection of 02.03.2021 updated 17/ 104Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method. Interpretation and Report Writing: Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Report, Layout. Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports. **Intellectual Property (IP) Acts:** Introduction to IP: Introduction to Intellectual Property (IP), different types of IPs and its importance in the present scenario, Patent Acts: Indian patent acts 1970.Design Act: Industrial Design act 2000. Copy right acts: Copyright Act 1957. Trade Mark Act, 1999.	

Reference Books *

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 SAGEPublications Ltd 3rd Edition, 2011 Study Material.
3. Conducting Research Literature Reviews: From the Internet to Paper Fink A Sage Publications, 2009.

Course Outcomes**

1. Identify the suitable research methods and articulate the research steps in a proper sequence for the given problem.
2. Explain the functions of the literature review in research, carrying out a literature search, developing theoretical and conceptual frameworks and writing a review.
3. Explain various research designs, sampling designs, measurement and scaling techniques.
4. Perform the data collection from various sources segregate the primary and secondary data.
5. Apply some concepts/section of Copy Right Act /Patent Act /Cyber Law/ Trademark to the given case and develop –conclusions.

23PCA107C	Introduction to Programming Languages	Credits:NA
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:100
Total Hours/Week: 40 Hrs		SEEMarks: NA

UNIT-I	10 Hrs.
Overview of C: Features of C, Structure of C program, process of compiling and executing the C program. **Constants, Variables and Data types:** Introduction,Character set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of variables, Example programs. **Operators and Expressions:** Overview of operators, Evaluation of expressions, Type conversion in expressions. **Managing Input and Output Operations:** Formatted and Unformatted input and output statements **Decision making and Branching:** Decision making with if, if-else, Nesting of if-else statements, else-if ladders, switch statement, Conditional Operator ?:, goto statement.	
UNIT–II	**10 Hrs.**
Looping: while statement, do-while statement, for statement, jumps in loops. **Arrays:** Introduction, One dimensional arrays, declaration and initialization of one-dimensional arrays, Two dimensional arrays, declaration and initialization of two-dimensional arrays. Operations on arrays. **Strings:** Introduction, Declaring and initializing string variables, String-handling functions, Array of String.	
UNIT–III	**10 Hrs.**
User defined functions: Introduction, Elements of user defined function, Category of functions: Based on call by value, call by reference, recursive functions. **Structures:** Defining a structure, Declaring structure variables, Accessing structure members, Initialization.	
UNIT–IV	**10 Hrs.**
Pointers: Introduction, Accessing the address of a variable, Declaring and initialization of pointer variables, Pointers as function arguments. **Classes and Object-Based Programming in C++:** Introductions to Object Oriented programming concepts (OOPS), Declaration, creation of class and object using C++, Accessspecifiers of a Class, Constructors and Destructors in a Class, Nested Classes.	
Reference Books *	

1. E. Balaguruswamy, Programming in ANSI C, 7th Edition, Tata McGraw Hill Publications, 2017.

2. E. Balagurusamy,, Object Oriented Programming with C++, Tata McGraw Hill Education Pvt.Ltd, Fourth Edition 2010.
3. K R Venugopal, Rajkumar Buyya and T. Ravishankar, Mastering C++, Tata McGraw-Hill, 2006.

Course Outcomes**

After completion of the course student will be able to:

1. Demonstrate the key concepts introduced in C programming by writing and executing the programs.
2. Demonstrate the concepts of structures and pointers for the given application/problem.
3. Implement the single/multi-dimensional array for the given problem.
4. Explore user-defined data structures like structures and pointers in implementing solutions like heterogeneous data processing.
5. Design and Develop Solutions to problems using modular/object oriented programming constructs using functions.

<table>
<tr><td>23PCA108L</td><td rowspan="3">Python Programming Laboratory</td><td>Credits: 1.5</td></tr>
<tr><td>Hrs/Week:L:T:P:S
0:0:3:0</td><td>CIEMarks:50</td></tr>
<tr><td>Total Hours/Week:
40 Hrs</td><td>SEEMarks:50</td></tr>
</table>

1. Program on Decision Control Structure Statements.
2. Program on List and Dictionary of data.
3. Program on User Defined Functions.
4. Program on Regular Expressions.
5. Program on Object Oriented Concepts.
6. Program on Overloading Operator.
7. Program on File Handling Mechanism.
8. Program on Working with database.
9. Program on Exception Handling.
10. Creation of GUI application.

Course Outcomes (COs):

After completion of the course student will be able to:

1. Understand the basic programming elements of Python.
2. Apply and analyze the different python data structures.
3. Understand the concepts of OOPS using Python.
4. Implement and debug the real world applications using GUI, file handling and Database.

23PCA109L	Web Programming Laboratory	Credits: 1.5
Hrs/Week:L:T:P:S **0:0:3:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

1. Design and develop a static web page using basic HTML tags to demonstrate use of different color, font, table format, bold, italic etc.
2. Design and develop a web page to demonstrate different types of style sheets.
3. Design and develop external CSS style sheet to create a registration form and validate using JavaScript.
4. Write a JavaScript to demonstrate use of alert, prompt and confirm message box by considering general feedback form.
5. Using HTML and JavaScript design a web page to calculate a payroll of an employee.

   Note:

   1. Read employee details such as employee id, name, designation, dept, DOJ and basic salary.
   2. Read deduction in percentage such as PF (Employee side), LIC.
   3. Read allowance in percentage such as PF (Employer side), DA, and HRA.
   4. Calculate gross and net salary of an employee as output.
6. Demonstrate use of hyperlink to pass parameters and validate those parameters in second page using JavaScript.
7. Design and develop a Registration and login page. Forward the request to success and failure page by validating user credentials through AJAX.
8. Create an HTML form with Student Name, USN, DOB, Branch, Sem, Address and E-mail fields, on submitting the page store them in MySQL table. Retrieve and display the data based on USN using PHP.
9. Using Rails and MySQL, develop a program to accept book Information viz. Accession number, title, authors, edition and Publisher from a web page and store the information in a database And to search for a book with the title specified by the user and to Display the search results with proper headings.
10. Design and develop a responsive web site by considering any real time scenario.

Course Outcomes (COs):

After completion of the course student will be able to:

1. Design and develop static web pages.
2. Demonstrate use of different types of CSS.
3. Apply the knowledge of JavaScript/AJAX to develop interactive web pages.
4. Design and develop dynamic web pages using PHP.

23PCA110S	Seminar	Credits: 02
Hrs/Week:L:T:P:S **0:0:0:2**		CIEMarks:50
Total Hours/Week: 28 Hrs		SEEMarks:50

Seminars are used as a course delivery mode to gather current trends in technology,research literature and self learn topics of their interests. Student has to search a technicaltopic, make presentation and give a detailed document on their findings in consultation with theguide.

Course Outcomes (COs):

At the end of the course student should be able to:

1. Identify seminar topics based on contemporary technical, societal and environmental issues.
2. Conduct literature survey in the selected domain.
3. Explore advanced concepts and technologies.
4. Make oral and written technical presentation.

SEMINAR ASSESMENT:

CIE and SEE marks Award : The committee, constituted for the purpose by the Head of the Department, shall award the CIE and SEE marks for the seminar. The committee comprising of Guide/Co-Guide, Senior faculty of the department and HoD/HoD nominee.

CIE and SEE marks Evaluation: Based on technical papers, application development, emerging technology etc.

Presentation skill : 50% of Marks

Report Writing : 25% of Marks

Question and answering : 25% of Marks

MCA II SEMESTER SYLLABUS

23PCA201C	Data Structures and Algorithms	Credits: 03
Hrs/Week:L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Introduction to data structures: Information and meaning Stack**:** Definition and examples Primitive operation,Example,Testing for exceptional conditions,implementing the push operation.**Example**:Infix,postfix and prefix,Basic definitions and examples. Evaluating a postfix expression,Program to evaluate a postfix expression,converting an expression from infix to postfix, Program to convert an expression from infix to postfix.**Recursion:** Recursive definition and processes, Factorial function, Multiplication of natural numbers, Fibonacci sequence, Binary search, Properties of recursive definition or algorithms, Towers of Hanoi problem. **Queue:** The queue and its sequential representation,C implementation of queues,Priority queue,Array implementation of a priority queue, circular queue and its implementation, deque(doubly endedqueue)implementation.	

UNIT–II	10 Hrs.
Lists: Linked lists, Inserting and removing nodes from a list, Linked implementation of stacks,Getnode and freenode operations, Linked implementation of queues, Linked list as a data structure,Exampleoflistoperation,Header nodes, Arrayimplementationoflists,Limitationsofarray Implementation,Allocatingandfreeingdynamicvariables,Linkedlistsusingdynamicvariable,Non integer and non- homogeneous lists. Other list structures, Circular lists, Stack as a circular list,Queue ascircular list, Primitive operations on circular lists, doubly linked lists.	

UNIT–III	10 Hrs.
Binary Trees: Binary trees, Operations on binary trees, Applications of binary trees. Binary treerepresentation,Noderepresentationofbinarytree,Internalandexternalnodes,implicitarrayrepresentation of binary trees, choosing a binary tree representation, binary tree traversal using C,threaded binary trees. Tree traversals using a father field, heterogeneous binary tree, **Representinglist as binary tree:** finding the k^{th} element, deleting an element, finding minimum and maximumelement in atree, evaluatinggeneral expressions usingtrees.	

UNIT–IV	10 Hrs.
Sorting: Exchange sort**:** Bubble sort, Quick sort. Selection sort and Tree sorting: Straight selectionsort, Binary tree sorts, sorting using a heap. Insertion sorts: Simple Insertion, Shell sort, Merge andRadixsorts. **Searching:** Sequential searching, Indexed sequential search, Binary	

search, Interpolation search.Tree Searching: Insertion into a Binary search tree, Deleting from a Binary search tree. Optimumsearchtrees, Balanced trees.

Reference Books *

1. Data structures using C by Yedidyah Langsam and Moshe J.Augenstein and Aaron M. Tenanbaum, PHI.
2. Mark Allen Weiss, data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education Asia.
3. Anany Levitin, Introduction to design and analysis of algorithms, Pearson Education, 2003

Course Outcomes**

After completion of the course student will be able to:

1. Understand the basic concepts of data structures like stack and queue
2. Analyze the logical representation of linked lists
3. Understand the working procedure of binary trees
4. Design and analyze sorting and searching techniques
5. Be able to compare functions and describe the relative merits of worst-, average-, and best-case analysis.

23PCA202C	Java and J2EE	Credits: 04
Hrs/Week:L:T:P:S **4:0:0:0**		CIEMarks:50
Total Hours/Week: 52 Hrs		SEEMarks:50

UNIT-I	13 Hrs.
An Overview of Java: The Java Class Libraries, Data Types, Variables, Introducing to Object Oriented programming concepts Encapsulation using Classes: Class Fundamentals, data members, Declaring Objects, Assigning Object Reference Variables, Introducing to Polymorphism using Constructors and Methods, Abstract Classes and methods.	
UNIT–II	**13 Hrs.**
Inheritance: Types of Inheritance, Using overloading and overriding of constructors and methods , this and super keywords , Interfaces, Exception Handling.**J2EE-Overview:** Enterprise Architecture Types-Single tier, 2-tier,-3-tier, n-tier, objectives of Enterprise Applications, features of J2EE, introduction to servers-web servers vs Application servers. Working with **Servlets 3.1:** Exploring the features of servlet 3.1, request and response model, servlet with API-packages, web directory structure-packaging, deploying and running web applications, servlet-lifecycle, working with ServletConfig and ServletContext Objects, HttpServletRequest and HttpServletResponse Interfaces.	
UNIT–III	**13 Hrs.**
Handling Sessions in Servlet 3.1: Describing the session, Introduction to session tracking, Exploring session tracking mechanisms – using cookies, Hidden Form Fields, URLRewriting, session creation and tracking. **Java Server Pages 2.3(JSP):** Introduction to JSP technology, advantages of JSP over servlet, architecture of JSP- Model-1,Model-2,life cycle of JSP, JSP Basic tags – scripting , directive , action tags, JSP implicit objects , Java Beans API, Bean properties, declaring beans in JSP Pages, bean components.	
UNIT–IV	**13 Hrs.**
JDBC 4.0: Introducing JDBC- architecture, features , JDBC Driver Types, JDBC API- sql Packages, A Brief Overview of the JDBC process with java.sql packages- JDBC Database Connection; Associating the JDBC/ODBC Bridge with the Database, Describing Classes and Interfaces- Driver Manager class, Driver Interface, Connection Interface, Statement Interface, Prepared Statement ,Callable Statement Interface, Result Set, Batch Updates. Transaction Processing; Metadata, Data types; Exceptions. **J2EE Design Patterns**: Introducing Design Patterns, Role of design patterns, types of design patterns.**Spring Framework:** Introduction to Spring	

framework, Features and Spring framework architecture- core module, AOP module, ORM Module.

Reference Books *

1. Herbert Schildt: JAVA the Complete Reference, 7th/9th Edition, Tata McGraw Hill, 2020.
2. Kogent Learning Solutions Inc and Dreamtech Press: Java Server Programming Java EE 7 Black Book, 2020
3. Keogh, Jim (2002). J2EE: the complete reference. New Delhi : Tata McGraw-Hill.

Course Outcomes**

After completion of the course student will be able to:

1. Demonstrate the basic programming constructs of Java and OOP concepts to develop Java programs.
2. Understand J2EE framework and technologies (Servlet/JSP).
3. Work with Java.sql.* package to design, implement and debug database applications.
4. Develop reusable software components using Java patterns.
5. Understand Spring framework and Develop Web based applications successfully.

23PCA203C	Database Management System	Credits: 04
Hrs/Week:L:T:P:S **3:0:2:0**		CIEMarks:50
Total Hours/Week: 40 Hrs + 12 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Databases and Database Users: Introduction, An Example, Characteristics of the Database Approach, Actors on the scene, Workers behind the scene, Advantages of using the DBMS approach, A brief history of database applications, When not to use a DBMS, **Database System Concepts and Architecture**: Data models, schemas and instances, Three-schema architecture and data independence, Database language and interfaces, The database system environment. **Data Modeling Using the Entity-Relationship(ER) Model:** Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationships, Relationship Types, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design for the COMPANY Database; ER Diagrams, Naming Conventions and Design Issues.	
UNIT–II	**10 Hrs.**
The Relational Data Model and Relational Database Constraint: Relational Model Concepts, Relational Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations. Relational Algebra and Relational Calculus: Unary Relational Operations, Relational Algebra Operations from Set Theory, Binary Relational Operations, Additional Relational Operations; Examples of Queries in Relational Algebra. **Relational Database Design Using ER and EER to-Relational Mapping:** Relational Database Design Using ER to Relational Mapping. **SQL-99: Schema Definition, Constraints, Queries and Views:** SQL Data Definition and Data types, Specifying Constraints in SQL, Schema Change statement in SQL, Basic Queries in SQL, More Complex SQL Queries, Insert, Delete and Update Statements in SQL, Specifying Constraints as Assertion and Triggers, Views (Virtual Tables) in SQL, Additional Features of SQL.	
UNIT–III	**10 Hrs.**
Functional Dependencies and Normalization for Relational Database: 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. **Relational Database Design Algorithms and Further Dependencies:** Properties of Relational Decompositions, Algorithms for Relational Database Schema Design; Multi-valued Dependencies and fourth normal form, Join Dependencies and fifth normal form, Inclusion Dependencies; Other Dependencies and Normal Forms. **Overview of Query Evaluation** The System Catalog: Information in the Catalog;	

Introduction to Operator Evaluation: Three Common Techniques, Access Paths; Algorithms for Relational Operations: Selection, Projection, Join, Other Operations; Introduction to Query Optimization: Query Evaluation Plans, Multi-operator Queries, Pipelined Evaluation, The Iterator Interface; Alternative Plans: A Motivating Example: Pushing Selections, Using Indexes; What a Typical Optimizer Does: Alternative Plans Considered, Estimating the Cost of a Plan.

UNIT–IV	10 Hrs.

Overview of Transaction Management: The ACID Properties: Consistency and Isolation, Atomicity and Durability; Transactions and Schedules; Concurrent Execution of Transactions: Motivation for Concurrent Execution, Serializability, Anomalies due to Interleaved Execution, Schedules Involving Aborted Transactions; Lock- Based Concurrency Control: Strict Two-Phase Locking, Deadlocks; Performance of Locking; Transaction Support in SQL: Creating and Terminating Transactions, What Should We Lock? Transaction Characteristics in SQL: Introduction to Crash Recovery: Stealing Frames and Forcing Pages, Recovery - Related Steps during Normal Execution, Overview of ARIES recovery algorithm, Atomicity: Implementing Rollback. Database Security, Introduction to Database Security; Access Control; Discretionary Access Control: Grant and Revoke on Views and Integrity Constraints; Mandatory Access Control: Multilevel Relations and Poly instantiation, Covert Channels, DoD Security Levels.

Reference Books *

1. R. Elmasri and S. Navathe, Fundamentals of Database Systems, Fifht Edition, Pearson Education 2011.
2. Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems,Third Edition, McGraw-Hill 2003.
3. Silberschatz,Korth and Sudarshan, Database System Concepts, Fourth Edition, McGraw-Hill.

Course Outcomes**

After completion of the course student will be able to

1. Identify, analyze and define database objects, enforce integrity constraints on a database using RDBMS
2. Use Structured Query Language (SQL) for database manipulation and also demonstrate the basic of query evaluation.
3. Design and build simple database systems and relate the concept of transaction, concurrency control and recovery in database
4. Develop application to interact with databases, relational algebra expression.
5. Develop applications using tuple and domain relation expression from queries.

DBMS Laboratory Assignments:

1. Demonstration of basic queries like create, update, drop and select (with aggregate and group functions)
2. Design and demonstration of ER Module.
3. Use of Intermediate SQL queries based on inner queries, working on constraints, different types of JOIN, filters etc.
4. Demonstrate use of subroutines
5. Demonstrate use of stored procedures.
6. Demonstrate use of triggers.
7. Database design and normalization.
8. Queries on database backup and Revoke.
9. User creation and authentication.
10. Use of advanced data types such as BLOG, Timestamp, Binary etc.

Course Outcomes (COs):

At the end of the course student should be able to:

1. Understand the fundamental concepts like data, information, DBMS, Data Models.
2. Design and Create Databases.
3. Implement and Manipulate the data.
4. Optimize query performance.

23PCA204C	Technical Communications	Credits: 03
Hrs/Week:L:T:P:S **2:2:0:0**		CIEMarks:50
Total Hours/Week: 40Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Fundamentals of Technical Communication: Technical Communication: Features; Distinction between General and Technical Communication; **Levels of Communication:** Extrapersonal Communication, Intrapersonal Communication, Interpersonal Communication, Organizational Communication and Mass Communication. **The Flow of Communication:** Downward Communication, Upward Communication, Lateral or Horizontal Communication, Diagonal or Crosswise Communication, The Importance of Technical Communication.	
UNIT–II	**10 Hrs.**
Listening Skills: Types of Listening, Traits of a Good Listener, and Barriers to Effective Listening.**Effective Presentation Strategies:** Introduction, Defining Purpose, Analyzing Audience and Locale, Organizing Contents, Introduction Main Body, Conclusions, Preparing an Outline, Kinesics, Personal Appearance: Posture, Gesture, Facial Expression, Eye Contact, Proxemics, Paralinguistics, Quality, Volume, Pace/Rate, Pitch, Articulation Pronunciation, Voice Modulation, Pauses, Chronemics.	
UNIT–III	**10 Hrs.**
Letter Writing and Email: Business Letters, Significance, Purpose, Structure Layout, Principles, Types and Samples. **Emails:** Advantages and Limitations, Style, Structure, and Content.**Technical Reports:** Introduction, Importance of Reports, Objectives of Reports, Characteristics of a Report, Categories of Reports, Formats, Prewriting, Structure of Reports (Manuscript Format), Types of Reports, Writing the Report, Revising, Editing, and Proofreading.	
UNIT–IV	**10 Hrs.**
Introduction to business ethics and values: Meaning, Nature of business ethics, Importance of business ethics, Factors influencing business ethics, Arguments for and against business ethics, Types of ethical dilemmas. Values: Meaning, Types of values.**Introduction to Corporate Governance:** Definition and Conceptual Framework of Corporate Governance, Business Ethics – an important dimension to Corporate Governance, Fair and Unfair Business Practices. Theoretical Basis of Corporate Governance, Mechanism- Corporate Governance Systems, Indian Model of Governance, Good Corporate Governance.	

Reference Books *
1. Meenakshi Raman, Technical Communication Oxford University Press, 2017. **2.** C.S.V. Murthy, Business Ethics, Himalaya Publishing House; Mumbai, 2007. **3.** Andrew Crane and Diark Matten, Business Ethics, Oxford Publication, New Delhi, 2007.
Course Outcomes**
After completion of the course student will be able to: 1. Understand the fundamental principles of effective technical communications. 2. Understand the fundamental principles of good listening skills and effective presentation strategies. 3. Develop various types oftechnical reports/letters/emails and practice in their professional life. 4. Understand the Business Ethics and corporate governance. 5. Imbibe the ethical issues in corporate governance and to adhere to the ethical codes.

23PCA205L	Data Structures Laboratory	Credits: 2
Hrs/Week:L:T:P:S **0:0:4:0**		CIEMarks:50
Total Hours/Week:25Hrs		SEEMarks:50

1. Write a C Program to demonstrate Stack operations using arrays.
2. Write a C Program to evaluate postfix expression, postfix expression contains single digit integers and the operators +,-,*and /.
3. Write a C Program to convert infix to postfix expression.
4. Write a C Program to demonstrate Queue operations using arrays.
5. Write a C Program to demonstrate different operations on singly linked list.
6. Write a C Program to demonstrate different operations on circular doubly linked list.
7. Write a C program to implement the following operation on binary treeusing array:
   i. Insert
   ii. Delete
   iii. Tree traversal
8. Write a C program to demonstrate binary search using recursion.
9. Write a C Program to perform the Merge sort.
10. Write a C Program to perform the Quick sort.

Course Outcomes (COs):

At the end of the course student should be able to:

1. Evaluate the Expressions like postfix, prefix conversions.
2. Implementing various data structures viz. Stacks, Queues, Linked Lists, and Trees.
3. Implementing various searching techniques.
4. Implementing various sorting techniques.

<table>
<tr><td>23PCA206L</td><td rowspan="3">Java and J2EE Laboratory</td><td>Credits: 2</td></tr>
<tr><td>Hrs/Week: L:T:P:S
0:0:4:0</td><td>CIEMarks:50</td></tr>
<tr><td>Total Hours/Week:
25Hrs</td><td>SEEMarks:50</td></tr>
</table>

1. Write a JAVA program to demonstrate use of class members and object members.
2. Write a JAVA program to demonstrate polymorphismusing constructor and methods
3. a) Write a JAVA program to demonstrate abstract class concept.

   b) Write a JAVA program to demonstrate the inheritance concept.
4. Write a Servlet program to demonstrate the basic servlet using doGet(), doPost() and service() methods.
5. Write a servlet program to demonstrate session tracking.
6. Write a JSP script to demonstrate scripting, directive and expression tags.
7. Write a JSP script to demonstrate bean concept.
8. Write a Servlet/JSP to demonstrate CRUD operations using JDBC.
9. Write a J2EE application to demonstrate complete login process.
10. Write a program to demonstrate spring framework.

Course Outcomes (COs):

At the end of the course student should be able to:

1. Demonstrate OOPS concepts.
2. Demonstrate simple web applications using servlet and JSP.
3. Design and develop web applications to solve real world problems.
4. Demonstrate the basic use of spring framework.

23PCA207P	Mini Project	Credits: 02
Hrs/Week: L:T:P:S **0:0:4:0**		CIEMarks:50
Total Hours/Week:` 25 Hrs		SEEMarks:50

Students are expected to take up mini project with a team size not exceeding three. The objective of this course is to develop real time mini projects using latest technologies.

Course Outcomes (COs):

At the end of the course student should be able to:

1. Apply the technical knowledge gained through different courses to solve the real world problems.
2. Exhibits the presentation and communication skills.
3. Prepare a technical report based on work carried out.
4. Exhibit the responsibilities in a team.

Mini Project Assessment:

CIE and SEE marks Award : The committee, constituted for the purpose by the Head of the Department, shall award the CIE and SEE marks for the Mini Project. The committee comprising of Guide/Co-Guide, Senior faculty of the department and HoD/HoD nominee.

CIE and SEE marks Evaluation :

Application development, Presentation skill : 50% of Marks
Report Writing : 25% of Marks
Question and answering : 25% of Marks

Professional Elective-I		Professional Elective-II	
Subject Code	**Subject**	**Subject Code**	**Subject**
23PCC208E	Data Mining	23PCC212E	Introduction to AI
23PCC209E	Cloud Computing	23PCC213E	DevOps
23PCC210E	Mobile Application Development	23PCC214E	Android Programming Concepts
23PCC211E	Computer Vision	23PCC215E	Natural Language Processing

23PCC208E	Data Mining	**Credits: 03**
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40Hrs		SEEMarks:50

UNIT-I	**10 Hrs.**
Introduction to data mining: Definition of Data Mining, Motivating Challenges of DM, Data Mining Tasks. Data: Data Attributes, Types of Data, Quality of Data and Data Preprocessing, Measures of Similarity and Dissimilarity.	
UNIT–II	**10 Hrs.**
Association Analysis: Definition of Association Analysis, Frequent Item Set Generation, Rule Generation, Compact Representation of Frequent Item Sets. Alternate Method of Generating Item Sets, FP Growth Algorithms, Evaluation of Association Pattern.	
UNIT–III	**10 Hrs.**
Classification: Preliminaries, General Approach To Solving Classification Problem, Decision Tree Based Classifier, Rule Based Classifier, Nearest Neighbor Classifier. Cluster Analysis: Overview, K-means, DBSCAN.	
UNIT–IV	**10 Hrs.**
Mining Object, Spatial, Multimedia, Text and Web Data: Multidimensional Analysis and Descriptive Mining of Complex Data Objects – Spatial Data Mining – Multimedia Data Mining – Text Mining – Mining the World Wide Web.	

Reference Books *

1. "Introduction to Data Mining", Pang-Ning Tan, Michael Steinbach, Vipin Kumar, Pearson Education.
2. "Data Mining – Concepts and Techniques", Jiawei Han and Micheline Kamber, Morgan Kaufman, 2006, 2nd Edition.
3. "Introduction to Data Mining with Case Studies", G K Gupta, PHI.

Course Outcomes**

After completion of the course student will be able to:

1. Comprehend the fundamentals of Data mining.
2. Apply data preprocessing techniques.
3. Apply association rule mining techniques like a priory, FP tree and ECLAT and analyze the usefulness of rules.
4. Apply classification methods like decision tree, rule based and nearest neighbor, cluster analysis, K-MEANS etc.
5. Comprehend advanced mining applications and algorithms like web mining, search engines etc.,

23PCC209E	Cloud Computing	**Credits: 03**
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40Hrs		SEEMarks:50

UNIT-I	**10 Hrs.**
Introduction to Cloud Computing: Eras of computing, The vision of Cloud Computing, Defining a cloud, A closer look, Cloud computing reference model, Historical developments: Distributed systems, Virtualization, Web 2.0; Service oriented computing; Utility oriented computing. Architectures for parallel and distributed computing: Parallel Vs Distributed computing, Elements of distributed computing, Technologies for distributed computing.	
UNIT–II	**10 Hrs.**
Virtualization: Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples: Xen: Para virtualization, VmWare: Full virtualization, Microsoft Hyper – V.	
UNIT–III	**10 Hrs.**
Cloud computing architecture: Introduction, Cloud reference model: Architecture, IaaS, PaaS, SaaS, Types of Clouds: Public, Private, Hybrid and Community clouds, Economics of the cloud, Open challenges.	
UNIT–IV	**10 Hrs.**
Cloud Access: authentication, authorization and accounting - Cloud Provenance and meta-data - Cloud Reliability and fault-tolerance - Cloud Security, privacy, policy and compliance- Cloud federation, interoperability and standards.	

Reference Books *

1. Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelci, Mastering Cloud Computing, Tata McGraw Hill, New Delhi, India, 2013.
2. Barrie Sosinsky, " Cloud Computing Bible" John Wiley & Sons, 2010
3. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, "Distributed and cloud computing from Parallel Processing to the Internet of Things", Morgan Kaufmann, Elsevier – 2012

Course Outcomes**

After completion of the course student will be able to:

1. Articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing.
2. Understand and Identify the basic concepts of Virtualization and types.
3. Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
4. Explain the core issues of cloud computing such as security, privacy, and interoperability.
5. Provide the appropriate cloud computing solutions and recommendations according to the applications used.

<table>
<tr><td>23PCA210E</td><td rowspan="3">Mobile Application Development</td><td>Credits: 03</td></tr>
<tr><td>Hrs/Week: L:T:P:S
3:0:0:0</td><td>CIEMarks:50</td></tr>
<tr><td>Total Hours/Week:
40Hrs</td><td>SEEMarks:50</td></tr>
<tr><td colspan="2">UNIT-I</td><td>10 Hrs.</td></tr>
<tr><td colspan="3">Introduction: Preliminary Considerations – Cost of Development – Importance of Mobile Strategies in the Business World – Mobile Development Today - Mobile Myths - Third-Party Frameworks – Mobile Web Presence - Mobile Content -Mobile Browsers - Mobile Applications – Marketing. Web Services for Mobile Applications: What Is a Web Service? - Examples of Web Services - Advantages of Web Services - Web Services Languages (Formats) - eXtensible Markup Language (XML) - JavaScript Object Notation (JSON) - Transferring Non-textual Data - Creating an Example Web Service - Using the Microsoft Stack - Using the Linux Apache MySQL PHP (LAMP) Stack - Debugging Web Services - Tools - Advanced Web Service Techniques.</td></tr>
<tr><td colspan="2">UNIT–II</td><td>10 Hrs.</td></tr>
<tr><td colspan="3">MOBILE USER INTERFACE DESIGN: Understanding Mobile Applications Users – Understanding Mobile Information Design – Understanding Mobile Platforms – Using the Tools of Mobile Interface Design. Mobile Websites: Choosing a Mobile Web Option - Adaptive Mobile Websites - Dedicated Mobile Websites - Mobile Web Apps with HTML5.
MOBILE OPERATING SYSTEMS: Getting Started with Android Programming: Why Target Android? - Who Supports Android? - Android as Competition to Itself - Multiple Markets and Market Locks - Getting the Tools You Need - Installing Additional SDK Components – Development –Connecting to the Google Play - Android Development Practices- Building the Derby App in Android</td></tr>
<tr><td colspan="2">UNIT–III</td><td>10 Hrs.</td></tr>
<tr><td colspan="3">Getting Started With IoS :The iPhone Craze - Apple in Its Beauty - Apple Devices - Getting the Tools You Need - Hardware - xCode and the iOS SDK - The iOS Human Interface Guideline - iOS Project - Anatomy of an iOS App - Getting to Know the xCode IDE - Debugging iOS Apps - The iOS Simulator - Debugging Code - Instruments - Objective-C Basics - Classes - Control Structures - Try Catch - Hello World App - Creating the Project - Creating the User Interface - Building the Derby App in iOS - User Interface - Team Roster- Details - Leagues and Team Names - Other Useful iOS Things - Offline Storage – GPS.
Getting Started with Windows Phone : New Kid on the Block - Metro - Application Bar - Tiles - Tombstoning - Getting the Tools You Need - Hardware - Visual Studio and Windows Phone SDK - Windows Phone 7 Project - Silverlight vs. Windows Phone 7 - Anatomy of a Windows Phone 7 App - The Windows Phone 7 Emulator - Building the Derby App in Windows Phone 7 - Creating the Project - User Interface - Derby Names - Leagues - Distribution - Other Useful Windows Phone Things - Offline Storage - Notifi cations - GPS – Accelerometer - Web Services</td></tr>
<tr><td colspan="2">UNIT–IV</td><td>10 Hrs.</td></tr>
<tr><td colspan="3">GETTING STARTED WITH MONOTOUCH AND MONO FOR ANDROID: The Mono Framework - MonoTouch - Mono for Android - Assemblies - Why MonoTouch/Mono for Android? - Downsides -</td></tr>
</table>

Xamarin Mobile - Getting the Tools You Need - Mono Framework - MonoTouch - Mono for Android - Getting to Know MonoDevelop - Debugging - MonoTouch Specifics - Mono for Android Specifics - Mono Projects - Anatomy of a MonoTouch App - Anatomy of a Mono for Android App - Building the Derby App with Mono - MonoTouch - Mono for Android - Other Useful MonoTouch/Mono Features - Local Storage – GPS.

Reference Books *

1. Jeff & Scott, "Professional Mobile Application Development ", Wrox Publications.
2. Wei-Meng Lee, "Beginning Android Application Development", Wiley.

Course Outcomes**

After completion of the course student will be able to:

1. Understand Various Mobile Application Architectures. (Understand)
2. Develop applications using software development kits (SDKs), frameworks and toolkits.
3. Implement suitable platform for mobile devices
4. Design and develop open-source software based mobile application to the given problem.
5. Build and deploy competent mobile application to solve the societal/industrial problems.

23PCA211E	COMPUTER VISION	Credits: 03
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Introduction & Fundamentals: Origin of DIP, examples of fields that use DIP, fundamentals of DIP, components of an DIP system, Image formation model, Spatial & Gray level resolution, Image enhancement in special domain: Piecewise transformation functions, Histogram equalization, Histogram specification, image averaging, spatial filters- smoothing and sharpening, Laplacian filter, Canny edge detector., image sampling and quantization, some basic relationships between pixels	
UNIT–II	**10 Hrs.**
Enhancements in 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. **Enhancements in Frequency Domain:** Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphism Filtering.	
UNIT–III	**10 Hrs.**
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, Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations.	
UNIT–IV	**10 Hrs.**
Morphological Image Processing and Segmentation: Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation. Some Basic Morphological Algorithms, Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, RegionBased Segmentation.	

Reference Books *

1. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education.
2. Anil K. Jain, "Fundamentals of Digital Image Processing", Pearson Education.

Course Outcomes**

After completion of the course student will be able to:

1. Understand the concept of image formation, digitization and the role human visual system plays in perception of image data.
2. Acquire an appreciation for spatial and frequency-based techniques for enhancing the appearance of an image duly applying them in different applications.

3. Discern the difference between noise models, realize different spatial and frequency-based filtering techniques for reduction and removal of noise.
4. Design and create practical solutions using morphological operators and segmentation techniques for common image processing problems.
5. Apply image processing knowledge in building real time applications.

23PCA212E	Introduction to Artificial Intelligence	Credits: 03
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
Introduction: Overview of Artificial Intelligence- Problems of AI, AI Technique, Tic - Tac - Toe Problem. Intelligent Agents: Agents & Environment, Nature of Environment, Structure of Agents, Goal Based Agents, Utility Based Agents, Learning Agents. Problem Solving: Problems, Problem Space & Search: Defining The Problem As State Space Search, Production System, Problem Characteristics, Issues In The Design Of Search Programs.	
UNIT–II	**10 Hrs.**
Search Techniques: Solving Problems by Searching, Problem Solving Agents, Searching For Solutions; Uniform Search Strategies: Breadth First Search, Depth First Search, Depth Limited Search, Bi-directional Search, Comparing Uniform Search Strategies. **Heuristic Search Strategies:** Greedy Best-First Search, A* Search, Memory Bounded Heuristic Search: Local Search Algorithms & Optimization Problems: Hill Climbing Search, Simulated Annealing Search, Local Beam Search, Genetic Algorithms; Constraint Satisfaction Problems, Local Search For Constraint Satisfaction Problems.	
UNIT–III	**10 Hrs.**
Knowledge & Reasoning: Knowledge Representation Issues, Representation & Mapping, Approaches to Knowledge Representation, Issues in Knowledge Representation. **Using Predicate Logic:** Representing Simple Fact in Logic, Representing Instant & ISA Relationship, Computable Functions & Predicates, Resolution, and Natural Deduction. **Representing Knowledge Using Rules:** Procedural Verses Declarative Knowledge, Logic Programming, Forward Verses Backward Reasoning, Matching, Control Knowledge.	
UNIT–IV	**10 Hrs.**
Probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Bayesian Networks, Dempster-Shafer Theory. **Planning:** Overview, Components of A Planning System, Goal Stack Planning, Hierarchical Planning. **Learning:** Forms of Learning, Inductive Learning, Explanation Based Learning, Neural Net Learning & Genetic Learning.	

Reference Books *

1. Stuart J. Russell, Peter Norwig, Artificial Intelligence –A Modern approach, 3 rd Edition, Pearson Education, 2016.
2. Rich E. & Knight K. “Artificial Intelligence”, 2nd Edition, TMH, New Delhi.
3. Parag Kulkarni, Prachi Joshi, Artificial Intelligence –Building Intelligent Systems, 1st ed., PHI learning, 2015.

Course Outcomes**

After completion of the course student will be able to:

1. Understand the principles and approaches of artificial intelligence and different aspects of Intelligent agent.
2. Apply different search techniques for solving real world complex problems and select the most appropriate solution by comparative evaluation.
3. Design AI based systems and their components with reasoning even in the presence of in-complete and/or uncertain information.
4. Develop knowledge-based systems with proper representation schemes.
5. Analyze the pros and cons of different AI systems and their design.

23PCA213E	DevOps	Credits: 04
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week: 40 Hrs		SEEMarks:50

UNIT-I	10 Hrs.
What is DevOps?, Why is DevOps is needed? How is DevOps different from traditional IT? Why is DevOps used?, DevOps Lifecycle, DevOps Work Flow, DevOps Vs Agile, DevOps Principles, Roles, Responsibilities, and Skills of a DevOps Engineer, Various DevOps Tools Amazon Web Services - Cloud Web Computing, Advantages, Types of Cloud Computing, Amazon Overview, Services Cloud Platform Features of Elastic Compute Cloud (EC2), AWS Services, AWS Management Console, AWS Command Line Interface, Region, availability Zone and edge location, Amazon EC2 root device volume, Creating and Launching EC2 windows and Linux Instances, Connecting to Linux and Windows Instances, Managing Security Group, Identity access Management (IAM), Create IAM users and Group, Assign policy to IAM users and Groups, Configure IAM roles to access AWS resources.	
UNIT–II	**10 Hrs.**
Version Control with Git - About Version Control, Local Version Control Systems, Centralized Version Control Systems, Distributed Version Control Systems, What is Git?, A Short History of Git, difference between Git and any other VCS, The Three States of Git - modified, staged, and committed, Why Git for your organization, Install and Using Git, Common commands in Git, Working with Remote Repositories Container Technology - Introduction to Containers? Benefits of Containerization, How Do Containers Work?, Virtual Machines vs Containers, brief intro to Container Terminology, Overview of Container Architecture, Installing Container engine tool, Creating Containerized Services, Provisioning Containerized Services.	
UNIT–III	10 Hrs.
Managing Containers - What is Container management, Benefits of Container management, Container management strategy, Pull Docker images from Docker hub, Managing the Life Cycle of Containers, Attaching Persistent Storage to Containers, Accessing containers, Managing Container Images - Accessing Registries (public and Private), Manipulating Container Images.	
UNIT–IV	10 Hrs.
Security and Monitoring: Security in Jenkins and VSTS, Monitoring Jenkins and Microsoft Azure, Monitoring Jenkins, Azure Web Apps troubleshooting and monitoring, Azure App Services- CPU and memory consumption, Azure App Services- Activity log, Azure Application Insights for application monitoring, Azure web application monitoring, Diagnostics logs.	
Reference Books *	

1. DevOps For Dummies 2ndIBMLimitedEdition by Sanjeev Sharma and Bernie Coyne.
2. Deepak Gaikwad, Viral Thakkar, DevOps Tools: from practioner's point of view, Wiley, 1 st Edition,2019.
3. Effective DevOps by Jennifer Davis & Katherine Daniels.

Course Outcomes**

After completion of the course student will be able to:

1. Illustrate the importance and principles of DevOps
2. Utilize Principles and techniques of DevOps to solve problems
3. Demonstrate the usage of Application Lifecycle Management tools
4. Apply security tools used in DevOps to cloud applications
5. Effective use of DevOps tools like Git, Docker etc in various aspects of DevOps delivery model.

23PCA314E	Android Programming Concepts	Credits:03
Hrs/Week: L:T:P:S **3:0:0:0**		CIEMarks:50
Total Hours/Week :40Hrs		SEEMarks:50

UNIT-I	**10Hrs.**
Overview- BasicsofAndroid,MVC,GUI,Components,Events,LayoutManager,MultipleActivities,PassingDatabetweenActivities, Transitions,Persistent.	
UNIT–II	**10Hrs.**
CreatingMenus,SQlite,ManagingDeviceOrientation,TouchesandSwipe,Graphics,Animations,SoundandGaming	
UNIT–III	**10Hrs.**
Fragments,UsingLibrariesandtheirAPIs,UsingGPSandLocationServices,UsingAnotherAppwithintheApp	
UNIT–IV	**10Hrs.**
XMLandContantApps,AndroidWidget,In-AppAdvertising,SecurityandEncryption	

Reference Books*

1. HerveFranceschi,“AndroidApplicationDevelopment“,JonesandBartlletLearning.
2. TrishCornezandRichardCornez,“AndroidProgrammingConcepts”,JonesandBartlletLearning.

Course Outcomes**

After completion of the course students will be able to:

1. Demonstrate the Understanding of fundamental of Android Programming.
2. Buildtheirabilitytodevelopsoftwarewithreasonablecomplexityonmobileplatform.
3. Discover the lifecycles of Activities, Applications, intents and fragments.
4. Design the Android apps by using Java Concepts.
5. Build and deploy mobile application.

<table>
<tr><td>23PCA215E</td><td rowspan="3">Natural Language Processing</td><td>Credits: 03</td></tr>
<tr><td>Hrs/Week: L:T:P:S
3:0:0:0</td><td>CIEMarks:50</td></tr>
<tr><td>Total Hours/Week:
40 Hrs</td><td>SEEMarks:50</td></tr>
</table>

UNIT-I	10 Hrs.

Introduction to Natural Language Processing: Overview, What is Natural Language Processing, Origins of NLP, Language and Knowledge, The Challenges of NLP, Language and Grammar, Processing Indian Languages, NLP Applications, Some Successful Early NLP Systems, Information Retrieval
Language Modelling: Introduction, Various Grammar-based Language Models, Statistical Language Model.
Word Level Analysis: Chapter Overview, Introduction, Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and Correction, Words and Word Classes, Part-of-Speech Tagging

UNIT–II	10 Hrs.

Syntactic Analysis: Introduction, Context-Free Grammar, Constituency, Parsing, Probabilistic Parsing, Indian Languages.
Semantic Analysis: Introduction, Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation.
Discourse Processing: Introduction, Cohesion, Reference Resolution , Discourse Coherence and Structure.

UNIT–III	10 Hrs.

Natural Language Generation : Introduction, Architectures of NLG Systems, Generation Tasks and Representations, Applications of NLG
Machine Translation: Introduction, Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Direct Machine Translation, Rule-based Machine Translation, Corpus-based Machine Translation, Semantic or Knowledge-based MT systems, Translation involving Indian Languages.
Information Retrieval- Introduction, Design Features of Information Retrieval systems, Information Retrieval Models, Classical Information Retrieval Models, Non-classical models of IR, Alternative Models of IR , Evaluation of the IR System.

UNIT–IV	10 Hrs.

Information Retrieval- Introduction, Natural Language Processing in IR, Relation Matching, Knowledge-based Approaches, Conceptual Graphs in IR, Cross-lingual Information Retrieval.
Other Applications: Introduction, Information Extraction, Automatic Text Summarization, Question-Answering System.
Lexical Resources: Introduction, WordNet, FrameNet, Stemmers, Part-of-Speech Tagger, Research Corpora, Journals and Conferences in the Area.

Text Books *

1. Tanveer Siddiqui, U.S.Tiwary Natural Language Processing and Information Retrieval.
2. DanielJurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall, 2009.

3. Anne Kao and Stephen R. Poteet (Eds), "Natural Language Processing and Text Mining", Springer Verlag London Limited 2007.

Course Outcomes**

After completion of the course student will be able to:

1. Extract information from text automatically using concepts and methods from natural language processing (NLP) including stemming, n-grams, POS tagging, and parsing.
2. Analyze the syntax, and semantic using computational methods.
3. Understand the concepts Text mining.
4. Illustrate information retrieval techniques.
5. Analyse and apply knowledge of NLP in designing real time applications and research.