UBT616C	UPSTREAM PROCESSING TECHNOLOGY	Credits: 3
L: T: P – 2-2-0		CIE Marks: 50
Total Hours/Week: 04		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

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.

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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

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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	

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UBT625E	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

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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	-

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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

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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

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UBT515L	GENETIC ENGINEERING LABORATORY	Credits: 1
L: T: P – 0-0- 2		CIE Marks: 50
Total Hours/Week: 2		SEE Marks: 50

LIST OF EXPERIMENTS

1. Transformation.-
2. Blue white colony screening.
3. Thermal denaturation of DNA.
4. Restriction Digestion.
5. Ligation Experiment.
6. Southern Blotting – Agarose Gel Electrophoresis
7. Electroblotting and analysis.
8. **SOP for PCR**
9. **SOP for Gel Documentation**
10. **SOP for UV-Spectrophotometer**
11. **SOP for Lyophilizer**
12. PCR (Amplification with specific primers)

REFERENCE BOOKS*

1. Sadashiva and Manickam, “Biochemical Methods”, 2nd Edition, New age international Publishers,2017.
2. Sambrook & Russell, “Molecular Cloning”, Cold Spring Harber Lab, 3rd Edition, 2002.
3. Current protocols in molecular biology-Greena Publishing Associates, NY, 1988

COURSE OUTCOMES**

1. To demonstrate proficiency in Transformation and screening of transformants.
2. To apply the knowledge of thermal denaturation to calculate Tm value.
3. To evaluate the functions of restriction digestion and Ligation on DNA.
4. To demonstrate proficiency in Electro-blotting and detection.
5. To demonstrate understanding of SOP and PCR.
6. To gain knowledge in common and advanced laboratory practices in Genetic engineering lab.

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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**

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21UAI312C	Data Structures and Applications L:T:P:3:0:0	03-Credits
Hrs/Week:03		CIE Marks:50
Total Hours:40		SEE Marks:50

UNIT - I	10 Hrs

The stack: Definition and Examples: Primitive operations, An Example, The stack as an Abstract data type. Representing Stacks in C: Implementing pop operation, Testing for exceptional conditions, Implementing the push operations. , An Example- Infix, Postfix and Prefix: Basic Definitions and Examples, Evaluating a postfix expression, Program to evaluate a postfix expression, Limitations of the program, Converting an expression from Infix to Postfix, Program to convert an expression from Infix to Postfix.

UNIT – II	10 Hrs

Recursion: Recursive definition and processes: The factorial function, Properties of recursive definitions or Algorithms. , Recursion in C: Factorial in C., writing recursive programs: The Towers of Hanoi Problem.

Queues: The queue and its sequential representation: The queue as an abstract data type, C implementation of queues, The insert operation, The priority queue, Array implementation of a priority queue.

Lists: Linked lists: Inserting and removing nodes from a list, Linked implementation of stacks, The getnode and freenode operations, Linked implementation of queues, The linked list as a data structure, Examples of list operations, List implementation of priority queues, Header Nodes.

UNIT - III	10 Hrs

Lists in C: Array implementation of lists, Limitations of the array implementation, Allocating and freeing dynamic variables, Linked lists using dynamic variables, Queues as lists in C, Examples of list operations in C, Non integer and non homogeneous lists, Comparing the dynamic and array implementation of lists, Implementing Header Nodes. An example: simulation using linked lists.

Other list structures: Circular lists, The stack as a circular list, The queue as a circular list, Primitive operations on circular lists, The Josephus problem, Header nodes, Addition of long positive integers using circular lists.

UNIT - IV	10 Hrs

Trees: Binary trees: Basics, Operation on Binary trees, Applications of Binary trees. Binary

tree representations: Node representations of Binary trees, Node Representation of binary trees, Internal & external nodes, Implicit array representation of Binary trees, Choosing a Binary tree representation, Binary tree traversal in C, traversal using a father field, heterogeneous binary trees. **Trees and their applications**: C representation of trees, Tree traversals, General expressions as trees, Evaluating an expression tree, Constructing tree.

Text Books:

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

Reference books:

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

Course Outcomes:

CO 1. Identify different data structures and their applications

CO 2. Apply stack and queues in solving problems.

CO 3. Demonstrate applications of linked list.

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

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

*Text book is replaced for the subject

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21UAI403C	Operating Systems	Credits:03
L:T:P:3:0:2		CIE Marks:50
Total Hours/Week: 40/03		SEE Marks:50

UNIT-I	10 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	**10 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	**10 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	**10 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. Protection: Goals, principles and domain of protection, Access Matrix, Disk management and other issues: Disk management: Disk Structure and Scheduling.	

Text Books:

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

Reference Books

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

Course Outcomes : After completion of the course student will be able to

CO1: Explain the core structure and different services provided by Operating System at different levels

CO2: Apply the concepts of process scheduling algorithms and synchronization techniques

in solving real time problems

CO3: Exhibit the knowledge of memory management techniques

CO4: Exhibit the knowledge of secondary storage management techniques and security solutions

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

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21UAI417C	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.	

*Lab Assignments are added

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

Programming Exercises:

PART A:

1. Place the number 3Bh in internal RAM locations 30h to 32h.
2. Copy the data in external RAM locations 0123h to R6 and the data in external RAM location 1234h to R7 register.
3. Write instructions to invert every bit in register R6 using 3 differet methods.
4. XOR the number with whatever is in A register so that the result is FFh.
5. Multiply the byte in RAM location 22h with the byte in 15h and store the result in RAM locations 19h(LSB) and 1Ah (MSB).
6. Write an 8051 C program to send hex values for ASCII characters of 0, 1, 2, 3, 4, 5, A, B, C, and D to port P1.
7. Write an 8051 C program to toggle bit D0 of the port P1 (P1.0) 50,000 times.
8. Write an 8051 C program to toggle bits of P1 continuously forever with some delay.
9. LEDs are connected to bits P1 and P2. Write an 8051 C program that shows the count from 0 to FFH (0000 0000 to 1111 1111 in binary) on the LEDs.
10. Write an 8051 C program to get a byte of data form P1, wait 1/2 second, and then send it to P2.

PART B:

1. Data Transfer instructions: Block move, Exchange, Finding largest element in an array.
2. Arithmetic instructions: Addition, subtraction, multiplication and division.
3. Counters: Binary/BCD/Hexadecimal (up/ down).
4. Boolean & Logical instructions: To check whether 0^{th} bit and 5^{th} bit of data is 0 or 1. If the bit is 0 then set the bit (Bit manipulations).
5. Conditional CALL and RETURN: Multiplication of every element of an array with constant.
6. Write an 8051 C program to toggle only bit P2.4 continuously without disturbing the rest of the bits of P2.
7. A door sensor is connected to the P1.1 pin, and a buzzer is connected to P1.7. Write an 8051 C program to monitor the door sensor, and when it opens, sound the buzzer. You can sound the buzzer by sending a square wave of a few hundred Hz.
8. Write an 8051 C program to toggle all the bits of P0, P1, and P2 continuously with a 250 ms delay. Use the sfr keyword to declare the port addresses.
9. Write an 8051 C program to toggle all the bits of P0 and P2 continuously with a 250 ms delay. Using the inverting and Ex-OR operators, respectively.
10. Write an 8051 C program to read the P1.0 and P1.1 bits and issue an ASCII character to P0 according to the following table.

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21UAI402C	Analysis & Design of Algorithms (I) L:T:P:3:0:2	04-Credits
Hrs/Week : 04		CIE Marks:50
Total Hours:40+24		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: Mergesort, Quicksort, Binary Search, Binary Tree Traversals and Related Properties, Multiplication of Large Integers and Strassen's Matrix Multiplication. **Decrease and Conquer:** Insertion Sort, Depth First Search, Breadth First Search, Topological Sorting, Algorithms for Generating Combinatorial Objects.	
UNIT - III	**10 + 6 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.	
Text Books: 1. "Introduction to The Design & Analysis of Algorithms", Anany Levitin, Pearson Education, 3rd Edition, 2017	
Reference books: 1. "Introduction to Algorithms", Stein, PHI, 2nd Edition, 2. "Computer Algorithms", Horowitz E., Sahni S., Rajasekaran S., Galgotia Publications, 2001	
Course Objectives: 1) Understand the notion of an algorithm, asymptotic notations and different problem types. 2) Analyze the recursive and non-recursive algorithms. 3) Understand the algorithm design techniques using divide and conquer approach. 4) Understand the algorithm design techniques using dynamic programming and greedy approaches.	

5) Explain the algorithm design techniques using backtracking, branch & bound, NP-complete and NP-hard problems.

Course Outcomes

CO1: Understand the notion of an algorithm, asymptotic notations and different problem types.
CO2: Analyze the recursive and non-recursive algorithms
CO3: Ability to analyze the performance of algorithms.
CO4: Ability to choose appropriate algorithm design techniques for solving problems such as divide-and-conquer, decrease-and-conquer, greedy algorithms, dynamic programming and analyze them.
CO5: Design and analyze algorithm using backtracking, branch & bound, NP-complete and NP-hard problems.

Course Outcomes	Programme Outcomes														
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2	PSO3
CO1	3	2											3		
CO2	3	2		2									3		
CO3	3	3	2	1									3		
CO4	3	3	3	2									2		
CO5	3	2	3	2									2		

LAB ASSIGNMENTS

1) a) Write a C program to search a given element using binary search method and determine its time complexity.

b) Write a C program to sort a given set of numbers using the quick sort method and determine its time complexity.

2) Write a C program to sort a given set of numbers using the merge sort method and determine its time complexity.

3) Write a C program to check whether a given graph is connected or not using DFS method and determine its time complexity.

4) Write a C program to print all the nodes reachable from a given starting node in a digraph using BFS method and determine its time complexity.

5) Write a C program to sort a given set of numbers using the heap sort method and determine its time complexity.

6) a) Write a C program to find the Transitive Closure of a graph using Warshall's algorithm.

b) Write a C program to find all pair shortest path of a graph using Floyd's algorithm.

7) Write a C program to implement 0/1 Knapsack problem using Dynamic Programming and determine its time complexity.

8) Write a C program to find Minimum Cost Spanning Tree of a given undirected graph using Prim's algorithm and determine its time complexity.

9) Write a C program to find Minimum Cost Spanning Tree of a given undirected graph using Kruskal's algorithm and determine its time complexity.

10) Write a C program to find the shortest path from a given vertex to other vertices in a weighted connected graph using Dijkstra's algorithm and determine its time complexity

*Lab assignments are added

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

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

Text Books:

1. Tom Mitchell, Machine Learning, McGraw- Hill Publications, 2nd Edition, 2013.
2. Ethem Alpaydin, Introduction to Machine Learning, MIT press, Cambridge, Massachusetts, London, 2nd Edition, 2010.

Reference Books:

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

Course Outcomes:

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

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

Lab Assignments:

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

H.O.D. AI & ML
B.E.C.

B.V.V Sangha's

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

5th BOARD OF STUDIES MEETING

Resolutions

Resolutions of the 5th Board of Studies (BoS) meeting of Artificial Intelligence and Machine Learning (AIML) Department, Basaveshwar Engineering College (Autonomous), Bagalkot conducted on 03.08.2023 at 11.00 am through Offline and Online mode

Sub. (1)	:	Seeking approval for proposed B.E I to VIII semester scheme for 2023-2024 batch
Res. (1)	:	HOD presented the scheme from I to VIII semesters (NEP) for students taking admission to 1st year from academic year 2023-24 (160 credits) and for lateral entry students taking admission to 2nd year from academic year 2024-25 [Annex 1]. The BoS members suggested incorporating some of the changes in the scheme. After incorporating the suggestions it was resolved to approve the

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Asso. Professor

Mr. Nandakishore Kulkarni
Data Analytics Specialist,

		same.
Sub. (2)	:	Seeking approval for proposed B.E III to VIII semester scheme for 2022-2023 batch
Res. (2)	:	HOD presented the revised scheme from III to VIII semester (NEP) for students admitted to 1st year in the academic year 2022-23 (160 credits) and for lateral entry students taking admission to 2nd year from academic year 2023-24 [Annex 2]. It was resolved to approve the same.
Sub. (3)	:	Seeking approval for detailed syllabus of B.E VII and VIII semester of 2020-2021 batch
Res. (3)	:	HOD presented the syllabus for B.E VII and VIII semester of 2020-2021 batch. The BoS members suggested incorporating some changes in the syllabus of some courses. After incorporating the suggestions it was resolved to approve the same [Annex 3].
Sub. (4)	:	Seeking approval for detailed syllabus of B.E V and VI semester of 2021-2022 batch
Res. (4)	:	HOD presented the syllabus for B.E V and VI semester of 2021-2022. The BoS members suggested incorporating some changes in the syllabus of some courses. After incorporating the suggestions it was resolved to approve the same [Annex 4].

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Sub. (5) **Res. (5)**		Seeking approval for detailed syllabus of B.E III and IV semester of 2022-2023 batch HOD presented the syllabus for B.E III and IV semester of 2022-2023 batch. The BoS members suggested incorporating some changes in the syllabus of some courses. After incorporating the suggestions it was resolved to approve the same [Annex 5].
Sub (6) **Res. (6)**	: :	Seeking approval for Online Courses (NPTEL) to be offered during the academic year 2023-2024 HOD presented the list of Online Courses (NPTEL) to be offered during the academic year 2023-2024 [Annex 6]. It was resolved to approve the same.
Sub (7) **Res. (7)**	: :	Seeking approval for scheme of evaluation for the following courses (1) Integrated Professional Core Course (IPCC) (2) Mini-Project (3) Major-Project (4) Internship (5) Seminar HOD presented the scheme of evaluation for the following courses (1) Integrated Professional Core Course (IPCC) (2) Mini-Project (3) Major-Project (4) Internship (5) Seminar [Annex 7]. It was resolved to approve the same.
Sub (8)	:	Seeking approval for the equivalences defined for the courses of B.E (AIML) during 2022-2023

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Res. (8)	:	HOD presented the list of equivalences defined for some of the courses. It was resolved to approve the same [Annex 8].
Sub (9)	:	Seeking post-facto approval for scheme of evaluation for AICTE-100 Activity Points
Res. (9)	:	HOD presented the scheme of evaluation for AICTE-100 Activity Points. The indigenous software developed for the same was also discussed. It was resolved to approve the same [Annex 9].
Sub (10)	:	To approve the panel of examiners for valuation and conduction of lab exams.
Res. (10)	:	HOD presented the panel of examiners for valuation and conduction of lab exams for the academic year 2023-24 [Annex 10]. It was resolved to approve the same.
Sub (11)	:	Any other matters with the permission of the chair
Res. (11)	:	It was suggested to: • Introduce Software Development Life Cycle and types of Software development models in "Agile Methodologies" course as preamble • Change the Title of "Advanced AI and ML" to "Machine Learning Algorithms – II" • Include contents on Deep Learning and advanced topics related to it under the title "Advanced AI and ML" • Offer Internet of Things as an elective instead of core and add "Machine Learning Algorithms – II" as core • Add concepts on parallel processing and pipelining in the syllabus of Course on "Computer Organization" and possibly rename it as "Computer Organization and Architecture"

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		• Add concepts on Introduction of tools and technologies for Data Science in the course on "Python for Data Science" • To reduce the credits for Project from 9 and 6 and offer an extra online course. The meeting concluded with a vote of thanks by Dr. A. D. Devangavi

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Elements of Electrical Engineering			
Course Code:	**22UEE115C**	CIE Marks	50
Course Type	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

- Chalk and talk
- Animated/NPTEL videos
- Cut sections
- PPTs

Module-1 (10 Hrs)

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.

Module-2 (10 Hrs)

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.

Module-3 (10 Hrs)

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.

Module-4 (10 Hrs)

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:

At the end of the course the student shall be able to:

- Recall basics of magnetic circuits, electromagnetism, single phase & three phase circuits and electrical earthing
- Illustrate the laws of magnetic & electric circuits, concepts of single phase & three phase AC circuits, domestic wiring practices and electricity generation principles
- Derive the expressions for statically & dynamically induced emf, Self & mutual inductances, power in AC series & parallel circuits
- Calculate different parameters related to magnetic circuits, single phase & three phase AC circuits and energy consumption calculations

COs and POs Mapping:

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CO1	**3**	**1**	**1**			**1**	**1**	**1**		**1**		**1**
2	CO2	**3**	**1**	**1**	**1**		**1**	**1**	**1**		**1**		**1**
3	CO3	**3**	**2**	**3**	**1**								**1**
4	CO4	**3**	**3**	**3**	**2**								**1**

Introduction to Electrical Engineering			
Course Code:	**22UEE116E**	CIE Marks	50
Course Type	Theory	SEE Marks	50
		Total Marks	100
Teaching Hours/Week (L:T:P: S)	3:0:0:0	Exam Hours	03
Total Hours of Pedagogy	40 hours	Credits	03

Teaching-Learning Process

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes and make Teaching –Learning more effective

- Chalk and talk
- Animated/NPTEL videos
- Cut sections
- PPTs

Module-1 (10 Hrs)

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.

Module-2 (10 Hrs)

A.C. 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)

Module-3 (10 Hrs)

DC Generator, DC Motor, Transformers:

Working principle, construction, equations, types and classifications, specifications, applications, cost. Simple numerical.

Module-4 (10 Hrs)

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.

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6. S. K. Bhattacharya, "Basic Electrical and Electronics Engineering", 2nd Edition, Pearson Publications, 2017

Course outcomes:

At the end of the course the student shall be able to:

- Recall basics of DC, single phase & three phase circuits and electrical earthing
- Illustrate the laws of DC circuit, concepts of single phase & three phase AC circuits, domestic wiring practices and electricity generation principles, construction-working principle-applications of electrical machines & transformers
- Apply circuit laws and concepts to calculate different parameters of DC circuits, single phase & three phase AC circuits
- Evaluate the emf induced in generators & transformers under given conditions and assess energy consumption in domestic loads

COs and POs Mapping:

Sl.	Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CO1	**3**	**1**	**1**			**1**	**1**	**1**		**1**		**1**
2	CO2	**3**	**1**	**1**	**1**		**1**	**1**	**1**		**1**		**1**
3	CO3	**3**	**2**	**2**	**1**								**1**
4	CO4	**3**	**2**	**2**	**2**								**1**

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE305C	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.

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE305C.1	3							1		1		1	3	1	1
2	21UEE305C.2	3	1						1		1		1	2	3	1
3	21UEE305C.3	3	3	2	2	1			1		1		1	1	1	1
4	21UEE305C.4	3	3	3	3	1			1	1	1		2	1	1	1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE306C	Electronic Circuits	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
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 Hrs.**
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 Hrs.**
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 Hrs.**
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, 2ndEdition, 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", 3rdEdition, Oxford, 2012.
4. Robert L. Boylestad, Louis Nashelsky, Electronic Devices and Circuits Theory, 9thEdition, Pearson/Prentice Hall, India, 2006.
5. Ramakanth A. Gayakwad, "Operational Amplifier and Linear ICS", 4thEdition, PHI, 2016.
6. Jacob Millman, Arvin Grabel, Microelectronics, 2ndEdition, 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	21UEE306C.1	3	2	2									2	3	3	3
2	21UEE306C.2	3	2										2	2	3	3
3	21UEE306C.3	3		3		1			1		1		1	2	2	1
4	21UEE306C.4	3	3	3		1			1		1		2	2	2	1

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE307C	Electrical Machines-I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.

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 Hrs.

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 Hrs.

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 Hrs.

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.

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE307C.1	3	2	2									2	3		3
2	21UEE307C.2	3	2										2	3		3
3	21UEE307C.3	3		3		1			1		1		1	3		2
4	21UEE307C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE308C	**Electrical & Electronic Measurements**	**03 - Credits (2 : 0 : 2)**
Hours/Week : 2L + 2P		CIE Marks : 50
Total Hours :		SEE Marks : 50

UNIT – I	**7 Hrs.**
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 Hrs.**
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	**7Hrs.**
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 Hrs.**
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 2022 – 2023

(For students admitted to I year in 2021-22)

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	21UEE308C.1	3	2	2									2	3		3
2	21UEE308C.2	3	2										2	3		3
3	21UEE308C.3	3		3		1			1		1		1	3		2
4	21UEE308C.4	3	3	3		1			1		1		2	3	1	3

Syllabus for B.E III - Semester for academic year 2022 – 2023

(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	**21UHS324C.1**							**3**	**2**	**3**			**1**			
2	**21UHS324C.2**						**3**	**3**	**1**	**1**			**1**			
3	**21UHS324C.3**						**3**	**3**	**2**	**1**			**1**			
4	**21UHS324C.4**						**2**	**2**	**3**	**2**			**1**			
5	**21UHS324C.5**								**3**				**1**			

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE405C	Power System I	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.

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 Hrs.

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 Hrs.

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 Hrs.

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, "Principles 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	21UEE405C.1	3											1	1	2	3
2	21UEE405C.2	3	1										1	1	1	2
3	21UEE405C.3	3	3	2	2	1	1						1	2	2	2
4	21UEE405C.4	3	3	3	3	1	1		1		1		2	1	1	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE407C	Electrical Machines-II	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	10 Hrs.
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 Hrs.**
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 Hrs.**
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 Hrs.**
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 2022 – 2023

(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	21UEE407C.1	3				1	1						1	1	3	2
2	21UEE407C.2	3	1										1	1	2	1
3	21UEE407C.3	3	3	2	2								1		2	1
4	21UEE407C.4	3	3	3	3	1		1					2	1	2	1

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(For students admitted to I year in 2021-22)

21UEE408C	Control Systems	03 - Credits (3 : 0 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 40		SEE Marks : 50

UNIT – I	(10 Hours)
Introduction and Transfer Function of Systems: Classification of control systems, open loop and closed loop systems, effects of feedback, Mathematical models of physical systems; definition of transfer function, Mechanical systems, Rotational systems, Electrical systems, Analogous systems. Usage of MATLAB command-line functions to verify the solution.	
UNIT – II	**(10 Hours)**
Block Diagrams and Signal Flow Graphs: Block diagrams (BD), Reduction of BD, Signal Flow graphs (SFG), Drawing block diagram and SFG of simple networks Mason's gain formula, Converting BD into SFG. Usage of MATLAB command-line functions to verify the solution.	
UNIT – III	**(10 Hours)**
Time Response of Feed Back Control Systems: Standard test signals, Unit step response of First and second order systems, time response specifications, and Time response specifications of second order systems, steady state errors and error constants. **Stability Analysis:** Concepts of stability, Necessary conditions for Stability, Routh's stability criterion. **Root–Locus Techniques:** Root locus concepts, Construction of root loci. Usage of MATLAB command-line functions to verify the solution.	
UNIT – IV	**(10 Hours)**
Frequency Domain Analysis: Introduction, frequency domain specifications, correlation between time and frequency response. Method to draw bode plot, phase margin, gain margin, Nyquist stability criterion. **Introduction to State Variable Analysis**: Concepts of state, state variables and state model, state models for linear continuous time systems, conversion of state model to transfer function and transfer function to state model. Usage of MATLAB command-line functions to verify the solution.	
Reference Books: 1. Norman S Nise "Control System Engineering", McGraw Hill, 2010. 2. Benjamin C Kuo, "Automatic Control System", VII- Edition , PHI, 2010. 3. Richard C. Dorf Robert H Bishop "Modern Control Systems", VII- Edition , Addison Wesle 4. Ogata, K., Modern Control Engineering, Prentice–Hall of India Private Limited, 2001	
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.	

Syllabus for B.E IV - Semester for academic year 2022 – 2023

(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	21UEE408C.1	3	3	2	2	1							1	1	2	
2	21UEE408C.2	3	3	3	2	2							1	1	3	2
3	21UEE408C.3	3	3	2	2	2			1		1		1	1	3	2
4	21UEE408C.4	3	3	2	2	2			1		1		1	1	3	1

Basaveshwar Engineering College (Autonomous)
[TEQIP Lead Institute, Govt. Aided Institution, AICTE Recognized, Affiliated to VTU Belgaum]
Bagalkot-587103, Karnataka, India.
Department of Electrical and Electronics Engineering

Power Electronics	
Subject Code: UEE452C	**Credits: 04**
Contact Hours: 04 (4L-0T-0P)	**Assessment: CIE 50 and SEE 50**

Course Outcomes:

Students able to

1. Recall, list and define the various semiconductor switches employed in power electronics circuits
2. Students able to describe the operation and switching characteristics of switches and operation of various power converters.
3. Derive the expressions of performance parameters for various power converters connected to R and R L loads
4. Analyze power converter circuits and its behavior and resolve the output parameters connected to R and R-L loads.
5. Design various components for choppers, commutation circuits and snubber elements of switching elements
6. Assess the impact of source and load inductance on operation of power converter and summarize the impact in industrial application.

UNIT-I	
Introduction:	**02**
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:	**06**
Introduction to Power BJT's, MOSFETs and IGBT's – static characteristics, switching characteristics, switching limits, di/dt and dv/dt protection, cooling, heat sinks and snubber circuits.	
Thyristors	**05**
Introduction, static characteristics, two transistor model. Switching characteristics, di/dt and dv/dt protection.	
UNIT-II	
Controlled Rectifiers:	**13**
Introduction. Classification of rectifiers, principle of phase controlled converter operation. Single- phase half wave, semi-converters and full converters and problems. Three-phase half wave, semi converters and full converters with R, R-L, R-C and RLE load. Performance evaluation of Rectifier, Effects of Load and Source Inductances.	
UNIT-III	
Commutation Techniques:	**05**
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, Buck and Boost converter, Control Strategies: constant frequency, Variable Frequency, Four quadrant operation of dc-dc converter. Derivation of duty cycle of buck and boost converter for continuous mode of operation, Introduction for discontinues mode of operations	**08**
UNIT-IV	
Inverters:	
Introduction. Types of inverters, performance parameters, principle of operation of half bridge and full bridge inverters with R and R-L load. Three phase inverter configuration to operate with 120 and 180 degree modes. Voltage control of single-phase inverters – single pulse width modulation, multiple pulse width modulation and sinusoidal pulse width modulation and Current source inverters.	**08**
AC Voltage Controllers: Introduction. Principle of ON-OFF control and phase control. Single-phase half wave and full wave AC voltage controllers with resistive and inductive loads.	**05**

Reference Books:

1. M.H.Rashid "Power Electronics", 3rd - Edition, P.H.I./Pearson, New Delhi, 2002.
2. Mohan, Undeland, Robbins" Power Electronics" Wiley Edition 2003
3. P.S.Bimbra, "Power Electronics", IV- edition, Khanna Publishers, 2009.
4. G.K. Dubey, S.R. Dorodla, A. Joshi and R.M.K. Sinha, "Thyristorised Power Controllers", New Age International Publishers, 2005.
5. M.D. Singh and Khanchandani K.B., "Power Electronics", 2nd - Edition Khanna Publisher, 2007.

Syllabus for B.E. V - Semester for academic year 2022 – 2023

(For students admitted to I year in 2020-21)

UEE551C	Field Theory	03 - Credits (2 : 2 : 0)
Hours/Week : 03		CIE Marks : 50
Total Hours : 52		SEE Marks : 50

UNIT – I	(7L-6THours)

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-7THours)

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-6THours)

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-7THours)

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" V-edition McGraw-Hill, 1999.
3. Edward C. Jordan and Keith G Balmain, **"**Electromagnetic Waves and Radiating Systems**,"** II- 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 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
1	UEE551C.1	3	1	1	1	3	1		1		1		1
2	UEE551C.2	3	2	1	1				1		1		1
3	UEE551C.3	3	2	2	2	1		1	1		1		1
4	UEE551C.4	3	3	3	2	1			1	1	1	1	2

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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.,andEI-Abaid,A.H.,"Computer Methodsin Power System Analysis", (2019Edition), 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.

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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
1	UEE751C.1	**3**							**1**		**1**		**1**
2	UEE751C.2	**3**	**1**						**1**		**1**		**1**
3	UEE751C.3	**3**	**3**	**2**	**2**	**1**			**1**		**1**		**1**
4	UEE751C.4	**3**	**3**	**3**	**3**	**1**			**1**	**1**	**1**		**2**

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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.

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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
1	UEE752C.1	3	1		1	3	1		1		1		1
2	UEE752C.2	3	2	1	1				1		1		1
3	UEE752C.3	3	3	2	2	1			1		1		1
4	UEE752C.4	3	3	3	2	1			1	1	1	1	2

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

UHS754E	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
1	UHS753C.1	3	1		1	3	1		1		1		1
2	UHS753C.2	3	2	1	1				1		1		1
3	UHS753C.3	3	3	2	2	1			1		1		1
4	UHS753C.4	3	3	3	2	1			1	1	1	1	2

Syllabus for B.E VII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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 2022 – 2023

(For students admitted to I year in 2019-20)

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
1	UHS753C.1	2	1		1		1		1		1		1
2	UHS753C.2	2	2	1	1				1		1		1
3	UHS753C.3	2	2	2	2				1		1		1
4	UHS753C.4	2	2	2	2				1	1	1	1	2

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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”, (4^{th} 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
1	UEE851E.1	3							1		1		1
2	UEE851E.2	3	1						1		1		1
3	UEE851E.3	3	3	2	2	1			1		1		1
4	UEE851E.4	3	3	3	3	1			1	1	1		2

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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 Numericalproblems**).**

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.

Syllabus for B.E VIII - Semester for academic year 2022 – 2023

(For students admitted to I year in 2019-20)

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.

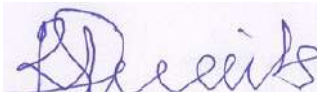
Course Outcomes:

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
1	UEE852E.1	3							1		1		1
2	UEE852E.2	3	1						1		1		1
3	UEE852E.3	3	3	2	2	1			1		1		1
4	UEE852E.4	3	3	3	3	1			1	1	1		2



HoD EE

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

Professor & Head,
Department of Industrial and Production Engineering
Basaveshwar Engineering College

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 – Basics of Geometric dimensioning and tolerances (GD & T) and the principles, reading the parts & assembly drawings and blue prints, surface finish representations in the drawing.

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**

**** 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	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

Professor & Head,
Department of Industrial and Production Engineering
Basaveshwar Engineering College

1.1.2 Number of Programmes where syllabus revision was carried out during the year: 2022-23

Following are the courses whose syllabus revision was carried out during the year 2022-23.

Sl. No	Name of the Course	Course Code	Course Category	Credits
01	Digital Electronics and Logic Design	21UEC303C	Professional Core Course	03
02	Linear Integrated Circuits and Its Applications	21UEC403C	Professional Core Course	03
03	Automotive Electronics	UEC549E	Professional Elective Course	03

Link to access the revised syllabus
https://drive.google.com/file/d/1869aGMVMOUlSBGDg2ATIDB2X3PpUCg1P/view?usp=sharing

Professor and Head
Department of Electronics & Communication Engg.
Basaveshwar Engineering College
BAGALKOT-587102.

21UEC303C	Digital Electronics and Logic Design	Credits: 03
L: T: P-3:0:0		CIE Marks: 50
Total Hours : 40		SEE Marks: 50

UNIT-I	10Hrs.
Principles of Combinational Logic and Design: Review of Boolean algebra, simplification and implementation of Boolean expression using basic gates and universal gates. Definition of combinational logic, canonical forms and generation of switching equations from truth tables, K-maps (upto5 variables), Quine-McCluskey minimization technique and map entered variables.	
UNIT–II	**10Hrs.**
Analysis and Design of Combinational Circuit using MSI Components: General approach, binary adder and subtractors, cascading full adders, look ahead carry, decimal adders, comparators, decoders, encoders, multiplexers.	
UNIT–III	**10Hrs.**
Flip-Flops: The basic bi-stable element, latches, timing considerations, master-slave SR flip-flops, master slave JK flip-flop, edge triggered flip-flop, positive edge triggered D flip-flop, negative edge triggered D flip-flop, characteristic equations. **Applications of Flip-Flops:** Registers (SISO, SIPO, PISO and PIPO) and bidirectional shift register.	
UNIT–IV	**10Hrs.**
Applications of Flip-Flops: Counters, binary ripple counters, synchronous binary counters, counters based on shift registers, design of synchronous counters, design of asynchronous counter using clocked JK, D, T and SR flip-flops. **Sequential Circuit Design and Analysis:** Introduction to Mealy and Moore models, state machine notation, synchronous sequential circuit analysis, construction of state diagrams.	

Reference Books*

1. Donald D Givone, 2002, "Digital Principle and Design". Tata McGraw Hill
2. John M Yarbrough, 2001, "Digital Logic Applications and Design", Thomson Learning
3. Thomas L. Floyd, "Digital Fundamentals", 9th Edition, PHI
4. Charles H Koth, 2004, "Fundamentals of Logic Design", Thomson Learning
5. Meno and Kim, 2001, "Logic and Computer Design Fundamentals", 2nd edition, Pearson
6. Malvino and Leech, "Digital Principles & Applications", 2nd edition, PHI

Course Outcomes**

After completion of the course students will be able to

1. Simplify the given Boolean expressions using Boolean algebra, K-map, Quine McCluskey and map entered variables methods.

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2. Design and analyze combinational circuits using i) basic gates ii) universal gates iii) MUXs and iv) Decoder and gates.
3. Analyze different types of latches, flip flops and shift registers.
4. Design, model and analyze synchronous and asynchronous sequential circuits.

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	-	-	-	-	-	3	1	-
CO2	3	3	3	2	1	-	1	-	-	-	-	-	3	1	-
CO3	3	3	3	2	1	-	1	-	-	-	-	-	3	1	-
CO4	3	2	3	2	2	-	1	-	-	-	-	-	3	1	-

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21UEC403C	Linear Integrated Circuits and Its Applications	Credits: 03
L: T: P-3:0:0		CIE Marks: 50
Total Hours/Week:03		SEE Marks: 50

UNIT-I	10Hrs.
Differential Amplifiers: Introduction, differential amplifier, differential amplifier circuit configurations, dual- input balanced output differential amplifier, dual- input unbalanced output differential amplifier, single input balanced output differential amplifier, single input unbalanced output differential amplifier, constant current bias, current mirror, cascaded differential amplifier stages, level translator. **Introduction to operational amplifiers:** Introduction, block diagram representation of a typical op-amp, the ideal op-amp, equivalent circuit of an op-amp, ideal voltage transfer curve, open loop op- amp configurations. **Self study component:** Numericals on differential amplifiers.	
UNIT–II	**10Hrs.**
Op-amp with negative feedback: Block diagram representation of feedback configuration, voltage series feedback amplifier, voltage shunt feedback amplifier, differential amplifier. **The practical op-amp:** Input offset voltage, input bias current, input offset current, total output offset voltage, common mode configuration, common mode rejection ratio, power supply rejection ratio, slew rate **Self study component:** To derive gain, input resistance of differential amplifier with three op-amps	
UNIT–III	**10Hrs.**
General applications: The peaking amplifier, summing, scaling and averaging amplifiers, integrator, differentiator. **Active filters:** First order and second order low pass Butterworth filter, first order and second order high pass butter worth filter, higher order filters, band pass filter, band reject filters. **Self study component:** To study All pass filter	
UNIT–IV	**10Hrs.**
Oscillators and waveform generator: Introduction, phase shift oscillator, Wien-bridge oscillator, square wave generator, triangular wave generator. **Comparators and converters:** Basic comparator, zero crossing detector, sample and hold circuit. **The 555 Timer:** Block diagram, connection diagram, 555 timer as Astable and Mono stable multivibrators **Self study component:** To study voltage-controlled oscillator and Schmitt trigger	
Reference Books*	
1. Gayakwad Ramakanth "Operational Amplifiers and Linear Integrated Circuits", 3rd & 4th Edition, PHI. 2. D. Roy Choudhary, "Linear Integrated Circuits", 2nd Edition.	

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Course Outcomes**

After completion of the course students will be able to

1. Identify and analyze the different configurations of differential amplifier.
2. Analyze the different feedback amplifiers and various parameters of practical op-amp.
3. Design the active filters and amplifiers using op-amp.
4. Design waveform generators, data comparators and converters.

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	1	1	-	-	-	1	-	-	-	3	1	-
CO2	3	3	1	1	1	-	-	-	1	-	-	-	3	1	-
CO3	3	3	2	2	1	1	1	-	1	-	1	1	3	1	-
CO4	3	2	2	1	1	1	1	-	1	-	1	1	3	1	-

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Course Title: Automotive Electronics		Course Code: UEC549E
Credits: 3 (3-0-0)	Teaching Hours: 40 Hrs	Contact Hours: 3 Hrs/Week
CIE Marks: 50	SEE Marks: 50	Total Marks: 100

Department : Electronics and Communication Engineering.
Designation : Elective

Course Objectives:

The objectives of the course is to make the student

1. Understand the electronics in automotive systems and industry
2. Familiar about various automotive applications
3. Learn various sensors, actuators and vehicle motion controls
4. Gain knowledge on automotive communication protocols and safety standards

Course Outcomes:

A student who successfully completes this course should be able to

1. Identify different electronic systems used for control of automobiles
2. Choose appropriate embedded system/systems for automotive safety
3. Select sensors, actuators and control systems for given automobile automation application
4. Suggest an application specific appropriate automotive communication protocol and safety standards

The topics that enable to meet the above objectives and course outcomes are given below

Unit I (10 Hrs.)

Automotive Systems, Design cycle and Automotive industry overview: Introduction to automobile systems, The Engine, Need for electronics in automobiles, Engine Electronics, Transmission Electronics, Chassis Electronics, Safety, Driver assistance, Passenger Comfort, Infotainment systems, Emissions Overview, Engine Exhaust Emissions - Hazardous Pollutants, Emission Control, The Control System, Driving Control, Emission Standard, Transmission system: Manual Transmission, Automatic Transmission, CVT (Continuous variable transmission), Braking System, Steering System, Overview of Hybrid Vehicles, Power Electronics in Hybrid Vehicles, ECU Design Cycle, Types of model development cycles (V Cycle), Development of Electronics Systems

Unit II (10 Hrs.)

Sensors and Actuators: Control System, Typical car sensors, Typical Electronic Engine Control System, Mass Air Flow Sensor (MAF), Manifold Absolute Pressure Sensor (MAP), Engine Crankshaft Angular Position Sensor, Engine Speed Sensor, Throttle Angle Sensor, Temperature Sensors, Oxygen Sensors, Knock Sensor.

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Unit III (10 Hrs.)

Automotive Engine Control: Actuators, Motors, Vehicle Motion, Anti-Lock Braking System (ABS), Electronic Stability Program, Cruise Control (CC), Adaptive Cruise Control (ACC), PID controllers, Traction Control Systems, Electronic suspension system, Electronic Steering Control, Automotive Infotainment, Vehicle Navigation System, GPS Functionality, Airbag Control Unit.

Unit IV (10 Hrs.)

Automotive communication protocols: Overview, Controller Area Network (CAN), Flexray, Local Interconnected Network (LIN)

Functional Safety: Need for safety standard-ISO 26262, safety concept, safety process for product life cycle, safety by design, validation.

Reference Books:

1) William B. Ribbens, "Understanding Automotive Electronics", 8th Edition, Elsevier Publishing.
2) Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley & Sons Inc., 2007.

POs satisfied by the course

(1) Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

(2) Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

(3) Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

(4) Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

(5) Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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Unit III (10 Hrs.)

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(6) The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

(7) Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

(8) Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

(9) Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

(10) Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

(11) Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

(12) Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes

(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 embedded systems.

(3) Demonstrate the conceptual knowledge with respect to architecture, design, analysis and simulation of computer networking and applications.

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Course Articulation Matrix:

Course Outcomes	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1: Comprehend the knowledge of electronics systems used for control of automobiles	3	3	2	1	1	2	1	-	-	1	1	1	1	1	1
CO2: Describe the embedded system for various automotive applications and safety systems	3	2	2	1	3	2	1	-	-	1	1	1	1	1	1
CO3: Select sensors, actuators and control systems based on the application	3	2	2	1	1	2	1	-	-	1	1	1	1	1	1
CO4: Analyze the automotive communication protocols and safety standards	3	1	2	1	3	2	1	-	-	1	1	1	1	1	1
Course Contribution to POs	**3**	**2**	**2**	**1**	**2**	**2**	**1**	**-**	**-**	**1**	**1**	**1**	**1**	**1**	**1**

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BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Proceedings of Board of Studies Meeting held on 22-07-2023

The Board of Studies meeting of the Department of Computer Science and Engineering was held on 22nd July 2023, at 11.00 am. Dr. V. B. Pagi, Chairman of BoS, welcomed all the members and started the meeting.

Agenda 1	:	To discuss and approve the schemes of 2022-23 and 2023-24 admitted batches of BE (CSE) and 2021-22 admitted batch for M. Tech. (CSE).
Res. 1	:	The schemes of the 2022-23 and 2023-24 admitted batches of BE(CSE) are discussed in detail and approved. Similarly, the scheme of the 2021-22 admitted batch of MTech (CSE) is discussed thoroughly and approved.
Agenda 2	:	To discuss and approve the detailed syllabi of a. 3rd to 8th semester BE (CSE), for 2022-23 admitted batch, b. 5th to 8th semester BE (CSE), 2021-22 admitted batch, c. 7th and 8th semester BE (CSE), 2020-21 admitted batch, d. 1st to 4th semester MTech (CSE), 2021-22 admitted batch.
Res. 2	:	Detailed syllabi of the following semesters are discussed and approved, with minor corrections. a. 3rd to 8th semester BE (CSE), for 2022-23 admitted batch, b. 5th to 8th semester BE (CSE), 2021-22 admitted batch, c. 7th and 8th semester BE (CSE), 2020-21 admitted batch,

Dr. V. B. Pagi	Dr. Pradeep N.	Dr. Rajendra Hegadi	Mr. Mallikarjun Bansode	Dr. S. V. Saboji	Prof. S. S. Yendigeri
Prof. K. S. Patil	Dr. V. H. Naik	Prof. J. M. Hurakadli	Prof. V. M. Bonal	Dr. G. B. Chittapur	Prof. S. N. Benkikeri
Prof. S. K. Gour	Prof. S. P. Madhavanavar	Prof. Smitha K.	Dr. P. S. Challagidad	Prof. J. S. Muimani	Prof. P. B. Madhavanavar
Prof. B. S. Malapur	Prof. S. R. Karjol	Dr. M. G. Kambalimath	Prof. Shama P. S.	Mr. Arbaz Shrirangapattan	

		d. 1st to 4th semester MTech (CSE), 2021-22 admitted batch.
Agenda 3	:	To approve the list of online courses (NPTEL) for the academic year 2023-24.
Res. 3	:	The proposed list of online courses (NPTEL) for the academic year 2023-24 is approved, with minor corrections.
Agenda 4	:	Seeking approval for inclusion of the following courses a. NSS b. PE and Sports c. Yoga in the curriculum of 2022-23 admitted batch.
Res. 4	:	Non-Credit Mandatory Courses (NCMC) courses NSS/PE and Sports/Yoga, introduced for the 3rd semester BE and considered for including in the grade card (as recommended by VTU Belagavi) are approved for inclusion in the 2022-23 admitted batch.
Agenda 5	:	Ratification of syllabus of the newly introduced elective during last academic year (2022-23).
Res. 5	:	Syllabus of the Elective offered (UCS072E: User Interface Design) was discussed and ratified.
Agenda 6	:	Seeking approval for the equivalence of courses defined for the courses of B.E (CSE) during 2022-23.
Res. 6	:	List of the courses with same content, LTP structure and credits, of 2021-22 and 2022-23 admitted batches, are approved as equivalent.
Agenda 7	:	Seeking approval for the Panel of Examiners
Res. 7	:	Panels of Examiners for the Odd and Even Semesters of 2023-24 admitted batch are approved.

Dr. V. B. Pagi	Dr. Pradeep N.	Dr. Rajendra Hegadi	Mr. Mallikarjun Bansode	Dr. S. V. Saboji	Prof. S. S. Yandigeri
Prof. K. S. Patil	Dr. V. H. Naik	Prof. J. M. Hurakadli	Prof. V. M. Bonal	Dr. G. B. Chittapur	Prof. S. N. Benkikeri
Prof. S. K. Gour	Prof. S. P. Madhavanavar	Prof. Smitha K.	Dr. P. S. Challagidad	Prof. J. S. Muimani	Prof. P. B. Madhavanavar
Prof. B. S. Malapur	Prof. S. R. Karjol	Dr. M. G. Kambalimath	Prof. Shama P. S.	Mr. Arbaz Shrirangapattan	

Agenda 8		Seeking approval for categorizing courses as Employability / Skill Development / Entrepreneurship
Res. 8		Courses were categorized as Employability/Skill Development/ Entrepreneurship, and approved.
Agenda 9	:	Any other matter with permission of the chair.
Res. 9		Suggestions given by the Members: 1. WireShark as a Packet Sniffer can be used in Computer Networks Lab. 2. Offer Compiler Design as an Elective Course instead of core course. 3. Miniproject in BE 6th semester of 2 credits based on ML and IoT, in place of Biology for Engineers (2022-23 admitted batch) OR Major Project of 10 credits (2 credits to be reduced) and a Miniproject of 2 credits may be introduced in 6th semester. 4. Software Engineering course can be re-titled as Software Engineering and Project Management 5. Digital Process Automation (Pega or Figma) Foundations of Generative AI or MOOCs or Weaka tool as AEC.

22/7					
Dr. V. B. Pagi	Dr. Pradeep N.	Dr. Rajendra Hegadi	Mr. Mallikarjun Bansode	Dr. S. V. Saboji	Prof. S. S. Yendigeri
					22/7
Prof. K. S. Patil	Dr. V. H. Naik	Prof. J. M. Hurakadli	Prof. V. M. Bonal	Dr. G. B. Chittapur	Prof. S. N. Benkikeri
	22/7/2023				22/7
Prof. S. K. Gour	Prof. S. P. Madhavanavar	Prof. Smitha K.	Dr. P. S. Challagidad	Prof. J. S. Muimani	Prof. P. B. Madhavanavar
22/7/23	Leave				
Prof. B. S. Malapur	Prof. S. R. Karjol	Dr. M. G. Kambalimath	Prof. Shama P. S.	Mr. Arbaz Shrirangapattan	

BVVS

BASAVESHWAR ENGINEERING COLLEGE (AUTONOMOUS), BAGALKOT

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Proceedings of Board of Studies Meeting held on 30-07-2022

The Board of Studies meeting of the Department of Computer Science and Engineering was held on 30th July 2022, at 11.00 am. Dr. V. B. Pagi, Head of the Department welcomed all the members and started the meeting.

Agenda 1	:	To discuss and approve the scheme of teaching for 1st year BE (CSE) 2021-22 admitted batch
Res. 1	:	After due deliberations, the Board of Studies recommend to approve the scheme of teaching for 1st year BE (CSE) 2021-22 admitted batch
Agenda 2	:	To discuss and approve the scheme of teaching for 2021-22 and 2022-23 batch from 2nd year to 4th year BE (CSE)
Res. 2	:	The Board approved the proposed scheme of teaching for 2021-22 and 2022-23 batch from 2nd year to 4th year BE (CSE)
Agenda 3	:	To discuss and approve Scheme of teaching for 2021-22 admitted batch of M.Tech. (CSE)
Res. 3	:	After thorough discussions, the Board approved the proposed scheme of teaching for 2021-22 admitted batch of M.Tech (CSE)
Agenda 4	:	To discuss and approve the detailed syllabus of 3rd and 4th semester BE (CSE) 2021-22
Res. 4	:	The Board approved the syllabus of 3rd and 4th semester BE (CSE) 2021-22 admitted batch onwards, with minor changes.
Agenda 5	:	Ratification of Syllabi of electives and open electives offered during last year
Res. 5	:	The Board approved Syllabi of electives and open electives offered during last year
Agenda 6	:	To discuss the regulations for Minor Degree Programme in Computer Science and Engineering
Res. 6	:	The Board discussed and approved the regulations for Minor Degree Programme in Computer Science and Engineering
Agenda 7	:	To discuss the regulations for B. E. Honors degree
Res. 7	:	The Board discussed and approved the regulations for B. E. Honors degree
Agenda 8		To ratify the equivalence cases of last academic year
Res. 8		The equivalence cases of last academic year are ratified.
Agenda 9	:	To ratify the compensation of shortage of credits
Res. 9		The Board ratified the compensation of shortage of credit for Mr. Rakshit Mannur, with NPTEL course on Ethical Hacking.
		Suggestions given by the experts during the meeting: 1. OOPs with C++ and Mastering Office may be offered as a course

V.A. Bhandage (V. A. Bhandage)

(Shridhar Dorwad)

(Pradeep N.)

30/7/22

(V. B. Pagi)

(Rajendra Hegadi)

		under AEC. 2. A bridge course may be offered at the beginning of 4th semester on OOP with C++ 3. Internship can be carried out on social work 4. Reframe the title of Data mining as Data Mining and Visualization 5. Offer Deep Learning course under Computer Vision elective stream 6. IoT , Fog and edge computing can be combined 7. Devops can be offered as an elective 8. Software Project Management can be offered with software Engineering. 9. In laboratory subjects include Part-A with fixed set of assignments and Part-B for new problem is to be given within the prescribed syllabus, a practice being introduced by VTU Belagavi. 10. Biology for Engineers subject can be offered.

Name and Signature of members present for the meeting

Sl. No.	Name	Nomination	Signature
1.	Dr. V. B. Pagi	Chairman	
2.	Dr. Rajendra Hegadi, IIIT Dharwad	Subject Expert	
3.	Dr. Venkatesh Bhandage, MIT Manipal	Subject Expert	
4.	Dr. Pradeep N., BIET Davangere	VTU Nominee	
5.	Dr. Shridhar Domanal, Accenture, Bangalore	Industry representative	
6.	Mr. Mallikarjun Bansode, Global e-Soft, Mangalore	PG Meritorious Alumnus	
7.	Dr. S. V. Saboji	Member	
8.	Prof. S. S. Yendigeri	Member	
9.	Prof. K. S. Patil	Member	
10.	Dr. V. H. Naik	Member	
11.	Prof. J. M. Hurakadli	Member	
12.	Dr. G. B. Chittapur	Member	

13.	Prof. S. N. Benkikeri	Member	
14.	Prof. S. K. Gour	Member	
15.	Dr. P. S. Challagidad	Member	
16.	Prof. S. P. Madhavanavar	Member	
17.	Prof. P. B. Madhavanavar	Member	

A copy of the above is forwarded to the following for information and necessary action.

1. Member Secretary, Academic Council, BEC(A), Bagalkot
2. The Principal, BEC(A), Bagalkot
3. The Controller of Examinations, BEC(A), Bagalkot
4. All members of Board of Studies in CSE, BEC(A), Bagalkot

B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Professional Communication

Course Code:	21UCS306C	CIE Marks	100
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	-
Credits	01	Hours	16

Course objectives:

- Develop communication skills relevant to engineering as a profession
- Make effective presentations
- Participate confidently in Group Discussions.
- Attend job interviews and be successful in them.
- Develop adequate Soft Skills required for the workplace.

Tutorials

1. **Communication skills (Verbal and Non Verbal):** Self-Introduction organizing the material - Introducing the topic – answering questions.
2. **Listening skills:** Exercises based on Listening (audio, speech, lectures, songs, listen and draw/speak etc)
3. **Conversations and Dialogues-** Exercises based on situations, scenarios, skits, telephonic.
4. **Public Speaking-** Exercises based on different topics.
5. **Presentation skills-** individual presentation practice— presenting the visuals effectively, qualities of a good presentation with emphasis on body language and use of visual aids.
6. **Group Discussions-** Participating in group discussions – understanding group dynamics - brainstorming the topic — questioning and clarifying –GD strategies- activities to improve GD skills, instruction activities.
7. **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.
8. **Writing skills(resume,letter)-** Letter writing, CV writing, Attending a meeting and Minute Preparation, Vocabulary Building.
9. **Reading Skills:** Speed Reading, Reading with the help of Audio Visual Aids, Reading Comprehension Skills.

Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying, L4-Analysis

Activities

1. **Communication skills (Verbal and Non-Verbal)**
   a) Speaking on the topic given.
2. **Listening skills:**
   a) Given a topic, a student should speak about it and the others should summarize the information using proper listening skills.
   b) Given instructions from the teacher, students should apply it and exhibit it.
3. **Conversations and Dialogues**
   a) Given a situation the students should carry out proper conversation.
   b) Carrying out telephonic conversations with different categories of persons.
4. **Public Speaking**
   a) Topics to be given to the student for giving awareness to the public.
5. **Presentation skills-**
   a) Presentation on technical topic using proper visual aids.
6. **Group Discussions**
   a) Participating in group discussions to solve any given situation.
   b) Carrying out debate.

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7. **Interview skills.** a) Carrying out mock face-to-face interview. 8. **Writing skills(resume, letter)** a) Resume writing. b) Formal letter writing (leave application, job application etc). 9. **Reading Skills:** a) Reading Comprehension and answering the questions.	
Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying , L4-Analysis

Course Outcomes

At the end of the course the student should be able to

- Analyze the variety of communication and listening skills.
- Discuss a given technical/non-technical topic effectively in groups.
- Create effective technical presentations.
- Write an impressive resume, technical letters and face the interview confidently.
- Reading clearly and precisely presenting the document.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	Technical Communication Principles and practices	Meenakshi Raman and Sangeet Sharma	Oxford University Press	2004
2	Business Communication	Meenakshi Raman and Prakas Singh	Oxford University Press, ISBN13: 9780195676952	2006
3	Business Communication	Urmila Rainad S,M Rai	Himalaya Publishing House	2011
4	Effective Technic Communication	M. Ashraf Rizivi	McGraw Hill	2nd Edition, 2017
5	Professional Communication	Aruna Koneru	Tata McGraw-Hill Education, 2008	2008

Question paper pattern:

Scheme of Evaluation:

1. CIE I - Activity 1- 25 marks

   Activity 2 – 25 marks

2. CIE II - Activity 1- 25 marks

   Activity 2 – 25 marks

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Bagalkot 587102

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

	Subject/*Subject Code:*	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
No	Programme Outcomes / Course Outcomes															
The students will be able to:																
1	Analyze the variety of communication and listening skills.		3		2			2	1	2	3		3	3		
2	Discuss a given technical/non-technical topic effectively in groups.		3		2				1	3			3	3		
3	Create effective technical presentations.	3							1	2	3		3	3		
4	Write an impressive resume, technical letters and face the interview confidently.	3						2	1	2	3		3			
5	Reading clearly and precisely presenting the document.								1	2	3		3			

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B.E (COMPUTER SCIENCE AND ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
SEMESTER – III

Digital Systems

Course Code:	21UCS307C	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Hours	40

Course objectives:

1. Make use of simplifying techniques in the design of combinational circuits.
2. Illustrate combinational and sequential digital circuits.
3. Demonstrate the use of flip flops.
4. Design and test registers and counters.

Unit -1 (10 hours)

Boolean algebra and Combinational Circuits: Boolean algebra definition, Principle of Duality, Boolean algebra theorems, Boolean formulas and functions, Normal forms. Minterm canonical form, m-notation, Maxterm Canonical form, M-notation.
Manipulation of Boolean expressions. Gates and combinational circuits. Incomplete Boolean functions and don't care conditions, Additional Boolean operations and Gates.

Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying, L4-Analysing

Unit II (10 Hours)

Simplification of Boolean expressions: Karnaugh-maps, Use of Karnaugh-maps to minimize Boolean Expressions. Minimal Expressions of Incomplete Boolean Functions.
The Quine-McCluskey and Decimal methods for generating prime implicants and prime implicates. Map Entered Variables (MEV)

Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying, L4-Analysing

Unit III (10 Hours)

Logic Design using MSI Components: Binary Adders and Subtractor, Comparators, Decoders, Encoders, Multiplexers.
Flip Flops and its Applications: Basic bistable element, Latches: SR Latch, S'R' Latch, Gated SR Latch, Gated D Latch, Master Slave SR and JK flip-flops, Master Slave D and T Flipflops, Edge Triggered flip-flops, Characteristic Equations.

Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying, L4-Analysing

Unit IV (10 Hours)

Registers: Serial In Serial Out, Circular, Parallel in Parallel Out, Parallel In Serial Out, 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.

Revised Bloom's Taxonomy Level	L_1 –Remembering, L_2 – Understanding. L3 –Applying, L4-Analysing

Course outcomes:

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

- Demonstrate the understanding of Boolean algebra.
- Describe the working of Combinational circuits.
- Apply the Boolean theorems, K-Map, Q-M and VEM methods to simplify Boolean expressions.
- Describe the working of Sequential circuits and its applications.
- Simulate combinational circuits using HDL programming

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Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference books				
1	Digital Principles and Design	D.D. Givone	McGraw Hill.	8th Edition, 2017
2	Logic Design - A simplified approach	R. D. Sudhakar Samuel	Sanguine Technical Publications	Revised Edition, 2005
3	Digital Principles and applications'	Malvino, Leach and Saha	McGraw Hill.	6th Edition, 2007
4	Fundamental of digital Logic with Verilog Design	Stephen Brown & Zvonko Vranesic	Tata McGraw Hill	2nd Edition, 2002

Web links and Video Lectures:

1. https://archive.nptel.ac.in/courses/108/105/108105132
2. https://archive.nptel.ac.in/courses/117/106/117106114
3. https://nptel.ac.in/courses/108/105/108105132/
4. http://vlabs.iitkgp.ac.in/dec

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

		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
Sl.No	Programme Outcomes / Course Outcomes															
The students will be able to:																
1	Demonstrate the understanding of Boolean algebra.	3	1	-	-	-	-	-	-	-	-	-	1	1	-	1
2	Describe the working of Combinational circuits.	2	1	-	-	-	-	-	-	-	-	-	1	1	-	1
3	Apply the Boolean theorems, K-Map, Q-M and VEM methods to simplify Boolean expressions.	2	-	-	-	-	-	-	-	-	-	-	1	1	-	1
4	Describe the working of Sequential circuits and its applications.	1	1	2	-	-	-	-	-	-	-	-	1	1	-	2
5	Simulate combinational circuits using HDL programming.	1	1	2	-	-	-	-	-	-	-	-	1	1	-	2

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ARTIFICIAL INTELLIGENCE AND ROBOTICS

Course Code	UCS632N	CIE Marks	50
Teaching Hours / Week (L:T:P)	(3:0:0)	SEE Marks	50
Credits	03	Hours	40

Course objectives:

- To have insight into the fundamentals of Artificial Intelligence (AI) and Robotics that includes the various peculiar search strategies for AI, Programming the Robots and Controlling Autonomous Robots etc.
- To have proficiency in developing the techniques to solve real world problems unconventionally withoptimality.

UNIT - I (10 hours)

1. Introduction to AI: The AI Problems, Underlying assumptions, AI technique, Level of the model, Criteria forsuccess (1.1 to 1.5 from Rich and Knight)

2. Problems: Problem spaces and search Problem as a state space search, Production systems, Problem characteristics, Production system characteristics, Issues in the design of search problems, additional problems (2.1 to 2.6 from Rich and Knight)

Revised Bloom's Taxonomy Level	*L_1 – Remembering, L_2 – Understanding*

UNIT- II (10 hours)

3. Search and control Strategies: Introduction, Generate and Test, Hill Climbing, Simulated annealing (3.1, 3.2 from Rich and Knight)

4. Expert systems Architectures : Introduction, Rule-Based System Architectures, Nonproduction System Architectures, Dealing with Uncertainty, Knowledge Acquisition and Validation (15.1 to 15.6 from Dan W. Patterson)

Revised Bloom's Taxonomy Level	*L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing*

UNIT- III (10 hours)

5. Introduction to Robotics: The Seven Criteria of Defining a Robot, Robot Categories,Sensors, Actuators, End Effectors, Controllers, Scenario, Giving the robot instructions. (Chapter 1 from Cameron Hughes)

6. Robot Vocabularies and RSVP: Additional Effort, Actions, The Autonomous Robot's ROLL Model, RSVP(Robot Scenario Visual Planning):Mapping the Scenario, Pseudocode and Flowcharting RSVP. (Chapter 2 and 3 from Cameron Hughes)

Revised Bloom's Taxonomy Level	*L_1 – Remembering, L_2 – Understanding, L_3 – Applying*

UNIT- IV (10 hours)

7. Actual Capabilities of Robot: The Reality Check for the Microcontroller, Sensor Reality Check,Determine Your Robot's Sensor, Limitations, Actuators End-Effectors Reality Check. (Chapter 4 from Cameron Hughes)

8. Sensors: Types of Sensors, Sensor Interfacing with Microcontrollers, Attributes of Sensors, Sensor Calibration. (Chapter 5 from Cameron Hughes)

Revised Bloom's Taxonomy Level	*L_1 – Remembering, L_2 – Understanding, L_3 – Applying, L_4 – Analysing, L_5 – Evaluating,*

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Course outcomes:

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

CO1: Explain the fundamentals of artificial intelligence, robotics and expert systems.

CO2: Identify knowledge associated and represent it by ontological engineering to plan a strategy to solve given problem.

CO3: Apply the suitable algorithms to solve AI problems

CO4: Solve problem using problem decomposition and planning

CO5: Design smart system using different informed search / uninformed search or heuristic approaches

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbook				
1	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar B. Nair	TMH Education (P) Ltd., New Delhi	3rd Edition, 2010
2	Introduction to Artificial Intelligence and Expert Systems	Dan W. Patterson	Prentice Hall of India, Private Ltd., New Delhi	1st Edition, 2015
3	Robot Programming: AGuide to Controlling Autonomous Robots	Cameron Hughes Tracey Hughes	Pearson Education	1st Edition, 2016
Reference Books				
1	Artificial Intelligence: A modern approach	Stuart Russell and Peter Norvig	Pearson Education, India	3rd Edition, 2016
2	Artificial Intelligence	Saroj Kaushik	Cengage Learning India	1st Edition, 2011
3	Introduction to AI Robotics	Robin R. Murphy	MIT Press	1st Edition, 2000
4	Introduction to Robotics	Saha S. K.	TMH Publications	1st Edition, 2008

Web links and Video Lectures:

1. https://nptel.ac.in/courses/106105077
2. https://nptel.ac.in/courses/106106126
3. https://aima.cs.berkeley.edu
4. https://ai.berkeley.edu/project_overview.html (for Practical's)

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	1	2	-	1	-	-	-	-	-	-	-
CO2	-	2	-	1	-	-	-	-	-	-	-	
CO3	1	2	3	2	-	-	-	-	-	-	-	2
CO4	3	3		2	3	-	-	-	-	-	-	2
CO5	3	3	3	3	2	-	-	-	-	-	-	3

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B.E (SCIENCE AND COMPUTER ENGINEERING)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
OPEN ELECTIVE

Python Application Programming

Course Code	**UCS659N**	**CIE Marks**	**50**
Teaching Hours/Week (L:T:P)	**(3:0:0)**	**SEE Marks**	**50**
Credits	**03**	**Hours**	**40**

Course objectives:

- Have insight into programming skills in python
- Have profiecence in designing simple python applications

UNIT 1 (10 hours)

Datatypes in python: Comments in python, How python sees variables, Datatypes in python, bool Datatype, Literals in python, Determining the data type of a variable, Identifiers and reserved words, Naming conventions in python
Operators in Python: Operator, operator precedence and associativity, Mathematical functions
Input and Output: Output statements, Input statements
Control Statements: Control statements

Revised Bloom's Taxonomy Level	L1- Remembering, L2- Understanding,L3-Apply, L4-Analyze

UNIT II (10 hours)

Strings and Characters:
Lists and tuples: lists,tuple
Dictionaries : Operations on dictionaries, dictionary methods, using for loop with dictionaries, converting lists into dictionary, converting strings into dictionary, ordered dictionaries

Revised Bloom's Taxonomy Level	L1- Remembering, L2- Understanding,L3-Apply, L4-Analyze, L5-Evaluate

UNIT III (10 hours)

Functions: Defining a function, calling a function, Returning Results from a function, Returning multiple values from a function, Formal and actual arguments, local and global variables, passing a group of elements to a function, recursive functions ,the special variable __name__
Files in python: files, types of files in python, opening a file, closing a file, working with text files containing strings, working with binary files
Regular Expressions in python: Regular expressions, using regular expressions on files

Revised Bloom's Taxonomy Level	L1-Remembering, L2- Understanding,L3-Apply, L4-Analyze, L5-Evaluate

UNIT IV (10 hours)

Graphical user Interfaces: GUI in python, the root window, working with container, canvas, frame, widgets
Graphics The Pizza Panic Game: Introducing the pizza panic game, Introducing pygame and livewires packages, Creating graphics window, setting background image, setting background image, understanding the graphics coordinate system, displaying sprite, displaying sprite, displaying text, displaying message, moving sprites, dealing with screen boundaries, handling mouse input, detecting collisions, back to the pizza panic game

Revised Bloom's Taxonomy Level	L1- Remembering, L2- Understanding,L3-Apply, L4- Analyze, L5-Evaluate,L6-Create

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Course Outcomes:

At the end of the course, students are able to:

- Explain syntax and semantics of Python programming structure
- Demonstrate the use of strings, files, lists, dictionaries, set and tuples in simple applications.
- Write simple applications using regular expressions ,files, dictionaries etc.
- Build applications with GUI and simple games
- Analyze the given problem and select appropriate data types and modules to develop the solution.

Sl No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Core Python Programming	Dr. R.Nageswawa Rao	Dreamtech press	2nd Edition 2018
Chapter Numbers:3,4,5,6,8,9,10,11,17,18,22				
2	Python Programming for the Absolute Beginner	Michael Dawson	Course Technology, a part of Cengage Learning	3rd Edition,2010
Chapter Number:11				
Reference Books				
1.	Learning Python		Cyberplus Publication	1 edition 17 May 2017
2.	Core Python Applications Programming	Wesley J. Chun	Pearson Education India,	Third Edition, 2015.
3.	Introduction to Python Programming	Gowrishankar S. Veena A.	CRC Press Taylor & Francis Group	1st Edition 2019
4.	Python Programming using problem solving approach	Reema Thareja	Oxford university press,	1st Edition 2017
5.	Python for Everybody: Exploring Data Using Python 3	Charles R. Severance	CreateSpace Independent Publishing Platform	1st Edition, 2016.
6.	Python Programming	Michael Urban and Joel Murach	Mike Murach Elizabeth Drake	1st Edition,2016

Web links and Video Lecture:

- http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf
- https://www.python.org/
- https://www.pdfdrive.com/introduction-to-python-programming-d176341873.html
- https://www.pdfdrive.com/python-programming-for-the-absolute-beginner-e34494394.html
- https://edubookpdf.com/programming/murachs-python-programming.html
- https://www.youtube.com/watch?v=rfscVS0vtbw
- https://www.youtube.com/watch?v=vaysJAMDaZw

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- https://www.youtube.com/playlist?list=PLS1QulWo1RIaJECMeUT4LFwJ-ghgoSH6n
- https://www.youtube.com/playlist?list=PL6gx4Cwl9DGAcbMi1sH6oAMk4JHw91mC_
- https://www.youtube.com/playlist?list=PLTTTcaxrixZSh3TyvoEoTTbEHyS4c6Su7

Course Articulation Matrix: Mapping of Course Outcomes (CO) with Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

No	Programme Outcomes / Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
The students will be able to:																
1	Explain syntax and semantics of Python programming structure	1	2	2		1								2		
2	Demonstrate the use of strings, files, lists, dictionaries and tuples in simple applications	2	3	3		1								3	1	1
3	Write simple applications using regular expressions, files, dictionaries etc.	3	3	3		1								3	1	1
4	Build applications with GUI and simple games	3	3	3		1								3	1	3
5	Analyze the given problem and select appropriate data types and modules to develop the solution.	2	3	1		1								3	1	1

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