DR. B.C. ROY SOCIETY ENGINEERING
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Course Name: Semiconductor Devices
Course Code: EC-301
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Knowledge of Mathematics
   Semiconductor Physics
   Basic Electronics
2. **Course Learning Objectives:**
   i. This course introduces the concepts about solid-state electronic components and their applications.
   ii. Students will also learn the construction, operation, and characteristics of various electronic devices, such as diodes, transistors (BJTs and MOSFETs), and other Optoelectronics devices.
   iii. This course introduces the concept of different fabrication processes for Integrated Circuits.
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Continuous Internal Assessment I (40 Marks)
   B. Continuous Internal Assessment II (40 Marks)
   C. End-Semester Exam (60 Marks)
4. **Course Content:**
   Course Name: SEMICONDUCTOR DEVICES
   Course Code: EC-301
   Hours per Week: 3L:0T:0P
   Credits: 3

Module	Topics	36L
1.	**Energy bands & Current Carriers in Semiconductors:** Bonding Forces in Solids, Energy Bands theory in crystals (Qualitative Analysis), Metals, Semiconductors, & Insulators, Fermi-Level, Intrinsic and Extrinsic Semiconductors, Concept of Holes, Carrier Concentration and Mobility, diffusion and drift of carriers, continuity equation, Injected minority carrier charge, Recombination and generation of charge carriers. Generation and recombination of carriers; Poisson equation.	10L
2.	**BJT and MOSFET:** Review on BJT working principle, Ebers-Mol Model**,** Physical Structure of MOSFET, MOS Capacitance: Oxide related and Junction, MOS C-V Characteristics, Metal-semiconductor work function difference, surface potential, bulk Fermi potential, Threshold calculation, flat-band potential, Interface states and their effects, I-V Characteristics, small signal model	10L
3.	**Opto–Electronic Devices:** Optical absorption in semiconductors, photovoltaic effects, solar cells (p-n junction), Photoconductors, Photodiode, PIN photodiode, Avalanche photodiode, Phototransistor, LED, Semiconductor Laser (p-n junction)	10L

Module	Topics	36L
4.	**Integrated Circuit:** fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process.	6L

5. References:

Text Books:

- Donald A. Neamen, Semiconductor Physics and Devices, 4th Edition, McGraw Hill Education, 2021.
- G. Streetman, and S. K. Banerjee, Solid State Electronic Devices, 7th edition, Pearson,2014.
- D. Neamen , D. Biswas "Semiconductor Physics and Devices," McGraw-Hill Education
- Simon Sze, and Ming-Kwei Lee, Semiconductor devices Physics and technology, Wiley, 2015.

Reference Books:

- A.K. Maini, Analog Electronics, Khanna Book Publishing, New Delhi, 2022.
- Dutta “Semiconductor Devices and circuits” Oxford, 2008.
- Y. Tsividis and M. Colin, “Operation and Modeling of the MOS Transistor,” Oxford Univ.Press,2011.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details /Statement	Action Verb	Knowledge Level
EC-301.1	Understand the principles of semiconductor Physics and apply it to electronic devices	Understand	Apply
EC-301.2	Differentiate the conduction techniques in semi-conductor materials.	Identify	Analyze
EC-301.3	Analyze characteristics of Semi-conductor diodes and solve problems.	Analyze	Analyzing
EC-301.4	Determine the characteristics of Bi-polar Transistors, MOS Transistors and solve problems.	Analyze	Analyzing
EC-301.5	Differentiate between different Opto-electronic devices	Identify	Understanding
EC-301.6	.Explain the basic concepts and fabrication technique.	Explain	Understanding

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	-	-	-	-
2	2	1	3	-	-	-
3	1	2	-	3	-	-
4	1	1	-	-	3	-
5	2	-	-	-	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	2	-	1
CO2	3	1	1	1	-	-	-	-	-	2	-	1
CO3	3	1	1	1	-	-	-	-	-	2	-	1
CO4	3	1	1	1	-	-	-	-	-	2	-	1
CO5	3	1	1	1	-	-	-	-	-	2	-	1
CO6	2	1	1	1	-	-	-	-	-	2	-	1

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

***** End of Syllabus*****

Course Name: Digital Electronics
Course Code: EC- 302
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Fundamental understanding on Mathematics: particularly algebra, Number System,
   Basic concept on logic gates, Circuit analysis, Computer programming and electronic components
2. **Course Learning Objectives:**
   i. This course introduces the concepts about digital logic gates and their applications.
   ii. Students will also learn to design and analyze combinational and sequential digital logic circuits.
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Continuous Internal Assessment I - (40 marks)
   B. Continuous Internal Assessment II - (40 marks)
   C. End-Semester Exam (60 Marks)
4. **Course Content:**
   Course Name: DIGITAL ELECTRONICS
   Course Code: EC - 302
   Hours per Week: 3L: 0T: 0P
   Credits: 3

Module	Topics	36L
1	**Review on Number System and Logic Optimization:** Number system, binary arithmetic, signed and unsigned number, complement method, Boolean algebra, De Morgan's Theorem, logic gates and their truth table, SOP, POS, Design with universal logic gates, Min-term, Max-term, Canonical forms, Logic Simplification using algebraic and karnaugh's map method.	6L
2	**Combinational Logic Design:** Half and Full Adder, Subtractor, serial adder, Parallel Adder/Subtractor, BCD adder, Fast Adder: CLA, Carry skip adder, Carry Select Adder etc., Comparator, Multiplexer, De-Multiplexer, Encoder, Decoder, Parity Generator-checker, code converter, Barrel shifter and 4-bit ALU.	12L
3	**Sequential Logic Design:** Latches and Flip-Flop: S-R, D, J-K and T, Master-Slave J-K flip-flop, Ring counter, Johnson counter, Shift registers, ripple and synchronous counters, Modulus counter, Irregular counter, State table and state transition diagram, Pulse train generator.	12L
4	**ADC, DAC and PLD:** A/D-Converter-Flash Type, SAR-Type etc. D/A-Convertor-Weighted Resistor, R-2R Ladder etc. Programmable Logic	

Module	Topics	36L
	Devices: PROM, PAL, PLA, Macro-Cell, CPLD.	6L

5. References:

Text Books:

- Morries Mano- Digital Logic Design- PHI

Reference Books:

- S. Salivahanan, Digital Circuits and Design, Oxford Higher Education
- A.Anand Kumar, Fundamentals of Digital Circuits- PHI
- A.K.Maini- Digital Electronics- Wiley-India
- Kharate- Digital Electronics- Oxford
- R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
- H.Taub&D.Shilling, Digital Integrated Electronics- McGraw Hill.
- Leach &Malvino—Digital Principles & Application, 5/e, McGraw Hill
- Floyed & Jain- Digital Fundamentals-Pearson.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC302.1	Understand and explain the fundamental concept of basic logic operations and logic elements.	Explain	Understanding
EC302.2	Design and analyze combinational logic circuits	Design	Creating
EC302.3	Design and analyze sequential logic circuits	Design	Creating
EC302.4	Select and apply different Analog-Digital Conversion technique	Select	Applying
EC302.5	Explain PLD for digital circuit design	Explain	Understanding
EC302.6	Identify the basic requirements and propose optimized solution for digital applications	Identify	Apply

7. Mapping of Course Outcomes (CO) to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	2	-	-	1
2	-	3	-	-	-	2
3	-	-	3	3	-	2
4	-	-	-	-	3	2

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	1	1	-	-	1	-	-	1	-	1
CO2	2	-	1	1	-	-	1	-	-	1	-	1
CO3	2	-	1	1	-	-	1	-	-	1	-	1
CO4	2	-	1	1	-	-	1	-	-	1	-	1
CO5	2	-	1	1	-	-	1	-	-	1	-	1
CO6	2	-	1	1	-	-	1	-	-	1	-	1

9. Mapping to Program Specific Outcome (PSO):

	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

***** End of Syllabus*****

DR. B.C. ROY SOCIETY ENGINEERING
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Course Name: Signals And Systems
Course Code: EC - 303
Course Type: PC
(Semester III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Knowledge of calculus (differential and integral)
   Linear algebra
   Basic complex numbers
   Knowledge of differential equations
2. **Course Learning Objectives:**
   i. To Make Students Understand the Representation and Properties of Continuous Time and Discrete Time Signals,
   ii. To Create Problem Solving Ability Among students for Analyzing Time and Frequency Domain Using Different Transforms.
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology– Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Continuous Internal Assessment I - (40 marks)
   B. Continuous Internal Assessment II - (40 marks)
   C. End-Semester Exam (60 Marks)
4. **Course Content:**
   Course Name: SIGNALS AND SYSTEMS
   Course Code: EC- 303
   Hours per Week: 3L: 0T:2P
   Credits: 3

Module	Topics	38L
1	**CLASSIFICATION OF SIGNALS AND SYSTEMS:** Standard signals- Step, Ramp, Impulse, Real and complex exponentials and Sinusoids, Classification of signals — With respect to time and with respect to properties. Classification of systems- CT systems and DT systems. Linear & Nonlinear, Time-variant & Time-invariant, Causal & Non-causal, Stable & Unstable ,FIR &IIR, Recursive & non recursive.	9L
2	**ANALYSIS OF CONTINUOUS TIME SIGNALS:** Representation of Fourier series, Continuous time Periodic Signals,-Properties of Fourier series, Trigonometric and Exponential Fourier series. Deriving Fourier Transform from Fourier series, Properties of Fourier Transform, Fourier Transform of standard and periodic signal,	9L
3	**CONTINUOUS TIME SYSTEMANALYSIS**: Continuous Time LTI systems - Laplace Transform, Concept of Region of Convergence (ROC). Analysis and characterization of LTI systems using the Laplace Transform.	6L
4	**DISCRETE TIME SIGNAL ANALYSIS:** Sampling Theorem-Reconstruction of a signal from its samples, Effect of under sampling -Aliasing- Fourier Series representation of Discrete Time Periodic Signals- Properties- Discrete Time Fourier Transform-Properties	8L

Module	Topics	38L
5	**DISCRETE TIMESYSTEMANALYSIS**: Discrete Time LTI systems- Concept of Z-Transform, Region of Convergence in Z .Transform, Constraints on ROC for various classes of Signals, Inverse Z- Transform, Properties of Z-Transforms	6L

6. Reference:

Text Books:

- AllanV. Oppenheim,S. WilskyandS. H. Nawab , "SignalsandSystems",Pearson,2007
- B.P. Lathi ,"PrinciplesofLinearSystemsandSignals",SecondEdition,Oxford,2009
- Signals and Systems A Primer with MATLAB®ByMatthew N. O. Sadiku, Warsame Hassan Ali, Sarhan M. Musa, Edition2nd Edition, First Published2024

Reference Books:

- Signals and Linear Systems: Robert A. Gable, Richard A. Roberts, John Wiley, 3rd edition, 1995.
- Signals and Systems: A NagoorKani.McGraw Hill Education **,** 2010

7. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC303.1	Understand and explain the mathematical description and representation of continuous and discrete time signals and systems.	Explain	Understand
EC303.2	Apply Fourier Series and Fourier transform to solve Continuous time signalanalysis	solve	Apply
EC303.3	Analyze and Simplify continuous time LTI systems using Fourier and Laplace Transforms.	Simplify	Analyze
EC303.4	Apply Fourier Series and Fourier transform to solve Discrete time signal analysis	solve	Apply
EC303.5	Apply the concept of Nyquist criterion Make use of sampling and reconstruction of signals	Make use of	Apply
EC303.6	Examine and Analyze discrete time LTI systems using Z transform and DTFT	Examine	Analyze

8. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3

9. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	-	-	-	-	-	2	-	1
CO2	3	1	1	1	-	-	-	-	-	2	-	1

CO3	3	1	1	1	-	-	-	-	-	2	-	1
CO4	3	1	1	1	-	-	-	-	-	2	-	1
CO5	3	1	1	1	-	-	-	-	-	2	-	1
CO6	2	1	1	1	-	-	-	-	-	2	-	1

10. Mapping to Program Specific Outcome(PSO)

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	2	-
CO5	3	2	-
CO6	3	1	-

***** End of Syllabus*****

DR. B.C. ROY SOCIETY ENGINEERING
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Course Name: Network Analysis and Synthesis
Course Code: EC - 304
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Class-XII level knowledge of Physics (Current Electricity)
   Mathematics
2. **Course Learning Objectives:**
   i. Develop techniques for designing and realizing electrical networks with specific properties, including passive and active circuit synthesis.
   ii. Understand the concepts of impedance, admittance, phasors, resonance, and frequency response in electrical networks.
   iii. Learn the characterization of electrical networks using two-port parameters such as Z, Y, h, and ABCD parameters.
   iv. Apply Fourier and Laplace transforms for circuit analysis and synthesis.

3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Continuous Internal Assessment I - (40 marks)
   B. Continuous Internal Assessment II - (40 marks)
   C. End-Semester Exam (60 Marks)
4. **Course Content:**
   Course Name: Network Analysis and Synthesis
   Course Code: EC 304
   Hours per Week: 3L: 0T:0P
   Credits: 3

Module	Topics	36L
1.	**TRANSIENTS:** DC and AC analysis of RL, RC and RLC series circuits. Resonance: Series and Parallel resonance. Loop and node variable analysis, Waveform Synthesis-The Shifted Unit Step, Ramp and Impulse Function, Waveform Synthesis, The Initial and Final Value Theorems, The Convolution Integral.	6L
2.	**IMPEDANCE FUNCTIONS ANDNETWORK THEOREMS:** The Concept of Complex Frequency, Transform Impedance and Transform Circuit, Series and parallel Combination of Elements, superposition and Reciprocity, Thevenin's Theorem and Norton's Theorem.	4L
3.	**NETWORK FUNCTIONS: POLES AND ZEROS**: Terminal Pairs and Ports, Network Function for the One Port and Two Port, The Calculation of Network Function - (a) Ladder Network (b) General Networks. Poles and Zero of Network Functions, Restrictions on Pole and Zero Locations for Driving-Point Functions, Restrictions on Pole and Zero Locations for Transfer Functions, Time- domain Behaviour from the Pole and Zero Plot, Stability of Networks.	6L

4.	**TWO-PORT PARAMENTERS:** Relationship of Two-Port Variables, Short-Circuit Admittance parameters, The Open-circuit Impedance Parameters, Transmission parameters, The Hybrid parameters, Relationships Between parameter Sets, Parallel Connection of Two-Port Networks.	6L
5.	**POSITIVE REAL FUNCTION**: Driving-Point Functions, Brune's Positive Real Functions, Properties of Positive Real Functions. TESTING DRIVING-POINT FUNCTIONS: An application of the Maximum Modulus Theorem, Properties of Hurwitz Polynomials, The Computation of Residues, Even and Odd functions, Sturm's Theorem, An alternative Test for Positive real functions.	6L
6.	**DRIVING-POINT SYNTHESIS WITH LC ELEMENTS**: Elementary Synthesis Operations, LC Network Synthesis, RC and RL networks. Properties of RC Network Function, Foster Form of RC Networks, Foster From of RL Networks, The Cauer Form of RC and RL Networks. RLC ONE TERMINAL - PAIRS: Minimum Positive Real Functions, Brune's Method of RLC Synthesis.	4L
7.	**TWO TERMINAL-PAIR SYNTHESIS BY LADER DEVELOPMENT**: Some properties of –y and z The LC Ladder Development, Other Considerations, The RC Ladder Development.	4L

5. References:

Text Books:

- Ashfaq Husain, Networks & Systems, Khanna Publishing House, New Delhi, 2018.
- Van, Valkenburg.; "Network analysis"; Prentice hall of India, 2000

Reference Books:

- Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi, 1994
- A William Hayt, "Engineering Circuit Analysis" 8th Edition, McGraw-Hill Education
  Ghosh, SP, Chakraborty AK, Network Analysis and Synthesis, Tata McGraw-Hill New Delhi**.**

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC304.1	Understand basics electrical circuits with nodal and mesh analysis.	Explain	Understand
EC304.2	Appreciate electrical network theorems	Identify	Analyze
EC304.3	Apply Laplace Transform for steady state and transient analysis.	Identify, Design	Apply
EC304.4	Determine different network functions	Design	Apply
EC304.5	Appreciate the frequency domain techniques	Implement	Apply
EC304.6	Develop skills in analyzing and designing various types of electrical networks.	Design	Analyze

7. Mapping of Course Outcomes (CO) to module / course content

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	3	-	2	-	-
2	3	3	-	2	-	-
3	3	2	3	2	-	-
4	3	2	-	2	3	-
5	3	3	-	2	-	3
6	3	2	2			1
7	3	2		1		

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2	3	2										
CO3	3	3										
CO4	3	2										
CO5	2	2										
CO6	2	3										

9. Mapping to Program Specific Outcome(PSO)

COs	PSO1	PSO2	PSO3
CO1	3		
CO2	3		
CO3	2		
CO4	3		
CO5	3		
CO6	3		

***** End of Syllabus*****

Course Name: Data Structure & Algorithm

Course Code: EC-305

Course Type: ES

(Semester-III)

Course Broad Category: (Ability Enhancement)

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1. **Course Prerequisite:**
   ESC-CS 202 (Programming for Problem Solving)
   BSC-M 101(Mathematics-I) & BSC-M 202(Mathematics-II), basics of set theory
2. **Course Learning Objectives:**
   i. To learn the basics of abstract data types.
   ii. To learn the principles of linear and nonlinear data structures.
   iii. To build an application using sorting and searching
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology– Lectures and Presentations, Interactive Discussions and Case Studies.
   Evaluation System –
   A. Continuous Internal Assessment I - (40 marks)
   B. Continuous Internal Assessment II - (40 marks)
   C. End-Semester Exam (60 Marks)
4. **Course Content:**
   Course Name: DATA STRUCTURE & ALGORITHM
   Course Code: EC- 305
   Hours per Week: 3L: 0T:0P
   Credits: 3

Module	Topics	40L
1	**Introduction to Data Structure:** Basic Terminologies: Elementary Data Organizations. Classification of Data Structure, Data Structure Operations: insertion, deletion, traversal etc. Algorithms, Different approaches to designing an algorithm. Asymptotic Notations: Big O, Omega, Theta notation. Time and Space complexity: (Worst-case, Average-case, Best-case time complexity).	5L
2	**Arrays:** Introduction, Declaration of Arrays, Operations on Arrays: (Traversing, Inserting, Deleting, Merging), Sparse Matrices, Applications of Arrays.	4L
3	**Linked Lists: Introduction, Singly linked lists (Algorithms and complexity analysis):** Operations: Traversing, Searching, Inserting, Deleting. **Circular Linked List (Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Doubly Linked List (Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Circular Doubly Linked List (Algorithms and complexity analysis):** Operations: Inserting, Deleting. **Header Linked List, Application of Linked List:** 3.7.1 Polynomial Representation.	10L
4	**Stacks (Algorithms and complexity analysis):** Introduction to Stack. Array Representation of Stacks. Operations on a Stack: Push, Pop, Peek and Display. Linked Representation of Stacks. Operations on a Linked Stack: Push, Pop and Display. Applications of Stacks: Recursion,	6L

	Evaluation of Arithmetic Expressions: Infix, Prefix, Postfix and Tower of Hanoi Problem. **Queues (Algorithms and complexity analysis):** Introduction to Queues. Array Representation of Queues. Linked Representation of Queues. Types of queues and their operations: Linear Queues, Circular Queues, Deques or Double Ended Queues, Priority Queues. Applications of Queues.	
5	**Trees (Algorithms and complexity analysis)**: **Introduction & Basic Terminologies. Binary Trees:** Binary Tree Creation, Binary Tree Traversal (Pre-order, In-order, Post-order), Constructing a Binary Tree from Traversal Result. **Binary Search Trees:** Operations of Binary Search trees: Searching, insertion, deletion, determining the height, finding the smallest and largest node etc. **Threaded Binary Tree:** Types, Traversing, Advantage and Disadvantage. **AVL Tree:** (Operations on AVL trees, Searching) [in Brief] **Red-Black Tree:**[in Brief] Properties, Operations, Applications. **Introduction to M-Way search Tree**.[in Brief] B Trees: Operations of B Tree (searching, insertion, deletion), Application of B Tree.	8L
6	**Sorting (Algorithms and complexity analysis)**: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Shell Sort and Radix Sort. **Searching (Algorithms and complexity analysis)**: Linear Search, Binary Search and Interpolation Search. **Hashing:** Introduction, Hash Tables, and Hash Functions. **Graph:** Introduction, Basic Terminologies, Graph Traversal algorithms (BFS and DFS), Shortest path algorithms.	7L

5. References:

Text Books:

- "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
- "Data Structure & Algorithms Using C", 5th Ed., Khanna Publishing House (AICTE Recommended – 2018).
- "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson freed.

References Books:

- "Data Structures in C" by Aaron M. Tenenbaum.
- "Data Structures" by S. Lipschutz.
- "Data Structures Using C" by ReemaThareja.
- "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
- "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
- "Data Structures through C" by YashwantKanetkar, BPB Publications.
- "Expert Data Structures with C++" by R.B Patel, Khanna Publishing House.

6. Course Outcomes:

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC- 305.1	Explain the choices of data structure & algorithm methods impact the performance of an algorithm.	Explain	L2
EC- 305.2	Discuss different kinds of operations, algorithms with complexity analysis and applications of stack, queue and linked list.	Compare	L2
EC- 305.3	Understand the non-linear data structure like trees and graphs, their definitions, algorithms with complexity analysis and applications.	Understand	L2
EC- 305.4	Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing.	Explain	L2
EC- 305.5	Illustrate the benefits of dynamic and static data structures implementations.	Summarize	L3

7. Mapping of course outcomes to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	1	1	1	-
2	2	3	-	-	1	-
3	2	3	-	-	1	-
4	2	3	-	-	1	-
5	1	-	3	-	1	-
6	1	-	2	3	1	-

8. Mapping of the Course outcomes to Program Outcomes:

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO 12
CO1	3	2	2	2		1						3
CO2	3	3	3	3		1						3
CO3	3	3	3	3		1						3
CO4	3	3	3	3		1						3
CO5	3	2	2	2								3
AVG.	3.0	2.6	2.6	2.6		1.0						3.0

9. Mapping to PSO:

COs	PSO1	PSO2	PSO3
CO1	3	1	1
CO2	3	2	2
CO3	3	2	2
CO4	3	2	2
CO5	2	1	1

***** End of Syllabus*****

DR. B.C. ROY SOCIETY ENGINEERING
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Course Name: Probability and Statistics
Course Code: EC - 306
Course Type: BS
(Semester III)
Course Broad Category: (Minor)

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1. **Course Prerequisite:**
   Concept of Mathematics in B. Tech 1st and 2nd semester
2. **Course Learning Objectives:**
   i) To familiarize the prospective engineers with techniques in probability and statistics.
   ii) It aims to equip the students with standard concepts and tools at an intermediate to advance level that will serve them well towards tackling more advance level of mathematics and applications that they would find useful in their disciplines.
3. **Teaching methodology and evaluation system for the course:**
   Teaching methodology – Lectures and Presentations, Interactive Discussions and Case Studies, Guest Lectures.
   Evaluation System –

A. Continuous Internal Assessment I - (40 marks)
B. Continuous Internal Assessment II - (40 marks)
C. End-Semester Exam (60 Marks)

4. **Course Name:** Probability and Statistics
   Course Code: EC-306 (ECE)
   Hours per Week: 3L: 1T: 0P
   Credits: 3

Module	Topics	42L
1	**Probability:** Review on Basic Probability theory, Random Variable, Discrete and continuous random variables, Mathematical expectation, properties of expectation and variance, Discrete (Binomial and Poisson's distribution) and Continuous Probability Distribution (Normal and exponential distribution). Continuous and Discrete Bivariate distributions and their properties, Conditional and Marginal densities.	12L
2	**Stochastic Process:** Definition, classification, and examples of stochastic processes; stationary and autoregressive processes; discrete-time Markov chains; continuous-time Markov chains, Poisson process.	8L
3	**Basic Statistics:** Law of large numbers, central limit theorem, sampling distributions, chi square distribution, Student's't' distribution, F distribution.	8L
4	**Inferential Statistics:** Estimation of Parameters: Point estimation: sufficiency, unbiased estimation, maximum likelihood estimation, confidence intervals for mean, Hypothesis testing: type-I and type-II errors, One and two tailed tests. Test for single mean, difference of means, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	8L
5	**Applied Statistics:** Correlation and regression – Rank correlation, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	6L

5. References:

Text Books:

- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
- Kapoor, V.K., and Gupta, S.C.: Fundamentals of Applied Statistics, Sultan Chand & Sons.
- Medhi, J.: Stochastic Processes, New Age International Publishers.

Reference Books:

- Mukhopadhyay, P.: Mathematical Statistics, New Central Book Agency.
- Dreyfus, S.E.: The Art and Theory of Dynamic Programming: Theory and Applications, Academic Press.
- Goon, A.M., Gupta, M.K., and Dasgupta, B.: Outlines of Statistics, Vol. II, The World Press Private Ltd.
- Hoel, P.G.: Introduction to Mathematical Statistics, John Wiley & Sons.
- Hogg, R.V., Tanis, E.A., and Rao, J.M.: Probability and Statistical Inference (7th Edition), Pearson.

6. Course Outcomes (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC-306.1	Learn to apply different tools in basic probability theory which would enable them to devise engineering solutions to encounter in their profession life.	Identify	Remember
EC-306.2	Understand and apply the concept of stochastics process in form of stochastic signal as carrier that is modulated by the information signal for communication.	Explain	Understand
EC-306.3	Understand the uncertainties and risks, and to model and analyze the lifetime or failure characteristics of components, systems, or processes.	Implement	Apply
EC-306.4	Apply the concept of Statistical techniques to make inferential decisions on the basis of hypothesis testing.	Organize	Analyze
EC-306.5	Apply statistical tool in analyzing the data in making decisions of any real-life problems.	Assess	Evaluate
EC-306.6	Build up logical and analytical skills to create a new idea appreciated by academics, research & emerging trends in industry.	Construct	Create

7. Mapping of course outcomes to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	2	-	-	1
2	2	3	-	-	-	1
3	2	1	3	1	-	1
4	1	2	2	3	-	1
5	2	-	1	1	3	1

8. Mapping of the Course outcomes to Program Outcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11

CO1	2	2	1	1	2	-	-	-	-	-	1
CO2	1	2	2	1	-	-	-	-	-	-	1
CO3	3	2	2	1	1	-	-	-	-	-	1
CO4	2	1	1	1	2	-	-	-	-	-	2
CO5	2	2	2	2	2	-	-	-	-	-	1
CO6	1	1	1	1	-	-	-	-	-	-	1

9. Mapping to Program Specific Outcome (PSO):

COs	PSO1	PSO2	PSO3
CO1	2	2	1
CO2	3	2	1
CO3	2	1	1
CO4	3	2	1
CO5	3	2	1
CO6	2	1	1

***** End of Syllabus *****

Course Name: Semiconductor Devices Laboratory
Course Code: EC- 391
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Knowledge of Physics
   Basic electronics practical
2. **Course Learning Objectives:**

i. Expose students to experimental skills on electronic circuit design and analysis
ii. To gain practical knowledge by applying experimental methods to correlate with the Semiconductor devicetheory.
iii. To apply the analytical techniques and graphical analysis to the experimental data.

3. **Teaching methodology and evaluation system for the course:**

Teaching methodology: Instruction: This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System –

A. **Internal Assessment (60 Marks)-** Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
B. **End-Semester Exam (40 Marks)-**Summative Assessment.

4. **Course Content:**
   Course Name: SEMICONDUCTOR DEVICES LAB
   Course Code: EC-391
   Hours per Week: 0L: 0T: 2P
   Credits: 1

Module	Topics	14P
1.	**Familiarization with electronic component and measuring instruments:** Familiarization with Electronic components such as Resistors, Capacitors, Diodes, Transistors, FET (JFET & MOSFET) etc. Familiarization with measuring equipment like Multimeter, Trainer-kit, CRO, Signal Generator etc.	1P
2.	**Characteristics Of Pn Junction Diode:** a) To Plot the Volt Ampere Characteristics of PN Junction Diode under Forward and Reverse Bias Conditions. b) To find the Cut-in voltage, Static Resistance, Dynamic Resistance for Forward Bias & Reverse Bias	2P
3.	**Characteristics Of Zener Diode & Load Regulation**: a) To Obtain the Forward Bias and Reverse Bias characteristics of a Zener diode. b) Find out the Zener Break down Voltage from the Characteristics. c) To Obtain the Load Regulation Characteristics.	2P
4.	**Common Base Bipolar Transistor Characteristics:** a) To plot the Input and Output characteristics of a transistor connected in Common Base Configuration and to find the h – parameters from the characteristics	2P
5.	**Common Emitter Bipolar Transistor Characteristics:** a) To plot the Input and Output characteristics of a transistor connected in Common Emitter Configuration and to find the h – parameters from the characteristics	2P

Module	Topics	14P
6.	Design Self Bias BJT Circuit	1P
7.	**JFET Drain & Transfer Characteristics (Common Source):** a) Drain characteristics b) Transfer Characteristics. c) To find rd, gm, and μ from the characteristics.	2P
8.	Study Characteristics of Photo transistor	1P
9.	Study Characteristics of LED & LDR	1P

5. References:

Text Books:

- SM Sze, Kwok K. Ng, "Physics of Semiconductor Devices", 3/e, Wiley- Interscience, 2006.
- Donald A. Neamen, Dhrubes Biswas "Semiconductor Physics and Devices", 4/e, McGraw-Hill Education, 2012.

Reference Books:

- Electronics Devices & Circuits by Salivahanan
- Electronics Circuits by Schilling & Belove

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC- 391.1	Measure and record experimental data, analyze the results, and prepare a formal laboratory report.	Analyze,Measure	Apply, Analyze
EC- 391.2	Verify the functioning of different diodes, transistors, CRO probes, and measuring instruments, and identify the procedure for conducting the experiment.	Verify, Identify	Apply
EC- 391.3	Analyze and design a basic Zener diode voltage regulator with a series resistor under different load conditions.	Analyze, design	Create
EC- 391.4	Understand the characteristics of BJT and determine different parameters for design purposes.	Understand ,Determine	Apply
EC- 391.5	Understand the characteristics of FET and determine different parameters for design purposes.	Understand ,Determine	Apply
EC- 391.6	Understand the properties of photoelectric devices.	understand	understand

7. Mapping of Course Outcomes (CO) to module / course content

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

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	1	-	-	-	-	-	-	2
CO2	3	3	-	2	1	-	-	-	-	-	-	2
CO3	3	3	-	2	1	-	-	-	-	-	-	2
CO4	3	3	-	2	1	-	-	-	-	-	-	2
CO5	3	3	-	2	1	-	-	-	-	-	-	2
CO6	3	3	-	2	1	-	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	2	-
CO2	3	2	-
CO3	3	2	-
CO4	3	2	-
CO5	3	2	-
CO6	3	2	-

***** End of Syllabus*****

Course Name: Digital Electronics Laboratory
Course Code: EC- 392
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Fundamental Knowledge of logic design and verification
2. **Course Learning Objectives:**

i. Expose students to experimental skills on digital combinational and sequential circuit design and analysis
ii. To gain practical knowledge by applying experimental methods to correlate with the digital electronics theory.
iii. To apply the analytical techniques and graphical analysis to the experimental data.

3. **Teaching methodology and evaluation system for the course:**

Teaching methodology: Instruction: This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System –

A. **Internal Assessment (60 Marks)-** Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
B. **End-Semester Exam (40 Marks)-** Summative Assessment.

4. **Course Content:**
   Course Name: DIGITAL ELECTRONICS LAB
   Course Code: EC- 392
   Hours per Week: 0L: 0T: 2P
   Credits: 1

Module	Topics	16P
1.	**Experiment on Logic Optimization:** Optimize and Implement a given Boolean expression in SOP/POS using logic gates, design XOR function with minimum number of NAND Gates and simulate using suitable circuit simulator	2P
2.	**Experiment on Combinational Logic Circuit:** Implementation and verification of Full-Adder using Logic Gates, Implementation and verification of decoder and encoder using logic gates, Implementation and verification of even/odd parity generator and checker using logic gates, Implementation and verification of parallel adder using IC-7483, Design and simulation of Multiplexer circuit using suitable circuit simulator, Design and simulation of a Magnitude Comparator using suitable circuit simulator, Design and simulation of 4-bit Binary-to-Grey and Grey-to-Binary Converter using suitable circuit simulator, Design and simulation of BCD-Adder using suitable circuit simulator, Design and simulation of PROM based combinational Circuit with suitable circuit simulator	9P

Module	Topics	16P
3.	**Experiment on Sequential Logic Circuit:** Implementation and verification of J-K Flip-Flop using logic gates, Implementation and verification of asynchronous counter using T-Flip/Flop, Design and simulation of Positive/Negative Level Triggered D-Latch with suitable circuit simulator, Design and simulation of Positive/Negative Edge Triggered D Flip-Flop with suitable circuit simulator, Design and simulation of Johnson Counter with suitable circuit simulator	5P

5. References:

Text books:

- Morries Mano- Digital Logic Design- PHI

Reference Books:

- S. Salivahanan, Digital Circuits and Design, Oxford Higher Education
- A.Anand Kumar, Fundamentals of Digital Circuits- PHI
- A.K.Maini- Digital Electronics- Wiley-India
- Kharate- Digital Electronics- Oxford
- R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
- H.Taub&D.Shilling, Digital Integrated Electronics- McGraw Hill.
- Leach &Malvino—Digital Principles & Application, 5/e, McGraw Hill
- Floyed & Jain- Digital Fundamentals-Pearson.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC392.1	Simplify and Analyze digital logic circuits	Simplify	Analyze
EC392.2	Construct Combinational Logic Circuits with logic gates	Construct	Apply
EC392.3	Explain combinational circuit through software simulation	Explain	Understand
EC392.4	Construct Sequential Logic Circuits with logic gates	Construct	Apply
EC392.5	Explain Sequential circuit through software simulation	Explain	Understand
EC392.6	Identify effective solution for digital applications	Identify	Apply

7. Mapping of Course Outcomes (CO) to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	2	-	1	-	1
2	2	3	3	-	-	2
3	2	-	-	3	3	2

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3	1	1	3	-	1	-	-	1	3	2
CO2	2	3	1	1	3	-	1	-	-	1	3	2
CO3	2	3	1	1	3	-	1	-	-	1	3	2
CO4	2	3	1	1	3	-	1	-	-	1	3	2
CO5	2	3	1	1	3	-	1	-	-	1	3	2
CO6	2	3	1	1	3	-	1	-	-	1	3	2

9. Mapping to Program Specific Outcome (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	3	-
CO2	3	3	-
CO3	3	3	-
CO4	3	3	-
CO5	3	3	-
CO6	3	3	-

***** End of Syllabus*****

Course Name: Signals and Systems Laboratory
Course Code: EC- 393
Course Type: PC
(Semester – III)
Course Broad Category: (Major)

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1. **Course Prerequisite:**
   Knowledge of calculus (differential and integral)
   Linear algebra
   Basic complex numbers
   Knowledge of differential equations
2. **Course Learning Objectives:**

i. To Make Students Understand the Representation and Properties of Continuous Time and Discrete Time Signals,

ii. To Create Problem Solving Ability Among students for Analyzing Time and Frequency Domain Using Different Transforms.

3. **Teaching methodology and evaluation system for the course:**

Teaching methodology: This method recognizes that students have different learning styles, abilities, and backgrounds, and aims to create a learning environment that accommodates these differences.

Evaluation System:

A. **Internal Assessment (60 Marks)-**Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]
B. **End-Semester Exam (40 Marks)-** Summative Assessment.

4. **Course Content:**
   Course Name: SIGNALS AND SYSTEMS LAB
   Course Code: EC 393
   Hours per Week: 0L: 0T: 2P
   Credits: 1

Module	Topics	16P
1	**Introduction to MATLAB:** The graphical interface to the MATLAB workspace, Creating Variables, arrays, conditional statements, loops, functions, and plots.	1P
2	**Generation of different test signals:** To create user defined functions for generating sinusoidal signal, delta function, unit step function and periodic signal.	1P
3	**Different operations:** To create user defined functions for signal operation: signal addition, time shifting, time scaling and time inversion.	2P
4	**Convolution:** To compute convolution of two signals and verify its properties.	1P
5	**Correlation:** To compute auto-correlation and cross-correlation of two signals and verify its properties.	1P

Module	Topics	16P
6	**Response of the LTI systems:** To obtain the response of LTI system defined by linear constant coefficient difference equations	2P
7	**Fourier series:** To synthesize the periodic signal using Fourier series.	1P
8	**Fourier transform:** To analyze the spectrum of the signal using Fourier transform and verify its properties.	2P
9	**Laplace transform:** To compute and plot the impulse response and pole-zero diagram of transfer function using Laplace transform.	2P
10	**Sampling:** To generate a continuous-time signal, sample it at different rates (above and below the Nyquist rate), and then attempt to reconstruct the original signal from the samples.	1P
11	**Z-transform:** To compute and plot the impulse response and pole-zero diagram of transfer function using Z-transform.	2P

5. References:

Text books:

- Signals and Systems: A Nagoor Kani.McGraw Hill Education **,** 2010
- B.P. Lathi ,"PrinciplesofLinearSystemsandSignals",SecondEdition,Oxford,2009
- Signals and Systems A Primer with MATLAB®ByMatthew N. O. Sadiku, Warsame Hassan Ali, Sarhan M.Musa, Edition2nd Edition, First Published2024

Reference Books:

- Allan V. Oppenheim, S. Wilskyand S. H. Nawab , "SignalsandSystems",Pearson,2007
- Signals and Linear Systems: Robert A. Gable, Richard A. Roberts, John Wiley, 3rd edition, 1995.

6. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
EC393.1	Understand and explain the mathematical description and representation of continuous and discrete time signals and systems.	Explain	Understand
EC393.2	Apply Fourier Series and Fourier transform to solve Continuous time signal analysis	solve	Apply
EC393.3	Analyze and Simplify continuous time LTI systems using Fourier and Laplace Transforms.	Simplify	Analyze
EC393.4	Apply Fourier Series and Fourier transform to solve Discrete time signal analysis	solve	Apply
EC393.5	Apply the concept of Nyquist criterion for sampling and reconstruction of signals	Make use of	Apply
EC393.6	Examine discrete time LTI systems using Z - transform and DTFT	Examine	Analyze

7. Mapping of Course Outcomes (CO) to module / course content:

Module	CO1	CO2	CO3	CO4	CO5	CO6
1	3	-	-	-	-	-
2	-	3	-	2	-	-
3	-	-	3	2	-	-
4	-	-	-	2	3	-
5	-	-	-	2	-	3

8. Mapping of the Course Outcomes (CO) to Program Outcomes (PO):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	1	2	2	-	-	-	-	-	-	2
CO2	3	3	1	2	2	-	-	-	-	-	-	2
CO3	3	3	1	2	2	-	-	-	-	-	-	2
CO4	3	3	1	2	2	-	-	-	-	-	-	2
CO5	3	3	1	2	2	-	-	-	-	-	-	2
CO6	3	3	1	2	2	-	-	-	-	-	-	2

9. Mapping to Program Specific Outcome (PSO):

COs	PSO1	PSO2	PSO3
CO1	2	3	-
CO2	2	3	-
CO3	2	3	-
CO4	2	3	-
CO5	2	3	-
CO6	2	3	-

***** End of Syllabus*****

Course Name: Data Structure and Algorithm Laboratory
Course Code: EC-395
Course Type: ES
(Semester – III)
Course Broad Category: (Ability Enhancement)

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1. Course Prerequisite:

Programming for Problem Solving Lab (EC-395)

2. Course Learning Objectives:

- To develop proficiency in implementing fundamental data structures such as arrays, stacks, queues, linked lists, and trees, along with their various operations.
- To enhance problem-solving skills by applying data structures in practical scenarios, including searching, sorting, expression conversion, and polynomial operations.
- To gain hands-on experience in implementing advanced data structures such as binary search trees and hash tables, along with associated algorithms.
- To understand and implement efficient algorithms for shortest path calculation and recursion, fostering algorithmic thinking and optimization.

3. Teaching methodology and evaluation system for the course:

Teaching methodology –Lectures and Presentations, Interactive Discussions and Case Studies.

Evaluation System –

A. **Internal Assessment (60 Marks)-** Formative Continuous Assessment [Continuous Assessment; Note Book (30 Marks), Viva Voce (20 Marks), Attendance (10 Marks)]

B. **End-Semester Exam (40 Marks)** - Summative Assessment.

4. Course Content:

5. Course Name: Data Structure and Algorithm Lab Course Code: EC-395
Hours per Week: 0L: 0T: 2P
Credits: 1

Module	Topics	
1	Implementation Function, Recursive Function, Tail Recursion, Structure related problem	2P
2	Implement 1D Array Data Structure and its Operations: insertion, deletion, traversal etc.; 2D Array representation: Row Major ordering, Column Major ordering, Sparse Matrix representation, Triangular Matrix	4P
3	Implement Stack and its operations: Push, Pop, Traversal, Applications of Stacks: Expression Conversion	2P
4	Implement Queue and its operations: Insert, Delete, Traversal; Circular Queue and its operations: Insert, Delete, Traversal	3P
5	Implement Single Link List and its operations: Insert, Delete, Traversal; Circular Link List; Double Link List and its operations: Insert, Delete, Traversal	3P
6	Implement Stack and Queue and its operations using Link List	2P

7	Implement Polynomial Addition and Multiplication	2P
8	Implement Searching : Linear and Binary, Sorting: Bubble, Insertion	2P
9	Implement Sorting: Selection Sort, Quick, Merge	2P
10	Implement Binary Search Tree and its operations: Insertion, Deletion, Pre-order Traversal, Post-order Traversal, In-order Traversal.	2P
11	Implement Shortest Path Calculation: Dijkstra's Algorithm	2P
12	Implement Hash Table: Inserting, Searching and Deleting	2P

6. References:

Text & References Books:

- "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung
- "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed
- "Data Structures in C" by Aaron M. Tenenbaum
- "Data Structures" by S. Lipschutz
- "Data Structures Using C" by Reema Thareja
- "Data Structures and Algorithm" by Arup Kr. Bhaumik, Santanu Haldar, Subhrajit Sinha Roy

7. Course Outcomes (CO):

After going through this course the Students will be able to:

Course Outcomes	Details	Action Verb	Knowledge Level
EC-395.1	Implement fundamental data structures such as arrays, stacks, queues, and linked lists along with their operations.	Implement	L-3
EC-395.2	Apply searching and sorting techniques (Linear Search, Binary Search, Bubble Sort, Quick Sort, Merge Sort, etc.) to organize and retrieve data efficiently.	Apply	L-3
EC-395.3	Develop and manipulate stack-based and queue- based algorithms, including expression conversion and circular queue operations.	Develop, Manipulate	L-4
EC-395.4	Construct and traverse Binary Search Trees, understanding their operations like insertion, deletion, and different traversal methods.	Construct, Traverse	L-4
EC-395.5	Implement polynomial operations and hash table techniques for optimized storage and retrieval of data.	Implement	L-3
EC-395.6	Analyze and apply graph algorithms like Dijkstra's algorithm to solve shortest path problems efficiently.	Analyze, Apply	L-5

8. Mapping of course outcomes to module / course content

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

9. Mapping of the Course outcomes to Program Outcomes (PO)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	2	2	-	-	-	1	1	1	2
CO2	3	3	2	2	2	-	-	-	1	1	1	2
CO3	3	3	2	2	3	-	-	-	2	2	1	2
CO4	3	3	3	2	3	-	-	-	2	2	2	3
CO5	3	2	2	2	3	-	-	-	1	1	1	2
CO6	3	3	3	3	3	-	-	-	2	2	2	3

10. Mapping to Program Specific Outcomes (PSO)

COs	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	3	3	3
CO3	3	3	3
CO4	3	3	3
CO5	3	2	2
CO6	3	2	3

***** End of Syllabus*****