Dr. B. C. Roy Engineering College, Durgapur
An Autonomous Institute
(approved by AICTE & affiliated to MAKAUT)

Programme Code: 016

Programme : B.Tech in Electrical Engineering

Year (Semester) : 2nd Year (3rd Semester)

SYLLABUS

Sl. No.	Broad Category	Course Category	Course Code	Course Name	Contact Hours/Week				Credits
					L	T	P	Total	
A. Theory									
1	ENGG	Major	EE-201	Network Theory	3	0	0	3	3
2	ENGG	Major	EE-202	Electromagnetic Field Theory	3	0	0	3	3
3	ENGG	Minor	EE-203	Digital Electronics	3	0	0	3	3
4	ENGG	Minor	EE-204	Data Structures & Algorithm	3	0	0	3	3
5	SC	Multidisciplinary	EE-205	Advanced Engineering Mathematics	3	0	0	3	3
6	HUM	Value Added Courses	EE-206	Values and Ethics in Profession	2	0	0	2	2
7	ENGG	Value Added Courses	EE-207	Biology for Engineers	2	0	0	2	1
TOTAL Theory					19	0	0	19	**18**
B. Practical/Sessional									
1	ENGG	Major	EE-208	Network Laboratory	0	0	2	2	1
2	ENGG	Minor	EE-209	Digital Electronics Laboratory	0	0	2	2	1
3	ENGG	Minor	EE-210	Data Structures & Algorithm Laboratory	0	0	2	2	1
4	ENGG	Minor	EE-211	Python Programming Laboratory	0	0	2	2	1
TOTAL Practical/Sessional					0	0	8	8	**4**
Total of Semester					19	0	8	27	**22**

Dr. Shibendu Mahata
Chairman, BOS(EE)

NETWORK THEORY

Course Code: EE-201

1. **Course Pre-requisites:**
   1. Basic Electrical Engineering
   2. Engineering Mathematics-I
   3. Engineering Mathematics-II

2. **Course Learning Objectives:**
   The Network Theory course provides students with a fundamental understanding of electrical circuits, their analysis, and practical applications. It covers essential concepts such as Ohm's Law, Kirchhoff's Laws, network theorems, transient and steady-state analysis, and resonance in AC and DC circuits. Students will learn techniques like nodal and mesh analysis, two-port networks, and Laplace transforms for circuit solutions. The course also explores power analysis, filters, and circuit stability. By the end, students will develop analytical and problem-solving skills to design, analyze, and optimize electrical circuits, preparing them for careers in electrical engineering, electronics, and related fields.

3. **Course Name: NETWORK THEORY**
   Course Code: EE-201
   Hours per Week: 3
   Credits: 3

   Course Contents:

Module	Topics	36L
1	**Introduction:** Continuous & Discrete, Fixed & Time-varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, and Sawtooth signals	03
2	**Network Theorems:** Formulation of network equations, Source transformation, Loop variable analysis (super mesh), Node variable analysis (super node). Network theorems (using dependent and independent sources): Superposition, Thevenin's, Norton's & Maximum power transfer theorem, Millman's theorem, and Tellegen's theorem. Three-phase balanced and unbalanced circuit analysis. Solution of Problems with DC & AC sources	05
3	**Laplace transforms:** Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions. Concept of Convolution theorem and its application. Solution of Problems with DC & AC sources	06
4	**Coupled circuits:** Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, and Solution of problems	04
5	**Two port networks analysis:** Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their interrelations. Driving point impedance & Admittance. Solution of Problems	05
6	**Graph theory and network equations:** Concept of Tree, Branch, Tree link, Incidence matrix, Tie-set matrix and loop currents, Cut set matrix, and node pair potentials. Duality, Solution of Problems	04

7	**Filter Circuits:** Analysis and synthesis of Low pass, High pass, Band pass, Band reject, and All pass filters (first and second order only) using an operational amplifier. Solution of Problems	04
8	**Fourier method of waveform analysis:** Fourier series and Fourier Transform (in continuous domain only). Application in circuit analysis, Solution of Problems	05

4. Text Books:

T1: Networks & Systems, Ashfaq Husain, Khanna Book Publishing, New Delhi
T2: Networks and Systems, D. Roy Chowdhury, New Age International Publishers
T3: Network Analysis and Synthesis, C.L. Wadhwa, New Age International Publishers
T4: Circuit and Networks: Analysis and synthesis, A. Sudhakar & S.S. Palli, 4th edition. TMH
T5: Circuit theory, Dr. Abhijit Chakrabarty, Dhanpat Rai & Co Pvt. Ltd.

5. References:

R1: Network Analysis, M.E. Valkenburg, Pearson Education

R2: Fundamental of Electric circuit theory, D. Chattopadhyay & P.C. Rakshit, S. Chand

R3: Engineering Circuit Analysis, W.H. Hyat, J.E. Kemmerly & S.M. Durbin, TMH

R4: Problems and Solutions of Electric Circuit Analysis, R.K. Mehta & A.K. Mal, CBS, New Delhi

6. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Describe different types of networks, sources, and signals with examples	Represent, Identify	Understand, Remember
CO2	Explain different network theorems, coupled circuits, and tools for the solution of networks	Analyze, Evaluating	Understand, Apply, Evaluating
CO3	Solve network problems using network theorems, Graph Theory, and Appropriate tools (e.g. Laplace Transform, Fourier Series)	Understand, Analyze	Understand, Apply
CO4	Select suitable techniques of network analysis for efficient solutions	Analyze, Evaluating	Understand, Apply, Analyze
CO5	Estimate parameters of two-port networks	Understand, Remember	Evaluate
CO6	Design filter circuit as per given specifications	Design	Create

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

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

8. Mapping of CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	3	-	1	1
CO3	3	2	2	1
CO4	3	-	2	1
CO5	3	-	1	2
CO6	3	2	3	2

ELECTROMAGNETIC FIELD THEORY
Course Code: EE-202

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1. Course Prerequisites:

1. Basic Electrical Engineering
2. Mathematics-I
3. Mathematics-II
4. Physics

2. Course Learning Objectives:

This course aims to introduce the fundamentals of electromagnetics with a focus on the description and resolution of static and dynamic electric and magnetic field issues.

3. Course Name: ELECTROMAGNETIC FIELD THEORY
Course Code: EE-202
Hours per Week: 3
Credits: 3
Course Content:

Module	Topics	36L
1	**Co-ordinate systems:** Cartesian, Cylindrical, Spherical coordinates, differential length, area and volume in different coordinate systems, line, Surface and Volume Integrals. **Vector calculus:** DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Stokes theorem, Laplacian of a scalar, Classification of vector fields.	07
2	**Electrostatic field:** Coulomb's law, field intensity, Gauss's law, Electric potential and Potential gradient, Relation between E and V, an Electric dipole and flux lines. Energy density in electrostatic field. Boundary conditions: Dielectric-dielectric, Conductor –dielectric, Conductor-free space. Poisson's and Laplace's equation, General procedure for solving Poisson's and Laplace's equation. Solution of problems	07
3	**Magneto static fields:** Biot-Savart law, Ampere's circuit law,Magnetic flux density, Magnetic static and Vector potential, Forces due to magnetic field, Magnetic torque and moments, Magnetisation in material, Magnetic boundary condition, Inductor and Inductances, Magnetic energy, Force on magnetic material. Solution of problems	07
4	**Electromagnetic fields:** Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems	04
5	**Electromagnetic wave propagation:** Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarisation. Solution of problems	06
6	**Transmission line:** Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems	05

4. Text Books:

T1: Electromagnetics, Mathew N.O. Sadiku, 4th edition, Oxford University Press.
T2: Elements of Electromagnetic Fields, S P Seth, Dhanpat Rai & CO.

5. Reference Books:

R1: Engineering Electromagnetics, W.H. Hyat & J.A. Buck, 7th Edition, TMH
R2: Theory and problems of Electromagnetic, Edminister, 2nd Edition, TMH

6. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Identify different coordinate systems for efficient solution of electromagnetic problems.	Identify, Apply	Understand, Apply
CO2	Describe vector algebra and calculus to solve electromagnetic problems.	Analyze	Understand, Analyze,
CO3	Describe static electric and magnetic fields, potentials, associated laws, their behavior in different media	Understand, Analyze	Understand, Apply, Analyze
CO4	Describe time varying fields, integral and point form of Maxwell`s equations for solving the problems of electromagnetic field	Understand Apply, Analyze	Understand, Analyze
CO5	Analyze electromagnetic wave propagation	Understand, Analyze	Understand, Analyze
CO6	Estimate transmission line parameters	Understand, Analyze	Understand, Analyze

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

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

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-
CO2	3	-	-	-
CO3	3	-	-	-
CO4	3	-	-	-
CO5	3	-	-	-
CO6	3	-	-	-

DIGITAL ELECTRONICS
Course Code: EE-203

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1. **Course Pre-requisites:**
   Basic Electronics Engineering

2. **Course Learning Objectives:**
   The Digital Electronics course provides an in-depth understanding of number systems, including binary, octal, hexadecimal, and their conversions, along with various codes such as ASCII, Excess-3, Gray, and BCD. It covers Boolean algebra, logic gates, arithmetic circuits, and methods for simplifying Boolean expressions using K-map techniques. The course delves into combinational and sequential circuits, including adders, subtractors, flip-flops, counters, and their applications in digital systems. Students will explore state machines, D/A and A/D converters, and programmable logic devices like PAL, PLA, and FPGA. It also introduces VHDL for implementing digital circuits.

3. **Course Name: DIGITAL ELECTRONICS**
   Course Code: EE-203
   Hours per Week: 3
   Credits: 3
   Course Contents:

Module	Topics	36L
1	**Number Systems and Codes:** Binary, Octal and hexadecimal conversions- ASCII code, Excess-3 code, Gray code, BCD, Error detection codes-Parity method. Signed numbers- representation, addition and subtraction, Fixed point and floating-point representation. Logic gates, Universal gates, TTL and CMOS logic families-Internal diagram of TTL NAND gate and CMOS NOR gate. Comparison of CMOS and TTL performance.	06
2	**Boolean Algebra and Arithmetic Circuits:** Boolean Laws and theorems, Sum of Products method, Product of Sum method – K map representation and simplification (up to four variables) - Pairs, Quads, Octets, don't care conditions. Adders -Full adder and half adder, Subtractors- half subtractor and full subtractor, 4-bit parallel binary adder/subtractor, Carry Look ahead adders.	06
3	**Combinational Circuits:** Comparators, Parity generators and checkers, Encoders, Decoders, BCD to seven segment decoder, Code converters, Multiplexers, Demultiplexers, Architecture of Arithmetic Logic Units	07
4	**Sequential Circuits:** Flip-Flops, SR, JK, D and T flip-flops, JK Master Slave Flip-flop, Preset and clear inputs, Conversion of flip-flops. Registers -SISO, SIPO, PISO, PIPO. Up/Down Counters: Asynchronous Counters – Modulus of a counter – Mod-N counters Ring counter, Johnson Counter Synchronous counters, Design of Synchronous counters.	08
5	**State Machines, D/A and A/D Converters:** State transition diagram, Moore and Mealy Machines Digital to Analog converter –Specifications, Weighted resistor type, R-2R Ladder type. Analog to Digital Converter – Specifications, Flash type, Successive approximation type.	05
6	**Programmable Logic Devices and VHDL:** PAL, PLA, FPGA (Introduction and basic concepts only), Introduction to VHDL, Implementation of AND, OR, half adder and full adder using VHDL.	04

4. **Text Books:**
   T1: Floyd T.L, Digital Fundamentals, 10/e, Pearson Education, 2011.
   T2: C.H. Roth and L.L. Kimney Fundamentals of Logic Design, 7/e, Cengage Learning, 2013.
   T3: Mano M.M, Logic and Computer Design Fundamentals, 4/e, Pearson Education.

T4: Anand Kumar, Fundamental of Digital Electronics, Prentice Hall .
T5: S. Salivahanan, Digital Circuits and Design, Oxford University Press.

5. Reference books:

R1: Donald P. Leach, Albert Paul Malvino, Goutam Saha, Digital Principles and Applications, McGraw Hill.
R2: Tocci R.J. and N.S.Widmer, Digital Systems, Principles and Applications, 11/e, Pearson Education.
R3: John F. Wakerly, Digital Design: Principles and Practices, 4/e, Pearson, 2005.
R4: Taub& Schilling: Digital Integrated Electronics, McGraw Hill, 1997.

6. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Identify various number systems, binary codes.	Identify, Select	Understand, Remember
CO2	Formulate digital functions using Boolean algebra.	Identify, Select	Understand, Apply
CO3	Design and implement combinational logic circuits.	Identify, Select	Understand, Apply, Analyze
CO4	Design and implement sequential logic circuits.	Identify, Select, Implement	Understand, Apply
CO5	Compare the operation of various analog to digital and digital to analog conversion circuits.	Analyze	Understand, Apply, Analyze
CO6	Explain the basic concepts of programmable logic devices and VHDL.	Identify, Analyze	Analyze

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

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

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	1	2
CO3	3	2	1	2
CO4	3	2	1	1
CO5	3	2	1	2
CO6	3	2	1	2

DATA STRUCTURES & ALGORITHM
Course Code: EE-204

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1. Course Pre-requisite:
Programming for Problem Solving

2. Course Learning Objectives:

I. **Fundamentals of Data Structure Programming & Algorithmic Thinking** – Understand the basics of DS-Programming, language syntax, compilation process, and develop algorithms and find details calculation.
II. **Introduction to Data Structures & Algorithm Analysis**– Importance of data structures in computing. Time and space complexity, Big-O notation. Recursion and its role in data structures.
III. **Linear & Non-Linear Data Structures** – Different Types of data structures.

3. Course Content:

Course Name: Data Structures & Algorithm
Course Code: EE-204
Hours per Week: 3
Credits: 3

Module	Topics	36L
1	**Introduction to C Programming:** Introduction to programming language. Introduction to C language. Introduction to pointer, Arrays (1-D, 2-D), Character arrays (Strings). Structures, Defining structures and Array of Structures, Union.	4
2	**Basic Concepts of Data Structures:** Introduction to programming methodologies – structured approach, object-oriented approach, stepwise refinement techniques, Algorithms, Performance Analysis, Space Complexity, Time Complexity, Asymptotic Notation, Complexity Calculation of Simple Algorithms	8
3	**Arrays:** Introduction to data structures: Stacks, Queues-Circular Queues, Priority Queues, Double Ended Queues, Evaluation of Expressions, Applications of stacks and queues	6
4	**Linked List:** Singly Linked List-Operations on Linked List. Doubly Linked List, Circular Linked List, Stacks and Queues using Linked List, Polynomial representation using Linked List	9
5	**Memory Management and Trees:** Memory Management - Memory allocation and de-allocation-First-fit, Best-fit and Worst-fit allocation schemes Trees, Binary Trees-Tree Operations, Binary Tree Representation, Tree Traversals, Binary Search Trees- Binary Search Tree Operations	5
6	**Graphs:** Definitions, Representation of Graphs, Topological Sort, Depth First Search and Breadth First Search on Graphs, Shortest-path algorithms, Minimum spanning tree, Prim's and Kruskal's algorithms, Applications of graphs	4

4. Textbooks:
T1: Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, University Press (India),2008.

5. Reference Books:

R1: Classic Data Structures, Samanta D., Prentice Hall India, 2/e, 2009.
R2: Data Structures: A Pseudocode Approach with C, 2/e, Richard F. Gilberg, Behrouz A. Forouzan, Cengage Learning 2005.
R3: Data Structures and Algorithms, Aho A. V., J. E. Hopcroft and J. D. Ullman Pearson Publication. 2nd Edition.
R4: Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.

6. Course Outcomes:

Course Outcomes	Details	Action Verb	Knowledge Level
CO1	Analyze the time and space efficiency of the data structure(L3)	Understand	L-2
CO2	Describe how arrays, records, linked structures, stacks and queues are used by algorithms (L1)	Apply	L-3
CO3	Compare and contrast the benefits of dynamic and static data structures implementations(L3)	Apply	L-3
CO4	Explain different memory management techniques and their significance (L4)	Analyze	L-4
CO5	Develop algorithms incorporating trees and graphs (L3)	Create	L-5

7. Mapping of course outcomes to module / course content

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

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	-
CO2	3	3	2	-
CO3	3	3	3	-
CO4	3	3	3	-
CO5	3	3	3	2

ADVANCED ENGINEERING MATHEMATICS
Course Code: EE-205

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1. **Course Pre-requisites:**
   Knowledge in functions of several variables and ODE, Set Theory.

2. Course Learning Objectives:

The objective of these courses to familiarize the prospective engineers with techniques in apply the concept of partial differential equations like heat and wave equations. It aims to equip the students with the concepts and tools of probability and statistics. It will also aim to enhance the knowledge and techniques to solve problems numerically.

3. Course Content:

Course Name: Advanced Engineering Mathematics
Course Code: EE-205
Hours per Week: 3
Credits: 3

Module	Topics	36L
1.	**Partial Differential Equations:** Formation and Solution of Partial Differential equations, solutions of First order Linear PDEs, Second order linear equations and their classification, Solution to Homogeneous and Non-Homogeneous Linear PDEs of second order by complimentary function and particular integral method.	8
2.	**Application Of Partial Differential Equations:** D'Alembert's solution of the wave equation, Duhamel's principle for one dimensional wave equation, Heat diffusion and vibration problems, Separation of variable method.	8
3.	**Basic concept in Probability and Statistics:** Probability: Definition of various probability axioms, Independent events, Conditional event, Baye's Theorem, Random variable and Expectation, Moment Generating Function, Probability mass function (Binomial Distribution, Poisson's Distribution) and Probability density function (Normal Distribution), Poisson approximation to Binomial (application). Statistics: Measure of central tendency, Correlation- Regression, confidence interval and testing of hypothesis.	12
4	**Numerical methods:** Interpolation by polynomial: forward, backward, Lagrange, divided difference. Concept of simple Difference equations. Solution of nonlinear equations: fixed point iteration, newton and secant methods. Convergence condition. Numerical Integration – trapezoidal and Simpson's one third Rule, solution of ODE – Euler's and RK method, Systems of ODE.	8

4. Textbooks:

T1: B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.

T2: Ramana B. V., Higher Engineering Mathematics, McGraw Hill Education.

5. Reference Books:

R1: E. Kreyszig--- Advanced Engineering Mathematics (9th Edition)

R2: Bali &Goel--- Text Book of Engineering Mathematics

R3: H. K. Das---Higher Engineering Mathematics

R4: Zafar Ahsan --- Differential Equations and Their Applications

R5: R. K. Jain and I. C. Gupta ---Partial Differential Equations

R6: M. G. Nadkarni ----Partial Differential Equations: A Unified Approach

R7: Stanley J. Farlow ----Partial Differential Equations for Scientists and Engineers

R8: Sheldon Ross---A First Course on probability

R9: R. N. Hazra &Moloy Sarakar ---Fundamental of Probability and Statistics

R10: T. Veerarajan --- Probability and Statistics

R11: Dr. S. A. Mollah ----Introduction to Numerical Analysis

R12: V. Rajaraman, V ---Numerical Methods.

R13: S. S. Sastry---Introductory Methods of Numerical Analysis

R14: Jain & Jain---Numerical Analysis for Scientists and Engineers

6. Course Outcomes (CO):

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Learn to apply different tools in Partial Differential Equations and Probability which would enable them to devise solutions to encounter engineering problems in their profession life.	Identify	Learn
CO2	Understand the concept of uses and applications of Probability and Statistics in applied sciences and engineering problems.	Explain	Understand
CO3	Apply the concept of Interpolation, Numerical Integration and Solution of nonlinear equations to find solutions in real life problems.	Implement	Apply
CO4	Analyze the ideas of mentioned mathematical tools to solve complex real-life problems.	Organize	Analyze
CO5	Evaluating the gradation of described Statistical and Numerical tools and determines the right approach to solve multidisciplinary engineering problems.	Assess	Evaluate
CO6	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	-	1
3	2	3	3	2	-	1
4	3	-	-	2	-	1

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	-	-	-
CO2	3	-	-	-
CO3	3	-	-	-
CO4	3	-	-	-
CO5	3	-	-	-
CO6	3	-	-	-

VALUES AND ETHICS IN PROFESSION

Course Code: EE-206

1. Course Pre-requisites: Nil

2. Course Learning Objectives:

The objective of this course is to inculcate human values to grow as a responsible human being with a proper personality, instill professional ethics to maintain ethical conduct and discharge professional duties, and to enable the students to imbibe and internalize the values and ethical behavior in the personal and professional lives.

3. Course Name: VALUES AND ETHICS IN PROFESSION
Course Code: EE-206
Hours per Week: 2
Credits: 2
Course Contents:

Module	Topics	24L
1	**Human values:** Morals, Values, and Ethics – Integrity –Trustworthiness – Work Ethics – Service-Learning – Civic Virtue – Respect for others – Living Peacefully – Caring – Sharing – Honesty –Courage – Value Time – Co-operation – Commitment – Empathy – Self-confidence – Spirituality- Character.	2
2	**Need, Basic Guidelines, Content and Process for Value Education**: Understanding the need, basic guidelines, content and process for Value Education; Self Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration; Continuous Happiness and Prosperity- A look at basic Human Aspirations; Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority	2
3	**Principles for harmony:** Truthfulness – Customs and Traditions -Value Education – Human Dignity – Human Rights – Fundamental Duties – Aspirations and Harmony (I, We & Nature) – Gender Bias – Emotional Intelligence – Salovey – Mayer Model – Emotional Competencies – Conscientiousness.	2
4	**Human Values and Ethics:** Meaning and nature of human values; Significance of human values in life; Relation between values and ethics. Relevance of Human values: Integrity, Empathy, Loksangrah, Brahmvihara. Theory of Naya (Jainism), Deontology, Virtue Ethics, Utilitarianism	2
5	**Engineering ethics and social experimentation**: History of Ethics – Need of Engineering Ethics – Senses of Engineering Ethics- Profession and Professionalism —Self Interest – Moral Autonomy – Utilitarianism – Virtue Theory – Uses of Ethical Theories – Deontology- Types of Inquiry –Kohlberg's Theory – Gilligan's Argument – Heinz's Dilemma – Comparison with Standard Experiments — Learning from the Past – Engineers as Managers – Consultants and Leaders – Balanced Outlook on Law – Role of Codes – Codes and Experimental Nature of Engineering.	4
6	**Engineers' responsibility towards safety and risk for sustainable development**: The concept of Safety – Safety and Risk – Types of Risks – Voluntary v/s Involuntary Risk – Consequences – Risk Assessment –Accountability – Liability – Reversible Effects – Threshold Levels of Risk – Delayed v/s Immediate Risk – Safety and the Engineer – Designing for Safety – Risk-Benefit Analysis-Accidents.	2

7	**Professional Practices in Engineering**: Professions and Norms of Professional Conduct, Norms of Professional Conduct vs. Profession; Responsibilities, Obligations and Moral Values in Professional Ethics, Professional codes of ethics, the limits of predictability and responsibilities of the engineering profession. Central Responsibilities of Engineers - The Centrality of Responsibilities of Professional Ethics; lessons from 1979 American Airlines DC-10 Crash and Kansas City Hyatt Regency Walkaway Collapse.	3
8	**Engineers' duties and rights**: Concept of Duty – Professional Duties – Collegiality – Techniques for Achieving Collegiality – Senses of Loyalty – Consensus and Controversy – Professional and Individual Rights – Confidential and Proprietary Information – Conflict of Interest-Ethical egoism – Collective Bargaining – Confidentiality – Gifts and Bribes – Problem solving-Occupational Crimes- Industrial Espionage- Price Fixing-Whistle Blowing.	2
9	**Global issues:** Globalization and MNCs –Cross Culture Issues – Business Ethics – Media Ethics – Environmental Ethics – Endangering Lives – Bio Ethics – Computer Ethics – War Ethics – Research Ethics - Intellectual Property Rights.	2
10	**Professional Ethics and Global Citizenship:** Nature, characteristics and scope of professional ethics; Types of Professional Ethics; Professional Values: Trusteeship, Inclusiveness, Commitment, Sustainability, Accountability, Transparency, Impartiality. Values for Global Citizenship: Equality, Justice, and Human Dignity. Nature and need of competency-based education; Types of Competencies, Core Competencies: communication, teamwork, planning and achieving goals, Functional Competencies: analytical thinking, knowledge sharing and learning, decision making, partnership building.	3

4.Textbooks:

T1: Professional Ethics: R. Subramanian, Oxford University Press, 2015.
T2: Ethics in Engineering Practice & Research, Caroline Whitbeck, 2e, Cambridge University Press 2015.
T3: Professional Ethics & Human Values, Premvir Kapoor, Khanna Publishing House, Delhi (AICTE Recommended Textbook).
T4: A text book on professional Ethics & Human values, R.S. Naagarazan, New Age international Publishing.
T5: Engineering Ethics, M. Govindarajan, S. Natarajan, V.S. Senthilkumar, Prentice Hall India.
T6: Human value and professional Ethics, Jayshree Suresh, B.S. Raghvan, S. Chand Publishing.

5. Reference Books:

R1: Engineering Ethics, Concepts Cases: Charles E Harris Jr., Michael S Pritchard, Michael J Rabins, 4e, Cengage learning, 2015.
R2: Business Ethics concepts & Cases: Manuel G Velasquez, 6e, PHI, 2008.
R3: Ethics in Science and Engineering, James G. Speight & Russel Foote, Wiley.
R4: Human values in engineering and profession A.N. Tripathy.
R5: Controlling technology ethics and responsible engineers, Stephan H Unger.
R6: Ethical issues in Engineering, Deborah Johnson.

6. Course Outcomes:

CO	COURSE OUTCOMES
CO1	Illustrate different aspects of human values, ethics, engineers' responsibility and duties.
CO2	Explain different principles, different theories and laws of engineering ethics and social experimentation.

CO3	Identify different factors in the light of engineers' responsibility towards safety and risk
CO4	Correlate ethics of different work environment.
CO5	Explain the need for intellectual property rights.
CO6	The students will understand the importance of Values and Ethics in their personal lives and professional careers. The students will learn the rights and responsibilities as an employee, team member and a global citizen.

7. Mapping of course outcomes /course content:

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

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	-	-	-	2
CO2	-	-	-	2
CO3	-	-	-	2
CO4	-	-	-	2
CO5	-	-	-	2
CO6	-	-	-	2

BIOLOGY FOR ENGINEERS
Course Code: EE-207

1. **Course Pre-requisite:**
   1. Class-X-XII level knowledge of Biology and Bio-Environmental Science.
   2. Undergraduate level introductory knowledge of Bio- Engineering.

2. **Course Learning Objectives:**
   1. This course imparts basic knowledge of biology, evolution, general awareness of environmental pollution effects and bio-engineering's aspects with cancer biology that provides the basic ideas among the engineering students for a better foundation of technical education.

   2. To provide fundamentals among the upcoming young engineers and to carry out advanced technical and machinery research projects in biology and allied domains.

3. **Course Content:**
   Course Name: Biology For Engineers
   Course Code: EE-207
   Hours per Week: 2
   Credits: 1

   Course Contents:

Module	Topics	24L
1	**Introduction to Biology in Engineering** • Science & Engineering • Biology in Engineering • Instruments inspired by Biology (Camera and Aeroplane) • Major Biological discoveries of 18^{th} to 21^{th} Century	2
2	**Cell Biology** • Cell types (Unicellular & Multicellular, Prokaryotic & Eukaryotic, Plant & Animal Cell) • Cell organelles and their function (Cell Wall, Cell Membrane, Nucleus, Ribosome, Mitochondria and other cellular organelles) • Cell Division • Biomolecules- Carbohydrates, Proteins, Lipids and Nucleic Acids • Biochemical qualitative tests for macromolecules	6
3	**Microbiology** • Classification of microorganisms, Bacteria, viruses, fungi, and protozoa. • Hierarchy classification of living organisms. • Growth curves and factors affecting growth. • Applications in Engineering (Industrial microbiology and Environmental Microbiology, Soil Engineering)	6
4	**Genetical Engineering** • Laws of inheritance, Monohybrid and dihybrid crosses, Extensions to Mendelism • Molecular basis of Inheritance (DNA replication, transcription, and translation, Genetic code and mutations) • Concept of Gene, Gene mapping, Concept of operon, Genetic disorders	5
5	**Biotechnology & Bioinformatics** • Principles and processes of Biotechnology	5

	• Application of Biotechnology in health and agriculture • Recombinant DNA Technology, Tissue Culture • Bioinformatics tools and databases, Sequence alignment and analysis, Applications	

4. Text Books:

T1: Biology For Engineers: Dr. Sandhimita Mondal & Dr. Arnab Ganguli : Aryan Publishing House
T2: Lehninger's Principles of Biochemistry by David L Nelson; A.L. Lehninger and Michael M. Cox, 5th edition, Worth Publishing.
T3: Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
T4: Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons.
T5: Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.

5. Reference Books:

R1: Molecular Genetics (Second edition), Stent, G. S.; and Calender, R.W.H. Freeman and Company.
R2: Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman.

6. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Explain that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.	Explain	Understand
CO2	Identify that the cell is a basic material of life, required biomolecules are valuable for Cell, i.e. living	Identify	Understand
CO3	Demonstrate the hierarchy classification of living organisms and their growth factors and also economic engineering application	Demonstrate	Apply
CO4	Develop that Genetics is the main part of bio-engineering.	Develop	Create
CO5	Remember that Evolution, is a very important part of human genetic mutation, which can keep pace with evolution.	Remember	Understand
CO6	Demonstrate applications of Bioinformatics and biotechnology in your daily life.	Demonstrate	Apply

7. Mapping of course outcomes to module / course content

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

8. Mapping of CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	1	2
CO3	3	2	1	2
CO4	3	2	1	3
CO5	2	2	1	2
CO6	3	1	1	2

NETWORK LABORATORY
Course Code: EE-208

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1. Course Pre-requisites:

1. Network Theory
2. Basic Electrical Engineering

2. Course Learning Objectives:

To provide students with hands-on experience in analyzing and testing of fundamental circuit analysis, experimental and measurement skills, and scenarios using specialized hardware, allowing them to gain a deeper understanding of real-world AC circuit analysis and power calculations, simulation and practical application, teamwork, and report writing.

3. Course Name: Networks Laboratory
Course Code: EE-208
Hours per Week: 2
Credits: 1
Course Content:

Module	Laboratory Experiments
1	Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB/SCILAB/Python in both discrete and analog form.
2	Verification of theorems using MATLAB/SCILAB/Multisim/LTSpice & hardware.
3	Determination of Laplace transform and Inverse Laplace transform using MATLAB/SCILAB.
4	Transient response of R-L and R-C network: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
5	Transient response of R-L-C series and parallel circuit: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
6	Separation of Self and Mutual Inductance in a coupled circuit & Determination of Coefficient of coupling: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
7	Determination of Impedance (Z) and Admittance(Y) parameters of two-port network: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
8	Frequency response of LP and HP filters: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
9	Frequency response of BP and BR filters: simulation with MATLAB/SCILAB/Multisim/LTSpice & hardware.
10	Amplitude and Phase spectrum analysis of different signals using MATLAB/SCILAB/Multisim/LTSpice & hardware.

4. Text Books:

T1: A. Chakrabarti, "A text book on Circuit Theory", Dhanpat Rai and Co.

T2: D. Chattopadhyay , PC Rakshit "Fundamentals of Electric Circuit Theory", S. Chand.

5. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Transient response of R-L and R-C network: simulation with software & hardware.	Analyze, Identify	Understand, Analyze, Apply.
CO2	Transient response of R-L-C series and parallel circuit: simulation with software & hardware.	Analyze, Identify	Understand, Apply, Analyze

CO3	Determination of Impedance (Z) and Admittance(Y) parameters of two-port network: simulation & hardware.	Analyze, Identify	Understand, Analyze, Apply.
CO4	Frequency response of LP and HP filters: simulation & hardware.	Analyze, Identify	Understand, Apply, Analyze
CO5	Frequency response of BP and BR filters: simulation & hardware.	Analyze, Identify	Understand, Analyze, Apply.
CO6	Determination of Coefficient of Coupling.	Analyze, Identify	Understand, Analyze, Apply.

6. Mapping of course outcomes /course content:

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

7. Mapping of the CO to PO:

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

8. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3
CO2	3	-	1	1
CO3	3	1	3	1
CO4	3	-	3	1
CO5	3	-	1	3
CO6	3	-	-	1

DIGITAL ELECTRONICS LABORATORY

Course Code: EE-209

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1. **Course Pre-requisites:** Nil

2. **Course Learning Objectives:**
   The objective of this course is to provide students with practical experience in designing, constructing, and analyzing digital electronic circuits. It aims to reinforce theoretical concepts through hands-on experimentation with logic gates, combinational and sequential circuits, and digital system components, while developing skills in circuit simulation, troubleshooting, and effective technical communication. Students will be able to design Adder, Subtractor, Multiplexer, Encoder, Decoder etc. They will be able to perform experiments on counter, register, flip/flops etc.

3. **Course Name: DIGITAL ELECTRONICS LAB**
   Course Code: EE-209
   Hours per Week: 2
   Credits: 1
   Course Contents:

Module	Topics
1	Realization of basic gates using Universal logic gates.
2	Construction of simple Decoder & Multiplexer circuits using logic gates.
3	Code conversion circuits- BCD to Excess-3 & vice-versa and parity generator, checker.
4	Construction of simple arithmetic circuits-Adder, Subtractor.
5	Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6	Realization of RS-JK & D flip-flops using Universal logic gates.
7	Realization of Universal Register using JK flip-flops and logic gates.
8	Realization of Synchronous and Asynchronous Up/Down counter.
9	Realization of Ring counter & Johnson's counter.
10	Familiarization with A/D and D/A converter circuits.

4. **Text Books:**
   T1. Mano M.M, Logic and Computer Design Fundamentals, 4/e, Pearson Education.
   T2. S. Salivahanan, Digital Circuits and Design, Oxford University Press
   T3. Taub & Schilling: Digital Integrated Electronics, McGraw Hill, 1997.
   T4. Digital Principles & Application, 5th Edition, Leach & Malvino, Mc Graw Hill Company.

5. **Course Outcomes:**

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	To understand and apply basic digital logic Gates (AND, OR, NOT, NAND, NOR, XOR, XNOR) using ICs and circuits.	Determine	Analysis
CO2	To design and verify combinational logic circuits such as adders, multiplexers, encoders, and decoders.	Evaluate	Evaluation
CO3	To validate the operation of code converter circuit –BCD to Excess 3 & vice versa, 4 bit parity generator and checker.	Implement	Application
CO4	To Design and test sequential logic circuits (flipflops, counter, register).	Design	Synthesis

CO5	To realize A/D and D/A circuits and programmable logic devices and VHDL.	Construct	Application

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

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

7. Mapping of the CO to PO:

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

8. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	3	1	2
CO3	3	2	-	1
CO4	3	-	2	-
CO5	3	3	-	-

DATA STRUCTURES & ALGORITHM LABORATORY

Course Code: EE-210

1. Course Prerequisite:

Programming for Problem Solving Laboratory

2. Course Learning Objectives:

This laboratory course enables students to get practical experience in design, develop, implement, analyze and evaluation/testing of (A) Dynamic memory management, (B) Linear data structures and their applications such as stacks, queues and lists, (C) Non-Linear data structures and their applications such as trees and graphs.

3. Course Content:
Course Name: Data Structures & Algorithm Lab
Course Code: EE-210
Hours per Week: 2
Credits: 1

Module	Topics
1	Develop a Program in C for the following: • Design, Develop and Implement a menu-driven Program in C for the following Array operations 1. Creating an Array of N Integer Elements 2. Display of Array Elements with Suitable Headings 3. Inserting an Element (ELEM) at a given valid Position (POS) 4. Deleting an Element at a given valid Position (POS) 5. Exit.
2	• Design, Develop and Implement a Program in C for the following operations on Strings 1. Read a main String (STR), a Pattern String (PAT) and a Replace String (REP) 2. Perform Pattern Matching Operation: Find and Replace all occurrences of PAT in STR with REP if PAT exists in STR. Report suitable messages in case PAT does not exist in STR.
3	• Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX). 1. Push an Element on to Stack 2. Pop an Element from Stack 3. Demonstrate how Stack can be used to check Palindrome 4. Demonstrate Overflow and Underflow situations on Stack 5. Display the status of Stack 6. Exit
4	• Design, Develop and Implement a Program in C for the following Stack Applications 1. Evaluation of Suffix expression with single-digit operands and operators: +, -, *, /, %, ^ 2. Solving Tower of Hanoi problem with n disks
5	• Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX) 1. Insert an Element on to Circular QUEUE 2. Delete an Element from Circular QUEUE 3. Demonstrate Overflow and Underflow situations on Circular QUEUE 4. Display the status of Circular QUEUE

	5. Exit
6	• Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo 1. Create a SLL of N Students Data by using front insertion. 2. Display the status of SLL and count the number of nodes in it 3. Perform Insertion / Deletion at End of SLL 4. Perform Insertion / Deletion at Front of SLL(Demonstration of stack) 5. Exit
7	• Design, Develop and Implement a Program in C for the following operations on Singly Circular Linked List (SCLL) with header nodes 1. Represent and Evaluate a Polynomial P(x,y,z) = 6x2y2z-4yz5+3x3yz+2xy5z-2xyz3 2. Find the sum of two polynomials POLY1(x,y,z) and POLY2(x,y,z) and store the result in POLYSUM(x,y,z) • Support the program with appropriate functions for each of the above operations.
8	• Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers 1. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2 2. Traverse the BST in Inorder, Preorder and Post Order 3. Search the BST for a given element (KEY) and report the appropriate message 4. Exit

4. Textbooks:

1. Data Structures: A Pseudocode Approach with C, 2/e, Richard F. Gilberg, Behrouz A. Forouzan, Cengage Learning 2005.

2. Data Structures and Algorithms, Aho A. V., J. E. Hopcroft and J. D. Ullman Pearson Publication. 2nd Edition

5. Reference Books:

1. Fundamentals of Data structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson-Freed, University Press (India), 2008.
2. Let us C - Yashavant Kanetkar, BPB Publications.

6. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Implement linear data structures such as arrays, linked lists, stacks, and queues using a programming language like C/C++/Java.	Analyze, Identify	Understand, Analyze, Apply
CO2	Implement linear data structures such as arrays, linked lists, stacks, and queues using a programming language like C/C++/Java.	Analyze, Identify	Understand, Apply, Analyze

CO3	Analyze and compare the performance of various searching and sorting algorithms with respect to time and space complexity.	Analyze , Identify	Understand, Analyze, Apply.
CO4	Apply appropriate data structures and algorithms to design efficient solutions for computational problems.	Analyze, Identify	Understand, Apply, Analyze
CO5	Develop recursive algorithms and understand their behavior with respect to stack usage and performance.	Analyze, Identify	Understand, Analyze, Apply
CO6	Work effectively as an individual and in teams to implement and test data structure concepts in a modular and structured manner.	Analyze, Identify	Understand, Analyze, Apply

7. Mapping of course outcomes /course content:

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

8. Mapping of the CO to PO:

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

9. Mapping to PSO:

	PSO1	PSO2	PSO3	PSO4
CO1	3	3	1	3
CO2	3	-	1	1
CO3	3	1	3	1
CO4	3	-	3	1
CO5	3	-	1	3
CO6	3	3	3	3

PYTHON PROGRAMMING LABORATORY
Course Code: EE-211

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1. Course Pre-requisite:

Programming for Problem Solving Laboratory.

2. Course Learning Objectives:

This laboratory course enables students to get practical experience in Python programming language.

3. Course Content:
Course Name: Python Programming Laboratory
Course Code: EE-211
Hours per Week: 2
Credits: 1

Course Contents:

Module	Topics
1	**Input and Output:** (a) Write a program to calculate compound interest when principal, rate and number of periods are given. (b) Given coordinates (x1, y1) and (x2, y2). Write a program to calculate the distance between two points. (c) Write a program to perform addition, subtraction, multiplication, division, integer division and modulo division on two integer numbers. (d) Write a program to find the largest element among three numbers
2	**Loops and Conditionals:** (a) Write a program to enter any character. If the entered character is in uppercase then convert it into lowercase and if it is lowercase character, then convert it into uppercase. (b) Write a program that prompts the user to enter a number between 1-7 and then display the corresponding day of the week. (c) Write a program to read the numbers until -1 is encountered. Also count the positives, negatives and zeros entered by the user. (d) Write a program using for loop to calculate factorial of a number. (e) Write a program to print the following pattern. 1 1 2 1 2 3 1 2 3 4
3	**Variables and Functions:** (a) Write a program to swap two numbers without using a temporary variable. (b) Write a program using functions and return statement to check whether a number is even or odd.
4	**Strings:** (a) Program performing slice operation on strings. (b) Write a program to reverse a string.

	(c) Write a program that accepts a string from user and redisplays the same string after removing vowels from it.
5	**Lists:** (a) Program to demonstrate operation on lists (add, insert, slicing). (b) Write a program to create a list of numbers in the specified range in particular steps. Reverse the list and print its values. (c) Write a program to create a list of first 30 even numbers using the shortcut method. (d) Write a program to calculate distance between two points using append ().
6	**Tuples:** (a) Program to demonstrate operation on tuple. (b) Write a program that has a list of numbers (both positive as well as negative). Make a new tuple that has only negative values from this list.
7	**Sets:** (a) Write a program that creates two sets-squares and cubes in range 1-20. Demonstrate the use of update(), pop(), remove(), add() and clear() functions.
8	**Dictionaries:** (a) Program to demonstrate the use of dictionary. (b) Write a program that creates a dictionary of cubes of even numbers in the range 1-20.
9	**Files:** (a) Write a program that reads data from a file and calculates the percentage of vowels and consonants in the file.
10	**Classes:** (a) Write a program that uses class to store the name and marks of students. Use list to store the marks in three subjects.
11	**Matrix:** (a) Write a program to add two matrices (using nested lists).

4. Textbooks:

1. Paul Barry, “Head-First Python”, O’Reilly.

2. Eric Matthes, “Python Crash Course”, No Starch Press, 3rd Edn.

5. Course Outcomes:

Course Outcomes	Details/Statement	Action Verb	Knowledge Level
CO1	Develop the application specific codes using python.	Analyze	Analyze
CO2	Understand Strings, Lists, Tuples, Sets and Dictionaries in Python.	Identify, Evaluate	Evaluate
CO3	Understand functions in Python.	Measure	Apply
CO4	Evaluate programs using Modular approach.	Determine, Calculate	Analyze
CO5	Evaluate programs using Python standard library, file I/O.	Simulate, Analyze	Analyze / Eval uate

6. Mapping of course outcomes /course content:

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

7. CO and PO mapping:

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

8. CO and PSO mapping:

	PSO1	PSO2	PSO3	PSO4
CO1	3	-	1	-
CO2	3	-	1	-
CO3	3	1	1	-
CO4	3	-	2	1
CO5	1	3	2	1