B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

SEMESTER-I

Sl No.	Course Code	Course Title	Hours Per Week			Total Credits
			Lecture	Tutorial	Practical	
1.	100102	Engineering Mathematics - I	3	0	0	3
2.	100104	Engineering Physics	3	0	0	3
3.	100105	Introduction to AI	3	0	0	3
4.	100108	Computer Fundamentals & Emerging Technologies	3	0	0	3
5.	100109	Universal Human Values	2	0	0	2
6.	100110	Essence of Indian Constitution	3	0	0	0
7.	100111	Basics of Electrical & Electronics Engineering	3	0	0	3
8.	100104P	Engineering Physics Lab	0	0	2	1
9.	100111P	Basics of Electrical & Electronics Engineering Lab	0	0	2	1
10.	100112P	Programming for Problem Solving Lab	0	0	2	1
TOTAL						20

Group A :

1. Computer Science & Engineering
2. Computer Science & Engineering (AI)
3. Computer Science & Engineering (Cyber Security)
4. Computer Science & Engineering (Data Science)
5. Computer Science & Engineering(AI & ML)
6. Computer Science & Engineering (IoT)
7. Computer Science & Engg (IOT & Cyber Security including Block Chain Technology)
8. Computer Science & Engineering (Networks)
9. Information Technology
10. 3-D Animation & Graphics
11. Mathematics & Computing

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code -100102 **Engineering Mathematics – I** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply the concept of Linear/ Matrix algebra to solve given engineering problems.
CO2	Demonstrate the ability to solve engineering problems based on the application of derivatives.
CO3	Solve the given optimization problems by using the concept of partial derivatives.
CO4	Evaluate the given multiple integrals in different coordinate systems to solve complex engineering problems.
CO5	Apply the concept of vector calculus to solve the given engineering problems.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Find the rank of a given Matrix by using various methods. *TSO 1b.* Test the Consistency of a given system of simultaneous linear equations representing an engineering situation. *TSO 1c.* Apply Cayley-Hamilton Theorem to find the integral powers of a given matrix. *TSO 1d.* Test the nature of the transformed matrix of a given homogeneous quadratic polynomial.	**Unit- 1.0: Basic Linear Algebra (8hrs)** 1.1 Elementary transformations and Rank of Matrix, Rank by using Echelon and Normal form of Matrices. Linear dependence & independence of vectors in R^n space 1.2 Consistency of System of Linear Equations 1.3 Eigenvalues & Eigenvectors, Cayley-Hamilton Theorem. 1.4 Similarity of Matrices & Diagonalization of Square Matrices. Quadratic Form, Canonical Form of Matrices.
CO2	*TSO 2a.* Find the nth order derivatives of given functions representing an engineering situation. *TSO 2b.* Apply the Mean Value Theorem to determine the nature of the tangent of given curves under certain conditions. *TSO 2c.* Evaluate limits of given functions applying L' Hopital Rule.	**Unit- 2.0: Differential Calculus: Single Variable (8hrs)** 2.1 Higher order derivatives; Successive differentiation and Leibnitz's Theorem 2.2 Mean Value Theorems (Rolle's; Lagrange's; Cauchy) 2.3 Indeterminate Forms; L' Hopital Rule 2.4 Tangents & Normal of Algebraic & Polar Curves, Curvature

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2d. Find the Curvature of a given curve representing an engineering situation.	
CO3	*TSO 3a.* Apply Euler's theorem on homogeneous functions of m independent variables of degree n. *TSO 3b.* Test the differentiability of a given function of several variables. *TSO 3c.* Apply Taylor's Theorem to expand a function representing an engineering situation in the nhd. of a given point. *TSO 3d.* Optimize a given function by applying Lagrange's Multiplier Method for given engineering problems.	**Unit- 3.0: Differential Calculus: Several Variables (9hrs)** 3.1 Partial differentiations; Euler's theorems 3.2 Limit, Continuity and differentiability of functions of Several Variables 3.3 Taylor's theorem with various forms of remainders, Maclaurin's theorem and related problems 3.4 Maxima & Minima for functions of several variables; Lagrange's Multiplier Method
CO4	*TSO 4a.* Evaluate the given definite integral using Leibnitz's rule. *TSO 4b.* Find the area of the given plane figure by using double integration. *TSO 4c.* Find the Volume of the given 3-D figure by using triple integration. *TSO 4d.* Evaluate given improper integrals by using Beta & Gamma functions.	**Unit- 4.0: Integral Calculus (9hrs)** 4.1 Differentiation under the integral sign; Leibnitz's rule 4.2 Double integral; Change the order of integration; Evaluation of double integration by changing it into polar co-ordinates 4.3 Triple Integral; Evaluation of Triple integral by changing to Spherical Polar co-ordinates & Cylindrical polar co-ordinates 4.4 Beta; Gamma; Elliptic integral; Relation between Beta & Gamma functions, General Properties and related problems.
CO5	*TSO 5a.* Find the divergence and curl of a given vector point function representing a physical quantity *TSO 5b.* Apply Stoke's theorem to convert given line integral into surface integral. *TSO 5c.* Apply Gauss' theorem to convert given surface integral into volume integral.	**Unit- 5.0: Vector Calculus (8hrs)** 5.1 Scalar and vector valued functions; Concepts of gradient, divergence and curl and their geometrical and physical significance; tangent plane; directional derivative; 5.2 Line, surface and volume integrals - Statement of Green's, Stokes' and Gauss divergence theorems -verification and evaluation of vector integrals using them.

Reference/Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1	Higher Engineering Mathematics	B. S. Grewal	Khanna Publishers, 44 Ed. ISBN No:9788174091154
2	Higher Engineering Mathematics	B. V. Ramana	Tata McGraw Hill New Delhi, 11th Ed, 2010, ISBN-13-978-0070634190
3	Advanced Engineering Mathematics	Erwing Kreyszig	John Wiley & Sons, 10th Ed, ISBN-978-0470-15836-5
4	A Textbook of Engineering Mathematics	N. P. Bali & Dr. Manish Goyal	University Science Press, 13th Ed, ISBN-978-93-83828-63-0
5	Understanding Engineering Mathematics	John Bird	Routledge; First Edition ISBN 9780415662840

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100104 **Engineering Physics** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply the concepts of wave optics phenomena in various engineering fields.
CO2	Apply the concepts of laser operation and fiber optic propagation in engineering applications
CO3	Apply the concepts of electromagnetics in engineering applications.
CO4	Utilize semiconductor devices, based on their I-V characteristics, for various engineering applications.
CO5	Apply the principles of Quantum mechanics to analyze quantum phenomena in engineering systems.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain the phenomenon of interference of light by division of amplitude of light waves. *TSO 1b.* Find the wavelength of a given monochromatic light source using an interference experiment. *TSO 1c.* Find the wavelength of a given light source by using an n-slit Fraunhofer diffraction pattern. *TSO 1d.* Determine the resolving power of a given optical instrument by using the Rayleigh criteria *TSO 1e.* Analyze the polarization of a given light source.	**Unit- 1.0: Wave Optics (8hrs)** 1.1 Interference, Division of amplitude, Newton's Ring experiment, Michelson interferometer. 1.2 Diffraction, Fraunhofer diffraction, Single and double slit, & Circular aperture 1.3 Diffraction, Grating, 1.4 Rayleigh criterion, resolving power of telescope. 1.5 Polarization, double-refracting crystal, Nicol prism.
CO2	*TSO 2a.* Differentiate between ordinary and laser light sources. *TSO 2b.* Derive the relations between Einstein A & B coefficients. *TSO 2c.* Explain the construction and working of the given laser with application. *TSO 2d.* Explain the Propagation mechanism of light in optical fiber and its application. *TSO 2e.* Differentiate between different	**Unit- 2.0: Lasers and Optical Fiber (8hrs)** 2.1 Characteristics of laser light, Einstein's A & B coefficients, Population inversion, pumping mechanism, Optical resonator 2.2 Ruby laser, He-Ne laser, and Semiconductor laser 2.3 Structure of optical fibre, Basic principles (TIR, Acceptance angle and Numerical Aperture), Types of optical fibres. 2.4 Propagation mechanism of light in fibre,

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	types of optical fiber *TSO 2f.* Explain the use of Lasers and Fiber optic Sensors in communications, medical, defense, and Industries	Attenuation in optical fibres. 2.5 Applications of optical fibres, Fibre optic sensors
CO3	*TSO 3a.* Interpret the role of dielectric constant in modifying the electric field inside a material. *TSO 3b.* Apply Gauss's Law in dielectric media to solve problems involving electric field in capacitors. *TSO 3c.* Classify magnetic materials as dia, para, and ferromagnetic based on their response to an external magnetic field *TSO 3d.* Explain Maxwell's equations in integral form with its physical significance. *TSO 3e.* Calculate the magnitude and direction of Poynting vector for a given EM wave and interpret energy transport per unit area.	**Unit- 3.0**: **Electromagnetism & Propagation of Waves (8hrs)** 3.1 Electric fields, Gauss' Law, Dielectrics and Capacitors. 3.2 Magnetic fields & Magnetic Materials. 3.3 Maxwell's Equations. 3.4 Electromagnetic waves & Poynting Theorem
CO4	*TSO 4a.* Explain the need and requirement for Quantum Mechanics *TSO 4b.* Implement the idea of the De-Broglie hypothesis and uncertainty principle for solving problems *TSO 4c.* Explain the concept of wave functions with physical significance. *TSO 4d.* Solve the fundamental governing equations of quantum mechanics to determine the evolution of quantum systems. *TSO 4e.* Calculate the quantized energy levels and normalized wave functions for a particle confined in a one-dimensional infinite potential well. *TSO 4f.* Analyze the phenomenon of quantum tunneling to explain	**Unit- 4.0: Quantum Mechanics (8hrs)** 4.1 Introduction to Quantum Mechanics. 4.2 De-Broglie hypothesis, Heisenberg uncertainty principle 4.3 Wave function and its characteristics 4.4 Schrödinger's equation (time-dependent and independent) 4.5 Particle in a box, Energy Eigen values and Eigen functions 4.6 Potential barrier and Tunneling

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	how particles penetrate classically forbidden energy barriers	
CO5	*TSO 5a.* Compare the band structures of metals, insulators and semiconductors to explain the differences in their electrical behavior. *TSO 5b.* Distinguish between drift and diffusion current density to solve problems involving carrier transport in semiconductors. *TSO 5c.* Analyse the significance of Hall coefficient in identifying n-type and p-type semiconductors. *TSO 5d.* Evaluate the suitability of solar cells as renewable energy conversion devices in engineering systems. *TSO 5e.* Explain the properties of nanomaterials with applications. *TSO 5f.* Classify various nanomaterials on the basis of confinement.	**Unit- 5.0: Semiconductors & Nano-materials (10hrs)** 5.1 Introduction, Types of materials (metal, semiconductor and insulator) 5.2 Intrinsic and extrinsic semiconductors, P-type and N-type semiconductors, Diffusion, Drift and Fermi level 5.3 Photodiode, P-N junction transistor, LED 5.4 Hall effect 5.5 Solar cell and its characteristics. 5.6 Introduction to nanoscience& nanotechnology, the significance of nanoscale 5.7 Unique Properties: Comparison of bulk and nanomaterials, large surface-to-volume ratio, change in band gap, and optical/electrical/mechanical properties at the nanoscale. 5.8 Classification of Nanostructured Materials: 0D (Quantum Dot), 1D (Nanowire

Reference/Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Optics	Ajay Ghatak	Mcgraw Hill Education,2012, 5th Edition, ISBN-10: 1259004340
2.	Principles of Lasers	O.svelto	Springer Science &Business Media,2010, 5th Ed, ISBN-10: 1441913017
3.	Introduction to electrodynamics	David J. Griffiths	Pearson Education Cambridge University Press, 2023, 5th Edition, ISBN-10: 1009397729
4.	Principles of Electronic Materials and Devices	S.O. Kasap	McGraw Hill Education, Third Edition, 2006, ISBN-10: 0073104647
5.	Semiconductor Physics and Devices	Donald A. Neuman	McGraw-Hill Education, Fourth Edition, 2011, ISBN-10: 0073529583
6.	Introduction to Quantum Mechanics	David J. Griffiths	Pearson Education Cambridge University Press, 2016, 2nd Edition, ISBN-10: 1107179866

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
7.	Nanotechnology: Principles and Practices.	Sulabha K. Kulkarni	Springer Nature, Third Edition,2014, ISBN-10: 3319091700
8.	Concepts of Engineering Physics	S.K. Roy	Novelty Publication, 1st Edition, 2016-17
9.	Concepts of Engineering Physics	Kumari Mamta and Raj Kumar Singh	CRC Press-Taylor and Francis, United Kingdom, 1st Edition, ISBN 9781041191834
10.	Physics Practical for Engineers	S.K. Roy	Novelty Publication, 1st Edition, 2018

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100111 **Basics of Electrical & Electronics Engineering** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply fundamental electrical laws to analyse DC circuits.
CO2	Analyse the performance of AC circuits.
CO3	Interpret the applications of basic electrical machines.
CO4	Analyse the characteristics of semiconductor devices such as diodes and transistors for its use in rectifiers, voltage regulators and amplifiers.
CO5	Explain and apply the fundamentals of digital and analog electronics, electrical measurement, sensors and transducers, power systems, and electrical safety practices including protective devices and earthing.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain classifications of electrical elements and their characteristics. *TSO 1b.* Apply Ohm's law and Kirchhoff's laws in circuit analysis. *TSO 1c.* Analyse circuits using mesh and nodal methods. *TSO 1d.* Apply divider rules and star-delta transformation in circuits.	**Unit- 1.0: Basic Electrical Circuits (8hrs)** 1.1 Electrical Circuit Elements: Resistance, inductance, and capacitance as active and passive elements 1.2 Classification of Elements: Unilateral and bilateral elements; linear and nonlinear elements 1.3 Basic Circuit Laws: Ohm's law and Kirchhoff's current and voltage laws 1.4 Circuit Configurations: Series and parallel circuits, voltage sources, current sources, and source transformation 1.5 Circuit Analysis Methods: Mesh analysis and nodal analysis techniques 1.6 Network Theorems and Transformations: Current divider rule, voltage divider rule, and star-delta transformation
CO2	*TSO 2.a* Explain common signals, waveforms, and AC quantities. *TSO 2.b* Apply phasor representation to analyse phase relationships in AC circuits. *TSO 2.c* Analyse impedance, admittance, power factor, and power triangle in AC circuits.	**Unit- 2.0: A.C. Circuits (8hrs)** 2.1 Signals and Waveforms: Common electrical signals and their waveform characteristics 2.2 AC Quantities: Instantaneous, peak, average, and RMS values of alternating signals

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2.d Explain the concepts and advantages of three-phase balanced and unbalanced systems.	2.3 Waveform Factors: Peak factor and form factor of sinusoidal waves 2.4 Phase and Phasors: Phase difference, lagging, leading, in-phase quantities, and phasor representation in rectangular and polar forms 2.5 AC Circuit Parameters: Impedance, admittance, power factor, and power triangle 2.6 Three-Phase Systems: Necessity, advantages, phase sequence, and balanced/unbalanced supply and load concepts
CO3	*TSO 3a.* Explain electromagnetic laws, self-inductance, and mutual inductance. *TSO 3b.* Describe the construction, operation, and applications of DC machines. *TSO 3c.* Apply transformer equations to determine ratios and regulation. *TSO 3d.* Explain the working principles and applications of induction and fractional horsepower motors.	**Unit- 3.0: Basic Electrical Machines (8hrs)** 3.1 Electromagnetic Principles: Basic laws of electromagnetism, self-inductance, and mutual inductance 3.2 DC Machines: Principle of operation, construction, classification, and applications of DC machines 3.3 Single-Phase Transformers: Necessity, working principle, construction, and E.M.F. equation of transformers 3.4 Transformer Performance: Voltage ratio, current ratio, and voltage regulation with significance 3.5 Induction Motors: Overview of single-phase and three-phase induction motors and their working principles 3.6 Motor Applications: Applications of induction motors and fractional horsepower motors
CO4	*TSO 4a.* Explain intrinsic, extrinsic semiconductors, and diode characteristics. *TSO 4b.* Analyse forward/reverse bias conditions and diode breakdown mechanisms. *TSO 4c.* Apply diodes in rectifiers, filters, and voltage regulation circuits. *TSO 4d.* Explain BJT operation and its use as amplifier and switch.	**Unit- 4.0: Semiconductor Devices (8hrs)** 4.1 Semiconductor Materials: Intrinsic and extrinsic semiconductor types 4.2 p-n Junction Diode: Construction, characteristics, forward bias, and reverse bias operation 4.3 Diode Behavior: Temperature effects and breakdown mechanisms in diodes 4.4 Diode Applications: Half-wave rectifier, full-wave rectifier, filters, and Zener diode as voltage regulator 4.5 BJT Fundamentals: PNP and NPN transistors, construction, and operating principles 4.6 BJT Applications: CE configuration as amplifier

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
		and transistor as a switch
CO5	TSO 5a Explain number systems and perform binary addition. TSO 5b Apply logic gates and Boolean algebra to solve digital logic problems. TSO 5c Describe the operation of LEDs and seven-segment displays using truth tables. TSO 5d Explain the functions and applications of digital and analog ICs, including IC 7805 and IC 7912. TSO 5e Explain the features and uses of multimeter and CRO. TSO 5f Describe the basics of sensors, transducers, and power system layout. TSO 5g Apply electrical safety practices using fuse, MCB, and MCCB. TSO 5h Explain the purpose and importance of earthing systems.	**Unit- 5.0: Fundamentals of Digital, Analog Electronics, Measurement and Electrical Safety (10hrs)** 5.1 Binary, octal, and hexadecimal number systems; binary addition and basic number operations 5.2 Basic logic gates, universal gates, and Boolean algebra 5.3 LEDs, seven-segment display and truth table; overview of digital and analog integrated circuits 5.4 Functions and applications of IC 7805 and IC 7912; basic features and applications of multimeter and CRO 5.5 Fundamentals, types, and uses of sensors and transducers; generation, transmission, and distribution of electrical power 5.6 Safe handling practices, prevention of electrical hazards; functions and applications of fuse, MCB, and MCCB 5.7 Purpose, importance, and methods of earthing systems

Reference/Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Basic Electrical Engineering	D. P. Kothari, I. J. Nagrath	McGraw-Hill Education, 2019, ISBN: 978-9353165727
2.	Electronic Device & Circuit theory	Robert L. Boylestad and Louis Nashelsky	Pearson, 2013, ISBN: 978-1292025636
3.	Digital Logic and Computer Design	M. Morris Mano	Pearson India, 2017, ISBN: 978-9332586048
4.	Electrical Machinery	P. S. Bimbhra	Khanna Publishers, 2024, ISBN: 978-9389139105

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
5.	A Course in Electrical and Electronic Measurements and Instrumentation	A. K. Sawhney	Dhanpat Rai & Co., 19th Edition, ISBN: 978-8177001006
6.	Electrical Safety of Low Voltage Systems	Massimo Mitolo	McGraw-Hill, 1st Edition, 2009 ISBN: 978-0071508186
7.	Fundamentals of Electric Circuits	Charles K. Alexander and Matthew N. O. Sadiku	McGraw-Hill, 7th Edition, ISBN: 978-9355320162

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100105 **Introduction to AI** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Explain the foundational concepts of Artificial Intelligence, including its inception, intelligent agents, and types of task environments.
CO2	Trace uninformed, informed, local, and adversarial search strategies for solving AI problems.
CO3	Perform manual logical inference using propositional and predicate logic by considering the methods of knowledge representation
CO4	Apply probabilistic reasoning and basic fuzzy-logic concepts to handle uncertainty in AI systems.
CO5	analyze the foundational machine learning paradigms underlying the design and implementation of AI-based systems.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain the evolution and foundational philosophies of AI. *TSO 1b.* Describe the structure and functioning of intelligent agents using the PEAS framework. *TSO 1c.* Classify task environments based on their properties. *TSO 1d.* Differentiate between types of agents based on their internal architecture. *TSO 1e.* Outline AI application domains across engineering disciplines.	**Unit- 1.0: Introduction to Artificial Intelligence (8hrs)** 1.1 What is AI? History and evolution of AI 1.2 Foundations of AI: philosophy, mathematics, and cognitive-science influences 1.3 Intelligent agents: agent–environment interaction, PEAS (Performance measure, Environment, Actuators, and Sensors) description 1.4 Types of environments (observable, deterministic, episodic, static, discrete, single/multi-agent) 1.5 Types of agents: simple reflex, model-based, goal-based, utility-based, learning agents 1.6 Overview of AI application domains across engineering disciplines
CO2	*TSO 2a.* Represent a given real-world problem as a state-space search problem.	**Unit- 2.0: Problem Solving by Search (9hrs)**

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2b. Trace uninformed search strategies manually and compare their complexity. *TSO 2c.* Trace informed search strategies using suitable heuristic functions. *TSO 2d.* Verify the admissibility and consistency of a given heuristic. *TSO 2e.* Illustrate local search techniques for simple optimisation problems. *TSO 2f.* Trace adversarial search with alpha-beta pruning for a two-player game. *TSO 2g.* Illustrate simple Constraint Satisfaction Problems (CSPs).	2.1 Problem formulation and state-space representation 2.2 Uninformed search: BFS, DFS, Uniform Cost Search, Depth-Limited and Iterative Deepening Search 2.3 Informed (heuristic) search: Greedy Best-First Search, A* algorithm 2.4 Heuristic function design and admissibility/consistency 2.5 Local search algorithms: Hill Climbing, Simulated Annealing (concept) 2.6 Adversarial search: Minimax algorithm, Alpha-Beta pruning 2.7 Constraint Satisfaction Problems (CSP): concept, backtracking (overview)
CO3	*TSO 3a.* Represent simple real-world facts using propositional and predicate logic. *TSO 3b.* Apply resolution manually to perform logical inference. *TSO 3c.* Trace forward and backward chaining to derive conclusions from a knowledge base. *TSO 3d.* Represent structured knowledge using semantic networks and frames. *TSO 3e.* Outline the design of a simple rule-based (production) system for a given domain.	**Unit- 3.0: Knowledge Representation and Reasoning (8hrs)** 3.1 Knowledge representation issues; propositional logic — syntax and semantics 3.2 Inference in propositional logic: resolution 3.3 First-order predicate logic — syntax, quantifiers (concept) 3.4 Inference in first-order logic: forward chaining, backward chaining, resolution (concept) 3.5 Structured knowledge representation: semantic networks, frames 3.6 Rule-based (production) systems
CO4	*TSO 4a.* Explain the need for probabilistic reasoning in AI. *TSO 4b.* Apply Bayes' theorem to compute conditional probabilities in AI problems. *TSO 4c.* Construct a simple Bayesian network for a given scenario. *TSO 4d.* Explain the basic principles of fuzzy logic and fuzzy-set operations.	**Unit- 4.0: Reasoning Under Uncertainty (7hrs)** 4.1 Sources of uncertainty; review of basic probability theory 4.2 Bayes' theorem and its application to AI reasoning 4.3 Bayesian networks: representation and manual inference (overview) 4.4 Introduction to fuzzy logic and fuzzy sets 4.5 Certainty factors and rule-based uncertainty (overview)

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO5, CO6	*TSO 5a.* Differentiate between supervised, unsupervised, and reinforcement learning paradigms. *TSO 5b.* Describe the working principle of basic regression, classification, and clustering techniques. *TSO 5c.* Describe the basic structure of a perceptron and an artificial neural network. *TSO 5d.* Describe applications of AI in natural language processing, computer vision, and expert systems. *TSO 5e.* Identify ethical, bias-related, and societal implications of AI deployment. *TSO 5f.* Relate AI applications to sustainable development goals and multidisciplinary engineering contexts.	**Unit- 5.0: Introduction to Machine Learning and AI Applications (10hrs)** 5.1 Machine learning paradigms: supervised, unsupervised, reinforcement learning (concept) 5.2 Overview of regression and classification concepts (linear regression, k-NN, decision trees) 5.3 Overview of clustering concept (k-means) 5.4 Introduction to artificial neural networks: perceptron, basic architecture (concept) 5.5 Overview of Natural Language Processing (NLP): concept and applications 5.6 Overview of Computer Vision: concept and applications 5.7 Expert systems: architecture and applications 5.8 Robotics and AI: overview of intelligent robotic systems 5.9 Ethics, bias, and responsible AI; societal impact; AI and Sustainable Development Goals (SDGs)

Reference/Books:

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Artificial Intelligence: A Modern Approach	Stuart Russell, Peter Norvig	Pearson; 4th Ed., 2020. ISBN: 978-0134610993
2.	AI for everyone	Saptarsi Goswami, Amit Kumar Das, Amlan Chakrabarti	Pearson Education: SBN-10 : 9361591754, ISBN-13: 978-9361591754
3.	Introduction to Artificial Intelligence and Expert Systems	Dan W. Patterson	PHI Learning; 2015. ISBN: 978-8120307775
4.	Artificial Intelligence	Elaine Rich, Kevin Knight, Shivashankar B. Nair	McGraw-Hill; 3rd Ed., 2017. ISBN: 978-1259029420

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
5.	Artificial Intelligence - A Modern Approach	Dilip Narayan Sahu, Kishore Kumar Dash, Abahy Kolhe, Agilandeswari Devarajan	ISBN-10: 9355151446 ISBN-13: 978-9355151445
6.	Machine Learning Essentials	Dhairya Parikh	Vibrant Publishers: ISBN-10: 1636513778, ISBN-13: 978-1636513775

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100108 Computer Fundamentals & Emerging Technologies 3 0 0 3

Course Outcomes (COs)	Course Outcome Statements
CO1	Analyze the structure and interaction of computer system components.
CO2	Apply number system conversions and data representation techniques to solve computational problems.
CO3	Differentiate types of operating systems based on their functions and suitability for various applications.
CO4	Analyse computer network components, topologies, and data communication processes.
CO5	Identify appropriate emerging technologies to address the given engineering problems.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Classify different types of computers based on application *TSO 1b.* Explain the organization of the CPU and its working process. *TSO 1c.* Illustrate memory architecture and hierarchy in a computer system. *TSO 1d.* Analyze the role of CPU registers and cache memory in system performance. *TSO 1e.* Identify motherboard components and their functions. *TSO 1f.* Explain the Von Neumann Architecture *TSO 1g.* Distinguish between machine language, assembly language, and high-level language. *TSO 1h.* Differentiate between compiler and interpreter.	**Unit- 1.0: Fundamentals of Computer Systems (8hrs)** 1.1 Classification of computers, Functional units 1.2 Central Processing Unit (CPU) organization and working 1.3 Memory: Architecture, Memory Representation, Memory Hierarchy 1.4 CPU Registers, Impact of Cache Memory on System Performance 1.5 Motherboard and its components 1.6 The Von-Neumann architecture 1.7 Machine language, assembly language, high-level programming languages Compiler, Interpreter
CO2	*TSO 2a.* Explain the fundamentals of data and its representation in computers.	**Unit- 2.0: Data Representation (8hrs)** 2.1 Data Representation & Number Systems. 2.2 Conversion between decimal and binary systems.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2b. Convert numbers between decimal and binary systems. *TSO 2c.* Convert numbers among binary, octal, and hexadecimal systems. *TSO 2d.* Perform binary arithmetic operations. *TSO 2e.* Differentiate signed number representations. *TSO 2f.* Perform signed number arithmetic. *TSO 2g.* Interpret character encoding schemes such as ASCII and Unicode. *TSO 2h*. Illustrate data representation in computer memory.	2.3 Conversion among binary, octal, and hexadecimal systems. 2.4 Binary arithmetic (addition, subtraction) 2.5 Signed number representation (1's complement). 2.6 Signed number representation (2's complement). 2.7 American Standard Code for Information Interchange (ASCII), Unicode Data representation in memory.
CO3	*TSO 3a.* Explain the concept and types of computer software. *TSO 3b.* Describe components of system software. *TSO 3c.* Classify application software based on usage. *TSO 3d.* Explain objectives of an operating system. *TSO 3e.* Compare operating system types for specific applications. *TSO 3f.* Analyze process and memory management techniques. *TSO 3g.* Evaluate user interfaces based on usability and efficiency. *TSO 3h.* Analyze file system organization for efficient data management. *TSO 3i.* Compare features of major operating systems.	**Unit- 3.0: Computer Software and Operating Systems (9hrs)** 3.1 Introduction to Software, Types of Software 3.2 System Software 3.3 Application Software 3.4 Operating System (OS), Objectives of Operating System 3.5 Types of OS (Batch, Time-sharing, Distributed, Real-time) 3.6 Functions of OS (Process, Memory Management) 3.7 User Interface (Command Line Interface Vs Graphical User Interface) 3.8 File system basics examples: Windows, Linux, macOS.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO4	*TSO 4a.* Explain the fundamental concepts of computer networking. *TSO 4b.* Justify the benefits of networking. *TSO 4c.* Explain the process and key components of data transmission in networks. *TSO 4d.* Differentiate between different data transmission media used in networking. *TSO 4e.* Analyze data transmission across different media. *TSO 4f.* Classify computer networks based on scale. *TSO 4g.* Differentiate between various network topologies. *TSO 4h.* Analyze the functions of network devices in data communication. *TSO 4i.* Describe IP addresses in a computer network *TSO 4j.* Explain basic communication protocols in networking. *TSO 4k.* Analyze Internet components and client-server architecture.	**Unit- 4.0: Computer Networks and Internet Basics (9hrs)** 4.1 Introduction to Computer Networks. 4.2 Importance of Networking. 4.3 Data Transmission Media, Data Transmission across Media. 4.4 Data Transmission in a Network. 4.5 Network Types: Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN). 4.6 Network Topologies (Star, Bus, Ring, Mesh), Communication Protocol. 4.7 Network Devices (Hub, Switch, Router, Modem, Gateway), Wireless Networking. 4.8 Introduction to Internet: Internet Protocol (IP) Address. 4.9 Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Hypertext Transfer Protocol (HTTP), File Transfer Protocol (FTP), Domain Name System (DNS), Uniform Resource Locator (URL), Client-Server Architecture.
CO5	*TSO 5a.* Explain the concept and architecture of IoT. *TSO 5b.* Analyze IoT applications in real-world scenarios. *TSO 5c.* Explain basic cybersecurity concepts and terminologies. *TSO 5d.* Explain the effectiveness of cyber threats and appropriate countermeasures. *TSO 5e.* Explain the fundamentals of Artificial Intelligence and AI agents. *TSO 5f.* Analyze types of learning paradigms and their applications. *TSO 5g.* Explain the concept of blockchain and distributed ledger.	**Unit- 5.0: Emerging Technologies (8hrs)** 5.1 Internet of Things (IoT): Concept and architecture, Applications (Smart homes, Smart cities) 5.2 Cyber Security: Basic security Terminologies, CIA Triad, Types of cyber threats and countermeasures 5.3 Artificial Intelligence (AI): Introduction, AI agents, Applications. 5.4 Machine Learning (ML): Types of learning paradigms, Real-world applications. 5.5 Blockchain: Concept of distributed ledger, Blocks, hashing, decentralization. 5.6 Data Science: Data Lifecycle, Role of data in decision making.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 5h. Analyze the role of hashing and decentralization in blockchain systems. *TSO 5i.* Describe the concept of data science and the stages of the data science lifecycle. *TSO 5j.* Analyze the role of data in decision making.	

Reference/Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Computer Fundamentals	P. K. Sinha and Priti Sinha	BPB Publications, 6th Edition, ISBN: 978-8176567527
2.	Introduction to Computers	Peter Norton	McGraw Hill, 7th Edition, ISBN: 978-0070636774
3.	Data Representation and Computer Logic	Charles M. Gilmore	McGraw Hill, ISBN: 978-0070245754
4.	Operating System Concepts	Abraham Silberschatz, Peter B. Galvin and Greg Gagne	Wiley, 10th Edition, ISBN: 978-1119456339
5.	Data Communications and Networking	Behrouz A. Forouzan	McGraw Hill, 5th Edition, ISBN: 978-0073376226
6.	IoT for Beginners: Architecture, Principles and Applications	Amita Kapoor, Vinay Chopra	BPB Publications, 1st Edition, ISBN: 978-9355510063
7.	Fundamentals of Cyber Security	Mayank Bhushan, Rajkumar Singh Rathore, Aatif Jamshed	BPB Publications, 1st Edition, ISBN: 9789386551559
8.	Artificial Intelligence: A Guide for Thinking Humans	Melanie Mitchell	Farrar, Straus and Giroux, 1st Edition, ISBN: 9780374257835

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100110 **Essence of Indian Constitution** **3 0 0 0**

Course Outcomes (COs)	Course Outcome Statements
CO1	List salient features and characteristics of the constitution of India.
CO2	Follow fundamental rights and duties as responsible citizen and engineer of the country.
CO3	Explain the relevance of Directive Principles of State Policy and Identify their relationship with Fundamental Rights.
CO4	Explain the system of governance under Part-VI
CO5	Analyze major constitutional amendments in the constitution.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain the meaning of preamble of the constitution. *TSO 1b.* List the salient features of constitution. *TSO 1c*. List the characteristics of constitution. .	**Unit- 1.0: Constitution and Preamble (8hrs)** 1.1 Meaning of the constitution of India. 1.2 Historical perspective of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble to the Constitution of India.
CO2	*TSO 2a.* Enlist the fundamental rights. *TSO 2b*. Identify fundamental duties in general and with engineering field.	**Unit- 2.0: Fundamental Rights and Duties (8hrs)** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance.
CO3	*TSO 3a.* Identify situations where directive principles prevail over fundamental rights. *TSO 3b.* Explain the relevance and different articles of Directive Principles of State Policy under Part-IV.	**Unit- 3.0: Directive Principles (8hrs)** 3.1 Relevance of Directive Principles of State Policy under part-IV. 3.2 Different articles of State policies under part-IV
CO4	*TSO 4a*. Explain the system of Governance Under Part-VI *TSO 4b*. Differentiate between the Legislative Assembly and Legislative Council.	**Unit- 4.0: Governance (9hrs)** 4.1 Governance under part-VI 4.2 State Legislature, Legislative Assembly & Legislative Council.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO5	*TSO 5a*. Explain the process of constitution amendment and its significance. *TSO 5b*. Describe the major constitutional Amendment procedures with reference to Important amendments.	**Unit- 5.0 Amendments of Constitution (9hrs)** 5.1 Amendment of Constitutional Powers and Procedure. 5.2 Major Constitutional Amendment procedure - 42nd, 44th, 74th, 76th, 86th and 91st

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100109 **Universal Human Values** **2 0 0 2**

Course Outcomes (COs)	Course Outcome Statements
CO1	Explain Self-Exploration and Right Understanding for achieving Happiness and Prosperity.
CO2	Explain Right Understanding, Relationship and Physical Facility and analyze the co-existence of Self and Body.
CO3	Identify values in human relationships and explain Harmony in the Society.
CO4	Explain Harmony in Nature, mutual fulfilment among the four orders and co-existence in Existence.
CO5	Explain human values and ethical conduct with reference to Professional Ethics and Universal Human Order.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain the process of Self-Exploration as the process for Value Education. *TSO 1b.* Explain Continuous Happiness and Prosperity through Self-Exploration and Right Understanding.	**Unit- 1.0**: **Self-Exploration, Happiness and Prosperity** **(5hrs)** 1.1 Self-Exploration 1.2 Continuous Happiness and Prosperity 1.3 Right Understanding
CO2	*TSO 2a.* Explain the salient features of Right Understanding, Relationship and Physical Facility. *TSO 2b*. Explain Happiness and Prosperity in the given situation. *TSO 2c.* Explain human being as a co-existence of the sentient 'Self' and the material 'Body'.	**Unit- 2.0**: **Relationship, Physical Facility and Human Being** **(5hrs)** 2.1 Right Understanding, Relationship and Physical Facility 2.2 Happiness and Prosperity 2.3 Human being as a co-existence of the sentient 'Self' and the material 'Body'
CO3	*TSO 3a.* List the values in human-human relationship. *TSO 3b.* Explain the importance of values in establishing harmonious human relationships.	**Unit -3.0:Values in Human Relationships and Harmony in Society** **(5hrs)** 3.1 Values in human-human relationship

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 3c. Explain the process to establish Harmony in the given society.	3.2 Harmony in the Society
CO4	*TSO 4a.* Explain Harmony in Nature for the given situation. *TSO 4b.* Identify the four orders of nature with respect to mutual fulfilment. *TSO 4c***.** Explain Existence as Co-existence of mutually interacting units in all-pervasive space. *TSO 4d***.** Explain holistic perception of harmony at all levels of existence.	**Unit - 4.0 : Harmony in Nature and Existence** (6**hrs)** 4.1 Harmony in the Nature 4.2 Interconnectedness and mutual fulfilment among the four orders of nature 4.3 Existence as Co-existence of mutually interacting units in all-pervasive space 4.4 Holistic perception of harmony at all levels of existence
CO5	*TSO 5a.* Explain the natural acceptance of human values. *TSO 5b***.** Explain Definitiveness of Ethical Human Conduct. *TSO 5c.* Explain the basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. *TSO 5d***.** Explain competence in professional ethics and strategies for transition towards Universal Human Order at individual and society levels.	**Unit - 5.0: Implications of Holistic Understanding on Professional Ethics** (7**hrs)** 5.1 Natural acceptance of human values 5.2 Definitiveness of Ethical Human Conduct 5.3 Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 5.4 Competence in professional ethics 5.5 Strategy for transition from the present state to Universal Human Order: a. At the level of individual b. At the level of society

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100104P **Engineering Physics Lab** **0 0 2 1**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1&CO2	*LSO 1.1* Measure the wavelength of a given light source using a plane diffraction grating	LE- 1 Diffraction Grating.
CO1	*LSO 1.2* Measure the wavelength of given monochromatic light source using Newton's Ring Experiment *LSO 1.3* Measure the radius of curvature of the given plano-convex lens using Newton's Ring Experiment.	LE- 2 Newton's Ring Experiment
CO1	*LSO 1.4* Determine the resolving power of a given telescope	LE- 3 Resolving Power of Telescope
CO1	*LSO 1.5* Determine the specific rotation of cane sugar solution using a polarimeter	LE- 4 Polarimeter
CO2	*LSO 2.1* Determine the Numerical Aperture of given optical fiber	LE- 5 Numerical Aperture Optical Fiber (Virtual Lab)
CO3	*LSO 3.1* Measure the dielectric constant of given dielectric materials	LE- 6 Dielectric Constant
CO4	*LSO 4.1* Determine the value of Planck's constant using a photocell.	LE- 7 Measurement of Plank's Constant
CO4	*LSO 4.2* Determine the wavelength of a given electron beam.	LE- 8 LE-8 Stern-Gerlach Experiment (Virtual Lab)
CO5	*LSO 5.1* determines the I-V characteristic of a given p-n junction diode	LE- 9 p-n junction
CO5	*LSO 5.2* Determine hole and electron density in given semiconductor	LE- 10 Hall effect experiment
CO5	*LSO 5.3* Use four-probe method to determine the resistivity of the given semiconductor material	LE- 11 Energy Band Gap Measurement
CO5	*LSO 5.4* Demonstrate the change in absorption of light on changing size of nanoparticle	LE- 12 Changing nanoparticle size alters light absorption.

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100111P Basics of Electrical & Electronics Engineering Lab 0 0 2 1

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1	*LSO 1.1* Identify active and passive components used in electrical circuits. *LSO 1.2* Verify Ohm's Law for a resistive load.	LE- 1 Identification of active and passive components and Ohm's Law verification
CO1	*LSO 2.1* Analyse series and parallel circuits to verify Kirchhoff's Voltage and Current Laws. *LSO 2.2* Apply voltage division and current division rules to determine circuit parameters experimentally.	LE- 2 Application of Kirchhoff's Laws in series and parallel circuits
CO2	*LSO 3.1* Identify the effect of low power factor in a single-phase load. *LSO 3.2* Demonstrate power factor improvement of a single-phase load using a capacitor.	LE- 3 Improvement of power factor of a single-phase load using a capacitor
CO3	*LSO 4.1* Measure primary and secondary voltages of a single-phase transformer under test conditions. *LSO 4.2* Verify the turns ratio by comparing primary and secondary winding values.	LE- 4 Determination of voltage and turns ratios of a single-phase transformer
CO3	*LSO 5.1* Identify the main constructional parts of DC machines and induction machines using cut-section models. *LSO 5.2* Examine the functions of different components of DC machines and induction machines.	LE- 5 Identification of main parts of DC machines and induction machines using cut-section models
CO4	*LSO 6.1* Identify the behavior of a P–N junction diode under forward and reverse bias conditions. *LSO 6.2* Analyse the V–I characteristics of the diode from observed readings.	LE- 6 Determination of V–I characteristics of a P–N junction diode
CO4	*LSO 7.1* Verify half-wave and full wave rectifier circuits with and without filters. *LSO 7.2* Compare the output performance of rectifiers using sinusoidal input under filtered and unfiltered conditions	LE- 7 Performance of half-wave and full-wave rectifiers with and without filters using sinusoidal input
CO4	*LSO 8.1* Identify the components and circuit setup of a Zener diode voltage regulator. *LSO 8.2* Analyse the regulation performance of the Zener diode under varying input voltage or load conditions.	LE- 8 Analysis of the operation of a voltage regulator using a Zener Diode

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO4	*LSO 9.1* Identify the input and output characteristics of a common emitter (CE) bipolar junction transistor. *LSO 9.2* Analyse the variation of current and voltage in CE transistor operation from observed characteristics.	LE- 9 Input and output characterization of common emitter (CE) bipolar junction transistor
CO5	*LSO 10.1* Construct basic logic gates (AND, OR, NOT, XOR) using only NAND and NOR gates. *LSO 10.2* Verify the output of implemented gates using truth tables.	LE- 10 Implementation of logic gates (AND, OR, NOT, XOR) using Universal gates
CO6	*LSO 11.1* Measure amplitude and time period of signals using a Cathode Ray Oscilloscope (CRO). *LSO 11.2* Determine signal frequency from CRO waveform observations.	LE- 11 Measurement of signal parameters using a CRO
CO6	*LSO 12.1* Identify different types of electrical cables, wires, and fuses based on their construction, rating, and application. *LSO 12.2* Demonstrate proper selection and safe handling of cables, wires, and fuses for basic electrical circuit requirements.	LE- 12 Identification of different types of cable, wires and fuses
CO6	LSO 13.1 Identify the construction and functions of fuse, MCB, and MCCB. LSO 13.2 Evaluate the operation of fuse, MCB, and MCCB under fault and overload conditions.	LE- 13 Operation of protection devices such as fuse, MCB, and MCCB
CO6	*LSO 14.1* Demonstrate proper earthing techniques for electrical installations. *LSO 14.2* Apply electrical safety practices while handling equipment and circuits.	LE- 14 Demonstration of earthing techniques and electrical safety practices
CO6	*LSO 15.1* Implement domestic wiring for a single lamp and fan with regulator using switches. *LSO 15.2* Demonstrate fuse/MCB protection for safe household electrical circuits.	LE- 15 Wiring of single lamp and fan with regulator controlled by a switch with fuse/MCB protection
CO6	*LSO 16.1* Demonstrate the safe handling and operation of a Megger for insulation and earth resistance testing. *LSO 16.2* Measure earth resistance accurately and interpret the results for effective grounding performance.	LE- 16 Handling of Meggers and measurement of earth resistance.

B.Tech (1st Semester) **GROUP-A** **Batch (2026-2030)**

Course Code-100112P **Programming for Problem Solving Lab** **0 0 2 1**

Course Outcomes (COs)	Course Outcome Statements
CO1	Develop basic C programs to solve the given problems by developing algorithms.
CO2	Implement structured programming constructs to solve computational problems in C.
CO3	Apply advanced memory and data management techniques to design efficient C programs.
CO4	Design object-oriented C++ programs using foundational Object-Oriented Programming (OOP) principles.
CO5	Apply advanced Object-Oriented Programming (OOP) concepts to build robust software solutions.

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1, CO2	*LSO 1.1* Construct flowcharts to represent the algorithmic steps for solving given problems. *LSO 1.2* Apply type casting and data types to ensure accurate numerical results. *LSO 1.3* Apply standard input/output functions to interact with users in C programs.	**LE- 1 Algorithmic Logic & Basic I/O** • Write a C program to calculate the area of various geometrical shapes (circle, triangle, rectangle) using appropriate data types and type casting, accompanied by a flowchart.
CO1, CO2	*LSO 2.1* Implement conditional statements for decision making. *LSO 2.2* Use switch-case statements to implement multiway branching.	**LE- 2 Decision Making Systems** • Develop a Student Grading and Classification System using an if-else ladder and a switch-case to handle marks for grading and classify eligible fee waivers by category.
CO1, C02	*LSO 3.1* Apply iterative logic to solve numerical computation problems. *LSO 3.2* Formulate looping methods to generate sequential patterns.	**LE- 3 Iterative Problem Solving** • Develop a C program to perform the following tasks by using while and for loops: i) Find all prime numbers between 1 and N ii) Generate the Fibonacci sequence for the value of N.

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO2	*LSO 4.1* Implement a single-dimensional array for the given problem.	**LE- 4 1-D Array Operations** • Write a C program to: i) Find the maximum/ minimum element using Linear Search ii) Calculate the average of elements in a 1-D array.
CO2	*LSO 5.1* Perform operations on multi-dimensional array.	**LE- 5 Matrix Manipulation (2-D Arrays)** • Write a C program to perform the following tasks: i) Matrix Multiplication ii) Find the transpose of a matrix using 2-D arrays
CO2, CO3	*LSO 6.1* Apply pointer arithmetic to traverse and manipulate the string elements. *LSO 6.2* Design a string reversal algorithm using pointer-based swapping logic.	**LE- 6 Pointer Arithmetic & Strings** • Write a C program to perform the following tasks without using pointer arithmetic: i) Reverse a string ii) Count vowels/consonants of the given string using pointers
CO2, CO3	*LSO 7.1* Develop iterative and recursive functions to solve mathematical problems. *LSO 7.2* Evaluate the time and space complexity of different functional methods.	**LE- 7 Recursion vs. Iteration** • Write a C program to perform the following tasks by using both iterative and recursive functions to compare logic flow: i) Find the factorial value for the given number ii) Find the Greatest Common Divisor (GCD)
CO2, CO3	*LSO 8.1* Use call-by-value and call-by-reference mechanisms. *LSO 8.2* Implement swap operations using pointers.	**LE- 8 Parameter Passing Mechanisms** • Develop a C program that swaps two values and updates an array using both Call by Value and Call by Reference.
CO2, CO3	*LSO 9.1* Construct hierarchical data models using structures to manage the related features simultaneously. *LSO 9.2* Implement unions to optimize memory usage for mutually exclusive data members. *LSO 9.3* Analyze the memory occupation of structures and unions using the sizeof operator.	**LE- 9 User-Defined Data Types** • Create an "Employee Payroll System" using Structures and Unions in C to store employee details and compare memory allocation between them.
CO3	*LSO 10.1* Create structured records into external text files. *LSO 10.2* Use file reading operations to retrieve the stored data.	**LE- 10 File Handling Operations**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	LSO 10.3 Display the stored data on the console. *LSO 10.3* Design search logic to extract specific file records based on keywords.	• Write a program to create a text file and perform the following tasks: i) Write student records ii) Read the student records and display records
CO4	*LSO 11.1* Construct a class to encapsulate the data using private access specifiers. *LSO 11.2* Implement public member functions to define controlled interfaces for interacting with internal object states. *LSO 11.3* Instantiate multiple objects to demonstrate independent state management within the given class framework.	**LE- 11 Classes, Objects & Encapsulation** • Design a Bank Account class with private data members for balance and public member functions for deposit, withdraw, and display.
CO4	*LSO 12.1* Use multiple constructors to initialize objects with different types of data values. *LSO 12.2* Apply dynamic memory allocation within constructors. *LSO 12.3* Apply destructors to deallocate the memory automatically.	**LE- 12 Constructors & Memory Management** • Implement a String class that utilizes Constructors (Default, Parameterized, and Copy) and a Destructor to manage the memory dynamically.
CO4	*LSO 13.1* Implement static data members to maintain a shared state across all instances. *LSO 13.2* Use static member functions to access class members independently. *LSO* 13.*3* Create friend functions to permit controlled access to private data members.	**LE- 13 Static Members & Friend Functions** • Develop a program that uses a static member to track the number of objects created and a friend function to compare private data of two different classes.
CO5	*LSO 14.1* Implement inheritance concepts.	**LE- 14 Implementation of Inheritances** • Write a C++ program to demonstrate the various arithmetic operations using the following different inheritance concepts: i) Single Inheritance ii) Multiple Inheritance iii) Multilevel Inheritance iv) Hierarchical Inheritance v) Hybrid/virtual Inheritance
CO5	*LSO 15.1* Design abstract classes containing pure virtual	**LE- 15 Polymorphism & Abstract Classes**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	functions to establish mandatory interfaces. *LSO 15.2* Apply function overloading to perform arithmetic operations. *LSO 15.3* Use operator overloading to redefine standard arithmetic symbols on complex number objects.	• Write C++ programs to demonstrate the following: i) Create an Abstract Class Shape with a pure virtual function draw (). ii) Find the area of the shape using function overloading. iii) Perform the addition of two complex numbers using operator overloading.
CO5	*LSO 16.1* Implement try-catch blocks to handle runtime errors. *LSO 16.2* Utilize the throw mechanism to signal specific error conditions. *LSO 16.3* Design resilient error-handling logic to prevent invalid data entry.	**LE- 16 Robust Error Management** • Write a C++ program to demonstrate the exception handling process using try, catch, and throw blocks to handle exceptions such as "Division by Zero" or "Negative Stock Input."
CO5	*LSO 17.1* Write function templates and class templates for generic algorithms.	**LE- 17 Template Implementation** • Write a C++ program using template functions and class templates: a function to find the max of two values, and a class template like pair to store values of any data type.