SEMESTER –I

Sl No.	Course Code	Course Title	Hours Per Week			Total Credits
			Lecture	Tutorial	Practical	
1.	100101	Communication Skills	3	0	0	3
2.	100102	Engineering Mathematics-I	3	0	0	3
3.	100103	Engineering Chemistry	3	0	0	3
4.	100105	Introduction to AI	3	0	0	3
5.	100107	Engineering Graphics and Design	2	0	0	2
6.	100101P	Communication Skills Lab	0	0	2	1
7.	100103P	Engineering Chemistry Lab	0	0	2	1
8.	100107P	Engineering Graphics and Design Lab	0	0	4	2
9.	100112P	Programming for Problem Solving Lab	0	0	2	1
10.	100113P	Sports/Yoga/NCC/NSS	0	0	2	1
TOTAL						20

GROUP-C:

1. Mechanical Engineering
2. Mechanical and Smart Manufacturing Engineering
3. Robotics and Automation
4. Civil Engineering
5. Civil Engineering with Computer Applications
6. Petrochemical Engineering
7. Chemical Engineering (Leather Technology)
8. Chemical Engineering (Plastic & Polymer)
9. Waste Management
10. Aeronautical Engineering
11. Biomedical & Robotics Engineering
12. Mechatronics Engineering
13. Mining Engineering
14. Chemical Engineering
15. Fire Technology and Safety
16. Food Processing and Preservation
17. Food Technology and Management

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

Course Code-100101 **Communication Skills** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Use vocabulary accurately in professional communication.
CO2	Construct grammatically correct and effective sentences.
CO3	Deliver presentations confidently with appropriate body language.
CO4	Prepare well-structured professional documents
CO5	Interpret literary and unseen texts effectively.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Structure sentences by selecting appropriate vocabulary. *TSO 1b.* Assess the nature of word formation *TSO 1c.* Create new words with prefixes and suffixes ensuring root words *TSO 1d.* Use expressions in English. *TSO 1e.* Distinguish abbreviations and acronyms for clarity and appropriateness in formal and informal communication	**Unit- 1.0: Vocabulary Enrichment (8 hrs)** 1.1 Technical Vocabulary Development 1.2 Nature of Word Formation 1.3 Root Word and Morpheme, Prefix, and Suffix 1.4 Foreign Expressions in English 1.5 Synonyms and Antonyms, Homophones and Homographs, Abbreviations and Acronyms
CO2	*TSO 2a.* Use the concept of the fundamental Grammar and its uses in communication. *TSO 2b.* Apply articles and prepositions to construct correct sentences. *TSO 2c.* Develop complex sentences *TSO 2d.* Apply tense and voice for correct sentences *TSO 2e.* Distinguish redundancies and clichés to avoid unnecessary repetition.	**Unit- 2.0: Basics of English Grammar (10 hrs)** 2.1 Parts of Speech, 2.2 Articles, Prepositions 2.3 Subject Verb Agreement, 2.4 Phrase and Clause 2.5 Formation of Questions using Primary Auxiliaries, Modals, and Wh-Words. 2.6 Tenses, Voice 2.7 Redundancies/Clichés
CO3	*TSO 3a.* Apply analytical and persuasive writing techniques *TSO 3b.* Record accurate proceedings, decisions and action points *TSO 3c.* Incorporate the purpose of internal communication	**Unit- 3.0: Technical Communication (8 hrs)** 3.1 Communication: Role and Relevance, 3.2 Process / Steps, Types: formal and informal/verbal and non-verbal (Kinesics, Chronemics, Proxemics, Haptics, Vocalics/Paralanguage 3.3 Barriers to Communication:

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 3d. Prepare a professional resume/CV highlighting skills and experience *TSO 3e.* Develop the ability to write coherent and well-structured essays	3.4 Pattern/channels of communication 3.5 7C's, for effective communication
CO4	*TSO 4a.* Apply analytical and persuasive writing techniques *TSO 4b.* Record accurate proceedings, decisions and action points *TSO 4c.* Develop internal communication process in an organisation *TSO 4d.* Prepare a professional resume *TSO 4e.* Write coherent and well-structured essays	**Unit- 4.0: Techniques of Professional Writing (8 hrs)** 4.1 Letter Writing (formal/informal/ cover letter/application) 4.2 Report Writing, Proposal, Notice, Agenda, and Minutes of Meeting 4.3 Memorandum 4.4 Bio-Data/Resume/Curriculum Vitae 4.5 Essay Writing, Email Writing
CO5	*TSO 5a.* Explain the literary text *TSO 5b.* Illustrate central ideas and messages *TSO 5c.* Interpret the text effectively *TSO 5d.* Illustrate unfamiliar texts effectively	**Unit- 5.0: Comprehension and Interpretation Skills (8 hrs)** 5.1 If (Poem) by Rudyard Kipling 5.2 Of Studies (Essay) by Sir Francis Bacon 5.3 India: Our Motherland (Essay) by Swami Vivekananda 5.4 A Devoted Son (Story) by Anita Desai 5.5 Unseen/Untaught passage

Reference/Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Communicative English for Engineers and Professionals	Nitin Bhatnagar, Mamta Bhatnagar	Publisher: Pearson Education Edition: 1st Edition, Year: 2010 ISBN: 978-8131724323
2.	Oxford Communicative English	Oxford University Press	Edition: Latest Revised Edition Year: 2014, ISBN: 978-0198076018
3.	Technical Communication: Principles and Practice	Meenakshi Raman, Sangeeta Sharma	Edition: 3rd Edition Year: 2015 ISBN: 978-0199452132
4.	Communication Skills in English	Dr. Anjana Tiwari	Khanna Publishers, New Delhi
5.	Business Communication	Dr. Nishith Rajaram Dubey, Anupam Singh	Indra Publishing House, 2023 ISBN- 978-93-93577-69-6
6.	Employability Skills	Dr. Nishith Rajaram Dubey, Anupam Singh	Indra Publishing House, 2023 ISBN

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
			978-93-93577-68-9
7.	Essential English Grammar in Use	Raymond Murphy	Cambridge University Press

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

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 (8 hrs)** 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. *TSO 2d.* Find the Curvature of a given curve representing an engineering situation.	**Unit- 2.0: Differential Calculus: Single Variable (8 hrs)** 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)
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 (9 hrs)** 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 (9 hrs)** 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 (8 hrs)** 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-C** **Batch (2026-30)**

Course Code-100103 **Engineering Chemistry** **3 0 0 3**

Course Outcomes (COs)	Course Outcome Statements
CO1	Predict the bonding and geometry of molecules using quantum-mechanical, MO and VSEPR principles.
CO2	Select suitable smart materials for engineering applications.
CO3	Apply polymer and rubber materials to solve engineering problems.
CO4	Apply adsorption and colloidal principles in chemical and industrial applications.
CO5	Apply green chemistry principles, water purification methods and adulteration testing methods in practical contexts.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain quantization of energy and the experimental basis of the photoelectric effect. *TSO 1b.* Solve particle-in-a-box problems to determine energy levels. *TSO 1c.* Construct MO diagrams of a given molecule. *TSO 1d.* Predict the 3-D geometry and bond angle of a given molecule using VSEPR theory and Bent's Rule. *TSO 1e.* Determine coordination number, geometry, and possible isomers for given complexes.	**Unit- 1.0: Quantum Mechanics & Molecular Structure (9 hrs)** 1.1 Planck's theory, photoelectric effect, dual nature of electrons. 1.2 Wave Mechanics: Heisenberg Uncertainty Principle, Schrödinger's wave equation (concept & particle-in-a-box). 1.3 LCAO Method, MO diagrams of diatomics, VSEPR theory (geometries / Bent's Rule). 1.4 Coordination number, isomerism in transition-metal compounds; CFT (octahedral, tetrahedral and Square Planer).
CO2	*TSO 2a.* Explain the working principle of rotational, vibrational and electronic spectroscopy with an example. *TSO 2b.* Describe the role of UV-Vis, IR and NMR spectroscopy in identifying organic functional groups. *TSO 2c.* Interpret the UV-Vis, IR (fingerprint region) and ^{1}H-NMR spectrum of a given simple molecule.	**Unit- 2.0: Spectroscopy & Smart Materials Science (8 hrs)** 2.1 Spectroscopy: fundamentals of rotational, vibrational & electronic spectra; Beer–Lambert law. 2.2 Analytical Tools: UV-Vis, IR (fingerprint region) & NMR principles; applications in identifying organic functional groups. 2.3 Smart Materials: chemical sensors, piezoelectric materials used in MEMS & instrumentation

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2d. Explain the working principles of chemical sensors and piezoelectric materials. *TSO 2e.* Select an appropriate smart material (piezoelectric, chemical sensor) for a stated MEMS and instrumentation application.	
CO3	*TSO 3a.* Explain free-radical, ionic and condensation polymerisation mechanisms. *TSO 3b.* Classify polymers such as PVC, PS, PMMA and PTFE based on their properties and applications. *TSO 3c.* Explain the characteristics and applications of phenol-formaldehyde, epoxy resins and silicones. *TSO 3d.* Apply synthetic rubbers in suitable industrial and engineering applications.	**Unit- 3.0: Industrial Polymers & Advanced Materials (8 hrs)** 3.1 Introduction of Organic reactions, Polymerization: free-radical, ionic and condensation mechanisms; degree of polymerization. 3.2 Classification: thermoplastics vs. thermosets (PVC, PS, PMMA, PTFE). 3.3 Engineering Synthetics: Phenol-formaldehyde, Epoxy resins and Silicones. 3.4 Elastomers**:** synthetic rubbers (Buna-S, Buna-N, Neoprene).
CO4	*TSO 4a.* Explain the principles of electrochemical cells and electrode potentials. *TSO 4b.* Calculate the cell potential / EMF of a given electrochemical cell using the Nernst equation. *TSO 4c.* Explain the primary & secondary cells, Li-ion batteries, Pb-storage and Ni-Cd batteries. *TSO 4d.* Explain the working of an H_2-O_2 fuel cell, a solar cell, Lubricants (Flash point, Fire point, acid value. *TSO 4e.* Explain the mechanisms of corrosion and protective techniques. *TSO 4f.* Explain the properties and behaviour of colloidal systems and adsorption processes**.**	**Unit- 4.0: Electrochemistry, Corrosion & Colloidal (9 hrs)** 4.1 Electrochemical Theory: EMF, electrode potential, Nernst equation; numerical problems. 4.2 Storage Systems: primary & secondary cells, Li-ion batteries, Pb-storage and Ni-Cd batteries. 4.3 Next-Gen Energy: H_2-O_2 and methanol, (fuel cells, solar cells), Lubricants (Flash point, Fire point, acid value. 4.4 Material Durability: corrosion -waterline, stress, pitting, galvanic; protection, cathodic, anodic, coatings, e-coat. 4.5 Colloidal and adsorption
CO5	*TSO 5a.* Explain the principles of the EDTA method for hardness estimation and alkalinity determination.	**Unit- 5.0: Water Chemistry & Environmental Sustainability (8 hrs)** 5.1 Water Analysis: unit of concentration, estimation of hardness by EDTA, and alkalinity.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 5b. Apply water purification and softening techniques in practical situations. *TSO 5c.* Explain the causes and effects of boiler scales, sludge, priming, foaming and caustic embrittlement. *TSO 5d.* Explain the impact of pollution, adulteration and e-waste on the environment and health.	5.2 Purification: lime-soda, zeolite & ion-exchange softening; measurement of BOD and COD. 5.3 Industrial Challenges: boiler scales, sludge, priming, foaming, caustic embrittlement. 5.4 Green Chemistry & Sustainability**:** principles, air/water pollution, adulteration (fat butter, sugar, turmeric powder and chilli powder), E-waste management.

Reference/Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Engineering Chemistry	Jain and Jain	Dhanpat Rai Publishing Co., 17th Ed. (ISBN: 978-9383182626)
2.	A Textbook of Engineering Chemistry	Shashi Chawla	Dhanpat Rai & Co., 2024 Ed. (ISBN: 978-8127262143)
3.	Principles of Materials Science and Engineering	William F. Smith	McGraw-Hill Education, 3rd Ed. (ISBN: 978-0070592025)
4.	Concise Inorganic Chemistry	J.D. Lee	Oxford University Press, 5th Ed. (ISBN: 978-0632052936)

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

Course Code- 100107 **Engineering Graphics and Design** **2 0 0 2**

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply standard conventions and methods of engineering drawing for the representation of engineering components.
CO2	Determine true dimensions of constructed points, lines, and planes and using orthographic projections.
CO3	Develop orthographic projection of solids, sectional views of solids for accurate visualization according to engineering applications.
CO4	Draw isometric views, and development of surfaces of a solid object for various engineering applications.
CO5	Develop 2D and 3D drawings using CAD (Computer-Aided Drafting) software for a given engineering drawing and physical object as per industry standards.

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
CO1	*TSO 1a.* Explain general principles of Engineering Drawing with their significance in engineering communications. *TSO 1b.* Use relevant instruments for engineering drawing. *TSO 1c.* Interpret the given drawing data to solve the given problem. *TSO 1d.* Draw the given regular geometric construction with tangents and normal. *TSO 1e.* Draw the given engineering curve with tangents and normal.	**Unit- 1.0: Fundamentals of Engineering Drawing, Geometrical Constructions and Scales (6 hrs)** 1.1 Principles, significance, BIS conventions, drawing instruments, sheet layout, technical drawings, and dimensioning. 1.2 Drawing Conventions- Different types of lines, lettering, dimensioning systems, symbols. 1.3 Geometric construction related to line, circle, regular Polygons by general method. 1.4 Engineering Scales- Scales on Drawings, Plain scale, Diagonal scale, Vernier scale. 1.5 Engineering Curves- Construction of conic sections (Ellipse, Parabola, and Hyperbola) using General Methods. Cycloidal curves, Involute curves.
CO2	*TSO 2a.* Apply knowledge of First and Third angle method of Projections. *TSO 2b.* Draw 2D projections of given objects *TSO 2c.* Prepare Front View, Top View and Side Views of an object as per first angle projection.	**Unit- 2.0: Orthographic Projection (Multiview Projections) (6 hrs)** 2.1 Principles of Orthographic Projections multi-view projection (First angle and Third angle) conventions. 2.2 Conventions - Projections of Points and lines inclined to both planes

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	TSO 2d. Convert pictorial views into orthographic views. *TSO 2e.* Determine true dimensions of given object as per orthographic projection	2.3 Projections of planes, inclined Planes - Auxiliary Planes. Traces of lines. 2.4 Construction of orthographic projections.
CO3	*TSO 3a.* Draw orthographic Projections of a regular given solid. *TSO 3b.* Develop sectional views of a given object inclined to HP. *TSO 3c.* Develop sectional views of a given object when the sectional plane is inclined to HP. *TSO 3d.* Develop the lateral surfaces of the given regular solids.	**Unit- 3.0: Projection of Regular Solids and Sectional View (6 hrs)** 3.1 Orthographic Projections of regular solids 3.2 Sectional View of Solid when sectional plane is parallel to HP (Horizontal Plane). 3.3 Sectional View of Solid when sectional plane is perpendicular to HP (Horizontal Plane). 3.4 Sectional View of a regular solid when the sectional plane is inclined to HP (Horizontal Plane).
CO4	*TSO 4a.* Apply the concepts of lateral surfaces of given solid (prism/ cylinder/ pyramid/ cone) *TSO 4b.* Use suitable parallel /radial line method in given situations. *TSO 4c.* Apply the concept of sectional solids and prepare development of surfaces. *TSO 4d.* Find out true shape and size of the given sectioned surface. *TSO 4e.* Convert orthographic views into isometric views / projections and vice versa.	**Unit- 4.0: Development of Surfaces & Isometric Projection (5 hrs)** 4.1 Development of lateral surfaces of right regular prisms, cylinders, pyramids and cones resting on HP. 4.2 Parallel Line Method- Used for prisms and cylinders, where all sides or elements are parallel to each other. 4.3 Radial Line Method- Used for pyramids and cones, where the lines or elements radiate outward from a central vertex or apex. 4.4 Isometric Views– conventions – Plane figures, simple and compound solids.
CO5	*TSO 5a.* Develop 2D drawing using CAD software for a given engineering drawing. *TSO 5b.* Develop 2D drawings for physical objects. *TSO 5c.* Develop 3D drawing using CAD software for a given engineering drawing. *TSO 5d.* Develop 3D drawings for physical objects.	**Unit- 5.0: 2D and 3D Drawings Using CAD (Computer-Aided Drafting) Software (5 hrs)** 5.1 2D drawings for a given orthographic projection of objects like screw, nut, bolt etc. 5.2 2D drawings for a given isometric projection of a plumber block. 5.3 2D drawings of physical objects such as screw, nut, bolt, plumber block, washer etc. 5.4 Solid Modeling for a given isometric

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
		projection. 5.5 Solid Modeling a given physical object.

Reference/Books

S. No.	Titles	Author(s)	Publisher and Edition with ISBN
1.	Engineering Drawing	N. D. Bhatt	Charotar Publishing House
2.	Engineering Drawing	P.J. Shah	S. Chand Publisher
3.	Engineering Drawing	K.Venu Gopal & V.Prabu Raja	New Age Publications
4.	Engineering Drawing and Graphics + AutoCAD	Venugopal K.	New age International Publishers, Delhi, 2022, ISBN: 978-8122472752
5.	Engineering Drawing	Basant Agrawal and Agrawal C. M.	Tata McGraw Hill, New Delhi, 2013 ISBN: 978-1259062889
6.	Engineering Graphics	S. K. Pradhan K.K. Jain	Khanna Book Publishing Company Pvt. Ltd., New Delhi ASIN : B0BM5BMMXT ISBN-10 : 9355381891
7.	Bureau of Indian Standards, Engineering Drawing Practice for Schools and Colleges IS: SP-46, BIS,	BIS, Government of India,	BIS, Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

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 (8 hrs)** 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. *TSO 2b.* Trace uninformed search strategies manually and compare their complexity. *TSO 2c.* Trace informed search strategies using suitable	**Unit- 2.0: Problem Solving by Search (9 hrs)** 2.1 Problem formulation and state-space representation 2.2 Uninformed search: BFS, DFS, Uniform Cost Search, Depth-Limited and Iterative Deepening Search

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	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).	2.3 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 (8 hrs)** 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 (7 hrs)** 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)
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	**Unit- 5.0: Introduction to Machine Learning and AI Applications (10 hrs)** 5.1 Machine learning paradigms: supervised, unsupervised, reinforcement learning (concept) 5.2 Overview of regression and classification concepts (linear regression, k-NN, decision trees)

Mapped CO(s) Number	Relevant Major Theory Session Outcomes (TSOs)	Relevant Units/ Body of Knowledge (BoK)
	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.	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
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-C** **Batch (2026-30)**

Course Code-100101P **Communication Skills Lab** **0 0 2 1**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1 CO2 CO4	*LSO 1.1* Integrate all four skills (LSRW) for effective communication *LSO 1.2* Improve accuracy, fluency, and clarity in English usage *LSO 1.3* Develop practical communication competence.	**LE- 1 Skills of Communication (LSRW)** • Listening to audio/video lectures and summarizing, Reading comprehension with group discussion. • Role play on workplace Scenarios, Story/narrative reconstruction from audio input • Group presentations based on reading materials, note-taking, and report writing from lectures
CO1 CO2	*LSO 2.1* Demonstrate effective interpersonal communication *LSO 2.2* Participate in academic activities like presentations and group discussions *LSO 2.3* Communicate effectively across different environments	**LE- 2 Introduction: Social, Academic, and Professional** • Self-introduction and introducing others. • Face-to-face conversation practice. • Role plays (workplace interactions, daily situations) • Group presentations, Group discussion, and practice • Debate and panel discussion, Seminar presentation with Q&A • Situational communication (office, social, academic contexts)
CO3	*LSO 3.1* Recognize audience, context, and Objective of a presentation *LSO 3.2* Deploy appropriate body language, gestures, and eye contact *LSO 3.3* Utilize tools like slides, charts and visuals effectively	**LE- 3 Oral Presentation** ➢ Oral presentation: Audience • Selection, Presentation Techniques ➢ Posture, gesture, and stage presence • Facial expressions • Eye contact techniques ➢ Basics of slide design • Text vs visuals, • Using an image and icon, • Slide timing and pacing, • Common slide mistakes
CO1 CO3	*LSO 4.1* Demonstrate the role of an anchor and speaker in events *LSO 4.2* Introduce speakers, guests, and events effectively	**LE- 4 Anchoring and Addressing** ➢ Role of an anchor vs speaker • Types of anchoring

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	LSO 4.3 Apply body language, gestures, and eye contact effectively	• Event flow management ➢ Formal vs. informal introduction • Avoiding common mistakes • Building audience interest ➢ Emotional connection, • Voice modulation • Movement on stage • Managing nervous habits.
CO2 CO4	*LSO 5.1* Comprehend the expectations of interviewers and candidates *LSO 5.2* Prepare answers to relevant questions *LSO 5.3* Demonstrate active listening during the interview *LSO 5.4* Apply proper greetings and etiquette	**LE- 5 Interview** ➢ Interviews: Types, • Employer vs candidate • Common interview mistakes • SWOT Analysis ➢ Structuring clear and concise answers • Avoiding memorized/robotic answers. ➢ Listening to questions cautiously • Non-verbal listening cues (nodding, eye contact), • Avoiding interruptions ➢ First impressions in interviews, • Professional greetings (verbal + non-verbal)
CO2 CO4	*LSO 6.1* The purpose and types of group discussions *LSO 6.2* Perform in different roles such as initiator, participant, and moderator *LSO 6.3* Analyse topics from multiple perspectives	**LE- 6 Group Discussion** ➢ GD: types • (academic, professional, selection-based) • Do's and Don'ts in GD ➢ Role of initiator • Role of participant • Role of moderator/leader • Managing interruptions, • Handling conflicts and disagreements ➢ Structuring arguments logically, • Supporting points with examples/data.
CO1 CO2 CO3	*LSO 7.1* Differentiate between debate, seminar, symposium, and conference *LSO 7.2* Respond to other speakers'	**LE- 7 Debate, Seminar, Symposium, Conference**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO4 CO5	viewpoints *LSO 7.3* Apply basic research techniques on assigned topics	➢ Debate • Seminar, • Symposium, • Conference. ➢ Paraphrasing and summarizing • Avoiding interruptions • Constructive feedback techniques • Identifying reliable sources (websites, journals, reports), • Note-taking and organizing information, • Plagiarism • Converting research into speaking points, • Using data/examples
CO1 CO2 CO5	*LSO 8.1* Generate creative and original ideas on unfamiliar topics *LSO 8.2* Use imagination effectively in communication *LSO 8.3* Express ideas clearly and logically within a short time	**LE- 8 Just A Minute Technique with Out of the Box Thinking** ➢ Techniques for Idea Generation • Brainstorming, • Mind mapping • SCAMPER technique (Substitute, Combine, Adapt, Modify, put to other use, Eliminate, Reverse) ➢ Storytelling • Creating mental images through words • Emotional connection and expression ➢ Speaking within time limits • Organizing thoughts quickly,
CO5	*LSO 9.1* Apply basic concepts of phonetics and pronunciation *LSO 9.2* Use the International \ Phonetic Alphabet (IPA) symbols *LSO 9.3* Improve clarity and accuracy in pronunciation	**LE- 9 Sounds, Intonation, and IPA** ➢ Phonetics • Sounds: Vowels and consonants, • Syllables and word stress • Common pronunciation errors influenced by mother tongue) ➢ IPA symbols for English sounds, • IPA for vowels (short, long, diphthongs), • IPA for consonants, using a dictionary with IPA Stress marks in IPA

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
		➢ Word stress and sentence stress, • Commonly mispronounced words, • Rhythm and fluency • Self-correction techniques,
CO3 CO5	*LSO 10.1* Identify the purpose of role play, peer learning, and group activities *LSO 10.2* Adapt communication style based on roles and situations *LSO 10.3* Develop creative thinking and problem-solving skills	**LE- 10 Activities: Role Play, Peer Activities, and Group Activities** • Role Play • Group Activities ➢ Role-Based Communication • Situational Communication • Tone, language, and • Behaviour adjustment, • Verbal and non-verbal • adaptation, ➢ Problem-solving • Creative thinking techniques • Decision-making • Evaluating multiple • solutions, • Real-life problem • Innovation and idea • generation.

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

Course Code-100103P **Engineering Chemistry Lab** **0 0 2 1**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO5	*LSO 1.1* Calibrate and operate a digital pH meter accurately *LSO 1.2* Perform acid-base titration to determine the molarity and pH of the unknown acid.	LE- 1 Determination of pH of a given acid solution using a standard sodium hydroxide solution.
CO5	*LSO 2.1* Prepare a standard EDTA solution *LSO 2.2* Calculate Total, Temporary, and Permanent hardness in terms of $CaCO_3$ equivalents.	LE- 2 Estimation of hardness of water by the EDTA method.
CO5	*LSO 3.1* Operate the ion exchange column. *LSO 3.2* Evaluate the efficiency of the softening process by comparing hardness before and after treatment.	LE- 3 Removal of hardness of water by ion exchange method.
CO5	*LSO 4.1* Perform the titration to estimate hardness *LSO 4.2* Determine the Hardness of water.	LE- 4 Estimation of the hardness of water by the alkalinity method
CO4	*LSO 5.1* Set up a potentiometric cell using reference and indicator electrodes. *LSO 5.2* Determine the equivalence point of a redox titration (e.g., Fe^{2+} vs $K_2Cr_2O_7$) from an EMF vs Volume graph.	LE- 5 Potentiometric determination of redox potentials and emf.
CO3	*LSO 6.1* Detect specific functional groups (such as Alcohols, Phenols, Aldehydes, or Acids) using characteristic chemical reagents. *LSO 6.2* Use the physical properties to narrow down the identity of an unknown organic sample.	LE- 6 Identification of organic substances and their functional groups.
CO5	*LSO 7.1* Perform Standard tests *LSO 7.2* Interpret the results to identify the sources of adulteration	LE- 7 Test of adulteration of fat butter, sugar, turmeric powder and chilli powder
CO4	*LSO 8.1* Use standard analytical procedures. *LSO 8.2* Determine the saponification value and acid value of the given oil sample *LSO 8.3* Observe and record the colour change of indicators to find the exact endpoint of the reaction.	LE- 8 Saponification/acid value of an oil.
CO5	*LSO 9.1* Estimate the residual chlorine content in a water sample using colourimetric analysis. *LSO 9.2* Demonstrate safe laboratory practices while handling water samples and chemical reagents.	LE- 9 Estimation of Residual Chlorine in a water sample by Colourimetric analysis.
CO2	*LSO 10.1* Prepare a sample for the FT-IR machine (such as using a liquid film or a solid pellet).	LE- 10 Identification of organic functional groups in an unknown sample using FT-IR Spectroscopy.

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	LSO 10.2 Identify key peaks and valleys in an IR spectrum to recognize groups like –OH (Alcohols), C=O (Carbonyls), and -NH2 (Amines).	
CO2	*LSO 11.1* *Perform* TLC to separate amino acids in a mixture. *LSO 11.2* *Determine* R_f values and *identify* amino acids	LE- 11 Qualitative analysis of a mixture of amino acids by TLC and visualisation under UV light.
CO4	*LSO 12.1 Operate the Flash Point apparatus* *LSO 12.2 Determine the flash point and pour.*	LE- 12 Determination of Flash point, Pour point.
CO3	*LSO 13.1* Use standard polymerisation techniques. *LSO 13.2* Prepare the resin. *LSO 13.3* Follow safe laboratory practices during polymer synthesis and handling of chemicals	LE- 13 Synthesis of polymer like Urea-formaldehyde resin.

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

Course Code-100107P **Engineering Graphics and Design Lab** **0 0 4 2**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1	*LSO 1.1* Use manual drawing instruments and BIS conventions properly. *LSO 1.2* Identify various types of lines and uses in engineering drawing	LE- 1 Basics of Engineering Drawing.
CO1	*LSO 2.1* Draw engineering curves and engineering scales accurately using appropriate methods.	LE- 2 Geometrical constructions of lines, circles, curves, tangents and regular polygons.
CO2	*LSO 3.1* Draw projections of points and lines. *LSO 3.2* Analyze the concepts of Orthographic Projections	LE- 3 Orthographic Projection First/Third Angle method of projections, projection of points & projection of lines in different positions.
CO2, CO3	*LSO 4.1* Drawing 2D Views using Orthographic Projections *LSO 4.2* Apply orthographic projection principles to obtain true length and true shape in given situation.	LE- 4 Drawing views of objects (plane and solid) using Orthographic Method of Projection.
CO3	*LSO 5.1* Draw projections of solids in different orientations. *LSO 5.2* Analyze the concepts of Isometric Projections *LSO 5.3* Draw sectional views and determine the true shape of sections.	LE- 5 Orthographic Projection of solids (prisms, pyramids, cylinders, cones and auxiliary views) and also sectional view.
CO3	*LSO 6.1* Draw multiview orthographic projections of engineering objects. *LSO 6.2* Interpret pictorial and orthographic views.	LE- 6 Conversion between pictorial and orthographic views.
CO4	*LSO 7.1* Drawing 3D objects on 2D surfaces using Isometric Projections.	LE- 7 Drawing objects using Isometric Projections.
CO4	*LSO 8.1* Convert orthographic views into isometric views.	LE- 8 Orthographic–isometric conversion.
CO4	*LSO 9.1* Develop lateral surfaces of solids	LE- 9 Drawing objects using Development of surfaces (prisms, pyramids, cylinders and cones)
CO5	*LSO 10.1* Use commands in draw, modify, annotate and layer panels	LE- 10 Introduction to AutoCAD – 2D drawing.
CO5	*LSO 11.1* Develop 2D drawings using CAD software for orthographic projection	LE- 11 Develop 2D drawings using CAD software for a given engineering drawing – drawings of like screw, nut, bolt.

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO5	*LSO 12.1* Develop 2D drawings using CAD software for an isometric project.	LE- 12 Develop 2D drawings using CAD software for a given engineering drawing – drawing of engineering components.
CO5	*LSO 13.1* Prepare 2D engineering drawings using CAD	LE- 13 Preparation of orthographic, sectional and isometric drawings of engineering components/layouts.
CO5	*LSO 14.1* Prepare 2D drawings in CAD software for physical engineering objects	LE- 14 Preparation of basic 3D models and engineering drawings of machine components,

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

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.
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)**

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
		• 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. *LSO 10.3* Display the stored data on the console. *LSO 10.3* Design search logic to extract specific file records based on keywords.	**LE- 10 File Handling Operations** • 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	**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.

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	interfaces for interacting with internal object states. *LSO 11.3* Instantiate multiple objects to demonstrate independent state management within the given class framework.	
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 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.	**LE- 15 Polymorphism & Abstract Classes** • 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-	**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."

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	handling logic to prevent invalid data entry.	
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.

B.Tech (1st Semester) **GROUP-C** **Batch (2026-30)**

Course Code- 100113P **Sports/Yoga/NCC/NSS** **0 0 2 1**

Course Outcomes (COs)	Course Outcome Statements
CO1	Apply the principles of health, physical fitness, nutrition, sports, and healthy lifestyle practices for enhancing personal well-being and professional effectiveness.
CO2	Perform fundamental yogic postures, breathing techniques (Pranayama), and yogic principles for improving flexibility, posture, and physical fitness
CO3	Apply meditation and relaxation techniques to improve concentration, emotional balance, stress management, and mental well-being.
CO4	Participate effectively in sports and recreational activities while demonstrating teamwork, leadership, sportsmanship, ethics, and discipline and develop a personal lifelong fitness and wellness programme

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
CO1	*LSO 1.1* Measure and interpret personal health and fitness indicators *LSO 1.2* Follow safe exercise practices	LE- 1 Assessment of Body Mass Index (BMI), resting heart rate and physical fitness parameters
	LSO 1.3 Physical fitness tests (Sit-and-Reach, Push-up, Sit-up, Shuttle Run, Standing Broad Jump)	LE- 2 Evaluate Flexibility using standard fitness tests.
		LE- 3 Evaluate Endurance using standard fitness tests.
		LE- 4 Evaluate muscular strength using standard fitness tests.
		LE- 5 Evaluate agility using standard fitness tests.
	LSO 1.4 Perform warm-up and stretching exercises safely before and after physical activity	LE- 6 Practice of warm-up, stretching and cool-down exercises
	LSO 1.5 Prepara individual weekly fitness and nutrition plan	LE- 7 Develop a simple fitness and healthy lifestyle plan based on personal fitness assessment.
CO2	*LSO 2.1* Perform standing yoga postures with correct posture and balance.	LE- 8 Perform Standing Asanas (Tadasana, Trikonasana, Vrikshasana
	LSO 2.2 Demonstrate sitting and relaxation postures to improve flexibility and digestion.	LE- 9 Perform Sitting Asanas (Vajrasana, Paschimottanasana, Pavanamuktasana)
	LSO 2.3 Perform prone postures for strengthening the back and improving spinal flexibility.	LE- 10 Practice of Prone Asanas (Bhujangasana, Shalabhasana, Makarasana

Mapped CO(s) Number	Practical/ Lab Session Outcomes (LSOs)	Laboratory Experiment/ Practical Titles
	LSO 2.4 Perform breathing techniques to improve respiratory efficiency and concentration	LE- 11 Practice of Pranayama (Deep Breathing, Anulom-Vilom, Bhramari and Kapalbhati)
CO3	*LSO 3.1* Perform mindfulness meditation to improve attention and concentration.	LE- 12 Practice of Mindfulness Meditation
	LSO 3.2 Perform breath awareness and chanting techniques for mental relaxation.	LE- 13 Practice of Om Chanting and Breath Awareness Meditation
	LSO 3.3 Apply relaxation techniques to reduce stress and improve mental calmness.	LE- 14 Practice of Shavasana and Guided Relaxation (Yoga Nidra)
	LSO 3.4 Monitor personal stress levels and evaluate the benefits of regular meditation practice.	LE- 15 Daily Meditation Log and Stress Self-Assessment
CO4	*LSO 4.1* Practice and demonstrate basic athletic skills with proper techniques	LE- 16 Practice fundamental skills in Athletics (Sprint, Relay, Long Jump or Throw Events)
	LSO 4.2 Practice and demonstrate basic game skills, teamwork and communication during play	LE- 17 Practice fundamental skills in one Team Game (Volleyball, Football, Basketball, Cricket or Kho-Kho)
	LSO 4.3 Apply the basic rules of games and demonstrate leadership and fair play.	LE- 18 Officiating and Conduct of Mini Sports Competition
	LSO 4.4 Design and implement a personal fitness programme for lifelong health and wellness.	LE- 19 Preparation and presentation of a Personal Lifelong Fitness and Wellness Programme including Stress Management Practices