SHIV NADAR
UNIVERSITY
CHENNAI

Rajiv Gandhi Salai, Kalavakkam – 603 110

SSN School of Engineering

DEPARTMENT OF INFORMATION TECHNOLOGY

B.TECH. INFORMATION TECHNOLOGY

CURRICULUM & SYLLABUS

REGULATIONS 2025

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will apply strong foundations in information technology, computing, data science, and artificial intelligence, and leverage latest and emerging technologies to analyze and solve complex real-world engineering problems in industry, research, and academia.

PEO 2: Graduates will develop innovative IT solutions, products, and services using emerging technologies and demonstrate leadership, entrepreneurship, and professional excellence in their careers.

PEO 3: Graduates will practice information technology with professional ethics, social responsibility, and environmental awareness, contributing to sustainable technological development

PEO 4: Graduates will pursue lifelong learning, adapt to evolving technologies, and collaborate effectively in multidisciplinary teams to address global technological challenges.

PROGRAM OUTCOMES (POs)

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization to develop to the solution of complex engineering problems. (WK1 to WK4)

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Intelligent Data and Computational Systems: Graduates will be able to analyze and model complex computing problems using data structures, algorithms, and statistical techniques, and develop intelligent solutions using data science, machine learning, deep learning, and generative AI technologies

PSO 2: Scalable Software and Distributed Systems Development: Graduates will be able to design, develop, and deploy scalable software systems and applications using modern computing platforms such as full-stack development frameworks, cloud and edge computing, Internet of Things, mobile computing, and distributed systems.

PSO 3: Secure and Emerging Technology Solutions: Graduates will be able to design innovative and secure IT solutions by applying emerging technologies such as cybersecurity, information security, GPU computing, AR/VR systems, and quantum computing, while addressing societal and technological challenges.

CURRICULUM

SEMESTER – I

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Mathematics I	MD	4	3	1	0	4
2	Engineering Physics	MD	3	3	0	0	3
3	Communicative English	AEC	4	2	0	2	3
4	Computational Thinking and Problem Solving with Python	MC	4	2	0	2	3
5	Introduction to Web Programming	MC	4	2	0	2	3
6	Professional Ethics and Human Values	VAC	2	2	0	0	2
7	Engineering Physics Laboratory	MD	4	0	0	4	2
8	Open-Source Tools and Prompt Engineering	SEC	4	0	0	4	2
9	Extra Academic Activity 1*	VAC	2	0	0	2	1*
Total			**31**	**14**	**1**	**16**	**22+1***

SEMESTER - II

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Mathematics II	MC	3	3	0	0	3
2	Technical Writing	AEC	4	2	0	2	3
3	Electrical and Electronics Essentials for IT	MC	2	2	0	0	2
4	Environmental Science	VAC	2	2	0	0	2
5	C Programming and Data Structures	MC	3	3	0	0	3
6	Data Science Principles and Analytical Tools	MC	4	2	0	2	3
7	Introduction to AR/VR	SEC	4	0	0	4	2
8	C Programming and Data Structures Laboratory	MC	4	0	0	4	2
9	Extra Academic Activity 2*	VAC	2	0	0	2	1*
Total			**28**	**14**	**0**	**14**	**20+1***

***Note at a later page on Extra Academic Activity.**

SEMESTER – III

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Mathematical Foundations for Computing Technology	MS	3	3	0	0	3
2	Object Oriented Programming with Java	MC	2	2	0	0	2
3	Artificial Intelligence Concepts and Applications	MS	2	2	0	0	2
4	Digital Systems and Microprocessors	MC	6	2	0	4	4
5	Design, Thinking, Innovation and Entrepreneurship	SEC	2	0	0	2	1
6	Information and Communication Systems	SEC	2	2	0	0	2
7	Advanced Data Structures and Design and Analysis of Algorithms	MC	4	2	0	2	3
8	Object Oriented Programming with Java Laboratory	MC	4	0	0	4	2
9	Introduction to Cyber Security	SEC	2	0	0	2	1
10	Interactive Engineering Graphics	VAC	2	0	0	2	1
Total			**29**	**13**	**0**	**16**	**21**

SEMESTER – IV

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Principles of Software Engineering and Practices	MC	3	3	0	0	3
2	Computer Organization and Architecture	MC	3	3	0	0	3
3	Database Management Systems	MC	3	3	0	0	3
4	Pattern Recognition and Machine Learning	MC	4	2	0	2	3
5	Data Analytics and Business Intelligence	MS	4	2	0	2	3
6	Principles of Operating Systems	MC	4	2	0	2	3
7	Database Management Systems Laboratory	MC	4	0	0	4	2
8	GPU Architectures	SEC	2	0	0	2	1
9	Independent Research / Extra Academic Activity	MD	2	0	0	2	1
10	Engineering Practice Lab	VAC	2	0	0	2	1
Total			**31**	**15**	**0**	**16**	**23**

SEMESTER – V

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Full Stack Development	MC	6	2	0	4	4
2	Data Communication and Networks	MC	6	2	0	4	4
3	Automata Theory and Compiler Design	MC	3	3	0	0	3
4	Deep Learning Concepts and Architectures	MS	4	2	0	2	3
5	Quantum Computing Fundamentals	MS	2	2	0	0	2
6	Mini Project	MC	6	0	0	6	3
7	Independent Research / Extra Academic Activity	MD	2	0	0	2	1
Total			**29**	**11**	**0**	**18**	**20**

SEMESTER - VI

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Generative AI and Agentic Systems	MC	3	3	0	0	3
2	Cloud and Edge Computing	MC	5	3	0	2	4
3	Internet of Things and Artificial Intelligence of Things	MC	5	3	0	2	4
4	Program Minor 1	MS	3	3	0	0	3
5	Program Minor 2	MS	3	3	0	0	3
6	Capstone Project Phase 1	PD	8	0	0	8	4
7	Mobile Application Development Laboratory	MC	4	0	0	4	2
Total			**31**	**15**	**0**	**16**	**23**

SEMESTER - VII

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Information Security and Cryptography	MC	5	3	0	2	4
2	Distributed and Parallel Computing	MC	3	3	0	0	3
3	Program Minor 3	MS	3	3	0	0	3
4	Program Minor 4	MS	3	3	0	0	3
5	Program Minor 5	MS	2	2	0	0	2
6	Ability Enhancement Course	AEC	2	2	0	0	2
7	Capstone Project Phase 2	PD	12	0	0	12	6
8	Internship	SI	4	0	0	4	2
Total			**34**	**16**	**0**	**18**	**25**

The following is a list of courses that are offered under the Ability Enhancement Course:
1. Writing for Research
2. Creative Writing
3. Psychology and Communication
4. Professional Communication

SEMESTER - VIII

Sl. No	Course Title	Course Category	Contact Periods	L	T	P	C
1	Program Minor – 6	MS	2	2	0	0	2
2	Program Minor – 7	MS	3	3	0	0	3
3	Capstone Project Phase 3	PD	4	0	0	4	2
Total			**9**	**5**	**0**	**4**	**7**

COURSE SUMMARY

The listed courses are broadly classified as per the recommendations from the UGC.

Sl. No.	Broad Category of Course	Minimum Credit Requirement	Credit Distribution (SNU)
1	Major Core (MC)	80	81
2	Minor Stream (MS)	32	32
3	Multidisciplinary (MD)	09	11
4	Ability Enhancement Course (AEC)	08	08
5	Skill Enhancement Course (SEC)	09	09
6	Value Added Courses (VAC)	06-08	06+2*
7	Summer Internship (SI)	02-04	02
8	Project Dissertation (PD)	12	12
Total		**160**	**161+2***

The semester wise credit breakup of the Curriculum based on the above credit breakup proposed by the UGC is as follows:

Semester / Category	MC	MS	MD	AEC	SEC	VAC	SI	PD	TOTAL
1	6	-	9	3	2	2+1*	-	-	**22+1***
2	13	-	-	3	2	2+1*	-	-	**20+1***
3	11	5	-	-	4	1	-	-	**21**
4	17	3	1	-	1	1	-	-	**23**
5	14	5	1	-	-		-	-	**20**
6	13	6	-	-	-	-	-	4	**23**
7	7	8	-	2	-	-	2	6	**25**
8	-	5	-	-	-	-	-	2	**7**
Total	**81**	**32**	**11**	**8**	**9**	**6+2***	**2**	**12**	**161+2***

*The credits earned through the Extra Academic Activities under Value added courses are not included in the calculation of Cumulative Grade Point Average (CGPA).

MINOR STREAMS

The Department of Information technology offers its students the following list of Minor Streams.

- AI Engineering and Automation
- AI for Smart Manufacturing (Foundation minor)

Each Minor Stream has seven courses worthn19 credits. The student must enroll in any one of the above two Minor streams. Minor Streams tagged with Foundations must not be enrolled by students whose Major Core courses overlap with the listed courses in the Minor Stream.

MINOR STREAM 1 - Artificial Intelligence and Automation

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Mathematical Fundamentals for Machine Learning	6	3	3	0	0	3
2	Optimization Techniques for Machine Learning	6	3	3	0	0	3
3	Speech and Natural Language Processing	7	2	2	0	0	2
4	Minor Stream Basket 1	7	3	3	0	0	3
5	Minor Stream Basket 2	7	3	3	0	0	3
6	Minor Stream Basket 3	8	3	3	0	0	3
7	Minor Stream Basket 4	8	2	2	0	0	2

The following is the list of courses that are offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit courses)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Multi- Agent Systems	MLOps and MLOps Pipelines	Applied Time Series and Sequential Data	Ethical and Observable AI
Deep Reinforcement Learning	Edge Intelligence	Advanced Optimization for ML	Foundations of Software Project Management
Computer Vision and Robotics	Forensic Analytics	Social Network Analysis	Advanced Java Programming with Spring boot
			Introduction to Game Design

MINOR STREAM 2 - AI for Smart Manufacturing

Sl. No.	Course Title	Semester	Contact Hours	L	T	P	C
1	Introduction to AI and Machine Learning	6	4	2	0	2	3
2	Databases and Applications Development	6	4	2	0	2	3
3	Introduction to Data Structures and Algorithms	7	4	2	0	2	3
4	Minor Stream Basket 1	7	3	3	0	0	3
5	Minor Stream Basket 2	7	2	2	0	0	2
6	Minor Stream Basket 3	8	2	2	0	0	2
7	Minor Stream Basket 4	8	4	2	0	2	3

The following is the list of courses that are offered under the ***Minor Stream Baskets***:

Minor Stream Basket 1 (3 Credit)	***Minor Stream Basket 2 (3 Credit courses)***	***Minor Stream Basket 3 (2 Credit courses)***	***Minor Stream Basket 4 (2 Credit courses)***
Generative AI and digital twins	Fundamentals of Augmented Reality and Virtual Reality	Industrial Internet of Things and Industry 4.0	Image Processing and Computer Vision
Applied AI for Manufacturing	Introduction to Cloud Computing	Real Time Embedded Systems	Bio-inspired Optimization Techniques
Modelling and Simulation of Manufacturing Systems			

Note: Students from B.Tech. (IT) must not opt for this Minor Stream.

MICRO SPECIALIZATION

The University offers Micro-Specializations to Undergraduate students. Its salient features are as follows:

Each Micro-Specialization has a defined structure in terms of three sequential components:

Component I - One Foundation course that constitutes a mandatory requirement and also a prerequisite for subsequent components.
Component II - Two courses from a specified vertical.
Component III - Project/Design/Term Paper (3)

A Student would be required to complete all three components (10-14 credits) from the specified stream to earn a Micro-Specialization.

Provisional List of Micro-Specialization Verticals

The following are the micro-specialization verticals that will be offered by our department:

Applied AI for Strategic Decisions

Component I

AI Launchpad: Understanding Data, Analytics and Intelligent Systems

Data Literacy and Data Types — Structured vs Unstructured Data — Data Collection and Quality — Exploratory Data Analysis — Data Visualisation Principles — Introduction to Statistical Thinking — Supervised and Unsupervised Learning Concepts — Neural Networks and Deep Learning Fundamentals — No-Code and Low-Code AI Tools — AI Model Evaluation and Interpretation — Real-World Case Studies in Business, Engineering and Law

Component II

1)AI in Practice: Predicting Outcomes, Optimising Operations and Improving Systems Predictive Analytics

Fundamentals — Fault Detection and Predictive Maintenance — AI in Quality Control and Supply Chain — Interpreting Model Outputs and Confidence Scores — Workflow Automation and Decision Support Systems — Evaluating and Selecting AI Tools — AI Governance and Adoption Frameworks — Responsible AI in Engineering and Operational Contexts

2) GenAI and Business Intelligence for Professionals

Generative AI Fundamentals — Large Language Models and Prompt Engineering — Retrieval-Augmented Generation (RAG) Concepts — AI-Assisted Research and Document Summarisation — Professional Use Cases: Legal Document Review, Business Report Generation and Academic Research — Responsible and Ethical Use of GenAI — Dashboard Design and Data Storytelling — Demand Forecasting and Customer Behaviour Analytics — AI Strategy and Regulatory Frameworks — Tools: ChatGPT, Microsoft Copilot, Power BI, Tableau

SYLLABUS

SEMESTER - I

Course Code	Category	MATHEMATICS I (Common to CSE, IT)	L	T	P	C	Contact Hours
	MD		3	1	0	4	4
Course Level		*Prerequisite Courses: Nil*					

Course Objectives:

This course aims to:

1. Introduce the concepts of limits, continuity, and differentiation, including an introduction to partial derivatives and gradients.
2. Cover the techniques of integration and their applications.
3. Familiarize with the sequences, series, and power series.
4. Introduce the basic concepts, classifications, and methods for solving first-order ordinary differential equations.
5. Cover methods for solving higher-order ordinary differential equations and introduce optimization with constraints using Lagrange multipliers.

Unit 1 CALCULUS (12 HOURS)

Limits, Continuity, Increment Theorem, Chain Rules, Extreme Values, Antiderivatives - The Definite Integral - The Fundamental Theorem of Calculus - Techniques of Integration (Substitution, Partial Fractions, Integration by Parts, Bernoulli's formula), Applications of Integration (Area, Volume, Arc Length), Surface Area of solids of Revolution - Improper Integrals.

Unit 2 VECTOR CALCULUS (12 HOURS)

Vectors in 2-space and 3-space, Scalar product, Vector product, Scalar and vector functions, Curl and Divergence of a vector field, Level curves and surfaces, Directional Derivative, Normal to Level Curve and Tangent Planes, Line Integral, Line Integral of Vector Fields, Conservative Fields, Green's Theorem, Surface Integral of a Vector Field, Stokes' Theorem, Gauss' Divergence Theorem.

Unit 3 SEQUENCES AND SERIES (12 HOURS)

Sequences - Convergence and Divergence - Series - geometric series, Convergence Tests (Integral Test, Comparison Tests, Ratio Test, Root Test) - Alternating Series - Absolute and Conditional Convergence - Power Series - Taylor and Maclaurin Series.

Unit 4 FIRST-ORDER DIFFERENTIAL EQUATIONS (12 HOURS)

Introduction to Differential Equations - Classification of Differential Equations (Order, Linearity - Solutions of Differential Equations - Initial Value Problems - First-Order ODEs: Separable Equations, Linear Equations, Exact Equations, - Applications of First-Order ODEs.

Unit 5 FUNCTIONS OF SEVERAL VARIABLES (12 HOURS)

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications: Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

References:

1. Stewart, J. (2015). *Calculus*. Cengage Learning.
2. Thomas, G. B., Weir, M. D., & Hass, J. (2014). *Thomas' Calculus*. Pearson.
3. Zill, D. G., & Wright, W. S. (2017). *Differential Equations with Boundary-Value Problems*. Cengage Learning.
4. Boyce, W. E., DiPrima, R. C., & Meade, D. B. (2017). *Elementary Differential Equations and Boundary Value Problems*. Wiley.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Understand and apply fundamental concepts of differential and integral calculus.	
CO2	Apply the concepts of integration to analyze the vector fields.	
CO3	Apply various test methods to study the convergence of sequences and series.	
CO4	Solve various types of first-order ordinary differential equations.	
CO5	Understand functions of two variables and apply them to solve optimization problems.	

Course Code	Category	ENGINEERING PHYSICS (Common to EEE, ECE, CSE & IT)	L	T	P	C	Contact Hours
	MD		3	0	0	3	3
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This is an introductory physics course that aims to enhance the understanding of physics concepts in the different areas of speech, ultrasonics, lasers, optical communication and quantum mechanics that are of relevance to respective engineering programs. The course will enable the students to

- Understand the perception of sound, its metrics, and production and applications of ultrasound.
- Understand basics of quantum mechanics and associated theories.
- Explain physics of semiconductors.
- Describe the principle of laser action and working of lasers.
- Analyze the propagation of light through optical fibres and its application to communication systems and sensors

UNIT 1: ACOUSTICS (4 HOURS)

Classification- Music & Noise - Characteristics of Sound: Pitch/Frequency, Loudness/Intensity-decibel scale - Weber–Fechner law – Loudness Curves- Quality/Timbre

UNIT 2: ULTRASONICS (5 HOURS)

Production - Magnetostriction and Piezoelectric methods – Detection – Piezoelectric, Acoustic grating – Non Destructive Testing – pulse echo system -reflection and transmission modes –Modes of data presentation- A, B and C scan displays – Sonogram.

UNIT 3: QUANTUM PHYSICS (9 HOURS)

Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh-Jeans law from Planck's theory – Properties of Matter waves - wave particle duality - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states – Quantum free electron theory – Density of states – Fermi-Dirac statistics– Free electron concentration in metals.

UNIT 4: SEMICONDUCTORS (9 HOURS)

Classification of semiconductors based on doping and band gap – Intrinsic semiconductor – Concept of hole – carrier concentration derivation –Fermi level and its variation with temperature – electrical conductivity – band gap determination –Extrinsic semiconductors – Carrier concentration derivation in n-type and p-type semiconductors – Variation of Fermi level with temperature and impurity concentration.

UNIT 5: LASERS (9 HOURS)

Interaction of Radiation with Matter-Spontaneous and stimulated emissions– Einstein's A and B coefficients – Conditions for Laser action –Population inversion – Active medium – pumping schemes – Optical resonant cavity- Light Amplification-Types of lasers – Nd: YAG, CO2 and Semiconductor lasers- homo junction & hetero junction laser.

UNIT 6: FIBRE OPTICS (9 HOURS)

Principle and propagation of light in optical fibres –Numerical aperture and Acceptance angle, Classification of optical fibres (material, mode & refractive index) – Losses in fibres – attenuation, dispersion – Fibre optical communication system (Block diagram) – Active and passive sensors – pressure, strain, displacement.

TEXTBOOK:

1. M. N. Avadhanulu, P. G. Kshirsagar , "A text book of Engineering Physics" , S. Chand & Co. Ltd. Revised Edition 2014

REFERENCE BOOKS:

1. Kasap, S.O., Principles of Electronic Materials and Devices, (Special Indian Editio McGraw-Hill Education, 3rd Edition, 2017.
2. Kittle Charles, "Introduction to Solid State Physics", Wiley, 2004
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai publishers, 2012
4. Halliday, D., Resnick, R. & Walker, J. — Principles of Physics. Wiley, 2015.
5. James Beauchamp (Editor) - Analysis, Synthesis, and Perception of Musical Sounds –The Sound of Music- Springer; 2007 th Edition (December 19, 2006)
6. Serway, R.A. & Jewett, J.W. — Physics for Scientists and Engineers. Cengage Learning, 2010.
7. Tipler, P.A. & Mosca, G. — Physics for Scientists and Engineers with Modern Physics', W.H.Freeman, 2007.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Analyze the characteristics and perception of sound, understand production and detection of ultrasonic waves and their applications.	KL4
CO2	Explain the basic quantum mechanical concepts and their applications.	KL3
CO3	Analyze the physics of semiconductors	KL4
CO4	Explain the principle, properties and working of different types of lasers Illustrate the principle of light propagation,	KL3
CO5	causes for losses and dispersion and evaluate their impact on fiberoptic communication systems and working of fiberoptics displacement, pressure and strain sensors	KL4

Course Code	Category	COMMUNICATIVE ENGLISH	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. Enhance conversation fluency and networking skills in English.
2. Contribute efficiently to meetings and group discussions.
3. Deliver well-structured presentations and participate in interviews.
4. Learn the language and strategies of successful negotiations.
5. Communicate effectively during conflict-resolving situations.

UNIT 1: CONVERSATION AND NETWORKING SKILLS (12 HOURS)

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Role-plays as a technique for practicing conversation. Writing professional emails.

UNIT 2: MEETING AND GROUP DISCUSSION SKILLS (12 HOURS)

Setting up and holding meetings; organizing and conducting effective meetings; learning the language used to lead a meeting; practicing how to agree and disagree with ideas and people politely. Research and pre-meeting preparation and mock meetings. Making notes, summarizing, and reporting in meetings. Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Research and pre-GD preparation, and mock GDs for practice.

UNIT 3: PRESENTATION AND INTERVIEW SKILLS (12 HOURS)

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Advance topic research and mock presentations for practice. Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interviewing language skills. Mock interviews for practice.

UNIT 4: NEGOTIATION SKILLS AND ASSERTIVENESS (12 HOURS)

Negotiation strategies; negotiating effectively; exchanging and comparing information; building rapport with people; practicing the language used in negotiations; considering and respecting cultural

differences while negotiating; making compromises. Communication styles: passive, aggressive and assertive. Reading case studies and mock negotiation role plays.

UNIT 5: CONFLICT RESOLUTION AND DECISION-MAKING SKILLS (12 HOURS)

Resolving conflicts: listening actively to ideas; handling people smoothly; dealing with and attempting to solve conflicting problems. Making a decision: thinking about various possibilities before decision-making; communicating the pros and cons of a decision; presenting a mutually beneficial solution. Reading case studies and mock conflict resolution role plays. Developing cross-cultural communication skills.

TEXTBOOKS:

1. Bovee, C. L.& Thill, J. V. (2016). Business Communication Today, 15/e. Pearson Education India.
2. Beebe, S. A., & Mottet, T. P. (2021). Business and Professional Communication (3rd ed). Pearson Higher Education AU.
3. Herbert Hirsch. (2007). Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals, 2nd edition. Wiley-IEEE Press.

REFERENCES:

1. Dodd, C. H. (2012). Managing business and professional communication (3rd ed). Allyn & Bacon/Pearson.
2. Dwyer, J. (2012). Communication for Business and the Professions: Strategies and Skills (7th ed). Pearson Higher Education AU.
3. Gill Hasson. (2012). Brilliant Communication Skills: What the Best Communicators Know, Do and Say. Ft Pr.
4. Jones, L., & Alexander, R. (2011). New international business English updated edition student's book: Communication skills in English for business purposes (Vol. 3). Cambridge university press.
5. Kerry Patterson, Joseph Grenny, Ron McMillan and Al Switzler. (2013). Crucial Conversations: Tools for Talking When Stakes Are High. Brilliance Audio.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Develop conversation skills and networking skills in English	KL3
CO2	Communicate effectively in meetings and group discussions	KL4
CO3	Deliver engaging presentations and professional interviews	KL5
CO4	Speak and negotiate strategically in formal and informal settings	KL4
CO5	Present effectively during conflict resolving situations	KL5

Course Code	Category	COMPUTATIONAL THINKING AND PROBLEM SOLVING WITH PYTHON	L	T	P	C	Contact Hours
	MC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To learn problem-solving strategies.
2. To learn programming constructs in Python.
3. To learn modularity in problem solving.
4. To solve complex problems using sequenced data types and advanced constructs like dictionaries and files of Python.
5. To develop simple software projects using Python.

UNIT 1: ALGORITHMIC PROBLEM SOLVING (6 HOURS)

Problem Solving and Algorithmic Thinking Overview – Algorithms – Properties, Constituents of Algorithms: Sequence, Selection and Repetition – Designing Algorithms, Expressing and Analyzing Algorithms (pseudo code, flow chart). Algorithms vs Programs – Logical Reasoning – Logical Errors – Problem Definition – Problem Understanding and Analysis – Designing Solutions

UNIT 2: CONDITIONAL AND ITERATION (6 HOURS)

Introduction to Python – Functional abstraction – Defining simple functions – Data abstractions and objects, built-in objects, Expressions and operators (methods), Variables and Assignment, conditional (if), alternative (if-else), case analysis (if-elif-else), pattern matching – Iteration: while, for, break, continue, pass.

UNIT 3: FUNCTION AND STRINGS (6 HOURS)

Functions: Local and global scope, Methods of passing arguments, Recursion, Lambda functions; Strings: string slices, immutability, string functions and pattern matching.

UNIT 4: LISTS AND TUPLES (6 HOURS)

Lists: Operations, Slices, Methods, Iteration, Mutability, Aliasing, Cloning, Parameters, Nested lists, List comprehension; Tuples: Operations, Assignments, Return value.

UNIT 5: DICTIONARIES AND FILES (6 HOURS)

Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists; Files: Text files, reading and writing files , file operations and command line arguments.

LABORATORY COMPONENT (30 HOURS)

1. Use Linux shell commands, use Python in interactive mode, and an editor
2. Develop programs with expressions (area of a geometric shape, simple interest, solve quadratic equation, net salary).
3. Develop programs using conditional statements (leap year, maximum of 2 numbers, maximum of 3 numbers, simple calculator, grade of the total mark).
4. Develop programs using loops and nested loops (gcd, prime number, integer division, sum of digits of an integer, multiplication table, sum of a series, print patterns, square root using Newton's method).
5. Develop programs using functions (sine and cosine series, Pythagorean triplets).
6. Develop programs using recursion (efficient power of a number, factorial, Fibonacci number).
7. Develop programs using strings (palindrome, finding substring) without using in-built functions.
8. Develop programs using lists and tuples (linear search, binary search, selection sort, insertion sort, quicksort).
9. Develop programs using nested lists (matrix manipulations).
10. Develop simple programs using dictionaries (frequency histogram, nested dictionary).
11. Develop programs using Files (read and write files).
12. Develop programs to perform any task by reading arguments from the command line.
13. Implement a simple application using appropriate datatypes and files.

TEXTBOOKS

1. Allen B. Downey, “Think Python”', 3rd edition, O'Reilly Media, 2024, Online Version: https://allendowney.github.io/ThinkPython/
2. Sridhar, Indumathi, Hariharan, “Python Programming”, Pearson, 2023.

REFERENCE BOOKS

1. Karl Beecher, “Computational Thinking – A beginner's Guide to Problem Solving and Programming”, British Computer Society (BCS), 2017.
2. John V Guttag, “Introduction to Computation and Programming Using Python”', 3rd edition, MIT Press, 2021.
3. Ashok Namdev Kamthane, Amit Ashok Kamthane, “Programming and Problem Solving with Python”, McGraw Hill Education (India) Private Limited, 2018.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, “Introduction to Programming in Python: An Inter-disciplinary Approach”', Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, 2nd Edition, CENGAGE Learning, 2018.
7. Alan D. Moore, “Python GUI programming with Tkinter”, Second Edition, Packt Publishing Ltd., 2021.
8. Joshua M. Willman, “Beginning PyQt: A hands-on approach to GUI programming with PyQt6”, Second Edition, APress, 2022.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Solve programming problems and express design solutions in pseudo code.	KL3
CO2	Apply sequential, alternate, and iterative approaches for solving problems.	KL3
CO3	Solve complex problems by using functions, strings, lists, tuples and dictionaries.	KL3
CO4	Apply files and exception handling concepts for handling large data.	KL3
CO5	Create simple software development projects in teams using best coding practices and communicate effectively through reflections, reports, and presentations.	KL4

Course Code	Category	INTRODUCTION TO WEB PROGRAMMING	L	T	P	C	Contact Hours
	MC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. Understand Web fundamentals.
2. Develop proficiency in using HTML and CSS.
3. Responsive web design with bootstrap
4. Enable students to create dynamic content on web pages & manipulate DOM

UNIT 1: WEB FUNDAMENTALS & HTML (6 HOURS)

Introduction to Web Technologies: History of the Web, Web Browsers, Web Servers, Internet Protocols (HTTP, HTTPS). Introduction to Frontend: HTML Structure, Basic Tags, Elements, attributes, Lists, Tables, Forms: input elements, Labels, Method Attribute, HTML5 Attributes, Block and Inline elements, Classes: Relationship between elements.

UNIT 2: CSS (6 HOURS)

Introduction, Inline, Internal & External styling, Type, ID & Class selector, Attribute selector, Attribute +value selector, Pseudo class selector, link, active & visited, Ascendant, descendant combinator, parent-child combinator, inheritance, combination of selectors, specificity values, Colors, RGB and Hexadecimals, box model, padding, margin, border, image, font styling.

UNIT 3: INTRODUCTION TO BOOTSTRAP (6 HOURS)

Introduction, responsive web design, Typography, images, tables, grid system, buttons, button groups, cards, carousel, forms, list groups, navs, navigation bar, progress bar, spinners, popover, colors, flex, media object.

UNIT 4: JAVASCRIPT FUNDAMENTALS (6 HOURS)

Introduction, data types, arithmetic operators, relational and logical operators, comments, branching, switch – case, functions, anonymous functions, arrays.

UNIT 5: JS DOCUMENT OBJECT MODEL (6 HOURS)

Introduction, DOM tree traversal, get Element by id, get Element by class, query selector, inner HTML, inner text, types of events: load, click, add Event Listener, Event Propagation, introduction to ES6, AJAX.

LABORATORY COMPONENT: (30 HOURS)

1. Design an HTML webpage that includes headings, paragraphs, lists, tables, and a registration form. The form should contain input fields such as name, email, password, gender, course selection, and submit button using proper labels and HTML5 attributes.
2. Create a webpage displaying personal information, education details, skills, and contact information using block and inline elements. Use tables for academic details and lists for skills.
3. Create a webpage and apply styling using type, ID, class, attribute, and pseudo-class selectors. Demonstrate inheritance, selector combinations, and specificity.
4. Create a webpage layout demonstrating margin, padding, border, background colors, font styling, and image styling. Apply RGB and hexadecimal colors.
5. Create a webpage using Bootstrap CDN. Design a responsive layout using the grid system, typography, buttons, and cards.
6. Design a webpage with a navigation bar, forms, progress bars, and spinners using Bootstrap components.
7. Write JavaScript programs using if–else, switch–case, functions, and arrays to perform simple calculations and decision-making tasks.
8. Develop programs using user-defined and anonymous functions along with array operations such as sorting and searching.
9. Create a webpage to access and modify elements using get Element By Id,
10. Get Elements By Class Name, query Selector, and handle click events using add Event Listener.
11. Develop a webpage that fetches data asynchronously from a server (or local JSON file) using AJAX and displays it dynamically without page reload.
12. Develop a responsive web application using modern web technologies to manage user inputs, real-time updates, priority handling, and notifications across multiple services or activities.

TEXTBOOKS:

1. Ethan Brown, "Learning JavaScript, Design and Build Modern Web Applications", O'Reilly Media, 2016.

REFERENCES:

1. Jon Duckett, "HTML and CSS: Design and Build Websites", Wiley, 2011.
2. David Flanagan, "JavaScript: The Definitive Guide", O'Reilly Media, 2020.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Create and style web pages using HTML & CSS.	KL3
CO2	Build responsive web applications using Bootstrap.	KL3
CO3	Develop dynamic & interactive web content using JS.	KL3
CO4	Manipulate the DOM to create dynamic web pages.	KL4

Course Code	Category	PROFESSIONAL ETHICS AND HUMAN VALUES	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. To provide students with a foundation in ethics and human values for personal, social, and professional life.
2. To enable students to understand and apply ethical principles in decision-making and workplace conduct.
3. To develop awareness of social responsibility, civic virtues, and sustainable practices in professional and personal contexts.

UNIT 1: INTRODUCTION TO ETHICS AND VALUES (6 HOURS)

Meaning and scope of ethics, morals, and values, Life skills and emotional intelligence, Personal versus professional ethics, Stakeholders and their influence on decisions, Ethical dilemmas and methods of resolution, Case studies highlighting basic ethical issues.

UNIT 2: RESPONSIBILITY, SOCIAL IMPACT, AND WORKPLACE CONDUCT (6 HOURS)

Attributes of a profession, roles, duties, and responsibilities, Professional obligations and social impact of decisions, Corporate Social Responsibility (CSR) and sustainable practices, Legal and social responsibilities, Workplace safety and rights, Case studies on societal and organizational ethical issues.

UNIT 3: THEORIES AND DECISION-MAKING FRAMEWORKS (6 HOURS)

Major ethical theories: Utilitarianism, Deontology, Virtue Ethics, Rights-based approaches, Application of theories in professional scenarios, Decision-making frameworks for dilemmas, Responsibility for safety, health, and well-being, Risk assessment and accountability, Case studies illustrating applied concepts.

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UNIT 4: RIGHTS, GLOBAL ISSUES, AND ETHICAL CODES (6 HOURS)

Rights and duties in workplace, Professional standards and codes of conduct, Ethics audit: implementation and evaluation, Global challenges: environmental ethics, media ethics, bioethics, research ethics, Cross-cultural considerations and international case studies.

UNIT 5: HUMAN VALUES AND PROFESSIONAL DEVELOPMENT (6 HOURS)

Nature, classification, and significance of human values, Value-based decision-making in personal and professional life, Integration of human values in daily life, Harmony with self, family, society, and environment, developing positive attitudes, moral courage, and integrity, Strategies for internalizing and applying values, Practical exercises and case studies on character building and ethical living.

TEXTBOOKS:

1. Professional Ethics Includes Human Values, R. Subramanian, Oxford University Press, 2nd Edition, 2017.
2. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 3rd revised edition, 2023.

REFERENCE:

1. A Textbook on Professional Ethics and Human Values by R.S. Naagarazan, New Age Intl. Publishers, 2006.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Human Values and Professional Ethics, by Vaishali R Khosla & Kavita Bhagat, Technical Publications, First Edition, 2009.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Explain the basic concepts of ethics, morals, and values, and differentiate between personal and professional ethics.	KL2
CO2	Describe the responsibilities of professionals and the social and legal impact of their decisions, including CSR and workplace safety.	KL2
CO3	Discuss major ethical theories and their role in resolving ethical dilemmas in professional situations.	KL2
CO4	Identify rights, professional standards, ethical codes, and global challenges relevant to workplace and international practices.	KL2
CO5	Illustrate human values in personal and professional life to foster integrity, positive attitudes, and responsible behavior.	KL3

Course Code	Category	ENGINEERING PHYSICS LABORATORY (Common to EEE, ECE, CSE & IT)	L	T	P	C	Contact Hours
	MD		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

1. Supplement their understanding of physical concepts in the areas of ultrasonics, lasers, fiber optic communication, quantum mechanics and electronics through experiments that use them to determine physical, optical and electronic properties of materials

2. Develop ability to plan and design procedures on their own to conduct investigations and arrive at inferences based on the results of the investigations

LIST OF EXPERIMENTS: (30 HOURS)

1. Determination of velocity and compressibility of the given liquid - Ultrasonic interferometer
2. Determination of Planck's Constant
3. Determination of specific resistance of the given wire - Carey Foster Bridge
4. Determination of energy bandgap of the given semiconductor - Band Gap of Semi-Conductor
5. Determination of grating element / average size of the particles of a given powder sample using laser
6. Determine the numerical aperture, acceptance angle & losses in fibres of the given optical fibre cable.

Advanced Physics Lab (Open-ended)

7. Mini Project that is conceived and executed by end of the semester

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Determine material properties of medium associated with ultrasound propagation.	KL3
CO2	Use lasers for study of materials and optical fibres.	KL3
CO3	Determine electrical properties of metals and semiconductors like specific resistance of a conductor, bandgap of semiconductors.	KL3
CO4	Develop appropriate procedures/methodologies based on study objectives. (mini project)	KL6

Course Code	Category	OPEN-SOURCE TOOLS AND PROMPT ENGINEERING	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To navigate and operate the Linux file system and manage files efficiently using command-line tools.
2. To write, test, and debug shell scripts for task automation, system monitoring, and workflow management.
3. To install, configure, and use Git for version control, including branching, commits, and collaborative development.
4. To process and transform text data using Linux tools such as grep, awk, sed, and pipelines.
5. To craft, refine, and evaluate AI prompts, analyze outputs, and integrate prompt engineering with Linux-based tools.

LIST OF EXERCISES

1. Perform the following exercises by exploring the Linux environment hands-on. Apply best practices such as writing clean, well-commented scripts. Test each program with multiple inputs and adapt an incremental approach to building and debugging solutions.

2. Programs for navigating the Linux file system (e.g., Explore the root directory hierarchy and identify the purpose of key directories such as /bin, /etc, /var, and /proc. Practice creating, copying, moving, and deleting files and directories. Use df and du to inspect disk usage.)

3. Programs for file permissions and links (e.g., Create files and directories with specific permission sets using both symbolic and octal notation. Investigate inode numbers using ls -li. Create hard and soft links and observe the difference in behaviour when the original file is deleted. Use pipes and redirection to chain commands and save output to files.)

4. Programs for Git installation and configuration (e.g., Install Git on the Linux system and verify installation using git --version. Configure user identity using git config –global user.name and git config --global user.email. Initialize a new repository using git init. Create and track files using git add, make commits using git commit, and view repository history using git log. Clone an existing repository using git clone and explore the working directory and .git structure.)

5. Programs for user, process, and system monitoring (e.g., Create and manage user accounts and groups. Monitor running processes using ps and top. Practice sending signals with kill. Manage foreground and background jobs using fg, bg, and jobs. Start, stop, and check the status of services using systemctl.)

6. Programs for basic shell scripting (e.g., Write a script that accepts command-line arguments and performs arithmetic or string operations. Use variables, positional parameters, and the export command. Modify PATH and .bashrc to create custom commands. Write a script that traps the SIGINT signal and performs a clean exit.)

7. Programs for advanced shell scripting with control flow (e.g., Write scripts using if/else/fi, for, while, and until loops. Define and call user-defined functions. Write a menu-driven script that uses case statements. Use select to build an interactive script.)

8. Programs for scheduling and automation (e.g., Write a cron job that runs a cleanup script every night at midnight. Schedule a script to run at startup using /etc/rc.local or a systemd unit file. Write a script that logs system resource usage to a file every 5 minutes.)

9. Programs for pattern matching with regex and find (e.g., Use egrep to search log files for lines matching a given pattern such as IP addresses, email addresses, or error codes. Use the find command to locate files by name, type, size, or modification date. Combine find with -exec to perform batch operations.)

10. Programs for text processing with AWK and sed (e.g., Use AWK's pattern-action model, built-in variables NR, NF, and FS to extract and summarize columns from a CSV data file. Use associative arrays to count word or field frequencies. Write user-defined AWK functions. Use sed for in-place find-and-replace in configuration files. Combine AWK and sed in a pipeline to clean and transform raw log data.)

11. Programs to create multiple prompts for the same task, such as text summarization, code generation, or data extraction. Store prompts in text files, run them with an AI model, and save outputs. Use Linux commands like cat, grep, or diff to compare outputs, refine prompts, and document which variation works best.

12. Programs to automate the sending of predefined prompts to a local or API-based AI model using shell scripting. Capture and save the AI responses to files for further processing or review. Use Linux pipelines, loops, and redirection to handle multiple prompts efficiently, demonstrating how automation can integrate AI workflows with scripting skills.

LABORATORY REQUIREMENT FOR A BATCH OF 30 STUDENTS

Hardware: 1. Standalone Desktops or Laptops — 30 Nos

Software:

1. Any Linux Distribution (Ubuntu 22.04 LTS or later recommended)
2. GNU Bash
3. GCC / Python 3
4. Git
5. AI or NLP tools for Prompt Engineering (e.g., OpenAI API access, local LLM like GPT4All, or Hugging Face transformers)
6. Text editors such as VS Code, Vim, or Nano for editing scripts and prompt files

7. Internet access for API-based prompt testing and GitHub repository access

TEXTBOOKS

1. Behrouz Forouzan, Richard Gilberg, "UNIX and Shell Programming: A Textbook", Thomson Learning, 2005.
2. Cameron Newham, Bill Rosenblatt, "Learning the Bash Shell", Third Edition, O'Reilly, 2005.
3. Ian Khan, The Quick Guide to Prompt Engineering: Generative AI Tips and Tricks for ChatGPT, Bard, Dall-E, and Midjourney, First Edition, Wiley, 2024.

REFERENCES

1. Mike Loukides, Tim O'Reilly, Jerry Peek, Shelley Powers, "Unix Power Tools", 3rd Edition, O'Reilly, 2009.
2. Sumitabha Das, "Unix: Concepts and Applications", Tata McGraw Hill, 2017.
3. Richard Blum, Christine Bresnahan, "Linux Command Line and Shell Scripting Bible", Wiley, 2015.
4. Stephen Kochan, Patrick Wood, "Shell Programming in UNIX, Linux and OSX", Addison Wesley, 2016.
5. Randal K. Michael, "Mastering Unix Shell Scripting", 2nd Edition, Wiley, 2008.
6. AI Prompt Engineering Absolute Beginner's Guide, 1st Edition, Addison-Wesley Professional, 2025.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Navigate and manage the Linux file system confidently, including files, directories, permissions, and links, using command-line tools.	KL3
CO2	Write, test, and debug shell scripts for task automation, system monitoring, and workflow management using variables, control flow, functions, and loops.	KL3
CO3	Install, configure, and use Git for version control, including repository setup, staging, committing, branching, merging, and collaborating with remote repositories like GitHub.	KL3
CO4	Process, analyze, and transform text data efficiently using Linux tools such as grep, awk, sed, pipelines, and regular expressions.	KL4
CO5	Create, refine, and automate AI prompts using Linux scripting and file handling, compare outputs, and implement simple workflows to evaluate and select the best results.	KL4

SEMESTER - II

Course Code	Category	MATHEMATICS II	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses: Nil*					

Course Objectives:

This course aims to:

1. Apply fundamental probability concepts, counting techniques, and Bayes' theorem to analyse uncertain events.
2. Analyse discrete random variables and apply standard discrete probability distributions to compute moments and probabilities.
3. Evaluate continuous random variables using probability density function, cumulative density function, and continuous distributions including the normal distribution.
4. Analyse joint behaviour of two random variables using marginal, conditional distributions, correlation, and regression techniques.
5. Apply appropriate statistical tests to analyse hypotheses and draw conclusions from sample data.

Unit 1: FOUNDATIONS OF PROBABILITY

Introduction to Probability - Sample Space - Events - Set Operations on Events - Probability Axioms - Conditional Probability - Independent Events - Bayes' Theorem.

Unit 2: DISCRETE RANDOM VARIABLES AND DISTRIBUTIONS

Introduction to Random Variables - Discrete Random Variables - Probability Mass Functions (PMF) - Cumulative Distribution Functions (CDF) - Moments - Moment generating functions - Expected Value of Discrete Random Variables - Variance of Discrete Random Variables - Bernoulli Distribution - Binomial Distribution - Poisson Distribution

Unit 3: CONTINUOUS RANDOM VARIABLES AND DISTRIBUTIONS

Continuous Random Variables - Probability Density Functions (PDF) - Cumulative Distribution Function (CDF) for Continuous Variables - Moments - Moment generating functions - Expected Value and Variance of Continuous Random Variables - Uniform Distribution (Continuous) - Exponential Distribution - Normal Distribution - Central Limit Theorem.

Unit 4: TWO-DIMENSIONAL RANDOM VARIABLES

Marginal Distributions - Joint Distributions - Conditional Distributions - Covariance - Correlation - Linear Regression

Unit 5: TEST OF SIGNIFICANCE

Sampling Distributions - Large Sample Test - Test based on Normal: Single and Difference of Mean and Proportion - Small Sample Test - t-distribution: Single and Difference of Means - F-test for Variance - $\chi 2$-test - Test for Goodness of Fit, Independence of Attributes.

References:

1. Devore, J. L. (2015). *Probability and Statistics for Engineering and the Sciences*. Cengage Learning.
2. Ross, S. M. (2014). *A First Course in Probability*. Pearson.
3. Montgomery, D. C., & Runger, G. C. (2014). *Applied Statistics and Probability for Engineers*. Wiley.
4. Wackerly, D. D., Mendenhall III, W., & Scheaffer, R. L. (2008). *Mathematical Statistics with Applications*. Cengage Learning.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Apply and analyse probability laws, counting techniques, and Bayes' theorem to solve uncertainty-based problems.	
CO2	Apply and analyse discrete random variables and standard discrete probability distributions to compute probabilities and moments.	
CO3	Apply and evaluate continuous probability distributions, normal distribution, and the Central Limit Theorem in solving real-world problems.	
CO4	Analyse and evaluate relationships between two random variables using joint distributions, correlation, and regression models.	
CO5	Apply, analyse, and evaluate appropriate statistical tests to draw valid inferences from sample data.	

Course Code	Category	TECHNICAL WRITING	L	T	P	C	Contact Hours
	AEC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To prepare effective instructions, checklists and emails
2. To write different kinds of paragraphs and argumentative essays
3. To develop and revise effective resumes, cover letters and SOPs
4. To document and organise various kinds of reports, case studies and white papers
5. To create well-structured proposals and press releases

UNIT 1:WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS (12 HOURS)

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples. Language skills: Tenses – present and past.

UNIT 2: WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS (12 HOURS)

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Writing argumentative essays; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion. Sample essays. Language skills: Connectors and definitions

UNIT 3: WRITING JOB APPLICATIONS AND SUMMARIES (12 HOURS)

Writing job applications; resumes and cover letters. Writing the statement of purpose (SOP): Outline – professional narrative, previous experience, research interests, and career goals. Writing summaries: reading the text; identifying the main ideas and supporting details. Writing paraphrases: step by step paraphrasing; text comparison; sentence analysis. Language skills: subject-verb agreements

UNIT 4: WRITING REPORTS, CASE STUDIES AND WHITE PAPERS (12 HOURS)

Writing datasheets: outline – descriptions, graphics, benefits, features and specifications, requirements, and contact information. Writing abstracts. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search for solutions, implementation of the solution and results. Language skills: Active voice, passive voice

UNIT 5: WRITING PROPOSALS AND PRESS RELEASES (12 HOURS)

Writing business proposals: format -- title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea. Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section. Language skills: Correction of errors, proofreading and editing

TEXTBOOKS

1. Laplante, P. A. (2018). Technical writing: A practical guide for engineers, scientists, and nontechnical professionals. CRC Press.
2. David Bonamy. (2013) Technical English Level 2 Course Book. Pearson

REFERENCES:

1. Kmiec, D., & Longo, B. (2017). The IEEE guide to writing in the engineering and technical fields. John Wiley & Sons.
2. Lewis Lansford; Peter Astley. (2013). Oxford English for Careers: Engineering 1: Student's Book. Oxford University Press.
3. Mark Ibbotson. (2008). Cambridge English for Engineering, 2008, Cambridge University Press.
4. Rubens, P. (2002). Science and technical writing: A manual of style. Routledge.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Write instructions, checklists and emails with clarity and readability.	KL3
CO2	Compose paragraphs, and structure an argumentative essay effectively	KL4
CO3	Create and edit resumes, cover letters and SOPs concisely	KL4
CO4	Document well-structured reports, case studies and white papers	KL5
CO5	Develop effective proposals and press releases	KL5

Course Code	Category	ELECTRICAL AND ELECTRONICS ESSENTIALS FOR IT	L	T	P	C	Contact Hours
	MC		2	0	0	2	2
Course Level		*Prerequisite Courses: NIL*					

COURSE OBJECTIVES:

This course aims to:

1. To learn the basic concepts of electric circuits.
2. To know the operation of various electrical machines.
3. To study the concepts of utilization of electrical power.
4. To comprehend the working principle of electronic devices and its applications.
5. To grasp the working principle of various sensors and transducers.

UNIT 1: ELECTRICAL CIRCUITS (6 HOURS)

DC Circuits: Ohm's Law- Kirchhoff's laws - Mesh current and Node voltage methods (Analysis with only independent source). AC circuit: Waveforms and RMS value, Power, Power factor. Three phase supply – Star connection, Delta connection, Maximum power transfer.

UNIT 2: BATTERY TECHNOLOGY (6 HOURS)

Introduction to Batteries (1 hour) – Primary vs Secondary batteries, Voltage, Capacity (Ah), Energy density, Power density, Open-circuit voltage vs terminal voltage, Internal resistance and polarization, Charge–discharge characteristics, Lead-acid battery, Nickel-based batteries, Lithium-ion batteries, Solid-state batteries (intro), Flow batteries (basic idea), Battery Management Systems, Cell balancing techniques, Electric vehicles (EV batteries), Fast charging technologies, AI in battery diagnostics

UNIT 3: ELECTRONIC DEVICES AND APPLICATIONS (6 HOURS)

Operation of PN junction diodes, VI characteristics, Half wave and full wave rectifier, MOSFET, Common source amplifier, Operational amplifier – comparator, differentiator, integrator, Basic analog to digital converter

UNIT 4: PRINCIPLES OF SENSORS AND ACTUATORS (6 HOURS)

Electric field Sensors and Actuators - Capacitive Sensors and Actuators, magnetic field sensors - Inductive Sensors - Magnetic Actuators - Voice Coil Actuators – Motors, Voltage and Current Sensors, Acoustic Sensors and Actuators – Microphones - Piezoelectric Sensors – Loudspeakers and buzzers – ultrasonic sensors and actuators, Electrochemical Sensors - Humidity and Moisture Sensors – Airbag

UNIT 5: BIO SENSORS (introduction level) (6 HOURS)

Introduction to Electrocardiogram (ECG), electroencephalogram (EEG), Photoplethysmography (PPG), Magnetic Resonance Imaging (MRI),

TEXTBOOKS:

1. Kothari DP and I.J Nagrath, “Basic Electrical and Electronics Engineering”, McGraw Hill Education,2014
2. Alan S. Moris, Principles of Measurements and Instruments, Prentice Hall of India Pvt. Ltd., New Delhi,1999.
3. S.Salivahanan, R.Rengaraj and G.R.Venkatakrishnan, Basic Electrical, Electronics and Measurement Engineering, McGrawHill, 2017.

REFERENCE:

1. S.B. Lal Seksena and Kaustuv Dasgupta, Fundaments of Electrical Engineering, Cambridge, 2016.
2. M.S. Sukhija and T.K. Nagsarkar, Basic Electrical and Electronic Engineering, Oxford, 2016.
3. S.K.Sahdev, Basic of Electrical Engineering, Pearson, 2015.
4. Edward Hughes, John Hiley, Keith Brown and Ian McKenzie Smith "Electrical And Electronic Technology" Pearson Education Ltd, 10 th Edition, 2008
5. H.Cotton, "Electrical Technology" 7th Edition,CBS; 2005

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Solve and analyse DC and AC circuits.	KL3
CO2	Explain the operating principle of AC and DC machines	KL2
CO3	Know the concepts electrical power utilization	KL1
CO4	Describe the working principle of various electronic devices and its applications	KL2
CO5	Describe the working principle of various sensors and transducers.	KL2

Course Code	Category	ENVIRONMENTAL SCIENCE (Common to All B.Tech. Programmes)	L	T	P	C	Contact Hours
	VAC		2	0	0	2	2
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

This course aims to:

1. To develop a better understanding of human relationship with environment.
2. To explain the importance of conservation of resources.
3. To create awareness on pollution and environmental degradation.
4. To acquire knowledge on sustainable development.
5. To apply technical skills for solving environmental problems.

UNIT I ECOSYSTEM AND BIODIVERSITY (6 HOURS)

Structure and function of an ecosystem – energy flow- food chains, food webs and ecological pyramids – ecological succession. Introduction to biodiversity definition and types– values of biodiversity – threats to biodiversity-conservation of biodiversity: In-situ and ex-situ conservation of biodiversity; role of individuals and communities in biodiversity conservation.

UNIT II NATURAL RESOURCES (6 HOURS)

Forest, Water, Food, Energy, Mineral and Land resources – uses and case studies on over exploitation of natural resources; Conservation of natural resources; Equitable use of resources for sustainable lifestyles

UNIT III CURRENT ENVIRONMENTAL AND SOCIAL ISSUES (6 HOURS)

Air pollution – particulate pollution (Smog, acid rain, climate change and global warming, ozone layer depletion); Water pollution; Soil pollution and solid waste management; Noise pollution; Nuclear pollution; Role of an individual in the prevention of pollution. Disaster management; Human health and Environment: Issues with water and sanitation; Human rights, HIV/AIDS, Women and child welfare

UNIT IV SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL GOVERNANCE (6 HOURS)

Sustainable development goals (SDGs): Origin, Purpose, importance, and challenges in achieving SDG; Circular economy (4 R and 10 R); Upcycling and waste to wealth strategies; Extended Producer Responsibility; Green buildings; Electric and hybrid electric vehicles; Mission LiFE and Sustainable Lifestyle Practices; Environmental legislations: National Green Tribunal; National missions and policies towards SDGs; ESG framework and corporate sustainability

UNIT V ENGINEERING INTERVENTION TO REDUCE ENVIRONMENTAL STRESSES (6 HOURS)

Role of technology in environmental studies – AI and IoT- Real time data collection and analysis - Environmental modelling and simulation – GIS - Remote sensing – satellite and sensors - Use of drone for aerial mapping and surveying.

TEXTBOOKS

1. Anubha Kaushik and Kaushik, C. P. "Environmental Science and Engineering", New Age International Publishers, 14thEdition, 2014.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006.

REFERENCE BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
3. M.H. Fulekar, Bhawana Pathak and R.K.Kale, 'Environment and Sustainable Development' Springer Nature, 2013

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Acquire the basic concepts of ecosystems; understand the importance of biodiversity and conservation strategies.	KL2
CO2	Develop knowledge on natural resources and equitable use of natural resource.	KL2
CO3	Analyse the current environmental and social problems and its plausible solutions.	KL2
CO4	Explain the concept of sustainable development, its importance and key challenges in implementation of sustainable goals.	KL2
CO5	Describe the role of technology for assessment and management of environment and human health.	KL2

Course Code	Category	C PROGRAMMING AND DATA STRUCTURES	L	T	P	C	Contact Hours
	MC		3	0	0	3	3
Course Level		*Prerequisite Courses:*					

COURSE OBJECTIVES:

This course aims to:

1. To learn C programming language.
2. To be exposed to the concepts of Sorting, Searching, Hashing.
3. To introduce the concepts of abstract data types.
4. To learn various linear and non-linear data structures.

UNIT 1: BASIC C PROGRAMMING (9 HOURS)

Structure of C program - C programming: Data Types, Operators: Precedence and Associativity - Expressions, Control Structures: Conditional, Looping statements, Arrays: One dimensional array Two dimensional arrays – String handling, Functions: function prototype – function definition Built-in functions – Recursion

UNIT 2: POINTERS, STRUCTURES AND FILES IN C (9 HOURS)

Structure – Nested structures – Array of structures – Union, Pointers: Pointer operators – Pointer arithmetic – Arrays and pointers – Structures and pointers – Dynamic memory allocation. Files: Sequential access - Random access, Command line arguments

UNIT 3: SORTING AND SEARCHING TECHNIQUES (9 HOURS)

Algorithm Analysis: Time and Space Complexity, Sorting algorithms: Selection sort - Insertion sort - Quick sort - Merge sort, Searching: Linear search - Binary search, Hashing: Hash Functions - Collision Handling: Separate Chaining – Open Addressing

UNIT 4: LINEAR DATA STRUCTURES – LIST, STACK AND QUEUE (9 HOURS)

Abstract Data Types (ADTs) – List ADT: array-based implementation, linked list implementation Doubly-linked lists – Circular linked list - Applications of lists, Stack ADT: Implementation of Stack - Applications of Stack, Queue ADT – Implementation of Queue – Circular Queue – Double ended Queues.

UNIT 5: NON-LINEAR DATA STRUCTURES - TREES (9 HOURS)

Trees: Binary Trees – Tree traversals – Expression Trees – Binary Search Tree, Priority Queues: Implementation of Heaps, Applications of Trees

TEXTBOOKS:

1. Stephen G. Kochan, Programming in C, Pearson Education, Third Edition. (Unit I & II)
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, Second Edition, 1997

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, "The C Programming Language", Pearson Education, Second Edition, 1988.
2. Aho, Hopcroft and Ullman, "Data Structures and Algorithms", Pearson Education,1983.
3. Horowitz, Sahni, Anderson-Freed, "Fundamentals of Data Structures in C", Universities Press, second edition, 2008.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Second Edition, Mcgraw Hill, 2002

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Solve problems using C programming language	KL3
CO2	Apply pointers and structures in problem solving	KL3
CO3	Design, implement, and analyze sorting, searching, and indexing techniques.	KL3
CO4	Design, implement, and analyze linear data structures, such as lists, queues, and stacks, according to the needs of different applications.	KL4
CO5	Design, implement, and analyze efficient tree structures	KL4

Course Code	Category	DATA SCIENCE PRINCIPLES AND ANALYTICAL TOOLS	L	T	P	C	Contact Hours
	MC		2	0	2	3	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. The primary objective of the course is to understand the
2. Understand fundamental concepts of data science and analytics
3. Learn data collection, preprocessing, and visualization techniques.
4. Apply statistical methods for data analysis.
5. Design visual data narratives.

UNIT 1: INTRODUCTION TO DATA SCIENCE (6 HOURS)

Definition of Data Science – Applications of Data Science – Facets of Data – Data Science Life Cycle - Data Science vs Data Analytics - Introduction to tools in Data Science

UNIT 2: DATA COLLECTION, PREPROCESSING AND EDA (6 HOURS)

Data sources – Data collection methods – Data cleaning – Handling missing values – Removing Duplicates – Data Transformations – Data Integration – Data Reduction – Introduction to Exploratory Data Analytics

UNIT 3: STATISTICAL FOUNDATIONS FOR ANALYTICS (7 HOURS)

Descriptive Statistics – Statistical Parameters – Normal Distribution - Correlation Analysis – Outlier Detection – IQR – Introduction to hypothesis testing – Sampling, Standard Error – p values, Z -Test.

UNIT 4: DATA VISUALIZATION (6 HOURS)

Importance of Data Visualization – Types of Graphs - Bar Chart, Line Chart, Pie Chart – Histogram - Box Plot – Principles of Good Visualization – Visualizations using Matplotlib and Seaborn.

UNIT 5: APPLICATIONS (6 HOURS)

Business Intelligence – The role of dashboards, Visual Analytics and storytelling with data – Tableau Fundamentals – Connection to data sources, dimensions and measures, building basic charts and creating interactive dashboards, PowerBI Fundamentals – Data modelling, Introduction to Power Query, basics of DAX and building reports

Laboratory Component
List of Experiments **(30 HOURS)**

1. Tools: - Python, Numpy, Scipy, Matplotlib, Pandas, statmodels, seaborn, plotly
2. Working with Numpy arrays
3. Importing, exporting and creating Pandas DataFrames
4. Handling missing values, dealing with duplicates, outlier detection using pandas
5. Basic plots using Matplotlib and Seaborn
6. Calculating summary statistics using Python
7. Visualizing data distributions and testing for normality.
8. Computing and plotting Correlation matrices
9. Hypothesis testing – t test
10. Hypothesis testing – z test
11. Tableau – Connecting Dataset to Tableau public and building multi-view interactive dashboard
12. Power BI – Importing and transforming data using Power BI Desktop to create a visual report
13. Mini Project – Design an interactive dashboard using either Power BI or Tableau from a cleaned dataset and presenting the business insights.

TEXTBOOKS:

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science", Manning Publications, 2016. (first two chapters for Unit I and II).
2. Robert S. Witte and John S. Witte, "Statistics", Eleventh Edition, Wiley Publications, 2017 (Chapters – 2, 3, 4, 5, 6, 10, 11 for Unit III)
3. Jake VanderPlas, "Python Data Science Handbook", O'Reilly, 2016. (for Unit IV)
4. Prachi Manoj Joshi et al. "Data Visualization and Storytelling with Tableau: A hands-on approach", CRC Focus (Unit V)
5. Dan Clark, "Beginning Microsoft Power BI: A Practical Guide to Self-Service Data Analytics", Apress. (Unit V)

REFERENCES:

1. Allen B. Downey, "Think Stats: Exploratory Data Analysis in Python", Green Tea Press, 2014.

COURSE OUTCOMES

	Course Outcomes	Knowledge Level
CO1	Explain data science concepts and life cycle.	KL2
CO2	Perform data processing and cleaning	KL3
CO3	Apply basic statistical analysis techniques.	KL3
CO4	Use Python analytical libraries for data analysis.	KL3
CO5	Visualize and Interpret data effectively.	KL4

Course Code	Category	INTRODUCTION TO AR/VR	L	T	P	C	Contact Hours
	SEC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To understand the basic concepts of Augmented Reality (AR) and Virtual Reality (VR).
2. To learn the fundamentals of 3D environment creation using Unity.
3. To develop simple interactive 3D applications using basic C# scripting.
4. To simulate virtual reality environments using first-person navigation techniques.
5. To create marker-based augmented reality applications using Vuforia in Unity.
6. To design and implement a basic AR/VR mini project with animation and interaction.

LIST OF EXPERIMENTS: (30 HOURS)

1. Install Unity (LTS version) and create a new 3D project with proper folder organization.
2. Create a basic 3D scene by adding Cube, Sphere, Capsule, and Plane objects and modify their position, rotation, and scale.
3. Design a simple virtual room environment using 3D objects and apply materials and textures.
4. Configure lighting (Directional Light, Point Light) and Camera settings, and apply a skybox to create an immersive background.
5. Create and apply a simple animation (rotation or movement) to a 3D object using the Animation window.
6. Develop a basic C# script to move a 3D object using keyboard inputs (W, A, S, D or arrow keys).
7. Write a C# script to change the color of a 3D object on key press or mouse click event.
8. Design a simple UI using Canvas, Text, and Button components and display information in the scene.
9. Implement scene navigation by creating multiple scenes and switching between them using UI buttons.
10. Create a basic first-person walkthrough scene using a First Person Controller to navigate inside a virtual environment.
11. Implement object interaction in a virtual scene such as clicking an object to trigger animation or color change.
12. Add background audio and interactive sound effects to objects within the virtual environment.
13. Integrate Vuforia Engine in Unity and set up an AR Camera in simulation (Play Mode).
14. Create an Image Target database and display a 3D model on detecting the image marker in Play Mode.
15. Develop a simple AR-based mini project (e.g., AR Information Card / AR Solar System) with animation and basic interaction, executed fully in Unity simulation mode.

Websites / Online Resources

- Unity Official Documentation – https://docs.unity3d.com
- Unity Learn (Tutorials & Courses) – https://learn.unity.com
- Vuforia Developer Portal – https://developer.vuforia.com
- Google AR & VR Overview – https://developers.google.com/ar
- Khronos Group (OpenXR Standards) – https://www.khronos.org/openxr

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Describe the fundamental concepts and applications of Augmented Reality (AR) and Virtual Reality (VR).	KL2
CO2	Create basic 3D environments and scenes using Unity.	KL4
CO3	Develop simple interactive applications using C# scripting in Unity.	KL3
CO4	Implement basic virtual walkthrough and object interaction features in a simulated VR environment.	KL3
CO5	Design and demonstrate a simple marker-based AR application using Unity and Vuforia.	KL4

Course Code	Category	C PROGRAMMING AND DATA STRUCTURES LABORATORY	L	T	P	C	Contact Hours
	MC		0	0	4	2	4
Course Level		*Prerequisite Courses: Nil*					

COURSE OBJECTIVES:

This course aims to:

1. To develop proficiency in C programming language fundamentals and structured programming concepts.
2. To build conceptual understanding and implementation skills in linear data structures such as arrays, lists, stacks, and queues.
3. To develop the ability to design and implement non-linear data structures, with specific focus on tree-based structures.
4. To enable the implementation and analysis of sorting and searching algorithms for efficient data processing.
5. To design and develop real-time applications using appropriate data structures for solving practical and real-world problems.

LIST OF EXPERIMENTS: (30 HOURS)

1. Implementation of Basic C Programming Constructs
2. Implementation of Modular Programming using Functions and One-Dimensional Arrays
3. Implementation of Two-Dimensional Arrays and String Manipulation Techniques
4. Implementation of Pointers and Dynamic Memory Allocation Techniques
5. Implementation of Structures, Unions, and File Handling Operations
6. Implementation of Abstract Data Types using List Data Structures
7. Implementation of Stack Data Structure and its Applications
8. Implementation of Queue Data Structure and its Applications
9. Implementation of Tree Data Structure and Tree Traversal Algorithms
10. Implementation and Analysis of Sorting Algorithms
11. Implementation and Analysis of Searching Algorithms
12. Design and Development of Real-Time Applications using Data Structures.

TEXTBOOKS:

1. Stephen G. Kochan, Programming in C, Pearson Education, Third Edition. (Unit I & II)
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, Pearson Education, Second Edition, 1997

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, “The C Programming Language”, Pearson Education, Second Edition, 1988.
2. Aho, Hopcroft and Ullman, “Data Structures and Algorithms”, Pearson Education,1983.

3. Horowitz, Sahni, Anderson-Freed, “Fundamentals of Data Structures in C”, Universities Press, second edition, 2008.
4. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, “Introduction to Algorithms”, Second Edition, Mcgraw Hill, 2002.

COURSE OUTCOMES:

	Course Outcomes	Knowledge Level
CO1	Apply C programming language constructs and structured programming techniques to develop modular and efficient programs.	KL3
CO2	Design and implement solutions using linear data structures such as arrays, linked lists, stacks, and queues.	KL4
CO3	Develop solutions non-linear tree data structures	KL4
CO4	Implement and analyze sorting and searching algorithms	KL3
CO5	Design and develop real-time applications using appropriate data structures.	KL3