JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY GURAJADA VIZIANAGARAM-535 003, A.P

(Established by Andhra Pradesh Act No.22 of 2021)

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COURSE STRUCTURE

(R26 Regulation)

For
Bachelor of echnology
B.Tech (CSE)
(Applicable for Batches Admitted from 2026-2027)

Department of
COMPUTER SCIENCE AND ENGINEERING

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY- GURAJADA VIZIANAGARAM
VIZIANAGARAM - 535003, ANDHRA PRADESH, INDIA

B.TECH. - COURSE STRUCTURE – R26

(Applicable from the academic year 2026-27 onwards)

Credit Distribution by Category

Category	Description	Credits
HSMC	Humanities, Social Science & Management	12.5 (10-14)
BSC	Basic Science Courses	19.5 (20-25)
ESC	Engineering Science Courses	24 (20-25)
PCC	Professional Core Courses	54 (49-59)
PEC	Professional Elective Courses (incl. Track / Emerging-Area & Interdisciplinary baskets)	18 (12-18)
SEC	Domain Specific skill Enhancement Courses	10
OEC	Open Elective Courses (institute-wide approved list)	11 (9-12)
PW&I	Employability Enhancement Course (Project Work/ Internship)	14 (14-16)
MC	Mandatory Non-Credit Courses (NSS/NCC, Environmental Science)	Non Credit

R26- COURSE TRUCTURE

SEMESTER I

Sl. No.	Course Code	Course Title	Category	L	T	P	C
		Theory Course					
1.		Linear Algebra and Calculus (Mathmatics-1)	BSC	3	0	0	3
2.		Advanced Physics	BSC	3	0	0	3
3.		Communicative English	HSMC	3	0	0	3
4.		Computational Thinking and Problem Solving Using C	ESC	3	0	0	3
5		AI Tools and Applications	HSMC	0	2	2	3
5.		Introduction to Computers	ESC	0	0	3	1.5
6.		Computational Thinking and Problem Solving Using C Laboratory	ESC	0	0	3	1.5
7.		Advanced Physics Lab	BSC	0	0	3	1.5
8.		Communicative English Lab	HSMC	0	0	3	1.5.
9.	AC	Health and Wellness, Yoga and Sports	HSMC	0	0	2	0
			Total	**12**	**2**	**16**	**21**

Semester II

Sl. No.	Course Code	Course Title	Category	L	T	P	C
		Theory Course					
1.		Mathematics-2(Differential Equations and Vector Calculus)	BSC	3	0	0	3
2.		Advanced Chemistry	BSC	3	0	0	3
3.		Design Thinking and Innovation	ESC	0	1	3	2.5
4.		Data Structures	ESC	3	0	0	3
5.		Basic Electrical & Electronics Engineering	PCC	3	0	0	3
6		Data Structures Laboratory	ESC	0	0	3	1.5
7.		Advanced Chemistry Laboratory	BSC	0	0	3	1.5
8		Basic Electrical & Electronics Engineering Laboratory	PCC	0	0	3	1.5
10	AC	NSS/NCC/Scouts &Guides/Community Service	AC	0	0	2	0
			Total	**12**	**1**	**14**	**19**

Semester III

Sl. No.	Course Code	Course Title	Category	L	T	P	C
Theory Course							
1.		Mathematical Foundations of Computer Science	BSC	3	0	0	3
2.		Operating Systems	PCC	3	0	0	3
3.		Digital Logic &Computer Organization	ES	3	0	0	3
4.		Object Oriented Programming using Java	PCC	3	0	0	3
5		Advanced Data Structures	PCC	3	0	0	3
6		Object Oriented Programming using Java Lab	PCC	0	0	3	1.5
7		Advanced Data Structures Lab	PCC	0	0	3	1.5
8		Python Programming	SC	0	1	2	2
9		Professional English &LLM Prompt Lab	AC	0	2	0	0
			Total	**15**	**3**	**8**	**20**

Semester IV

Sl. No.	Course Code	Course Title	Category	L	T	P	C
Theory Course							
1.		Probability and Statistics	BSC	3	0	0	3
2.		Business Economics and Financial Analysis for Engineers	HSM	3	0	0	3
3.		Database Management Systems	ESC	3	0	0	3
4.		Software Engineering	PCC	3	0	0	3
5		Computer Networks	PCC	3	0	0	3
5.		Database Management Systems Lab	PCC	0	0	3	1.5
		Software Engineering	PCC	0	0	3	1.5
		Full stack Development-1	SC	0	1	2	2
9.		Environmental Science	AC	0	2	0	0
			Total	**15**	**3**	**8**	**20**
08 weeks Internships/ Community Service Project during summer break							

Semester V

Sl. No.	Course Code	Course Title	Category	L	T	P	C
Theory Course							
1.			PCC	3	0	0	3
2.			PCC	3	0	0	3
3.			PCC	3	0	0	3
4.	**Professional Elective-I**						
			PEC	3	0	0	0
5.	**Open Elective-I**		OEC	3	0	0	3
Laboratory Course							
6.			PC	0	0	2	1
7.			PC	1	0	2	2
8.		Skill Oriented Course-III	SC	1	0	2	2
9.			MC	1	0	2	0
10.		Evaluation of Community Service Internship	SI	0	0	0	2
			Total	**18**	**0**	**8**	**22**

Semester VI

Sl. No.	Course Code	Course Title	Category	L	T	P	C
Theory Course							
1.			PCC	3	0	0	3
2.			HSM	3	0	0	3
3.			PCC	3	0	0	3
4.	**Professional Elective-II**		PEC	3	0	0	3
5.	**Professional Elective-III**		PEC	3	0	0	3
6.	**Open Elective-II**		OEC	3	0	0	3
Laboratory Course							
7.			PC	0	0	2	1
8.	R26CIT-SC3201	Skill Oriented Course-4	SC	1	0	2	2
			Total	**19**	**0**	**4**	**21**

Semester VII

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1.			PCC	3	0	0	3
2.	**Professional Elective-IV**		PEC	3	0	0	3
3.	**Professional Elective-V**		PEC	3	0	0	3
4.	**Open Elective-III**		OEC	3	0	0	3
5.	**Open Elective-IV**		OEC	3	0	0	3
6.	R26CIT-PR4201	(Skill Oriented Course -5)	SC	1	0	2	2
7.	R26CIT-SI4101	Evaluation of Summer Internship	SI	0	0	0	2
			Total	**16**	**0**	**2**	**19**

Semester VIII

Sl. No.	Course Code	Course Title	Category	L	T	P	C
1.	R26CIT-PR4201	Project Work Phase II	PR	0	0	20	10
2.	R26CIT-SI4201	Industrial training/Internship* (4 weeks)	PR	0	0	0	2
			Total	**0**	**0**	**0**	12

*Four weeks during any semester vacation from III to VI semester

TotalNo.ofCredits:163

Scheme of Credit distribution–Summary

Sl. No.	Stream	Credits/Semester								Credits (KPRIET)
		I	II	III	IV	V	VI	VII	VIII	
1.	Humanities and Sciences Including Management (HSM)	3.5	0.5	3	3		3			13
2.	Basic Science Courses(BSC)	7	7	3	3					20
3.	Engineering Science Courses (ESC)	8.5	9.5		2					20
4.	Professional Core Courses (PCC)		4	15	13	12	7	3		54
5.	Professional Elective Courses (PEC)					3	6	6		15
6.	Open Elective Courses(OEC)					3	3	6		12
7.	Skilled Course(SC)			2	2	2	2	2		10
8.	PROJECT(PR)								10	16
	Industrial Training/Internship					2		2	2	
Total		**19**	**21**	**23**	**23**	**22**	**21**	**19**	**12**	**163**
Total Credits										**163**

I Year I Semester	Linear Algebra and Calculus (Common to All Branches)	L	T	P	C
		3	0	0	3

Course Objectives
• The main objective of this course is to provide the learner with variety of linear algebra techniques to solve linear systems, orthogonal representation of the quadratic surfaces and apply its knowledge in optimization problems. • It aims further to calculate areas, surfaces and volumes in various coordinate systems.

Course Outcomes		
Upon completion of the course, the student will be able to:		Cognitive Level
CO1	Compute rank and inverse of a matrix and hence solves linear system of equations both homogeneous and non-homogeneous.	K2,K3,K5
CO2	Calculate eigenvalues and eigenvectors and hence orthogonalize the given matrix and represent given quadratic form into canonical form.	K2,K3,K5
CO3	Find the mean value of a given function and use it to estimate the bounds of a given function.	K2,K3,K5
CO4	Compute change in the dependent variable with respect to many independent variables and Jacobians. Apply the knowledge in optimizing functions of several variables.	K2,K3,K5
CO5	Compute double and triple integrals of functions of several variables and must be able to change the coordinate systems from Cartesian to polar, spherical and cylindrical coordinates.	K2,K3,K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Course Contents

UNIT I: Matrices, Eigen values, Eigenvectors

Rank of a matrix by echelon form, normal form. Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, Gauss elimination method, Jacobi and Gauss Seidel Iteration Methods. Eigen values, Eigenvectors and their properties.

UNIT II: Diagonalization of a matrix

Diagonalization of a matrix, Cayley-Hamilton Theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton Theorem, Quadratic forms and Nature of the Quadratic Forms, Reduction of Quadratic form to canonical forms by Orthogonal Transformation. Singular valued Decomposition.

UNIT III: Calculus

Mean Value Theorems: Rolle's Theorem, Lagrange's mean value theorem with their geometrical interpretation, Cauchy's mean value theorem, Taylor's and Maclaurin theorems with remainders (without proof), Problems and applications on the above theorems. Taylor's and Maclaurin series.

UNIT IV: Partial differentiation and Applications (Multi variable calculus)

Functions of several variables: Continuity and Differentiability, Partial derivatives, total derivatives, chain rule, Euler's Theorem, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, Maxima and Minima of functions of two variables without constraints and with Constraints-Method of Lagrange multipliers.

UNIT V: Multiple Integrals

Double integrals, change of order of integration, triple integrals, change of variables from Cartesian to polar, cylindrical and spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Text Books

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books

1. Thomas Calculus, George B. Thomas, Maurice D. Weir and Joel Hass, Pearson Publishers, 2018, 14th Edition.
2. Higher Engineering Mathematics, B.V.Ramana, McGraw HillEducation,2017.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, Micheael Greenberg, Pearson publishers, 9th edition.
5. Higher Engineering Mathematics, H. K Das, Er. Rajnish Verma, S. Chand Publications, 2014, Third Edition (Reprint 2021).
6. Advanced Engineering Mathematics by H. K Dass, S. ChandPublications,2022, Twenty Two Edition Reprint 2022).
7. Numerical Python: A Practical Techniques Approach for Industry, Robert Johansson, APress, 2015.

Web Resources

1. https://en.wikipedia.org/wiki/System_of_linear_equations
2. https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
3. https://www.math.hmc.edu/calculus/tutorials/eigenstuff/
4. https://en.wikipedia.org/wiki/Quadratic_form
5. https://en.wikipedia.org/wiki/Calculus
6. https://en.wikipedia.org/wiki/Partial_derivative
7. https://www.whitman.edu/mathematics/calculus_online/section14.03.html
8. https://en.wikipedia.org/wiki/Multiple_integral
   http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx

I Year I Semester	Advanced Physics (For CSE and Allied Branches of Engineering)	L	T	P	C
		3	0	0	3

Course Objectives

1. To provide knowledge on wave optics concepts such as interference, diffraction, and polarization with relevant engineering applications.
2. To explain various electron theories and interpret the effect of temperature on Fermi-Dirac distribution function and provide basic knowledge of quantum mechanics.
3. To understand the basic concepts of laser light sources and quantum computing applications.
4. To study the energy band formation, carrier density, conductivity, and Fermi level in semiconductors, along with drift-diffusion currents and the Hall Effect.
5. To impart knowledge on low temperature physics and superconductivity and their applications.

Course Outcomes (Cos)

CO	Course Outcome Statement	Cognitive Level
CO1	Examine the principles of interference, diffraction and polarization and utilize optical analysis techniques in engineering applications.	K3 (Apply)
CO2	Interpret the effects of temperature on Fermi energy and apply the concepts of quantum mechanics.	K3 (Apply)
CO3	Analyze the operation of various laser systems and to explain modem computational systems like Quantum Computing.	K4 (Analyze)
CO4	Able to analyze the electrical conductivity and charge transport behaviour of semiconductors using band theory.	K4 (Analyze)
CO5	Apply the concepts of low-temperature physics and superconductivity in modern technological applications and intelligent systems	K3 (Apply)

Course Contents

UNIT-1: WAVE OPTICS

Interference: Superposition Principle — Coherence -Types of Interference- Thin-film interference (reflection geometry) — Newton's rings — Determination of wavelength and refractive index.
Diffraction and Optical Surveying: Fresnel and Fraunhofer diffraction Fraunhofer's diffraction due to single slit, double slit & N. slits (qualitative) Diffraction Grating and grating spectrum — Dispersive and Resolving power of a grating. Polarization: of polarization Nicol's prism Half-wave and Quarter-wave plates.

UNIT -II: FREE ELECTRON THEORY & QUANTUM MECHANICS

Classical free electron theory merits and demerits — Quantum free electron theory equation for electrical conductivity Fermi-Dirac statistics Fermi level and variation with temperature.
Quantum Mechanics: de-Broglie concept of matter waves Heisenberg's uncertainty principle Wave function —

Schrödinger's time and time-independent wave equations Particle in a one- dimensional potential well Quantum tunneling (basic idea)

UNIT -III: QUANTUM PHOTONICS & QUANTUM COMPUTING

Lasers : Principles of Absorption Spontaneous and Stimulated Emission Population Inversion Three level and Four level laser systems — Construction and working of Ruby and He-Ne Laser Applications (qualitative).
Quantum Computing: to quantum computing Classical bits vs qubits — Superposition and entanglement Basic quantum operations Hadamard gate Pauli-X gate — Idea of quantum measurement.

UNIT- IV: SEMICONDUCTORS

Semiconductors: Formation of energy bands Classification of solids - Intrinsic semiconductors Density of charge carriers — Electrical conductivity Fermi level extrinsic semiconductors: density of charge carriers — dependence of Fermi energy on carrier concentration and temperature — Drift and diffusion currents Einstein's equation Hall effect Hall coefficient Applications of Hall effect.

UNIT- V: LOW TEMPERATURE PHYSICS & SUPERCONDUCTIVITY

Low Temperature Physics: Introduction — Low and its importance Properties of materials at low — Liquefaction of gases (basic concept only) — Liquid Nitrogen and liquid Helium (basic properties and uses).
Superconductors: Properties Critical parameters — Meissner effect Type-I and Type-II superconductors — BCS theory Cooper pairs and energy gap — DC and AC Josephson effect Applications (qualitative only): SQUIDs, magnetic levitation and lossless transmission.

Text books

1. Avadhanulu, MN, Kshirsagar, PG., & Murthy, T.V.SA., A textbook of engineering physics, S. Chand publishing (2019)
2. P.K. PalaniSamy, Engineering Physics, publications (2019)

Reference Books

1. D. K. Bhattacharya & Poonam Tandon, Engineering Physics, Oxford Press, 2015
2. B. K. Pandey & S. Chaturvedi, Engmeenng Physics, Cengage Learning, 2021
3. S. O. Pillai, Solid State Physics, New Age International (2019)
4. Nielsen & Chuang, Quantum Computation & Quantum Information, Cambridge (2010)

Web Resources & NPTEL Links

- NPTEL - nptel.ac.in
- MIT Open Course Ware - ocw.mit.edu
- Hyper Physics - hyperphysics.phy-astr.gsu.edu
- PhET Simulations — phet.colorado.edu
- Library of Congress-loc.gov/rr/scitech/selected-internet/physics.html

I Year I Semester	Communicative English	L	T	P	C
		3	0	0	3

Prerequisite: Intermediate English

Course Outline

This foundation course develops professional English communication competence through an integrated theory-and-laboratory format, combining 2 hours Of classroom instruction With 3 hours Of hands-on lab practice each week over 12 weeks. The course adopts an explicitly integrated (LSRW) approach: rather than treating the four skills as discrete components, each unit is designed so that listening, speaking, reading and writing reinforce one another through authentic, engineering-workplace scenarios. This integration strengthens alignment with Communicative Language Teaching (CLT) principles and reflects how communication actually functions in

Professional practice.

Lab exercises are embedded within each unit — role plays, JAM sessions, reading and vocabulary drills, writing workshops, virtual-meeting simulations and mock interviews — rather than taught as a separate component. Widely used A1 language tools are integrated throughout every unit to enable continuous practice, personalised feedback and reflective learning across all four skills, while explicit attention is given to using such tools critically and responsibly. The course equips students with the communication competence, digital-workplace readiness and employability skills needed for technical presentations, reports and professional interactions in higher-semester and industry contexts.

Course Objectives

The course aims to enable the teacher to:

- explain the verbal and nonverbal processes, models and barriers of communication, including intercultural and A1-mediated contexts;

- develop active listening skills and the traits of an effective listener using classroom activities and A1-based listening tools;
- Build speaking and presentation skills — including virtual presentations and digital meeting etiquette — through structured practice and A1 tools;
- teach reading techniques and information literacy — skimming, scanning, intensive, extensive, critical and the critical evaluation of digital and A1-generated content — to strengthen comprehension and employability;
- instruct technical and professional writing — paragraphs, reports, letters, emails and resumes — to enhance employability;
- Guide students in the responsible, ethical and critically evaluative use of A1 tools across all communication and language-learning tasks.

Course Outcomes

At the end of the course, the student will be able to:

CO1 Analyze the verbal and nonverbal processes, channels and barriers of communication, including intercultural contexts. [Analyze (K4)]

C02 Demonstrate active listening skills and assess the traits and barriers of effective listening. [Analyze (K4)]

C03 Construct and deliver confident, effective presentations — including in virtual and hybrid settings — applying

paralinguistic features and digital meeting etiquette. {Apply (K3)]

C04 Evaluate texts and digital/AI-generated content using reading and information-literacy techniques such as skimming, scanning and critical reading. [Evaluate (KS)]

C05 Construct professional technical writing —- including reports, letters, emails and resumes — using appropriate writing techniques. [Apply/Analyze (K3/K4)]

CO6 Evaluate the opportunities, limitations and ethical considerations of A1 tools in communication and language learning, and apply them responsibly across career-readiness tasks. [Evaluate (K5)]

Note: A1 competency (CX) has been separated from technical writing (CU) as a distinct, independently assessable outcome, in line With the curriculum gap analysis recommendation to improve assessment alignment.

UNIT I: Foundations of Communication

Content

Basics and of communication; levels of communication — interpersonal, group and mass; verbal and nonverbal communication; channels of communication; barriers to communication; intercultural communication.

Widely used A1 Tools for the Classroom

The following A1 tools are widely used in communication training and are introduced in this unit for the teacher to demonstrate in class:

A1 Tool	Classroom Application
Grammarly	Real-time grammar, spelling and punctuation correction for written communication exercises.
ChatGPT / Google Gemini	Generating and explaining communication scenarios and answering language queries in class discussion.
Google Speech-to-Text	Transcription practice and pronunciation feedback for spoken communication exercises.
CultureWizard	Simulating intercultural communication case studies for classroom discussion.
Quizlet A1	Vocabulary and concept-recall quizzes on communication theory.

Unit Outcomes

• Analyze the process, levels and channels of communication, including verbal and nonverbal elements, in a given workplace scenario.
• Assess barriers to communication, including intercultural barriers, and construct strategies to overcome them.
Practical Examples (for discussion)
• A multicultural project team from India, Japan and the United States faces communication breakdowns due to differing communication styles; discuss how intercultural communication theory explains the friction and how it can be resolved.
• A team member with an indirect communication style avoids eye contact in a stakeholder meeting; analyse the nonverbal cues involved and propose an approach to draw out their input effectively.

Exercise problems (for student practice)

• Describe the process of communication and its different levels, using an example from your own project work.

• Differentiate verbal from nonverbal communication and explain the importance of nonverbal cues, using a workplace scenario.

• Identify three communication barriers in a given case study and suggest strategies to overcome them.

Integration of LSRW Skills

This unit integrates listening through analysis of recorded communication scenarios, speaking through self-introductions and discussions, reading through case studies on communication barriers, and writing through reflective summaries and communication analyses. A1 tools provide continuous, personalised feedback across all four skills, reinforcing them as a single connected competence rather than isolated topics.

Integrated Lab Activity

Lab component: self-introduction and icebreaker practice; recording and reviewing a one-minute self-introduction using Google Speech-to-Text for pronunciation feedback, followed by a brief written reflection on the feedback received.

UNIT II: Listening and Speaking Skills

Content Effective listening; traits Of a listener; listening modes and barriers to effective listening; achieving confidence, clarity and fluency in speech; effective presentation strategies including Virtual presentations; meetings and conferences, including online meeting etiquette and asynchronous collaboration in virtual/hybrid workplaces; paralinguistic features; persuasive speaking; barriers to speaking.

Unit Outcomes

• Assess active listening skills and identify the traits and common barriers of effective listening in face-to-face and virtual settings.
• Construct and deliver a structured presentation — in person and virtual — applying paralinguistic features and persuasive-speaking techniques to engage an audience.
• Apply appropriate etiquette for online meetings and asynchronous communication in hybrid workplace settings.
Practical Examples (for classroom discussion)
• During a technical troubleshooting meeting, some team members are distracted and miss key information; analyse the listening barriers present and propose strategies to improve listening within the team.
• A team's presentation fails to engage stakeholders because of a monotone delivery and rushed pace; analyse the paralinguistic issues and propose specific improvements.
• A distributed project team spread across time zones struggles to stay aligned using only email; discuss how asynchronous collaboration tools and online-meeting etiquette could improve coordination.

Exercise "Problems (for student practice)

• List the traits of a listener and explain how each trait supports effective communication. Prepare and deliver a one-minute impromptu talk (Just A Minute) on a given engineering topic, then identify one paralinguistic feature you used effectively.
• Identify three barriers to effective speaking that a student might face and suggest strategies to overcome them.
• Draft a short agenda and set of ground rules for a virtual project-status meeting, including etiquette for muting, screen-sharing and turn-taking.

Listening activities lead naturally into speaking tasks such as presentations and discussions, followed by reading presentation materials, outlines and meeting agendas. and writing reflections or meeting minutes — including asynchronous written updates for distributed teams. A speech-coaching and feedback tools support improvement throughout this communication cycle.

Integrated Lab Activity

Lab component: Just A Minute (JAM) sessions and situational role plays (project-meeting and client-interaction scenarios, including a simulated Virtual meeting); fluency and filler-word feedback using an A1 speech-coaching tool such as Orai or ELSA Speak.

UNIT III: Reading Skills, Vocabulary and Information Literacy

Content Reading techniques for comprehension; study skills; intensive, extensive and critical reading; reading for different purposes; information literacy — evaluating the credibility of online and A1-generated content and using digital sources responsibly; vocabulary building through prefixes, suffixes and root words
Unit Outcomes

• Apply appropriate reading techniques — skimming, scanning, intensive, extensive and critical reading —to comprehend technical texts.
• Evaluate the credibility and reliability of online and A1-generated content, and apply principles of responsible source use.
• Construct technical vocabulary using prefixes, suffixes and root words.

Practical Examples (for classroom discussion)

• An engineering student researching renewable-energy technologies must read journal articles, industry reports and technical manuals; discuss which reading technique suits each source and Why.
• Given a paragraph containing unfamiliar technical terms, demonstrate how context clues and word roots can be used to infer their meaning.
• A student uses an A1 chatbot to summarize a technical topic and the summary contains a factual error; discuss how to verify A1-generated content against reliable sources before using it.

Exercise Problems (for student practice)

• Skim a given technical passage and summarize its main idea in two sentences, then scan it to locate a specific fact.
• Identify the prefixes, suffixes and words in five given engineering terms and explain their meanings.
• Read a short case study critically and list two assumptions or claims that need further verification. • Compare an A1-generated summary Of a technical article With the original source and identify any inaccuracies, omissions or bias.

Integration of LSRW Skills

Reading technical texts is integrated with listening to lectures or podcasts, speaking through discussions and presentations, and writing summaries, reviews and critical responses — including short written evaluations of A1-generated content. A1-assisted vocabulary and reading reinforce comprehension and language development, while explicit exercises build the critical-evaluation habits information literacy requires.

Integrated Lab Activity

Lab component: reading comprehension exercises on technical articles and case studies; vocabulary-building activities using flashcards and an A1 vocabulary tool such as Quizlet or Merriam-Webster Vocabulary Builder; a source-evaluation exercise comparing A1-generated and human-authored content.

UNIT IV: Technical and Professional Writing

Importance and characteristics Of technical writing; paragraph construction; essays and letter writing (formal and informal); professional email writing and etiquette; resume/CV writing.

Unit Outcomes

• Construct well-organized paragraphs, essays and technical reports using clarity, coherence and conciseness.

• Construct professional letters, emails and resumes following correct format and etiquette, and critically evaluate A1-suggested revisions accepting them.

Practical Examples for discussion)

• A recent graduate must summarize a technical safety-incident report for non-technical stakeholders; identify key techniques for translating technical detail into plain, accessible language.
• Draft a formal email requesting an extension on a project deadline; discuss the tone, structure and etiquette used.
Exercise problems (for student practice)
• Write a well-structured paragraph on a chosen engineering topic, including a topic sentence, supporting details and a clincher sentence.
• Draft a formal letter of complaint regarding a defective product received by your organization.
• Write a professional email to a client explaining a delay in project delivery, then revise it for tone using an A1 writing tool, and note any edit you chose to reject and Why.

Integration of LSRW Skills

Writing activities begin with listening to workplace situations or project briefings, reading authentic professional documents, speaking through review and collaborative discussions, and finally writing polished documents refined with A1-assisted feedback that the student critically reviews. Writing thus becomes the culmination of integrated communication rather than an isolated skill.

Integrated Lab Activity

Lab component: cover-letter and resume-writing workshop, email etiquette practice and peer review, With drafts refined using Grammarly or a similar A1 writing assistant and a brief note on what the student accepted, rejected or edited from the A1's suggestions

UNIT V: Communication for Career Readiness and Responsible Use of A1

Content Communication for career readiness and leadership; group discussions and technical interviews, including Virtual interviews; poster presentation; describing people, places, Objects and events; professional networking, digital portfolios and LinkedIn communication; role of A1 in communication and language learning — chatbots, automated translation, and ethical and responsible use of A1 tools.

Unit Outcomes

•Participate effectively in group discussions and technical interviews — in person and virtual — applying career-readiness communication strategies.

• Construct a professional digital presence, including a LinkedIn profile and digital portfolio, appropriate for engineering career readiness.

•Evaluate the opportunities, limitations and ethical considerations of using A1 in communication and language learning

Practical Examples (for classroom discussion)

• Ina mock technical interview, a candidate struggles to explain a project clearly to a non-technical panel; discuss strategies for structuring a clear, confident response.

• A student uses an A1 writing assistant to draft a report but submits it without review; discuss the ethical concerns involved and how to use A1 responsibly While maintaining academic integrity.

• A student's LinkedIn profile and do not reflect their project work; discuss how to present technical achievements professionally to a recruiter.

Exercise Problems (for student practice)

• prepare and deliver a two-minute self-introduction for a technical interview, highlighting your academic background and career goals.

• Design a one-page poster summarizing a mini-project using an A1 design tool, and present it in two minutes. Draft a LinkedIn summary and one project entry for a digital portfolio, describing your role and outcomes.

• Discuss two ethical considerations in using A1 for academic writing and propose one guideline for their responsible use.

Integration of LSRW Skills

Career-readiness tasks naturally integrate listening during interviews and discussions, speaking through presentations and group discussions, reading job descriptions and technical material, and writing resumes, emails, LinkedIn profiles and portfolio entries. A1 tools support interview practice, language refinement and responsible communication, reinforcing all four language skills simultaneously. Integrated Lab Activity

Lab component: mock group discussions and technical interviews, including at least one simulated virtual interview; poster design and presentation practice using an A1 design tool such as Canva A1 or Gamma.app; LinkedIn-profile and digital-portfolio drafting exercise.

Text Books

• Raman, M. , & Sharma, S. (2012). Technical communication (2nd ed.). Oxford university press.

Reference Books

• Pushplata, & Kumar, S. (2011). Communication skills. Oxford University Press.
•Rizvi, M. A. (2005). Effective technical communication. Tata McGraw-Hill.
• Mishra, S., & Muralikrishna, C. (2006). Communication skills for engineers. Pearson.
•Sudha Rani, D. (2011). A manual for English language laboratories. Pearson.
• Guffey, M. Loewy, D. (2022). Business communication: Process and (10th ed.). Cengage Learning. •Bovee, C L,, & Thill, J. V. (2023). Business communication today (16th ed.). Pearson.
• Selwyn, N. (2022). Education and technology: Key issues and debates (3rd ed.). Bloomsbury Academic. •Locker, K. 0., & Kaczmarek, S. K. (2021). Business communication: Building critical skills (8th ed.). McGraw-Hill.

Web Resources

• eGyanKosh. (nd). National digital repository. https•.//egyankosh.ac.in/
• ReadTheory. (n.d.). Adaptive reading comprehension practice. https://readtheory.org/
• National Digital Library Of India. (n.d.). https://ndl.iitkgp.ac.in/
• UNESCO. (2023). Guidance for generative A1 in education and research. https://www.unesco.org

Mapping of Course Outcomes to Program Outcomes
H: High emphasis M: Moderate emphasis L: low emphasis Not applicable

co\po	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	-	-	-	-	L	-	L	M	H	-	-
CO2	-	-	-	-	-	-	-	-	M	H	-	-
CO3	-	-	-	-	-	-	-	-	M	H	L	-
CO4	-	L	-	-	-	-	-	-	M	H	-	M
CO5	-	-	-	-	-	-	-	L	H	M	L	-
CO6	-	-	-	-	L	-	-	M	L	M	-	H

Note: Mapping has broadened beyond P09 (individual/teamwork), POIO (communication/ and P012 ('ifelong learning) to reflect communication's contribution to P02 (problem analysis, through critical reading), P06 (engineer and society, through intercultural and ethical awareness), P08 (ethics, through responsible A1 use) and POII (project management, through meetings, reports and presentations), per the curriculum gap analysis recommendation.

Review Questions

• Analyze the process of communication and identify its various levels.
• Distinguish between verbal and nonverbal communication with examples.
•Describe intercultural barriers to communicat.on and strategies to overcome them.
• What are the traits of a good listener? Explain the common barriers to effective listening, in both in-person and virtual settings.
•F xplain the role of paralinguistic features in effective public speaking.
• Differentiate between intensive, extensive and critical reading, giving examples Of When each is used. •Explain how information literacy and source evaluation apply to A1-generated content.
•Explain the Steps involved in constructing an effective technical paragraph.
• Describe the structure and key characteristics of a formal technical report.
•Explain the etiquette to be followed in professional email communication and in online meetings.
• Describe how a professional digital presence (LinkedIn profile, digital portfolio) supports career readiness.
•Discuss the opportunities and ethical considerations of using A1 tools in language learning and communication.

Practical Applications across Engineering Branches

Mechanical Engineering: Writing technical reports on machine design and failure analysis; delivering safety briefings on the shop floor.
Civil Engineering: Preparing site-inspection reports and communicating project proposals clearly to clients and stakeholders.
Electrical and Electronics Engineering: Documenting circuit and control-system specifications; drafting client and vendor correspondence.
Computer Science and Engineering: Writing user documentation and project reports; presenting technical work and in technical interviews for software roles.
Chemical preparing process and safety-incident reports; communicating effectively within cross-functional plant teams.
All Branches: Participating in group discussions, virtual meetings and poster presentations at technical conferences; building a professional digital presence, and preparing resumes and for campus placements

I Year-I Semester	Computational Thinking and Problem Solving using C	L	T	P	C
		3	0	0	3

Course Objective

To equip students with the fundamental knowledge and programming skills required to develop efficient C programs using control structures, arrays, functions, pointers, structures, and file handling techniques for problem-solving applications.

Course Outcomes

1. Analyze engineering problems and develop structured computational solutions using computer system concepts
2. Apply decision-making, looping, and branching statements to solve conditional and repetitive problems.
3. Use arrays and strings for data storage and manipulation.
4. Design modular programs using functions and apply pointer concepts for dynamic and memory optimized programs.
5. Devise programs to manage and store complex data using structures and files.

Course Contents

UNIT I

Computational Thinking (CT): Meaning and relevance to engineering practice. The four pillars of CT — Decomposition, Pattern Recognition, Abstraction, and Algorithm Design. Anatomy of a computer system: hardware vs. software, CPU–memory–I/O model, the fetch–decode–execute idea. Number systems and data representation: binary, octal, decimal, hexadecimal and inter-conversions. Problem-solving methodology: problem understanding, algorithm/pseudocode writing, flowchart notation, and dry-running an algorithm by hand. Structured problem solving with control logic: sequence, selection, and repetition. Control structures in code: conditional execution and repetition, mapping real-world decisions to the right construct. Functions and modular decomposition. defining and calling functions, parameters and return values, local vs. global scope — embodying the 'decomposition' pillar directly in code.

Unit – II

Introduction to Programming: Introduction to components of the Computer system, Algorithm, Flow chart, Program development steps, C Tokens, Data Types, Operator precedence and associativity, Expression Evaluation, Structure of C program, simple programs using formatted and unformatted I/O statements, preprocessor directives.

Control Structures: Decision statements: if, if-else, nested if, if-else-if ladder, and switch case. Iterative statements: while, do-while, for, nested loops. Branching Statements: Break and continue.

Unit – III

Arrays: Definition, Types of Arrays, declaration, initialization, Operations on arrays. Strings: Fundamentals, declaration, initialization, accessing string, String manipulation.

Unit – IV

Functions: Definition and use, Declaration, Types of Functions, Parameter passing (Call by value and call by reference), Passing Arrays, Recursion, Recursion vs Iteration, function Vs Macro, Storage classes. Pointers: Definition, Declaration, Initialization, Pointer arithmetic, functions and pointers, Pointer to pointer, arrays and pointers, Pointers as Function Arguments, DMA

Unit – V

Structures, Unions and File Handling Structures: Definition, Declaration, Accessing the structure elements, Array of structures, Arrays within structures, pointer to structure, passing structure to function, nested structures, self-referential structures, bit fields.

File Handling: Purpose, Types of files, file opening modes, closing a file, file I/O, Error handling, Random Access to Files, Command line arguments.

Text Books

1. Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem-Solving", BCS Learning & Development.
2. B. W. Kernighan and D. M. Ritchie, the C Programming Language, 2nd ed., Englewood Cliffs, NJ, USA: Prentice-Hall, 1988.
3. Y. Kanetkar, Let Us C, 20th ed., New Delhi, India: BPB Publications, 2024.
4. N. Kamthane, Programming in C, 3rd ed., New Delhi, India: Pearson Education, 2015.

Reference Books

1. E. Balagurusamy, Programming in ANSI C, 9th ed., New Delhi, India: McGraw-Hill Education, 2024.
2. B. S. Gottfried, Programming with C, 2nd ed., New York, NY, USA: McGraw-Hill Education, 2006.

Web Resource Links

- https://www.programiz.com/c-programming
- https://www.geeksforgeeks.org/c/c-programming-language/
- https://www.tutorialspoint.com/cprogramming/index.htm

I Year-II Semester	AI Tools and Applications	L	T	P	C
		0	2	2	3

Course Objective

To equip students with the knowledge and skills to design, optimize, evaluate, and apply prompt engineering techniques for effective interaction with large language models in software development, data analysis, research, and problem-solving applications.

Course Outcomes

1. Recall the categories, capabilities, and limitations of major AI tools (text, image, code, data).
2. Explain the principles of prompt engineering and how generative AI models process instructions.
3. Apply AI tools to solve first-year engineering problems in analysis, writing, and coding tasks.
4. Analyze AI-generated outputs for accuracy, bias, and reliability before use.
5. Evaluate the ethical, academic-integrity, and societal implications

Course Contents

Unit 1: Introduction to AI and the AI Tools Landscape

(Lecture: 3 hrs | Practical: 6 hrs) Topics Covered:

1. What is AI, Machine Learning, and Generative AI — basic definitions and how they relate to one another. Page 1 AI Tools and Applications — Common Syllabus (All Branches)
2. Core categories of AI tools: conversational/text, code assistants, data-analysis tools, image-generation tools, and writing/productivity tools.
3. How large language models process and generate responses (conceptual, non-mathematical overview).
4. Criteria for selecting the right AI tool for a given task — accuracy needs, cost, data sensitivity, and output format.
5. Setting up accounts and workspaces; understanding free-tier versus paid-tier capabilities and limitations. Widely Used AI Tools by Application (for classroom coverage):

Category	Example Tools	Typical Application
Conversational / General-Purpose AI	ChatGPT, Claude, Gemini, Perplexity	Writing, research, coding help, file/data analysis, cited web search
AI Coding Assistants	GitHub Copilot, Cursor, Claude Code	In-IDE code completion, AI-native editing, multi-file agentic coding
Data Analysis Tools	ChatGPT (Advanced Data Analysis), Microsoft Copilot in Excel, Julius AI	Upload a dataset, generate statistics/charts, spreadsheet formulas via natural language
Image Generation	Midjourney, DALL·E 3, Stable Diffusion / Flux	Illustrations, concept art, design mockups

Writing & Productivity	Grammarly, Gamma, Fathom, Notion AI	Grammar/style checking, slide generation, meeting summaries, task automation
Audio, Video & Presentation (optional)	ElevenLabs, Runway/Sora, Synthesia	Text-to-speech, AI video generation, script-to-video presentations

Unit 2: Prompt Engineering and Generative AI Tools

(Lecture: 3 hrs | Practical: 6 hrs) Topics Covered:

1. Anatomy of a good prompt — context, clear instruction, desired format, and constraints.
2. Zero-shot, few-shot, and chain-of-thought prompting techniques and when to use each.
3. Role-based and context-setting prompts (e.g., asking the AI to respond as a reviewer, tutor, or domain expert).
4. Iterative prompt refinement — diagnosing a poor AI response and rewriting the prompt to fix it.
5. Using generative AI for brainstorming, summarizing, and drafting technical content.

Unit 3: AI Tools for Data Analysis and Visualization

1. AI-assisted spreadsheet and dataset analysis using natural-language commands.
2. Natural-language querying of datasets to extract summary statistics and insights.
3. AI tools for generating charts, graphs, and visual summaries from tabular data.
4. Interpreting AI-generated statistical summaries correctly and recognizing their limitations.
5. Identifying and correcting errors or misinterpretations in AI-generated data analysis.

Unit 4: AI Tools for Coding, Writing, and Productivity

1.AI coding assistants — code generation, explanation, and debugging support for simple programs.
2. AI writing assistants for reports, emails, and technical documentation.
3. AI tools for scheduling, note-taking, and meeting/lecture summarization.
4. AI-assisted presentation and slide-outline generation from a topic prompt.
5. Integrating AI tools into an efficient day-to-day academic and engineering workflow.

Unit 5: Ethics, Reliability, and Emerging Trends

1.Bias and hallucination in AI outputs, and techniques for detecting and fact-checking them.
2. Academic integrity and appropriate citation of AI assistance in coursework and submissions.
3. Data privacy and security considerations, including obligations under India's Digital Personal Data Protection Act, 2023 (DPDP Act), when uploading personal or institutional data.
4. Copyright and intellectual property considerations in AI-generated text and image content.
5. Emerging trends — multimodal AI and AI agents — and their implications for future engineering practice.

Text Books

1.Marr, B. (2024). Generative AI in practice: 100+ amazing ways generative artificial intelligence is changing business and society. Wiley.
2. Mollick, E. (2024). Co-intelligence: Living and working with AI. Portfolio/Penguin.
Reference Books
1.Selwyn, N. (2022). Education and technology: Key issues and debates (3rd ed.). Bloomsbury.

Tools and Applications — Common Syllabus (All Branches)

2. Susskind, R., & Susskind, D. (2022). The future of the professions: How technology will transform the work of human experts (Updated ed.). Oxford University Press.
3. Russell, S., & Norvig, P. (2021). Artificial intelligence: A modern approach (4th ed.). Pearson.

Web Resources

1.Google. (n.d.). Google AI essentials. Grow with Google. https://grow.google/ai-essentials/
2. OpenAI. (n.d.). OpenAI documentation and guides. https://platform.openai.com/docs
3. Anthropic. (n.d.). Prompt engineering overview. Claude Docs. https://docs.claude.com/en/docs/build-with-claude/prompt-engineering/overview
4. UNESCO. (2023). Guidance for generative AI in education and research. https://unesdoc.unesco.org/ 5. AICTE. (2025). AICTE inputs on Artificial Intelligence — Year of AI initiative. https://www.aicte.gov.in/downloads/initiatives/AICTE%20inputs%20on%20Artificial%20Intelligence%20-compre hensive.pdf 6. Ministry of Electronics and Information Technology, Government of India. (2023). Digital Personal Data Protection Act, 2023. https://www.meity.gov.in/content/digital-personal-data-protection-act-2023

I Year-I Semester	Introduction to Computers	L	T	P	C
		0	0	3	1.5

Course Objective

The IT Workshop for engineers is a training lab course spread over 60 hours. The modules include training on PC Hardware, Internet & World Wide Web and Productivity tools including Word, Excel, PowerPoint and Publisher.

Course Outcomes

1. Perform Hardware troubleshooting
2. Understand Hardware components and inter dependencies
3. Safeguard computer systems from viruses/worms
4. Document/ Presentation preparation
5. Perform calculations using spreadsheets

Course Contents

PC Hardware

Task 1: Identify the peripherals of a computer, components in a CPU and its functions. Draw the block diagram of the CPU along with the configuration of each peripheral and submit to your instructor.
Task 2: Every student should disassemble and assemble the PC back to working condition. Lab instructors should verify the work and follow it up with a Viva. Also students need to go through the video which shows the process of assembling a PC. A video would be given as part of the course content.
Task 3: Every student should individually install MS windows on the personal computer. Lab instructor should verify the installation and follow it up with a Viva.
Task 4: Every student should install Linux on the computer. This computer should have windows installed. The system should be configured as dual boot with both Windows and Linux. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.

Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

Task 1 – Word Orientation: The mentor needs to give an overview of LaTeX and Microsoft (MS) office or equivalent (FOSS) tool word: Importance of LaTeX and MS office or equivalent (FOSS) tool Word as word Processors, Details of the four tasks and features that would be covered in each, Using LaTeX and word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter in word.
Task 2: Using LaTeX and Word to create a project certificate. Features to be covered:- Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in both LaTeX and Word.
Task 3: Creating project abstract Features to be covered:-Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
Task 4: Creating a Newsletter: Features to be covered:- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes, Paragraphs and Mail Merge in word.

Excel

Excel Orientation: The mentor needs to tell the importance of MS office or equivalent (FOSS) tool Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered in each. Using Excel – Accessing, overview of toolbars, saving excel files, Using help and resources.
Task 1: Creating a Scheduler - Features to be covered: Gridlines, Format Cells, Summation, auto fill, Formatting Text
Task 2: Calculating GPA - Features to be covered:- Cell Referencing, Formulae in excel – average, std. deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

PowerPoint

Task 1: Students will be working on basic power point utilities and tools which help them create basic PowerPoint presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.
Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.
Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

Text Books

1. Comdex Information Technology course tool kit Vikas Gupta, WILEY Dreamtech
2. The Complete Computer upgrade and repair book, 3rd edition Cheryl A Schmidt, WILEY Dreamtech
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
4. PC Hardware - A Handbook – Kate J. Chase PHI (Microsoft)
5. LaTeX Companion – Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide Third Edition by David Anfinson and Ken Quamme. – CISCO Press, Pearson Education.
7. IT Essentials PC Hardware and Software Labs and Study Guide Third Edition by Patrick Regan – CISCO Press, Pearson Education.

Reference Books

1. Scott.Mueller,Upgradingand RepairingPCs,22/e, QUE, 2008.
2. Cheryl A Schmidt, The CompleteComputerupgradeandrepairbook,3/e, Dream tech, 2002

I Year-I Semester	Computational Thinking and Problem Solving using C Laboratory	L	T	P	C
		0	0	3	1.5

Course Objective

To develop practical programming skills in C by implementing algorithms and solving problems using control structures, arrays, functions, pointers, dynamic memory allocation, structures, and file handling techniques.

Course Outcomes

1. Apply basic C programming constructs such as variables, data types, operators, and input/output operations to solve simple problems.
2. Develop programs using control structures to implement decision making and iterative tasks.
3. Demonstrate the usage of arrays to solve problems related to lists of elements.
4. Implement modular and memory optimized programs using functions and pointers.
5. Design programs using structures and file handling techniques to manipulate stored data.

List of Experiments

1.Given the coefficients a, b, and c, design an algorithm/flowchart and then a program that computes and classifies the roots of $ax^2 + bx + c = 0$ (real & distinct, real & equal, or complex), handling the a = 0 edge case separately. Trains decomposition (splitting the problem into discriminant computation, case analysis, and output formatting) and abstraction (treating the quadratic formula as a reusable procedure).

2. Write a program that (a) tests whether a given number is prime by recognising the repeating pattern of divisibility checks up to $\sqrt{n}$, and (b) computes the GCD and LCM of two numbers using the Euclidean algorithm. Students compare a naive brute-force approach with the optimised pattern-based approach and record the difference in number of operations.

3. Write the C programs to perform the following

a) Demonstrate the precedence and associativity among operators using single expression

b) Demonstrate the type casting operations

c) Demonstrate different format specifies on different data types

4. Write C programs for the following using decision making statements

a) Find roots of quadratic equation.

b) Find the max and min of three numbers using if-else.

c) Determine type of character (vowel, consonant, digit, special character).

5. Write the C programs to perform the following

a) Read a number and display in reverse.

b) Check for Armstrong number property

c) Convert a binary number (entered as an integer) into its decimal equivalent.

6. Write a menu-driven C program using switch-case and loops to display:

a) Prime numbers in a given range

b) Fibonacci series

c) Different patterns like Pascal triangle

7. Implement the following using arrays

a) Largest and smallest from a list of elements.

b) Program for Linear Search. c) Program for arranging elements

8. Implement the following using arrays

a) To count the total number of duplicate elements in an array.

b) Matrix addition

c) Matrix multiplication
9. Write a program in C using functions
a) Implementation of strong number property.
b) Implementation of call by value and call by reference
c) Demonstrate the string operations with and without library functions (length, reverse, copy, concatenation, compare)
10. Write the C programs to perform the following
a) GCD using recursion and non-recursion.
b) Demonstrate working of macros vs functions.
11. Write the C programs to perform the following
a) Find the sum and average of the list of elements using DMA Functions
b) Demonstrate pointer arithmetic.
12. Write the C programs to perform the following
a) Passing structure as a parameter to a function b) Nested structures.
13. Write the C programs to perform the following
a) Count the number of lines, words, and characters in a file using command line arguments.
b) Merging the contents of two files into a new file.

Text Books

1. B. W. Kernighan and D. M. Ritchie, The C Programming Language, 2nd ed., Englewood Cliffs, NJ, USA: Prentice-Hall, 1988.
2. Y. Kanetkar, Let Us C, 20th ed., New Delhi, India: BPB Publications, 2024.
3. N. Kamthane, Programming in C, 3rd ed., New Delhi, India: Pearson Education, 2015.

Reference Books

1. E. Balagurusamy, Programming in ANSI C, 9th ed., New Delhi, India: McGraw-Hill Education, 2024.
2. B. S. Gottfried, Programming with C, 2nd ed., New York, NY, USA: McGraw-Hill Education, 2006.

Reference Links

- https://www.programiz.com/c-programming
- https://www.geeksforgeeks.org/c/c-programming-language/
- https://www.tutorialspoint.com/cprogramming/index.htm

I Year I Semester	Advanced Physics Laboratory (CSE, IT and Allied Branches of Engineering)	L	T	P	C
		0	0	3	1.5

LIST OF EXPERIMENTS
(Any 10 of the following listed experiments)
(Out Of which any TWO experiments may conducted in virtual mode)

1. Determination of the Wavelength of a Given Laser Source and Grating Element Using a Plane Transmission Grating.
2. Determination of radius of curvature of a given plano convex lens by forming Newton's rings.
3. Determination of wavelengths of different spectral lines in mercury spectrum using grating in normal incidence configuration.
4. Determination or resolving power of telescope.
5. Determination of dielectric constant of given material.
6. Study the variation of B versus H by magnetizing the magnetic material (B-H curve).
7. Determination of temperature coefficients of a thermistor.
8. Determination of wavelength of Laser and grating element.
9. Estimation of Planck's constant using photoelectric effect.
10. Determination of the Resistivity of semiconductor by four probe method.
11. Determination of the energy gap of a semiconductor using p-n junction diode.
12. Study the variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
14. Determination of Acceleration due to gravity and Radius of gyration using Compound pendulum.
15. Determination of magnetic susceptibility by Kundt's method
16. Verification of Brewster's law.
17. Sonometer: Verification of laws of stretched string
18. Determination of frequency of electrically maintained tuning fork by Melde's apparatus.

References:

1. S. Balasubramanian, M.N. Srinivasan "A Text Book of Practical Physics". S chand Publishers, 2017.
V-Lab: vlab.co.in

I Year I Semester	Communicative English Laboratory (Common for All Branches)	L	T	P	C
		0	0	3	1.5

Prerequisite: Intermediate English

Course Outline

This course is designed to enhance the communication competencies of engineering students through focused practice in listening, speaking, reading, and writing skills. It aims to build proficiency in oral and written technical communication, and prepare students to meet the communication demands within and across cultures required for the engineering profession. Hence, it is a blend of academic, technical and professional communication.

Each unit has a common theme that runs across the unit to teach all the skills and language elements. Texts are interactive and engaging in nature. All the components of each unit are integrated to provide a contextualised learning experience for students. Tasks provide space for learning in the classroom with the teacher as a facilitator as well as autonomous learning. Reading texts are short and precise — not to learn by heart the contents but to develop reading sub-skills. Writing tasks mostly incorporate AI tools to help refine students' writing skills, but not rely on them completely. Grammar has to be taught remedially — no theoretical inputs are required; students need to be corrected where they frequently go wrong.

Course Objectives

To enhance communicative competencies in students to excel in academic and social skills that involve:

a. Listening to authentic texts to comprehend and respond appropriately as both audience and conversant.
b. Communicating in academic and social (formal) contexts with reasonable fluency and accuracy (neutral accent, social and grammatical appropriateness).
c. Comprehending a reading text of various types for academic (technical) and career purposes.
d. Writing for academic and professional purposes.
e. Communicating across cultures that requires a blend of cognitive, interpersonal, and linguistic skills.

Course Outcomes

CO1 Comprehend specific information, context, and central ideas from social, academic, or workplace conversations and audio-visual material. *[Understand (K2)]*

CO2 Apply appropriate social norms to bridge the gaps and collaborate effectively across diverse cultural backgrounds. *[Apply (K3)]*

CO3 Examine discourse features and speech strategies to participate effectively in group discussions, informal exchanges, and short presentations on technical and general topics. *[Analyse (K4)]*

CO4 Assess written and spoken texts to extract key ideas and produce concise, accurate summaries. *[Evaluate (K5)]*

CO5 Construct well-organised paragraphs, essays, critical reviews, and other professional documents suited to academic and workplace contexts. *[Create (K6)]*

Contents

Unit-I: Environment

Unit-II: Technology and Social Media

Unit-III: IKS / Gender Equity / Gender Sensitization

Related Unit-IV: Exploration — Technical / Professional Communication Unit-V: Cross-Cultural Communication

Unit No	Theme	Reading	Vocabulary	Writing	Grammar (only remedial)	Listening	Speaking
1	Environment	Different texts related to the environment (2-3 texts with about 500 to 600 words)	Drawn from the texts — Synonyms and antonyms	Answering the examination questions	Simple sentences required for answering to the point	Listening texts on environment: Listening for gist/main theme	Talking about nature around you / environmental issues
2	Technology and Social Media	Different texts related to communication on social media (2-3 texts with about 500 to 600 words)	Drawn from the texts — Homonyms	Information transfer from graph to text and text to graph	Reported speech, comparatives and superlatives	Listening to texts related to communication on social media — Listening for main and supporting ideas	Role-plays
3	IKS-Related	Different texts related to communication on Indian culture (2-3 texts with about 500 to 600 words)	Drawn from the texts — One word substitutes	Narrating -- letter and email writing	Tenses and time connectors	Listen to texts related to communication on Indian culture — listening for predicting and inferring	Story-telling / narrating events / anecdotes
4	Exploration — Technical / Professional Communication	Different texts related to technology and advancements (2-3 texts with about 500 to 600 words)	Drawn from the texts — Roots, prefixes and suffixes	Reporting	Voices and objective language	Listening texts related to technology and advancements — listening for specific information, listening for cause and effect	Debates on technology and its impact on various walks of life

5	Cross-Cultural Communication	Different texts related to communication across cultures (2-3 texts with about 500 to 600 words)	Drawn from the texts — Expanding vocabulary	Making notes and writing summaries	Nominalization, reporting verbs, reducing complex sentences	Listening to different texts on different cultures — listening for tone and attitude	Interviews (semi-formal) on cultures

Assessment Pattern

Internal Assessment: 40%

Unit-wise assessment: 5 × 10 = 50 marks

Mid-term assessments: 2 × 25 = 50 marks

External Assessment: 60%

1. Reading comprehension — unseen passages: 2 × 5 = 10 marks (tests vocabulary and reading sub-skills)
2. Writing — 2 tasks: 2 × 5 = 10 marks
3. Listening — 2 texts = 10 marks
4. Speaking — completing conversations and matching expressions as per context: 10 marks
5. Grammar — editing passages with errors: 10 marks
6. Information transfer: 10 marks

Text Books, Reference Books and Web Resources

Text Books

1. Technovate - An Elixir to Communicative Competence by Prof. Hari Prasad and Prof. Madhavi (Maruthi Publishers (3 units)
2. English for Engineers by Board of Editors (Orient Blackswan) (2 units)

Reference Books

- Know your language skills by Prof. Venkat Reddy and Dr. K V Temuzion
- Ingenuity by Tabitha Chekuri and Ravi Kumar Peramalla
- Introduction to Indian Knowledge System:Concepts and Applications by B. Mahadevan, Vinayak Rajat Bhat and Nagendra Pavana R.N., PHI Learning, 2022.

I Year II Semester	Differential Equations and Vector Calculus (Common for all branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES
• This course is aimed to provide the learner with several methods for solving differential equations and partial differential equations. • To prepare the student to calculate gradient, surface and volume integrals by applying standard theorems.

COURSE OUTCOMES		
Upon successful completion of the course, the student will be able to:		Cognitive Level
CO1	Model simple physical problems involving rate as first order differential equations and solve the resulting equation.	K2, K3, K5
CO2	Model electrical circuits problems or vibrating systems problems as linear higher order ordinary differential equations and solve.	K2, K3, K5
CO3	Solve partial differential equations that model physical processes.	K2, K3, K5
CO4	Apply the knowledge of gradient, divergence and curl and interpret the physical meaning of different operators.	K2, K3, K5
CO5	Compute the work done against a field, circulation and flux using vector calculus methods.	K2, K3, K5

K1- Remembering, K2- Understanding, K3-Applying, K4- Analyzing, K5- Evaluating, K6- Creating

Course Contents

UNIT I: Differential equations of first order and first degree:

Exact equations and equations reducible to exact form (integrating factor), Linear differential equations – Bernoulli's equations. Orthogonal Trajectories, Applications: Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

UNIT II: Linear differential equations of higher order (Constant Coefficients):

Definitions, homogenous and non-homogenous, complimentary function, particular integral (e^{ax}, sinx cosx, x^m, $e^{ax}v(x)$, $xv(x)$) general solution, Method of variation of parameters- Wronskian. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT III: Partial Differential Equations:

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method, Non-linear partial differential equations using charpit's Method. Higher-order homogeneous partial differential equations with constant coefficients of the type

$f(D, D')\, z = F(x, y)$, with $F(x, y) = e^{ax+by}$, $\sin(ax+by)$, $\cos(ax+by)$ and $x^m y^n$

UNIT IV: Vector differentiation:

Scalar and vector point functions, vector operator Del, Gradient and applications, Directional derivative, Divergence-Solenoidal and Curl-Irrotational Field - Scalar Potential, Vector identities.

UNIT V: Vector integration:

Line integral-circulation-work done by the force, surface integral-flux, Green's theorem in a plane (without proof), Stoke's theorem (without proof), volume integral, Divergence theorem (withou proof) and their applications.

Text Books

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, 2017, 44th Edition
2. Advanced Engineering Mathematics, Erwin Kreyszig, John Wiley & Sons, 2018, 10th Edition.

Reference Books

1. Thomas Calculus, George B.Thomas, Maurice D.Weir and Joel Has Pearson Publishers, 2018, 14th Edition.
2. Advanced Engineering Mathematics, Dennis G.Zill and Warren S.Wright, Jones and Bartlett, 2018.
3. Advanced Modern Engineering Mathematics, Glyn James, Pearson publishers, 2018, 5th Edition.
4. Advanced Engineering Mathematics, R.K.Jain and S.R.K.Iyengar, Alpha Science International Ltd., 2021, 5thEdition (9th reprint).
5. Higher Engineering Mathematics, B.V.Ramana, McGraw HillEducation,2017.
6. Advanced Engineering Mathematics by H. K Dass, S. ChandPublications,2022, Twenty two Edition (Reprint 2022).
7. Numerical Python: A Practical Techniques Approach for Industry, Robert Johansson, APress, 2015.

Web Resources

1. https://mathworld.wolfram.com/F.rst-OrderOrdinaryDifferentialEquation.html
2. https://en.wikipedia.org/wiki/Differential_equation
3. https://en.wikipedia.org/wiki/Partial_differential_equation
4. https://en.wikipedia.org/wiki/Vector_calculus
5. https://en.wikipedia.org/wiki/Vector_calculus

I Year II Semester	Advanced Chemistry (For Computer Science and allied Engineering)	L	T	P	C
		3	0	0	3

Course Objectives

1. To understand the fundamentals of quantum chemistry, including wave-particle duality, quantum numbers, and molecular orbital theory relevant to computing materials.
2. To comprehend the chemistry and electronic properties of semiconductor materials and the chemical processes involved in semiconductor-device fabrication.
3. To evaluate electrochemical principles governing batteries, supercapacitors, and fuel cells as energy-storage technologies for computing systems.
4. To analyze corrosion mechanisms in electronic devices and design appropriate protective techniques for PCBs, solder joints, and interconnects.
5. To explore the chemistry, synthesis methods, and properties of nanomaterials used in nanoelectronics, quantum computing, and sustainable electronics.

Course Outcomes (COs)

After successful completion of the course, the student will be able to:

CO	Course Outcome Statement	Bloom's Level
CO1	Apply quantum chemistry principles to analyze molecular systems and explain molecular orbital theory for computing materials.	L3–L4 (Apply, Analyze)
CO2	Analyze semiconductor materials, doping chemistry, and fabrication processes used in modern electronic devices.	L3–L4 (Apply, Analyze)
CO3	Evaluate energy-storage technologies including batteries, supercapacitors, and fuel cells for computing and data-centre applications.	L3–L4 (Apply, Analyze)
CO4	Analyze corrosion mechanisms in electronic devices and recommend appropriate protective techniques for PCBs and interconnects.	L3–L4 (Apply, Analyze)
CO5	Design advanced materials solutions using nanotechnology principles and AI-assisted tools for nanoelectronics and quantum computing.	L5–L6 (Evaluate, Create)

Course Contents

UNIT I: Quantum Chemistry **09 Hrs**

Fundamentals of quantum chemistry: black-body radiation, photoelectric effect, wave-particle duality, de Broglie wave equation, Heisenberg's uncertainty principle. Fundamentals of quantum mechanics: Schrödinger wave equation, significance of Ψ and Ψ^2; quantum numbers; particle in a one-dimensional box. Molecular orbital theory: bonding in homonuclear and heteronuclear diatomic molecules; energy-

level diagrams of O_2 and CO. π-molecular orbitals of butadiene and benzene; calculation of bond order.

UNIT II: Semiconductor Chemistry **10 Hrs**

Atomic structure and chemical bonding relevant to semiconductors; band theory - valence band, conduction band, band-gap energy. Intrinsic and extrinsic semiconductors: silicon, germanium, gallium arsenide. Doping chemistry: n-type (phosphorus, arsenic) and p-type (boron, aluminium) dopants. Chemical vapor deposition (CVD) for thin-film formation; silicon dioxide (SiO2) formation and properties. Chemistry of compound semiconductors: GaAs, InP, SiC.

UNIT III: Electrochemistry and Energy Storage **10 Hrs**

Electrochemical cells: galvanic cells, electrode potential, Nernst equation and problems; potentiometry (redox reactions); conductometry (strong acid vs strong base, weak acid vs strong base). Primary batteries: zinc-air battery, sodium-air battery; secondary batteries — chemistry of charging and discharging of lead-acid, nickel-cadmium, nickel-metal hydride. Lithium-ion batteries: construction, working, and applications of LiCoO2. Supercapacitors: definition, classification and applications; fuel cells — hydrogen fuel cells and direct methanol fuel cells (DMFC). Battery management systems: overcharge protection and thermal management.

UNIT IV: Chemistry of Corrosion and Protective Techniques **10 Hrs**

Corrosion: definition, examples, types — chemical corrosion and electrochemical corrosion; Pilling-Bedworth rule. Galvanic corrosion; concentration-cell corrosion; factors affecting corrosion. Deal-Grove model: thermal oxidation of silicon; passivation layers — silicon dioxide, silicon nitride, and aluminium oxide. Corrosion of printed circuit boards (PCBs): copper oxidation, tin whiskers; corrosion in solder joints and interconnects. Protective techniques: proper design, pure metals, metal alloys, inhibitors; cathodic protection — sacrificial anodic and impressed-current protection; electroplating (nickel) and electroless plating (copper).

UNIT V: Chemistry of Nanomaterials **09 Hrs**

Introduction to nano chemistry: size-dependent properties, quantum confinement. Carbon nanomaterials: fullerenes, carbon nanotubes (CNTs), graphene; synthesis methods — chemical vapor deposition (CVD), sol-gel process. Quantum dots: synthesis, properties, applications in displays and quantum computing. Metallic nanoparticles: preparation and applications of gold, silver, and copper

nanoparticles. Applications: nanoelectronics, interconnects, sensors (optical and biosensors), memory devices. Spintronics materials: magnetic nanoparticles, topological insulators; chemistry of quantum-computing materials — superconducting materials (NbTi, Nb3Sn), ion-trap materials.

Textbooks

1. Jain, P. C., & Jain, M. (2020). Engineering chemistry (17th ed.). Dhanpat Rai Publishing Company.
2. Agarwal, S. (2026). Engineering chemistry (5th ed.). Cambridge University Press.

Reference Books

1. Linden, D., & Reddy, T. B. (Eds.). (2001). Handbook of batteries (3rd ed.). McGraw-Hill.
2. Rao, C. N. R., Müller, A., & Cheetham, A. K. (Eds.). (2007). The chemistry of nanomaterials: Synthesis, properties and applications (Vols. 1–2). Wiley-VCH.
3. Poole, C. P., & Owens, F. J. (2003). Introduction to nanotechnology. John Wiley & Sons.
4. Sharma, B. K., & Gaur, H. (2019). Engineering chemistry. Krishna Prakashan Media.
5. Dara, S. S., &Umare, S. S. (2018). Engineering chemistry (15th ed.). S. Chand Publishing.

Web Resources

- NPTEL. (n.d.). Engineering chemistry courses. https://nptel.ac.in
- IBM Quantum. (n.d.). IBM Qiskit learning. https://learning.quantum.ibm.com
- Google. (n.d.). Google Colab. https://colab.research.google.com
- OpenCV. (n.d.). OpenCV Python documentation. https://docs.opencv.org
- Materials Project. (n.d.). Open nanomaterials database. https://materialsproject.org

I Year II Semester	Design Thinking and Innovation	L	T	P	C
		0	1	3	2.5

Course Objective

To develop students' ability to identify real-world problems, understand user needs, generate creative solutions, and apply design-thinking and innovation processes to develop feasible, user-centered, and sustainable solutions.

Course Outcomes

1. Explain the design thinking process as applied to UX/UI and software product development.
2. Apply user research methods (interviews, journey mapping, competitive analysis) to identify digital product opportunities.
3. Analyze user flows and information architecture to define scoped, testable feature requirements.
4. Create wireframes and interactive prototypes using digital design tools, applying visual hierarchy and accessibility principles.
5. Evaluate prototypes through usability testing and heuristic evaluation, and justify iterative design refinements.

Course Contents

Unit 1: Introduction to Design Thinking for Digital Products & User Empathy

Design thinking overview for software/UX; human-centered design in digital products; user research methods (interviews, surveys, contextual inquiry); empathy mapping for digital users; personas for software users.

Widely Used AI Tools by Application (for classroom coverage):

Category	Example Tools	Typical Application
Conversational / General-Purpose AI	ChatGPT, Claude, Gemini, Perplexity	Synthesizing interview notes, competitive research, drafting personas and journey narratives
AI-Assisted UX/UI Design Tools	Figma AI, Google Stitch, Uizard	Auto-generating wireframes, alternate UI styles, and onboarding microcopy variations
Design & Prototyping Platforms	Figma, Penpot	Industry-standard, free-to-use wireframing and clickable prototype tools
User Research & Transcription	Otter.ai, Fireflies.ai	Transcribing and summarizing user interviews and usability-test sessions
Accessibility & Usability Checking	WebAIM Contrast Checker, Figma accessibility annotations	Checking colour contrast, tap-target size, and screen-reader labels
Presentation & Pitch Tools	Gamma, Canva Magic Media	Building UX case-study pitch decks and visual before/after comparisons

Unit 2: Define — Problem Framing for Digital Solutions

Synthesizing UX research; affinity mapping; user journey mapping; POV & HMW statements; scoping an MVP; competitive/comparative app analysis. Teams of 3–4 are formed at the start of this unit and select one shared app/website problem to carry through the rest of the course.

Suggested AI Tools for This Unit:

ChatGPT / Claude — clustering pooled research notes into UX pain-point themes and drafting candidate POV/HMW statements.
Perplexity — quick competitive research on similar apps/websites for the comparative analysis exercise.

Unit 3: Ideation & Information Architecture

Divergent/convergent ideation for software features; Crazy 8s sketching; user flows; site maps and information architecture; card sorting; role of AI tools in ideation and content generation.

Suggested AI Tools for This Unit:

• Figma AI / Google Stitch / Uizard — generating alternate feature ideas or onboarding microcopy variations.
• ChatGPT / Claude — expanding a Crazy 8s sketch set with additional feature or flow ideas for comparison.

Unit 4: Prototyping — Wireframes, Clickable Prototypes & AI-Assisted UI Generation

Low-fidelity wireframes (paper and digital); wireframing and prototyping using Figma or Penpot (both free); UI design principles (visual hierarchy, typography, color, accessibility); building clickable prototypes; AI-assisted UI generation tools; design-system basics (components, tokens, reusable styles). Opens with a 30–45 minute guided tool-bootcamp session on Figma/Penpot before graded work begins. Suggested AI Tools for This Unit: Design Thinking — CSE and Allied Branches • Figma AI / Google Stitch / Uizard — auto-generating alternate visual styles (colour/typography) for a screen. • ChatGPT / Claude — drafting placeholder UI copy and reviewing design-system naming conventions for consistency.

Unit 5: Usability Testing, Iteration, Ethics & Pitching

Usability testing methods (moderated/unmoderated, task-based); think-aloud protocol; Nielsen's 10 usability heuristics; accessibility testing basics (colour contrast, tap-target size, screen-reader labels); dark patterns and inclusive design; iteration based on feedback; UX case-study presentation and dev-handoff. .

Suggested AI Tools for This Unit:

• ChatGPT / Claude — summarizing usability-test session notes into common themes and drafting the case-study pitch narrative.
• Gamma — building the UX case-study pitch deck from an outline; Otter.ai — transcribing usability-test recordings.

Text Books

1. Norman, D. A. (2013). The design of everyday things (Rev. ed.). Basic Books.
2. Garrett, J. J. (2011). The elements of user experience: User-centered design for the web and beyond (2nd ed.). New Riders.

Reference Books

1.Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). About face: The essentials of interaction design (4th ed.). Wiley.
2. Krug, S. (2014). Don't make me think, revisited: A common sense approach to web usability (3rd ed.). New Riders.
3. Pilot, L. (2024). AI for UX designers: Using artificial intelligence to supercharge your workflow and build AI-powered products.

Web Resources

1. Nielsen Norman Group. (n.d.). 10 usability heuristics for user interface design. https://www.nngroup.com/articles/ten-usability-heuristics/
2. Interaction Design Foundation. (n.d.). What is design thinking? https://www.interaction-design.org/literature/topics/design-thinking
3. Figma. (n.d.). Figma resources for design and prototyping. https://www.figma.com/resources/
4. WebAIM. (n.d.). Contrast checker. https://webaim.org/resources/contrastchecker/

I Year-II Semester	Data Structures	L	T	P	C
		3	0	0	3

Course Objective

To equip students with the knowledge and skills to design, implement, and analyze linear and non-linear data structures and algorithms for efficient data organization, searching, sorting, and problem-solving.

Course Outcomes

1. Explain the role of data structures in organizing and accessing data efficiently.
2. Design linked lists for dynamic data storage and manipulation.
3. Develop novel solutions to applications using linear data structures.
4. Apply stack and queue based algorithms for efficient task scheduling and traversals in graphs.
5. Explore different tree data structures and design hash-based solutions

Course Contents

Unit – I

Definition and importance of linear data structures, Abstract data types (ADTs) and their implementation, Types of data structures: Linear & Non-Linear. Searching Techniques: Linear & Binary Search, Sorting Techniques: Bubble sort, Selection sort, Insertion Sort.

Unit – II

Linked-Lists: Definition, Types, arrays Vs linked lists, Merits and Demerits; Operations: Creation, Insert, Delete, Traversals on Singly LL, doubly LL, circular LL.

Unit – III

Stacks: Definition, implementation of operations; QUEUES: Definition, types: Simple, Circular, Priority. Implementation of operations. Applications of Stacks & Queues: Conversion & Evaluation of expressions.

Unit – IV

Graphs: Basic Concepts, representation and storage of graphs: Adjacency Matrices and Adjacency Lists, graph traversals, DFS and BFS, Shortest-Path Algorithm: Dijkstra's Algorithm.

Unit – V

Trees: Basic concepts, Binary Tree traversals, Binary Search tree operations: insertion, deletion, traversals. HASHING: Introduction, hash functions, Collision resolution techniques: chaining and open addressing, Hash tables: basic implementation and operations.

Text Books

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, 3rd Ed, Computer Science Press.
2. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Fourth edition, Thomson, 2023
3. Data Structures Using C - A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, 2nd Ed, PHI/Pearson education, 201

Reference Books

1. C & Data structures – P. Padmanabham, 3rd Ed, B.S. Publications, 2016
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education, 1998.

Web Links

1. https://www.tutorialspoint.com › C programming › C – Home
2. https://www.programiz.com/c-programming

I Year II Semester	Basic Electrical &Electronics Engineering (For Other Branches)	L	T	P	C
		3	0	0	3

Prerequisites: Basic knowledge of Mathematics and Physics.

Course Objectives

- To introduce basic definitions, types of network elements, Ohm's Law, Kirchhoff's Laws and simple series, parallel and series-parallel circuits.
- To familiarize students with the principle of operation of DC generators, DC motors, single phase transformers, 3-phase and 1-phase induction motors and alternators.
- To introduce the construction and working principle of PMMC and Moving Iron measuring instruments, and measurement of power and power factor using a single-phase wattmeter.
- To introduce PN junction diodes, diode applications (half wave and bridge rectifiers) and the characteristics of PNP/NPN junction transistors.
- To introduce number systems, logic gates, truth tables, simple combinational circuits (half and full adders) and elementary sequential circuits (flip-flops).

UNIT I- BASIC CIRCUIT ELEMENTS AND ELECTRICAL QUANTITIES

Core Content: Electrical Elements -Resistance, Inductance and capacitance, Fundamental Electrical quantities: charge, current, voltage, EMF, work, power and energy; ideal and practical voltage and current sources, basic electrical symbols and terminology, Ohms law- Kirchhoff's Laws- Kirchhoff's current Law, Kirchhoff's voltage Law, Series ,Parallel – Series Parallel combination of Resistive networks-Inductive networks- Capacitive networks-Simple Numerical Problems.

AI-Integrated Topics

- AI-assisted identification and classification of network elements
- Data-driven verification of Ohm's Law and Kirchhoff's Laws using simulation tools
- AI-assisted solving and checking of series-parallel circuit problems
- Intelligent visualization of inductive and capacitive network behaviour

Suggested AI Tools

- Python (NumPy, Matplotlib)
- LTspice
- MATLAB
- PSpice

UNIT II ELECTRICAL MACHINES

Core Content: Principle of operation of DC generator and DC motor; magnetization characteristics of DC shunt generator; Principle of operation of single-phase transformer; construction and Principle of operation 3-phase induction motor and single phase induction motor (elementary Treatment).

Principle of operation of alternator —uses and applications.

AI-Integrated Topics

- AI-assisted plotting and analysis of DC shunt generator magnetization characteristics

- Data-driven comparison of transformer and induction-motor performance parameters
- Intelligent visualization of alternator output characteristics
- AI-based identification of applications for DC and AC machines

Suggested AI Tools

- Python
- MATLAB
- LTspice
- Excel

UNIT III ELECTRICAL MEASURING INSTRUMENTS AND ENERGY BILLING

Core Content: Indicating Instruments - operating torques -Deflecting torque, Controlling torque and Damping torque. Construction and working principle of Permanent Magnet Moving Coil (PMMC) and Moving Iron (MI) instruments-types -Attraction and Repulsion type instruments; measurement of power and power factor using single-phase wattmeter.

Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Definition of Unit of electrical energy -Energy billing for domestic households.

AI-Integrated Topics

- AI-assisted classification of PMMC and MI instruments from construction features
- Data-driven analysis of single-phase wattmeter readings for power and power factor
- Intelligent error and accuracy analysis for measuring instruments
- AI-based visualization of instrument torque and deflection characteristics

Suggested AI Tools

- Python
- MATLAB
- Excel
- LTspice

UNIT IV: ANALOG ELECTRONICS

Core Content: Introduction to Semiconductors-Intrinsic and Extrinsic semiconductors -P-type and N – type semiconductors, PN junction diodes-forward and reverse bias –diode characteristics, applications — half-wave and bridge rectifiers (circuit diagram and operation); Zener diode- characteristics, Zener diode as a voltage regulator, PNP and NPN junction transistors; input and output characteristics of Bipolar Junction Transistor-common base, common collector and common emitter configurations.

AI-Integrated Topics

- AI-assisted extraction of PN junction diode V-I characteristics

- AI-based analysis of half-wave and bridge rectifier output waveforms
- Intelligent identification of BJT operating regions from input/output characteristics
- Data-driven comparison of PNP and NPN transistor behaviour

Suggested AI Tools

- Python
- MATLAB
- LTspice
- PSpice

UNIT V DIGITAL ELECTRONICS

Core Content: Number systems, logic gates-truth tables and functionality - NOT, OR, AND, Universal Gates- NOR, NAND, XOR and XNOR; simple combinational circuits — half adder and full adder; introduction to sequential circuits — flip-flops -SR, JK and D flip-flops.

AI-Integrated Topics

- AI-assisted generation and verification of logic-gate truth tables
- AI-based simplification and checking of combinational circuit outputs
- Intelligent visualization of half adder, full adder and flip-flop operation
- Data-driven conversion and verification of number systems

Suggested AI Tools

- Python
- MATLAB
- Logisim
- LTspice

Course Outcomes (COs)

CO	Course Outcome Statement	Bloom's Level
CO1	Explain basic definitions, network elements, Ohm's Law and Kirchhoff's Laws, and solve series, parallel and series-parallel circuit problems.	L2, L3
CO2	Explain the principle of operation of DC generators, DC motors, single-phase transformers, 3-phase induction motors and alternators, and interpret DC shunt generator magnetization characteristics.	L2, L3
CO3	Explain the construction and working principle of PMMC and MI instruments, and determine power and power factor using a single-phase wattmeter.	L2, L3
CO4	Explain the working of PN junction diodes and their rectifier applications, and describe the construction and characteristics of PNP/NPN BJTs.	L2, L3
CO5	Explain number systems, logic gates and truth tables, and design simple combinational circuits (half/full adder) and elementary flip-flop based sequential circuits.	L2, L3

CO – PO Articulation Matrix

Scale: 3 – Strong, 2 – Moderate, 1 – Slight, '–' – No Correlation

CO	PO1	PO2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	1	-	-	-	-	-	-	3	1	1
CO2	3	2	2	2	3	1	-	-	1	1	-	3	2	2
CO3	3	2	2	1	2	-	-	1	1	1	-	3	2	2
CO4	3	2	2	2	2	-	-	-	1	1	-	3	2	2
CO5	3	3	2	2	3	-	-	1	1	2	1	3	3	3

Textbooks

1. Basic Electrical Engineering, V. K. Mehta and Rohit Mehta, S. Chand Publishing.
2. Electrical Machines, P. S. Bimbhra, Khanna Publishers.
3. Electronic Devices and Circuits, David A. Bell, Oxford University Press.

Reference Books

1. Electrical Measurements and Measuring Instruments, A. K. Sawhney, Dhanpat Rai Publishing.
2. Electrical Machines, I. J. Nagrath and D. P. Kothari, McGraw Hill Education.
3. Digital Fundamentals, Thomas L. Floyd, Pearson Education.

Web Resources & NPTEL Links

1. NPTEL – Basic Electrical Technology / Basic Electrical Engineering courses.
2. Virtual Labs – Electrical Engineering laboratory resources.

I Year II Semester	Data Structures Laboratory	L	T	P	C
		0	0	3	1.5

Course Objective

To develop practical skills in implementing and analyzing fundamental data structures and algorithms using C programming for efficient searching, sorting, recursion, linked lists, stacks, queues, trees, graphs, and hashing applications.

Course Outcomes

1. Demonstrate the role of linear data structures in organizing and accessing data efficiently in algorithms.
2. Implement dynamic data storage for demonstrating memory allocation in linked lists.
3. Develop programs for novel solutions by involving linear data structures Stacks and Queues to handle recursive algorithms, manage program states, and solve related problems.
4. Apply stack and queue based algorithms for efficient task scheduling and traversals in graphs.
5. Demonstrate scenarios where hashing is advantageous, and design hash-based solutions for specific problems.

List of Experiments

1. a) Write a C program to reverse the digits of a number using recursive function.
b) Write a C program to solve the Towers of Hanoi problem using recursive function.
c) Design & Develop a C program to perform linear search for a key value in a given list.
2. a) Design & Develop a C program to perform Binary search for a key value in a given list.
b) Develop a C program that implements Selection Sort to sort a given list of integers.
c) Develop a C program that implements Bubble Sort to sort a given list of integers.
3. a)Implement a singly linked list and perform insertion and deletion operations.
b) Develop a program to reverse a linked list iteratively and recursively.
c) Solve problems involving linked list traversal and manipulation.
4. a) Create a program to detect and remove duplicates from a linked list.
b) Implement a linked list to represent polynomials and perform addition.
5. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
a. Push an Element onto Stack.
b. Pop an Element from Stack.
c. Display the status (No. of elements, Empty/Full/not) of Stack.
d. Exit Support the program with appropriate functions for each of the above operations
6. Design, Develop and Implement a menu driven Program in C for the following operations on QUEUE of Characters (Array Implementation of Queue with maximum size MAX)
a. Insert an Element into QUEUE
b. Delete an Element from QUEUE
c. Display the status (No. of elements, Empty/Full/not) of QUEUE
d. Exit Support the program with appropriate functions for each of the above operations
7. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.
8. a) Design, Develop and Implement a C program to implement Binary tree traversals using iterative functions.
b) Design, Develop and Implement a C program to implement Binary tree traversals using recursive

9. Design, Develop and Implement a menu driven Prog.am in C for the following operations on Binary Search Tree (BST) of Integers
a. Create a BST of 'n' Integers:
b. Traverse the BST in In-order, Pre-order and Post-Order
c. Search the BST for a given element (Key) and report the appropriate message

10. Design & Develop a Program in C for the following operations on Graph (G) of Cities
a. Create a Graph of 'n' cities using Adjacency Matrix.
b. Print all the nodes reachable from a given starting node in a digraph using DFS or BFS method.
11. Design & Develop a Program in C to find the shortest paths to all Cities from a given City using . Dijkstra's Algorithm.
12. Given a File of N employee records with a set K of Keys(6-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT. Let the keys in K and addresses in L are Integers.
13. Design and develop a program in C that uses hash function H: K(L) as H(K)=K mod m (remainder method), and implement hashing technique to map a gi: en key K to the address space L. Resolve the collision (if any) using (a) linear probing.(b) Quadratic Probing

Text Books

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, 3rd Ed, Computer Science Press.
2. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Fourth edition, Thomson, 2023
3. Data Structures Using C - A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, 2nd Ed, PHI/Pearson education, 201

Reference Books

1. C & Data structures – P. Padmanabham, 3rd Ed, B.S. Publications, 2016
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education, 1998.

Reference Links

1. https://www.tutorialspoint.com › C programming › C – Home
2. https://www.programiz.com/c-programming

I Year II Semester	Advanced Chemistry Laboratory (For Computer Science and Allied Engineering)	L	T	P	C
		0	0	3	1.5

LIST OF EXPERIMENTS

(Any **TEN** of the following listed experiments)

(Out of which any **TWO** experiments may be conducted in virtual mode)

1. Verification of the photoelectric effect and estimation of Planck's constant.
2. Study of the emission spectrum of a hydrogen / mercury-vapour lamp using a spectrometer.
3. Determination of the band-gap energy of a semiconductor sample from its optical absorption edge.
4. Conductometric titration of a strong acid against a strong base.
5. Determination of the EMF of a Daniel cell and verification of the Nernst equation.
6. Determination of the charge–discharge characteristics of a lithium-ion battery / supercapacitor cell.
7. Determination of the specific and equivalent conductance of an electrolyte solution.
8. Determination of the corrosion rate of a copper / mild-steel specimen by the weight-loss method.
9. Study of electroless copper plating for PCB through-hole metallization (demonstration).
10. Preparation and observation of colloidal gold / silver nanoparticles (size-dependent colour-change demonstration).
11. Determination of the viscosity of a polymer / nanomaterial-dispersion solution using an Ostwald viscometer.
12. Determination of the pH and conductivity of an electronic-grade (deionized) water sample used in wafer/PCB cleaning.
13. Potentiometry - determination of redox potentials and emfs
14. Verify Lambert-Beer's law.(Colurimetric estimation of iron)
15. Determination of total hardness of a water sample by the EDTA titrimetric method.
16. Determination of acidity and alkalinity of a water sample by acid titration.
17. Determination of dissolved oxygen (DO) in a water sample by Winkler's method
18. Preparation and study of a urea-formaldehyde / phenol-formaldehyde resin sample.

Text Books:

1. "Practical Engineering Chemistry" by K.Mukkanti, etal. B.S.Publications, Hyderabad (2011).
2. "Lab Manual on Engineering Chemistry" by Sudharani, Dhanpat Rai Publications, Co., New Delhi., (2009).

Reference Books:

1. "Engineering Chemistry Lab Manual" by Shuchi Tiwari (2010), SCITECH Publications.
2. "Vogel's Text Book of Quantitative Chemical Analysis", 6th Edition by G. J. Jeffery, J. Bassett, J. Mendham, R.C. Denney, Longman Scientific & Technical Publications, New York.
3. "A Text Book of Engineering Chemistry" by R. N. Goyal and H. Goel, Ane Books (P) Ltd.(2009).
4. "A Text Book on experiments and calculations Engineering" by S.S. Dara, S.Chand& Company Ltd. (2003).
5. "Instrumental methods of Chemical Analysis", GurudeepR, Chatwal Sham, K. Anand, Latest Edition (2015), Himalaya Publications.

I Year – II Semester	Basic Electrical & Electronics Engineering Labratory (For Other Branches)	L	T	P	C
		0	0	3	1.5

Prerequisites: Basic knowledge of Mathematics and Physics.

List of Experiments

The following experiments are prescribed. A minimum of five experiments must be performed from each part (Part A and Part B), for a minimum of ten experiments overall.

Part A: Electrical Engineering Lab

Course Objectives

- To verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL).
- To study the performance characteristics of DC machines.
- To measure power and power factor for different types of loads.
- To determine Series and Parallel resistance combination

List of Experiments

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Ohm's Law
4. Verification of Series and Parallel resistance combination
5. Measurement of Power and Power factor using Single-phase wattmeter
6. Magnetization Characteristics of DC shunt Generator
7. Operation of single-phase transformer step down and step up

Course Outcomes

After completing Part A, the student will be able to:

CO1: Verify Kirchhoff's Current Law and Voltage Law, and the Superposition theorem, in electrical networks.

CO2: Analyze the magnetization characteristics of a DC shunt generator.

CO3: Measure power and power factor for different types of loads using a single-phase wattmeter.

CO4: Determine Series and Parallel resistance combination

Part B: Electronics Engineering Lab

Course Objectives

- To verify theoretical concepts practically through experimentation.
- To analyze the characteristics of PN junction diodes, Zener diodes and BJTs.
- To design and implement rectifier circuits from given specifications.
- To gain exposure to linear and digital integrated circuits.

List of Experiments

1. Plot V-I characteristics of PN junction diode in (i) Forward bias (ii) Reverse bias
2. Zener diode characteristics and its application as a voltage regulator
3. Implementation of half wave rectifier with and without filter
4. Implementation of full wave rectifier with and without filter
5. Plot Input & Output characteristics of BJT in CE configuration
6. Verification of Truth Tables of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs
7. Verification of Truth Tables of S-R, J-K and D flip-flops using respective ICs

Course Outcomes

After completing Part B, the student will be able to:

CO5: Analyze the V-I characteristics of a PN junction diode and the voltage-regulation of a Zener diode.

CO6: Design and implement half-wave and full-wave rectifier circuits, with and without filters, and analyze their outputs.

CO7: Plot and analyze the input and output characteristics of a BJT in CE configuration.

CO8: Verify the truth tables of basic logic gates and of S-R, J-K and D flip-flops using digital ICs.

Tools / Equipment Required

DC power supplies, multimeters, DC ammeters, DC voltmeters, AC voltmeters, Cathode Ray Oscilloscopes (CROs), and other required active devices.

Course Outcomes (COs)

CO	Course Outcome Statement	Bloom's Level
CO1	Verify Kirchhoff's Current Law (KCL) and Kirchhoff's Voltage Law (KVL), and validate the Superposition theorem in electrical networks.	**L2, L3**
CO2	Analyze the magnetization characteristics of a DC shunt generator by conducting the relevant test.	**L4**
CO3	Measure power and power factor for different loads using a single-phase wattmeter.	**L3**
CO4	Determine Series and Parallel resistance combination	**L3**
CO5	Analyze the V-I characteristics of a PN junction diode and the voltage-regulation characteristics of a Zener diode.	**L4**
CO6	Design and implement half-wave and full-wave rectifier circuits, with and without filters, and analyze their outputs.	**L3, L4**
CO7	Plot and analyze the input and output characteristics of a BJT in CE configuration.	**L4**
CO8	Verify the truth tables of basic logic gates and of S-R, J-K and D flip-flops using digital ICs.	**L2, L3**

CO – PO Articulation Matrix

Scale: 3 – Strong, 2 – Moderate, 1 – Slight, '–' – No Correlation

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	-	-	-	1	1	-	3	2	1
CO2	3	3	3	3	3	1	-	1	1	1	-	3	3	2
CO3	3	3	2	3	3	1	-	1	1	1	-	3	3	2
CO4	3	2	2	2	2	-	-	1	1	1	-	3	2	1
CO5	3	2	2	2	3	-	-	1	1	1	-	3	3	2
CO6	3	3	3	3	3	-	-	1	1	1	-	3	3	3
CO7	3	3	2	2	3	-	-	1	1	2	1	3	3	3
CO8	3	2	2	2	2	-	-	1	1	1	1	3	2	2

Reference Books

1. Basic Electrical Engineering, V. K. Mehta and Rohit Mehta, S. Chand Publishing.
2. Electronic Devices and Circuits, David A. Bell, Oxford University Press.
3. Digital Fundamentals, Thomas L. Floyd, Pearson Education

Online Learning Resources / Open-Source Software

Open-source software for Basic Electrical and Electronics Engineering experiments:

- LTspice
- PSpice
- Python (NumPy, Pandas, Matplotlib)
- MATLAB / Simulink (Student Version)
- Microsoft Excel / LibreOffice Calc