R26-COURSE STRUCTURE – ECE

I-SEMESTER

S. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	A2610011	English for Technical Communication	3	0	0	3
2	A2610002	Linear Algebra & Calculus	3	0	0	3
3	A2610401	Applied Physics	3	0	0	3
4	A2610003	Computational Thinking & Problem Solving using C	3	0	0	3
5	A2610402	Network Analysis	3	0	0	3
6	A2610012	English for Technical Communication and MOODLES Lab	0	0	3	1.5
7	A2610403	Applied Physics Lab	0	0	3	1.5
8	A2610008	Computational Thinking & Problem Solving using C Lab	0	0	3	1.5
9	A2610404	Network Analysis Lab	0	0	3	1.5
10	A2610013	Environmental Science	2	0	0	0
Total			**17**	**0**	**12**	**21**

II-SEMESTER

S. No.	Course Code	Course Title	Contact hours/week			Credits
			L	T	P	
1	A2620401	Applied Chemistry	3	0	0	3
2	A2620003	Differential Equations & Vector Calculus	3	0	0	3
3	A2620402	Data Structures and Algorithms using C	0	1	3	2.5
4	A2620012	Design Thinking & Innovation	0	1	3	2.5
5	A2620403	Electronic Devices and Circuits	3	0	0	3
6	A2620404	Electronic Devices and Circuits Lab	0	0	3	1.5
7	A2620008	AI Tools & Applications	0	1	3	2.5
8	A2620405	Applied Chemistry Lab	0	0	3	1.5
9	A2620014	IT and Electronics Workshop	0	0	3	1.5
10	A2620013	Sorts and Yoga or NSS/NCC	0	0	2	0
Total			**9**	**3**	**20**	**21**

B. Tech. (ECE)
I-Semester Syllabus

A2610011 – English for Technical Communication

B. Tech. (I Sem.)

L	T	P	Cr.
3	0	0	3

Course Objectives:

- Listen the authentic texts to comprehend and respond appropriately as both audience and conversant;
- Communicate in academic and social (formal) contexts with reasonable fluency and accuracy (neutral accent, social and grammatical appropriateness);
- Comprehend the texts of various types for academic, technical and career purposes;
- Write for academic and professional purposes;
- Communicate across cultures that requires a blend of cognitive, interpersonal, and linguistic skills

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

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

CO2: Apply appropriate social norms to bridge the gaps and collaborate effectively across diverse cultural backgrounds (K3)

CO3: Evaluate the content, limitations and ethical aspects of AI tools in communication and language learning, and apply them to create concise, accurate ssays/summaries/letters/paraphrases. (K5)

CO4: Examine discourse features and writing strategies to participate effectively in informal exchanges, short presentations on technical and general topics and to compile reports/E-mails. (K4)

CO5: Construct well-organized paragraphs, essays, critical reviews, and other professional documents suited to academic and workplace contexts. (K6)

Course Articulation Matrix:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	–	–	1	2	–	–	1	3	1	–	–	–
CO2	1	1	1	–	1	3	2	2	3	3	2	–	–	–
CO3	2	3	2	2	3	1	1	3	2	3	3	–	–	–
CO4	1	2	1	1	1	2	1	1	3	3	3	–	–	–
CO5	1	2	1	1	1	2	1	1	3	3	3	–	–	–

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT-I: Effective Communication: Exploring Channels and Methods (10 Hours)

Vocabulary: Roots, Prefixes, and Suffixes Homonyms

Grammar: Articles, Prepositions, Tenses.

Reading: Definition and Importance, Skills and Sub-Skills of Reading

Writing: Cohesion and Coherence, Paragraph Writing.

Listening: Listening for main ideas and supporting details, Note-taking

Speaking: Introducing self and others, Describing people and objects, JAM.

UNIT-II: Eco-Consciousness: Negotiating for a Sustainable Future (9 Hours)

Vocabulary: Contractions, Phrasal Verbs, Idioms & Phrases

Grammar: Subject-Verb Agreement, Conditional Sentences

Reading: Reading for Inference, Point of View, Tone and Perspective.

Writing: Note making, Summarizing, Paraphrasing.

Listening: Listening to various texts and comprehension

Speaking: Role-plays, Extempore.

UNIT-III: Disruptive Technologies: Ethical Implications and Future Prospects (9 Hours)
Vocabulary: One-Word Substitutes, Commonly Confused Words
Grammar: Degrees of Comparison, Active and Passive Voice, Question Tags.
Reading: Reading the extracts/articles/ essays of the News Papers, Journals and literary texts.
Writing: Paraphrasing, Letter Writing
Listening: Listening to stories, news, documentaries and discussions.
Speaking: Debate, Group Discussions

UNIT-IV: Entrepreneurship and Start-Up Culture: Emerging Trends (10 Hours)
Vocabulary: Business/ Profession/ Career/ Job-related Vocabulary.
Grammar: Sentence Synthesis, Simple, Compound and Complex Sentences.
Reading: Reading various texts for global understanding
Writing: Email Writing, Data Interpretation, Report Writing
Listening: Listening to debates and discussions.
Speaking: Power Point Presentations by Individuals and Teams.

UNIT-V: Ethical Leadership: Integrating Social Responsibility and Core Values (10 Hours)
Vocabulary: Advanced Vocabulary for GRE/TOEFL/ IELTS/CAT etc.
Grammar: Sentence Synthesis, Para Jumbles.
Reading: Reading texts for global comprehension.
Writing: Book/Film Reviews, Social Media Etiquette
Listening: Listening to the talks/speeches by the eminent personalities
Speaking: Team Discussions and Presentations

Textbooks:

1. Chekuri, T., & Perumalla, R. K. (2026). Next Gen English for engineers: A course book for technical English communication. Cengage.
2. Coelho, P. (2020). The alchemist. HarperCollins. (Non-Detailed Text)

Reference Books:

1. Technical Communication (2nd Ed.) by M. Raman & S. Sharma. Oxford University Press, 2012.
2. Effective Technical Communication by M.A. Rizvi, Tata McGraw-Hill, 2005.
3. English for Engineers and Technologists, Orient Black swan 2010 (Combined edition, Vol.1 &2).
4. The Oxford Guide to Writing and Speaking by John Seely, Oxford University Press, 2004.

Web Resources:

1. eGyanKosh. (n.d.). National digital repository. https://egyankosh.ac.in/
2. Read Theory. (n.d). Adaptive reading comprehension practice. https://readtheory.org/

A2610002 – Linear Algebra & Calculus

B. Tech. (I Sem.)

L	T	P	Cr.
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:

CO1	**:**	Analyse the solutions of homogeneous and non-homogeneous systems of linear equations. (K4)
CO2	**:**	Evaluate Eigen values and Eigen vectors to reduce quadratic form to canonical form. (K5)
CO3	**:**	Estimate the bounds of a given function by mean vale theorems. (K3)
CO4	**:**	Apply the knowledge of derivatives in optimizing functions of several variables. (K3)
CO5	**:**	Evaluate double and triple integrals in Cartesian and polar coordinates. (K5)

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

Course Articulation Matrix:

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT I: Matrices, Eigenvalues, Eigenvectors

Elementary row operations, Rank of a matrix by echelon form, normal form, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, Gauss elimination method, Inverse by Gauss-Jordan method, Gauss Seidel Iteration Methods**.** Eigenvalues, Eigenvectors and their properties (without proof).

UNIT II: Diagonalization of a matrix

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

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's theorems with remainders (without proof), Problems and applications on the above theorems. Taylor's and Maclaurin's 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 homogeneous function 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 by the 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).

TEXTBOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, 2024.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 11th Edition, John Wiley & Sons, 2025.

REFERENCE BOOKS:

1. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, 2017.
2. Glyn James, "Advanced Modern Engineering Mathematics", 5th Edition, Pearson Education, 2018.
3. H. K. Dass, "Advanced Engineering Mathematics", 22nd Edition, S. Chand Publishing, 2022.
4. R. K. Jain and S. R. K. Iyengar, "Advanced Engineering Mathematics", 5th Edition, Narosa Publications, New Delhi, 2016.

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
9. http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx

A2610401 – Applied Physics

B. Tech. (I Sem.)

L	T	P	Cr.
3	0	0	3

Course Objective:

1. To provide knowledge on wave optics concepts such as interference, diffraction, and polarization with relevant engineering applications.
2. To understand the basic concepts of Laser light sources and working principle of optical fibers and identify the engineering applications of lasers and optical fibers in communication.
3. To familiarize students with electrical properties of metals and semiconductors and relevant applications in electronic devices.
4. To equip students, the fundamentals of quantum mechanics and principles relevant to engineering applications such as quantum computing.
5. To impart knowledge on electromagnetic field theory and its applications.

Course Outcomes: On completion of the course, the student should be able to

CO1: Explain the need for coherent sources and apply the principles of interference, diffraction, and polarization of light in engineering applications **(Explain (K3))**.

CO2: Analyze the working of lasers, fiber optics, and advanced sensing systems in optical communication and signal processing techniques **(Analyze (K4))**.

CO3: Analyze the electrical properties of metals, classify the energy bands of semiconductors, identify the type of semiconductor using the Hall Effect, and identify the applications of semiconductors in electronic devices **(Analyze (K4), Identify (K5))**.

CO4: Apply the concepts of quantum mechanics and quantum computing for secure communication applications **Apply ((K3))**.

CO5: Apply Maxwell's equations and electromagnetic field concepts to antenna-based systems **(Apply (K3))**.

Mapping of course outcomes with program outcomes:

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	–	–	2	–	–	–	–	1	2	–	–	–
CO2	3	2	2	1	3	–	–	–	1	1	2	–	–	–
CO3	3	3	2	2	3	–	–	–	1	1	2	–	–	–
CO4	2	3	2	2	2	1	–	–	1	1	2	–	–	–
CO5	3	2	–	–	2	–	–	–	–	1	2	–	–	–

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT–I: Applied Wave Optics **10Hrs**

Interference: Superposition Principle - Coherence - Types of Interference - Thin-film interference (reflection geometry) - Newton's rings - Determination of wavelength and refractive index.

Diffraction: 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: Types of polarization - Nicol's prism - Half-wave and Quarter-wave plates.

UNIT–II: Quantum Photonics **9Hrs**

Lasers: Principles of Absorption- Spontaneous and Stimulated Emission-Population Inversion -ThreelevelandfourlevellasersystemsConstructionandworkingofRubyandHe-NeLaser - Applications (qualitative).

Fiber Optics: Propagation mechanism - Numerical Aperture - Acceptance angle - Types of optical fibres - Classifications and Modes of optical fibres.

UNIT–III: Free electron theory of Metals & Semiconductors 10Hrs

Free electron theory of Metals: Classical free electron theory - merits and demerits, Quantum free electron theory - equation for electrical conductivity - Fermi-Dirac statistics - Fermi level and variation with temperature.

Semiconductors: Formation of energy bands - Classification of solids - Intrinsic semiconductors - Density of charge carriers - Electrical conductivity - Fermi level - extrinsic semiconductors: density of charge carriers (qualitative) - 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–IV: Introduction to Quantum Mechanics & Quantum Computing 10Hrs

Quantum Mechanics: de-Broglie concept of matter waves - Heisenberg's uncertainty principle - Wave function - Postulates of quantum mechanics - Schrödinger's time dependent and time-independent wave equations - Particle in a one- dimensional potential well - Quantum tunneling (basic idea).

Quantum Computing: Introduction to quantum computing - Classical bits vs qubits - Superposition and entanglement - Basic quantum operations - Hadamard gate – Pauli- X gate - Idea of quantum measurement.

UNIT–V: Introduction to EM Theory 9Hrs

Introduction - Wave Equation in differential form in free space - Vector Analysis - Divergence and Curl of electric field and magnetic field (static) - Gauss' divergence theorem - Stokes' theorem - Derivations of the four Maxwell Equations and their significance. Maxwell's equations in vacuum, Energy transport and Poynting Vector.

Text books:

1. Avadhanulu, M.N., Kshirsagar, P.G., & Murthy, T.V.S.A., A text book of engineering physics,
2. S. Chand Publishing (2019)
3. P. K. Palani Samy, Engineering Physics, SciTech Publications (2019).
4. B. K Pandey and S. Chaturvedi, Engineering Physics, 2nd Edition, CENGAGE learning (2021).

Reference Books:

1. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker, John
2. Wiley & Sons publications, 12th Edition (2021).
3. Solid State Physics by S. O. Pillai, New Age International Publishers, 9th edition (2023).
4. Concepts of Modern Physics by Arthur Beiser, Shobit Mahajan & S. Rai Choudhury
5. MC Graw Hill, 8th Edition (2026).
6. Nielsen & Chuang, Quantum Computation & Quantum Information, Cambridge University
7. Press, 10th Edition, (2010).
8. D. J. Griffiths, Introduction to Electrodynamics, Cambridge University Press, 5th Edition
9. (2023).

Web Resources:

1. NPTEL. National Programme on Technology Enhanced Learning. https://nptel.ac.in
2. MIT Open Course Ware, Physics courses. https://ocw.mit.edu
3. Georgia State University, Hyper Physics. http://hyperphysics.phy-astr.gsu.edu
4. PhET Interactive Simulations, University of Colorado Boulder. https://phet.colorado.edu
5. American Concrete Institute, (2021). ACI 228.2R: Nondestructive test methods for evaluation of concrete in structures. https://www.concrete.org

B. Tech. (I Sem.) **A2610003 – Computational Thinking & Problem Solving using C**

L	T	P	Cr.
3	0	0	3

Pre-requisite: Mathematics and logical reasoning at 10+2 level. No prior programming experience is assumed.

Course Objectives: The main objectives of the course are to

- Familiarize students with computers, computational thinking, and the process of algorithmic problem solving.
- Build strong programming fundamentals using the C language, including operators, control structures, and loops.
- Develop the ability to design and implement solutions using arrays, strings, and user-defined data types.
- Impart working knowledge of pointers, recursion, dynamic memory allocation, functions, and file handling for building modular, reusable programs.

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

		Knowledge Level (K)#
CO1	Apply computational thinking techniques (decomposition, abstraction, pattern recognition) to design algorithms and flowcharts for a given problem.	K3
CO2	Develop C programs using appropriate operators, expressions, selection statements, and loops to implement a given logic.	K3
CO3	Analyze problems involving arrays, strings, structures and unions and construct suitable C solutions.	K4
CO4	Apply pointers, recursion, and dynamic memory allocation to solve computational problems efficiently.	K3
CO5	Construct modular C programs using user-defined functions and perform text/binary file input-output operations.	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	3	3	2	1	-	-	-	-	-	-	1	3	1	-
CO2	3	2	3	-	2	-	-	-	-	-	-	3	1	-
CO3	3	3	3	2	-	-	-	-	-	-	1	3	1	-
CO4	3	3	3	2	2	-	-	-	-	-	-	3	1	-
CO5	3	2	3	1	2	-	-	-	1	-	1	3	1	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

UNIT – I: Computational Thinking and Introduction to C:

Computational Thinking: Decomposition, Pattern Recognition, Abstraction, Algorithm Design; representing solutions as algorithms, pseudocode, and flowcharts; Number Systems and Data Representation (integers, reals); Overview of Computer Organization and Program Execution.

Introduction to C: Background, Structure of a C Program, Identifiers, Keywords, Variables, Constants, Basic Data Types, Input/Output statements; Expressions, Operators, type of operators-arithmetic, relational, logical, bitwise, assignment, conditional, increment, decrement, etc., unary, binary, ternary, Operator Precedence and Associativity, Type Conversion; Scope, Storage Classes, and Type Qualifiers.

UNIT – II: Selection and Decision-Making: Simple if, Two-Way selection- if-else, nested-if, else-if ladder, and Multi-Way Selection- switch.
Repetition: Counter- and Event-Controlled Loops: for, while, do-while, and nested loops; Break and continue, Programming Applications combining Selection and Repetition.
Arrays: One-Dimensional and Two-Dimensional Arrays, Multidimensional Arrays, Array-based Problem Solving (searching, sorting, etc.).

UNIT – III: Functions: Designing Structured/Modular Programs, Function Declaration and Definition, Parameter Passing (by value, by reference using pointers), Passing Arrays and Pointers to Functions, Standard Library Functions, Inter-Function Communication.
Recursion: Recursive vs. Iterative Solutions, Designing Recursive Algorithms, Recursion with Arrays and Pointers, Efficiency Considerations.
Strings: String Representation, Standard String-Handling Functions, Arrays of Strings, String-to-Data Conversion.

UNIT – IV: Pointers: Pointer Fundamentals, Pointer-to-Pointer, Pointer Arithmetic, Pointers and Arrays, Array of Pointers, types of pointers, Compatibility and L-value/R-value concepts. Dynamic Memory Allocation: malloc, calloc, realloc, free.
User-Defined Types: typedef, Enumerated Types, Structures, Unions, and Nested Structures; Programming Applications using Structures and Arrays of Structures.

UNIT – V: Pre-processor: Directives and Macros. Command Line Arguments.
File I/O: Streams, Text vs. Binary Files, Standard Library File Functions, formatted and Character I/O, Sequential File Processing.

Text Books:

1. Behrouz A. Forouzan & Richard F. Gilberg, Computer Science: A Structured Programming Approach Using C, 3rd Edition, Cengage Learning, ISBN-13: 978-0-534-49132-1.
2. Brian W. Kernighan & Dennis M. Ritchie, The C Programming Language, 2nd Edition, Pearson Education / Prentice Hall India, 1988.

Reference Books:

1. Sumitabha Das, "Computer Fundamentals and Programming", 18th Edition, McGraw Hill Education, 2018.
2. Ashok N. Kamthane, Amit Ashok Kamthane, "Programming in C", 4th Edition, Pearson Education, 2025. ISBN: 978-9332543633.
3. Pradip Dey, Manas Ghosh, "Computer Fundamentals and Programming in C", 2nd Edition, Oxford University Press, 2013. ISBN: 978-0198068842.

Web References:

1. NPTEL – Programming in C, IIT Kanpur: https://onlinecourses.nptel.ac.in/noc21_cs81/preview
2. Geeks for Geeks – C Programming Language: https://www.geeksforgeeks.org/c-programming-language/
3. Programiz – Learn C Programming: https://www.programiz.com/c-programming
4. cplusplus.com – C Standard Library Reference: https://cplusplus.com/reference/clibrary/
5. TutorialsPoint – C Programming: https://www.tutorialspoint.com/cprogramming/index.html
6. W3Schools – C Tutorial: https://www.w3schools.com/c/

A2610402 – Network Analysis

B. Tech. (I Sem.)

L	T	P	Cr.
3	0	0	3

COURSE OBJECTIVES:

- To introduce basic laws, mesh & nodal analysis techniques for solving electrical circuits
- To impart knowledge on applying appropriate theorem for electrical circuit analysis
- To explain transient behavior of circuits in time and frequency domains
- To teach concepts of resonance
- To introduce open circuit, short circuit, transmission, hybrid parameters and their interrelationship.

COURSE OUTCOMES:

At the end of this course students will demonstrate the ability to

CO1: Understand the theorems, components working and functionality of circuits. **(Understand – L2)**

CO2: Apply the laws and theorems to compute variables of DC and AC circuits. **(Apply – L3)**

CO3: Analyze Resonance circuits and networks in Laplace domain. **(Analyze – L4)**

CO4: Evaluate the Network parameters and circuit variables. **(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

UNIT-I: Types of circuit components:

Introduction to active and passive components, Ohm's Law, Kirchhoff's Laws, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also, principle of duality with examples, Star-Delta conversion and Delta-Star Conversion, Source Transformations.

Network Theorems: Superposition, Thevenin's, Norton's, Max Power Transfer, Millman's, Reciprocity- problem solving using dependent sources also.

UNIT-II: Transients:

First order differential equations, R-L circuit, R- C circuit with DC excitation, definition of time constants, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation.

Laplace transform: Laplace transformation, basic theorems, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform.

UNIT-III: AC Circuits:

A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, peak factor, Voltage and current relationship with phasor diagrams in R, L, and C circuits, Concept of Impedance, Active power, reactive power and apparent power, Concept of power factor (Simple Numerical problems).

Steady State Analysis:
Series R-L, R-C, R-L-C circuits. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis.

UNIT-IV: Resonance:
Introduction, Definition of Q, Series resonance, Bandwidth of Series resonance, Parallel resonance **Coupled Circuits:** Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Dot rule of coupled circuits - problem solving.

UNIT-V: Two-port Networks:
Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h-parameters, Relationships Between Parameter Sets, Parallel & series connection of two port networks, cascading of two port networks.

TEXTBOOKS:
1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.
3. Network lines and Fields by John. D. Ryder 2nd Edition, PHI

REFERENCE BOOKS:
1. D. Roy Choudhury, Networks and Systems, New Age International Publications, 2013.
2. Joseph Edminister and Mahmood Nahvi, Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2017
3. Fundamentals of Electric Circuits by Charles K. Alexander and Matthew N. O. Sadiku, McGraw-Hill Education.

Web Resources& NPTEL Links:
1. NPTEL: Network Analysis –https://nptel.ac.in/courses/108104002
2. MIT OpenCourseWare –Circuits and Electronics: https://ocw.mit.edu/courses/6-002
3. Falstad Circuit Simulator (free online): https://www.falstad.com/circuit
4. Python / Google Colab: https://colab.research.google.com
5. PartSim Free Circuit Simulator: https://www.partsim.com
6. Scilab (free MATLAB alternative): https://www.scilab.org

Recommended Free & Open-Source AI/Computational Tools:
1. Python (NumPy, SciPy, Matplotlib) –FREE on Google Colab for circuit simulation and Laplace transform analysis
2. Scilab (free, open-source) –For matrix-based circuit and two-port network computations
3. Falstad Circuit Simulator (free, open-source) –For interactive circuit visualisation and transient analysis
4. PartSim (free online) –SPICE-based circuit simulation for verification
5. ChatGPT / Gemini (free tiers) –AI/LLM tools for concept explanation and step-by-step problem walkthrough
6. NPTEL Video Lectures –Free network analysis and circuit theory course

B. Tech. (I Sem.) **A2610012 – English for Technical Communication and MOODLES Lab**

L	T	P	Cr.
0	0	3	1.5

Part – A

Course Objectives:

- Develop active listening skills and the traits of an effective listener using lab activities and Ai-based listening tools.
- Develop speaking and presentation skills through structured practice and AI-speech coaching tools.
- Apply reading techniques and Analyze the texts to strengthen comprehension and employability.
- Apply writing techniques for technical and professional letters, emails, resumes and report writing to enhance employability.

Course Outcomes: At the end of the course, the students will be able to

CO1: Apply a variety of strategies to interpret and comprehend spoken texts/ discourse using contextual clues.

CO2: Apply appropriate speaking strategies to interpret content/material related to engineering and technology domain.

CO3: Participate in discussions and presentations on general and technical topics.

CO4: Possess an ability to write clearly on topics related to technology and workplace communication.

CO5: Choose functional language, cohesive devices and skills of organization to express clearly in speaking.

CO6: Demonstrate proficiency in using Moodle LMS and digital learning tools to access learning resources, manage academic activities, submit assignments, participate in quizzes and discussions, and organize learning effectively.

CO7: Apply digital communication, academic, research, and presentation skills while demonstrating academic integrity, responsible use of AI and digital technologies, and professional online behaviour.

Course Articulation Matrix:

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

List of Experiments:

1. **Phonetics & Accent Neutralisation**
   - Sound Lab Drills — Students record minimal pairs (/p/–/b/, /t/–/d/) and compare wave forms using free apps like Voice Recorder.
   - Pronunciation Clinics — Peer-correction circles where each student reads a short passage focusing on stress and intonation.
   - IPA Treasure Hunt — Give IPA transcriptions; students identify the words and pronounce them.
   - Shadowing Practice — Students mimic short clips (newsreader, documentary narrator) to reduce mother-tongue influence.

2. **Introducing Self and Others**
   - Speed Networking — Students rotate every 2 minutes and introduce themselves to a new partner.
   - Identity Cards — Each student prepares a "professional identity card" and introduces another student using it.
   - Role-based Introductions — introduce yourself as a student, intern, job applicant, club member, etc.

3. **Brief Talk in Formal/Informal Contexts, JAM/Extempore**
   - JAM Box — A box with random topics; students pick one and speak for 60 seconds.
   - Context Switch — Students speak on the same topic twice: once formally (seminar), once informally (friends).
   - Prompt Cards — Situational prompts: "Convince your friend to join a club", "Address a class meeting".

4. **Listening Comprehension**
   - Audio Quizzes — Play short clips (announcements, interviews) and ask MCQs.
   - Gap-fill Listening — Provide partially blank transcripts; students fill missing words.
   - Error Spotting — Students listen to a narration and identify factual inconsistencies.

5. **Process Description & Paragraph Writing (Technical Lab Context)**
   - Lab-to-Paragraph — After a lab experiment, students write a process description using sequence markers.
   - Flowchart to Paragraph — Provide a technical flowchart; students convert it into a coherent paragraph.
   - Reverse Engineering — Give a paragraph; students convert it back into steps and check accuracy.

6. **Group Discussions & Deliberations – Coming to Consensus**
   - Consensus Challenge — Groups must agree on one solution to a problem (e.g., "Best way to reduce campus waste").
   - Fishbowl GD — Inner circle discusses; outer circle observes and gives feedback.
   - Ranking Task — Groups rank items (e.g., skills for employability) and justify their consensus.

7. **Micro Presentations (2–5 minutes)**
   - One-Slide Presentation — Students prepare a single slide and speak for 3 minutes.
   - Teach a Concept — Students explain a simple technical idea (e.g., "How Wi-Fi works").
   - Object Talk — Students bring an object and present its use, history, or mechanism.

8. **Presenting Logical Arguments – Debates**
   - Two-Minute Debates — Quick debates with timed arguments and rebuttals.
   - Evidence Hunt — Students gather data or examples to support their stance before debating.
   - Role-based Debates — Students debate from assigned roles (environmentalist, policymaker, student).

9. **Talking About Social Issues & Data Interpretation**
   - Data Talk — Provide charts/graphs (literacy rates, pollution levels); students interpret and present insights.
   - Issue Circles — Groups discuss a social issue and propose one actionable solution.
   - Poster-to-Speech — Students convert an infographic into a 2-minute talk.

10. **Interviews – Formal & Semi-formal**
    - Mock Interview Panels — Students face a panel of peers acting as interviewers.
    - Resume-based Q&A — Students ask each other questions based on their resumes.
    - Situational Interviews — Semi-formal scenarios: club membership, internship, volunteer role.

Lab Manual

- Propel: A Course Book for Technical English Communication. Cengage Publishers, 2026.

Reference Books:

1. Raman Meenakshi, Sangeeta-Sharma.TechnicalCommunication. OxfordPress.2018.
2. Taylor Grant: English Conversation Practice, Tata McGraw Hill Education India,2016.
3. Hewing's, Martin. Cambridge Academic English (B2). CUP, 2012.
4. J. Sethi & P.V. Dhamija. A Course in Phonetics and Spoken English, (2ndEd), Kindle, 2013
5. Richards, Jack C., Jonathan Hull, and Susan Proctor. Interchange Level 3 Student's Book with Self-study DVD-ROM. Vol. 3. Cambridge University Press, 2012.

Web Resources:

1. www.esl-lab.com
2. www.englishmedialab.com
3. www.englishinteractive.net
4. https://www.britishcouncil.in/english/online
5. http://www.letstalkpodcast.com
6. https://www.youtube.com/c/mmmEnglish_Emma/featured
7. https://www.youtube.com/c/ArnelsEverydayEnglish/featured
8. https://www.youtube.com/c/engvidAdam/featured
9. https://www.youtube.com/c/EnglishClass101/featured
10. https://www.youtube.com/c/SpeakEnglishWithTiffani/playlists
11. https://www.youtube.com/channel/UCV1h_cBE0Drdx19qkTM0WNw
12. https://www.youtube.com/user/letstalkaccent/videos
13. https://www.youtube.com/c/EngLanguageClub/featured
14. https://www.youtube.com/channel/UC_OskgZBoS4dAnVUgJVexc
15. https://www.youtube.com/channel/UCNfm92h83W2i2ijc5Xwp_IA

Part B

Moodle Learning Management System: Digital learning and Academic Skills Course Objectives

- To become familiar with model LMS and on-line learning
- To develop basic Digital and Academic Skills needed for Engineering students
- To learn effective on-line communication and collaboration
- To develop skills in Assignments, Quizzes, Presentation and Refreshing
- To practice Academic Integrity and Responsible use of Digital Technology

Moodle Learning Management System: Digital learning to enhance Academic Skills. Students familiarize with model LMS and on-line learning, communication and collaboration. They develop skills in Assignments, Quizzes, Presentation and online interviews. They exercise academic Integrity and responsible use of Digital Technology. They adopt the usage of Grammarly, ChatGPT, Culture Wizard, Quizlet AI and Google Speech –to-text to enhance their respective skills.

List of Experiments

1. **Introduction to Moodle LMS**
   - Introduction to Moodle
   - Student login and profile management
   - Moodle dashboard and course navigation
   - Accessing announcements and course materials
   - Notifications and calendars

2. **Learning Through Moodle**
   - Accessing PDFs, videos, web resources, and lecture materials
   - Downloading and organizing study materials
   - Moodle lessons and learning activities
   - Tracking course completion
   - Managing deadlines and study schedule

3. **Assignments, Quizzes and Assessments**
   - Understanding assignment instructions
   - Creating and uploading assignments
   - File formats and file naming
   - Online quizzes and question types
   - Viewing marks and teacher feedback
   - Re-submission and revision

4. **Academic honesty**
   - Plagiarism and how to avoid it
   - Copyright and fair use
   - Responsible use of AI tools
   - Digital privacy and cyber security
   - Evaluating reliable online information
   - Professional behavior in online environments
   - Practical Activities

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A2610403 – Applied Physics Lab

B. Tech. (I Sem.)

L	T	P	Cr.
0	0	3	1.5

Course Objective:

1. **To** develop experimental understanding of fundamental principles of **optics, semiconductor physics, quantum physics, magnetism and electromagnetism** relevant to advanced computing technologies.
2. **To** experimentally determine important **optical, electrical, electronic, magnetic and material parameters** using appropriate measurement techniques and instrumentation.
3. **To** develop skills in **experimental data acquisition, graphical analysis, interpretation of characteristics, and application of physical principles** to understand the behavior of materials and devices used in modern electronic and computing systems.

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

CO1: Apply the principles of **interference, diffraction, and polarization** to experimentally determine optical parameters such as radius of curvature, wavelength, grating element, and Brewster angle. **K3 (Apply)**

CO2: Analyze the principles and characteristics of lasers and determine the wavelength of a laser source using diffraction. **K4 (Analyze)**

CO3: Analyze the **electrical and electronic characteristics of semiconductor materials and devices** to determine parameters such as temperature coefficient, energy gap, and Hall coefficient using appropriate experimental techniques. **K4 (Analyze)**

CO4: Apply the principles of **quantum physics and photoelectric effect** to experimentally estimate Planck's constant and relate experimental observations to fundamental quantum concepts. **K3 (Apply)**

CO5: Analyze the electromagnetic field characteristics of current-carrying systems by studying the magnetic field distribution along the axis of a circular coil and electromagnetically maintained vibrations using appropriate experimental methods and instruments. **K4 (Analyze)**

Course Articulation Matrix:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	3	–	3	2	–	–	–	1	2	–	–	–	–
CO2	3	3	–	3	3	–	–	–	1	2	–	–	–	–
CO3	3	3	–	3	3	–	–	–	1	2	–	–	–	–
CO4	3	3	–	3	3	–	–	–	1	2	–	–	–	–
CO5	3	3	–	3	3	–	–	–	1	2	–	–	–	–

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

LIST OF EXPERIMENTS

(Any **TEN** of the following listed experiments)
(Out of which any **TWO** experiments may be conducted in virtual mode)

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

References:

1. S. Balasubramanian, M. N. Srinivasan "A Text Book of Practical Physics"- S Chand Publishers, 2017.

V-Lab: vlab.co.in

B. Tech. (I Sem.) **A2610008 – Computational Thinking & Problem Solving using C Lab**

L	T	P	Cr.
0	0	3	1.5

Pre-requisite: - Basic understanding of computer fundamentals and problem-solving concepts

Course Objectives: The main objectives of the course are to

- Apply the principles of C language and computational thinking techniques in problem solving.
- Design flowcharts and algorithms, and to develop the ability to trace and debug programs.
- Design and develop C programs using arrays, strings, pointers, recursion, and functions.
- Apply dynamic memory allocation, file operations, and preprocessor commands in program design.

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

CO	Course Outcome Statement	Knowledge Level (K)#
CO1	Apply computational thinking to construct algorithms and flowcharts for a given problem and translate them into working C programs.	K3
CO2	Develop C programs using operators, selection statements and loops to implement a specified logic.	K3
CO3	Develop C programs that manipulate arrays, strings, structures and pointers to solve computational problems.	K3
CO4	Construct modular programs using user-defined functions and recursion, and perform file input-output operations.	K3
CO5	Analyse a C program by tracing and debugging it, and evaluate alternative implementations for correctness and efficiency.	K4

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

Lab Requirements (tools / software to carry out the experiments):

- C compiler: GCC (GNU Compiler Collection) — via MinGW-w64 on Windows, or the built-in gcc on Linux/macOS.
- IDE / editor: Code::Blocks, Dev-C++ or Visual Studio Code with the C/C++ extension.
- Command-line terminal to compile and run programs (gcc, ./a.out) and observe the compile–link–run stages.
- Debugger: GDB (GNU Debugger), integrated in Code::Blocks / VS Code, for tracing and step-by-step debugging.
- Operating system: Windows 10/11 or a Linux distribution (e.g., Ubuntu); any 64-bit PC with 4 GB RAM or more.
- No-install alternative: OnlineGDB, Programiz or Replit for quick practice and testing in a browser.

List of Experiments

Exercise 1: Getting Started with

1. Write, compile and run a C program that prints "Hello, World!" on the screen. Identify the source file, the object file and the executable produced, and record the command used at each stage.
2. Write a C program that declares variables of type int, float, char and double, reads a value for each from the user, and displays each value together with the size of its type using sizeof.
3. Write a C program to read the height and width of a rectangle from the user and compute its perimeter and are.

Exercise 2: Operators and Expressions

1. Write a C program to compute the distance between two points whose coordinates are entered by the user.
2. Write a C program that reads four integers p, q, r, s and, using relational and logical operators, prints 'Correct values' if q > r, s > p and (r + s) > (p + q); otherwise 'Wrong values'.
3. Write a C program to compute simple and compound interest for values entered by the user.

Exercise 3: Selection and Decision Making

1. Write a C program to read a character and classify it as a vowel, consonant, digit or special symbol.
2. Write a C program to find the largest of three numbers using nested if-else.
3. Write a menu-driven C program to compute the area of various geometrical shapes (circle, rectangle, triangle, square) using switch-case.

Exercise 4: Loops and Series

1. Write a C program to display the first n even natural numbers and their sum.
2. Write a C program to reverse a given integer and check whether it is a palindrome.
3. Write a C program to display the sum of the harmonic series 1 + 1/2 + 1/3 + ... up to n terms.

Exercise 5: Nested Loops and Number Patterns

1. Write a C program to print the multiplication table pyramid for numbers 1 to n using nested loops.
2. Write a C program to check whether a given number is prime, then extend it to print all prime numbers and all Armstrong numbers below.

Exercise 6: One-Dimensional Arrays

1. Write a C program to print all unique elements of an array, and implement linear search to find a given element in the array.
2. Write a C program to separate the odd and even elements of an array into two different arrays, and implement binary search to find a given element in a sorted array.
3. Write a C program to sort the elements of an array in ascending order using selection sort, and compare the efficiency of linear search vs. binary search on the sorted array by counting the number of comparisons each method takes.

Exercise 7: Matrices

1. Write a C program to perform addition of two square matrices and display the resultant matrices.
2. Write a C program to multiply two square matrices and display the resultant matrices.
3. Write a C program to find the transpose of a given matrix.

Exercise 8: Strings:

Write C programs to perform the following without using string handling functions

- **Find the length** of a given string.
- **Copy** one string into another.

- **Concatenate** two strings.
- **Compare** two strings and display whether they are equal, or which one is greater.
- **Reverse** a given string (using a separate swap function to exchange characters).
- **Search for a character** in a string and display its position (or indicate if not found).
- **Count the number of vowels, consonants, and words** in a given string

Exercise 9: Pointers Fundamentals

1. Write a C program to demonstrate the use of the & (address-of) and * (value-at-address) operators.
2. Write a C program to add two numbers using pointers.
3. Write a C program to swap two values using call by reference.

Exercise 10: Pointers and Dynamic Memory

1. Write a C program to dynamically allocate memory for an array using malloc, find the largest element and the sum of all elements in it, then repeat using calloc and note the difference between the two.
2. Write a C program to count the number of vowels in a string using a pointer.

Exercise 11: User-Defined Functions

1. Write a C program to check whether a number is prime using a user-defined function.
2. Write a C program to compute the GCD and LCM of two numbers using functions.
3. Write a C program to demonstrate a function that returns a pointer.

Exercise 12: Recursion

1. Write a C program to compute the factorial and the n-th Fibonacci term using recursion.
2. Write a C program to compute the sum of digits of a number using recursion.
3. Write a C program to convert a decimal number to its binary equivalent using a recursive function.

Exercise 13: File Handling

1. Write a C program to append multiple lines at the end of an existing text file.
2. Write a C program to copy the contents of one file into another file.
3. Write a C program to count the number of characters, words and lines in a text file.

Web References:

- NPTEL – Programming in C, IIT Kanpur: https://onlinecourses.nptel.ac.in/noc21_cs81/preview
- Virtual Labs – Problem Solving Lab, IIIT Hyderabad: https://ps-iiith.vlabs.ac.in/
- GeeksforGeeks – C Programming: https://www.geeksforgeeks.org/c-programming-language/

A2610404 – Network Analysis Lab

B. Tech. (I Sem.)

L	T	P	Cr.
0	0	3	1.5

COURSE OBJECTIVES:

- To gain hands on experience in verifying Kirchhoff's laws and network theorems
- To analyze transient behavior of circuits
- To study resonance characteristics
- To determine 2-port network parameters

COURSE OUTCOMES:

CO1: Demonstrate the function of components, theorems and circuits. **(Understand – L2)**
CO2: Model RC, RL, RLC and Theorem based circuits. **(Apply – L3)**
CO3: Analyze Two port networks, Reasonant and RLC circuits. **(Analyze – L4)**
CO4: Adapt effective communication, presentation and report writing skills. **(Apply – L3)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	1	2	-	-	-	2	1	2	-	1	-
CO2	2	2	-	1	2	-	-	-	2	2	2	-	1	-
CO3	2	2	-	1	1	-	-	-	2	1	2	-	2	-
CO4	-	-	-	-	-	-	-	3	2	-	-	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

The following experiments need to be performed using both Hardware and simulation Software.

LIST OF EXPERIMENTS: (Minimum of Ten Experiments has to be performed)

1. Study of components of a circuit and Verification of KCL and KVL.
2. Verification of mesh and nodal analysis.
3. Verification of Superposition theorem.
4. Verification of Thevenin's & Norton theorems.
5. Verification of maximum power transfer theorem.
6. Study of DC transients in RL, RC circuits.
7. To study frequency response of various 1^{st} order RL & RC networks.
8. Find the Q Factor and Bandwidth of a Series Resonance circuit.
9. Find the Q Factor and Bandwidth of a Parallel Resonance circuit.
10. Verification of Dot Convention and Determination of Mutual Inductance.
11. Determination of open circuit (Z) and short circuit (Y) parameters.
12. Determination of hybrid (H) and transmission (ABCD) parameters.

HARDWARE REQUIREMENTS:

Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital), Voltmeters (Analog or Digital), Active & Passive Electronic Components

SOFTWARE REQUIREMENTS:

Multisim/ Pspice /Equivalent simulation software tool, Computer Systems with required specifications

REFERENCES:

1. Network Analysis – ME Van Valkenburg, Prentice Hall of India, revised 3rd Edition, 2019.
2. Engineering Circuit Analysis by William H. Hayt, Jack Kemmerly, Jamie Phillips, Steven M. Durbin, 9th Edition 2020.

A2610013 – Environmental Science

B. Tech. (I Sem.)

L	T	P	Cr.
2	0	0	0

Course Objectives:

- To understand the fundamental structures and interactions of natural ecosystems biogeochemical cycles, and Earth's natural resources
- To evaluate the causes, impacts, and mitigation strategies of various forms of environmental pollution (air, water, soil, noise)
- To analyze current global environmental issues, climate change mechanisms, and principles of sustainable development and green engineering.
- To apply social, legal, and ethical frameworks to environmental management, environmental impact assessments (EIA), and corporate social responsibility.
- To propose sustainable engineering concepts and analytical solutions for contemporary environmental problems through case-based design approaches.

Course Outcomes: On completion of the course, the student should be able to

CO1: Assess natural resource distribution, ecological balance mechanisms, and biodiversity index parameters.

CO2: Analyze pollution control options and waste handling strategies for air, water, and solid waste systems based on regulatory guidelines.

CO3: Evaluate carbon footprints, evaluate climate change mitigation policies, and integrate life-cycle thinking into industrial plans.

CO4: Understand environmental legislation, outline introductory Environmental Impact Assessments (EIAs), and practice professional environmental ethics.

CO5: Implement green building concepts, renewable energy applications, and circular economy practices conceptually in professional environments.

Course articulation matrix

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO	2	2	–	–	–	1	**3**	–	–	–	–	–			
CO	2	**3**	–	–	–	**3**	**3**	1	–	–	–	–			
CO	2	**3**	–	–	–	**3**	**3**	1	–	–	–	–			
CO	1	2	–	–	–	**3**	**3**	**3**	–	–	–	–			
CO	2	2	–	–	–	**3**	**3**	2	–	–	–	–			

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT I: Ecosystems, Natural Resources, and Biodiversity

Concept, structure, and functions of an ecosystem - Producers, consumers, decomposers; **Energy flow in ecosystems:** Food chains, food webs, ecological pyramids; **Biogeochemical cycles:** Carbon, Nitrogen, Phosphorus, and Water cycles; **Natural resources:** Renewable and non-renewable resources - Forest, Water, Mineral, Energy and Food resources and associated exploitation challenges; **Biodiversity:** Levels - genetic, species, ecosystem, values, hot-spots, threats, and conservation methods (In-situ and Ex-situ); **Case Studies & Activities.**

UNIT II: Environmental Pollution and Control Technologies

Air Pollution: Sources, primary/secondary pollutants, ambient air quality standards, control equipment principles - Electrostatic Precipitators, Baghouses, Scrubbers; **Water Pollution:** Characteristics of wastewater, parameters - BOD, COD, TDS, municipal wastewater treatment

principles - Primary, Secondary, Tertiary treatment; **Soil Pollution:** Industrial waste, agricultural runoff, solid waste management Municipal Solid Waste - generation, segregation, incineration, composting, landfilling; **Noise and Thermal Pollution:** Sources, measurement metrics (dB, dBA), physiological impacts, and mitigation techniques; **Case Studies & Activities.**

UNIT III: Global Environmental Issues and Climate Change

The Earth's climate system, enhanced greenhouse effect, and global warming potential (GWP); **Ozone layer depletion:** CFCs, catalytic destruction cycles, and the Montreal Protocol; **Acid rain formation** - atmospheric chemistry impacts, and regional degradation; **International Conventions and Policies**: UNFCCC, Paris Agreement, Kyoto Protocol, and Carbon Trading mechanisms; **Concepts of Life Cycle Assessment (LCA)**: Carbon Footprint analysis, and Net-Zero carbon engineering; **Case Studies & Activities.**

UNIT IV: Environmental Ethics, Laws, and Sustainable Development

Sustainable Development Goals (SDGs) set by the United Nations: Targets and engineering intersections; **Environmental Legislation**: Overview of Water (Prevention and Control of Pollution) Act, Air Act, Environment (Protection) Act, and Wildlife Protection Ac; **Environmental Impact Assessment (EIA)**: Process, scoping, public consultation, clearance lifecycle, and Environmental Management Plan (EMP); **Environmental Ethics:** Corporate Social Responsibility (CSR); **Case Studies & Activities.**

UNIT V: Green Technology and Sustainable Engineering

Renewable Energy Technologies: Solar photovoltaic, wind energy, biomass conversion, and hydrogen fuel cells; **Green Building Concepts:** Leadership in Energy and Environmental Design (LEED), IGBC ratings, energy-efficient architecture, and waste-water recycling loops; **Circular Economy:** Upcycling, industrial symbiosis, waste-to-energy recovery systems, and sustainable supply chains; **Case Studies & Activities and Field Activity(Plantation, Species identification, Study of ecosystems etc)**

Text books:

1. **Rajagopalan, R.** (2023). *Environmental Studies: From Crisis to Cure*, 4th Edition. Oxford University Press, New Delhi. ISBN: 9789354978944.
2. **Masters, G. M., & Ela, W. P.** (2013). *Introduction to Environmental Engineering and Science* (3rd ed.). Pearson.
3. **Bharucha, E.** (2021). *Textbook of Environmental Studies for Undergraduate Courses*. Universities Press.
4. **Kaushik, Anubha and Kaushik,** C. P. (2021). *Perspectives in Environmental Studies*, 7th Edition. New Age International Pvt. Ltd., New Delhi.

Reference Books:

1. **De, A. K.** (2010). *Environmental Chemistry* (7th ed.). New Age International Publishers.
2. **Nebel, B.J., & Wright, R.T.** (2008). *Environmental Science: Toward a Sustainable Future.* Pearson.
3. KVSG Murali Krishna, The Book of Environmental Studies, 2/e, VGS Publishers, 2011.
4. **UN Environment Programme (UNEP):** Official publications and Sustainable Development Goals resource repositories [unep.org].
5. **Coursera / edX Online Modules:** Introduction to Sustainability or Circular Economy and Sustainable Technologies (DelftX / LundX).
6. NPTEL, Environmental Science, Prof. Sudha Goel and Prof. Shamik Chowdhury, IIT Kharagpur,NPTEL–SWAYAM. https://onlinecourses.nptel.ac.in/noc26_hs120/preview?utm_source=chatgpt.com

B. Tech. (ECE)
II-Semester Syllabus

A2620401 – Applied Chemistry

B. Tech. (II Sem.)

L	T	P	Cr.
3	0	0	3

Pre-requisite: Basic knowledge of Chemistry (Higher Secondary level).

Course Objectives:

- Understand quantum chemistry concepts relevant to electronic systems.
- Study spectroscopy techniques used in material and spectral analysis.
- Analyze semiconductor and electronic material chemistry.
- Explore electrochemical energy storage for communication systems.
- Explain synthesis, properties and applications of nanomaterials relevant to nanoelectronics, sustainable electronics and emerging technologies.

Course Outcomes: *After successful completion of this course, the student will be able to:*

CO1: Explain the principles of quantum chemistry, apply molecular orbital theory to explain the electronic structure and bonding in molecular systems. (K2, K3)

CO2: Interpret the principles and instrumentation of UV-Visible, IR, microwave spectroscopy and MRI, **apply** spectroscopic concepts to relevant applications. **(K2, K3)**

CO3: Understand the principles and properties of semiconductors, superconductors, and conducting polymers; **apply** them to relevant electronic applications. **(K2, K3)**

CO4: Summarize electrochemical principles, **apply** them to electrochemical calculations and energy-storage devices, including batteries, fuel cells and supercapacitors. **(K2, K3)**

CO5: Illustrate nanomaterial synthesis methods, **analyze** their properties and applications, including spintronic materials. **(K2, K4)**

CO-PO/PSO Articulation Matrix:

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT I: Quantum Chemistry [10 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's wave equation (time independent), significance of Ψ and Ψ^2; particle in a one-dimensional box.

Molecular Orbital Theory: Bonding in homo-nuclear and hetero-nuclear diatomic molecules; energy-level diagrams of O_2, N_2, HF and CO, π-molecular orbitals of butadiene and benzene; calculation of bond order.

UNIT II: Spectroscopy-Instrumental methods and applications [9 hrs]

Electromagnetic spectrum.

UV-Visible spectroscopy: Introduction, Principle, Beer-Lambert law, chromophore, auxochrome, shifts, instrumentation, applications of UV-Vis Spectroscopy.

Infrared (IR) spectroscopy: Introduction, principle, instrumentation and applications.

Microwave spectroscopy: Introduction, principle, instrumentation and applications.

MRI: Working principle (NMR spectroscopy), applications.

UNIT III: Chemistry of Electronic materials (metals and polymers) [10 hrs]

Band theory of semiconductors, Intrinsic and extrinsic semiconductors, Preparation of pure and doped semiconductors, photoconductors (Se)-working principle of photocopy (Xerox) machine, silicon dioxide (SiO_2) formation and properties.

Chemistry of compound semiconductors: GaAs, InP, SiC.

Photolithography: Basic principle, applications

Superconductors: Characteristics, types, applications.

Conducting polymers: p and n type conducting polymers, photoresist polymers (definition, applications), structure and applications of PMMA (Poly methyl methacrylate), Polyimide, BCB (Benzocyclobutene), PBO (Polybenzoxazole)

UNIT IV: Electrochemistry and Energy storage devices [10 hrs]

Galvanic and electrolytic cells, redox reactions, electrode potential, Nernst equation and problems.

Primary batteries: Lithium battery, zinc-air battery (construction, working and applications).

Secondary batteries: lithium-ion, sodium-ion batteries (construction, charging-discharging reactions and applications). Battery management systems (main functions, basic working, Battery protection).

Fuel cells: PEMFC, DMFC (working, advantages, applications).

Supercapacitors: EDLC, pseudo-capacitors, hybrid supercapacitors.

UNIT V: Chemistry of nanomaterials [10 hrs]

Introduction to Nano-chemistry.

Carbon nanomaterials: Fullerenes, carbon nanotubes (CNTs), graphene; synthesis methods [chemical vapor deposition (CVD)], Applications.

Quantum dots: Synthesis, properties, applications in displays and real time applications (photovoltaics, biological imaging and sensing).

Metallic nanoparticles: Preparation (sol-gel process) and applications of gold, silver, and copper nanoparticles. Applications in nanoelectronics, interconnects, sensors (optical and biosensors), memory devices.

Materials of Spintronics: Magnetic nanoparticles, ferromagnetic materials, topological insulators.

Text books

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 Streetman, B. G., & Banerjee, S. K. (2015). Solid state electronic devices (7th ed.). Pearson Education.
2 Sze, S. M., & Ng, K. K. (2006). Physics of semiconductor devices (3rd ed.). John Wiley & Sons.
3 Dara, S. S., & Umare, S. S. (2018). Engineering chemistry (15th ed.). S. Chand Publishing.

Web Resources

1 IEEE Electron Devices Society. (n.d.). IEEE EDS resources. https://eds.ieee.org
2 SEMI. (n.d.). Semiconductor manufacturing standards. https://www.semi.org
3 NPTEL. (n.d.). Engineering chemistry courses. https://nptel.ac.in
4 IEEE Photonics Society. (n.d.). IEEE Photonics Society resources. https://www.photonicssociety.org
5 U.S. Department of Energy. (n.d.). Energy storage database. https://www.energy.gov

A2620003 – Differential Equations & Vector Calculus

B. Tech. (II Sem.)

L	T	P	Cr.
3	0	0	3

Course Objectives: It 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 completion of the course, the student will be able to:

CO1 : **Create** a Mathematical model for simple physical problems. (K6)

CO2 : **Apply** second order differential equations to analyse L - C - R circuits. (K3)

CO3 : **Formulate** and **solve** the partial differential equations that model physical processes. (K6)

CO4 : **Apply** knowledge of Gradient, divergence, Curl and interpret the physical meaning of different operators. (K3)

CO5 : **Compute** the work done against a field, circulation and flux using vector calculus methods. (K3)

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

Course Articulation Matrix

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

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. Applications: Orthogonal Trajectories in Cartesian Coordinates, Newton's Law of cooling – Law of natural growth and decay- Electrical circuits.

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

Definitions of linear and non – linear equations, homogenous and non-homogenous equations, complementary function, particular integral, general solution, Method of variation of parameters - Wronskian. Simultaneous linear equations, Applications to L-C-R Circuit problems.

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. Homogeneous Linear Partial differential equations with constant coefficients.

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 (without proof) and their applications.

TEXTBOOKS:

1. B. S. Grewal, "Higher Engineering Mathematics", 45th Edition, Khanna Publishers, 2024.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 11th Edition, John Wiley & Sons, 2025.

REFERENCE BOOKS:

1. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Education, 2017.
2. Glyn James, "Advanced Modern Engineering Mathematics", 5th Edition, Pearson Education, 2018.
3. H. K. Dass, "Advanced Engineering Mathematics", 22nd Edition, S. Chand Publishing, 2022.

WEB RESOURCES

1. https://mathworld.wolfram.com/First-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

A2620402 – Data Structures and Algorithms using C

B. Tech. (II Sem.)

L	T	P	Cr.
0	1	3	2.5

Prerequisite: Basic knowledge of problem-solving and Programming in C

Course Objectives: The main objectives of the course are to

- Introduce students to fundamental programming concepts using C and strengthen their computational problem-solving skills.
- Develop an understanding of fundamental data structures, their representations, operations and applications.
- Provide hands-on experience in implementing data structures and algorithms using both C and Python.
- Develop the ability to analyze algorithms using time and space complexity and compare alternative solutions.

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

		Knowledge Level (K)#
CO1	Implement basic data structures using C	K3
CO2	Apply arrays, linked lists, stacks and queues to solve computational problems.	K3
CO3	Implement and analyze trees, heaps, graphs and hashing techniques using C.	K3
CO4	Implement searching and sorting algorithms and analyze their time and space complexity.	K3
CO5	Apply suitable data structures and algorithms to solve practical engineering problems.	K3

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	–	–	–	1	1	–	2	1	1
CO2	3	3	3	2	2	–	–	–	1	2	–	3	2	1
CO3	3	3	3	3	3	–	1	–	2	2	1	3	2	2
CO4	3	3	3	3	3	–	–	–	1	2	–	3	2	2
CO5	3	3	3	3	3	2	2	1	2	3	2	3	2	2

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

UNIT – I: ARRAYS, ALGORITHM ANALYSIS

Introduction to data structures, Need for data structures, Classification of data structures, Linear and non-linear data structures, Abstract Data Types.

Arrays and their representation, Array traversal, Insertion and deletion, Searching and updating, Two-dimensional arrays, Sparse matrices.

Searching: Linear search, Binary search, Comparison of searching algorithms

Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Comparison of sorting algorithms.

Introduction to algorithms, Time and space complexity, Big-O, Omega and Theta notations

Experiments using C:

1. Implement array traversal, insertion, deletion and updating.
2. Implement sparse matrix representation.
3. Implement linear search.
4. Implement binary search.

5. Implement bubble sort.
6. Implement selection sort.
7. Implement insertion sort.
8. Implement merge sort.
9. Implement quick sort.

UNIT – II: LINKED LISTS

Introduction to linked lists, singly linked lists, Linked-list operations, Applications of linked lists, Doubly linked lists, Circular linked lists, Insertion and deletion operations.

Experiments using C:

1. Implement a singly linked list.
2. Perform insertion and deletion in a singly linked list.
3. Search for an element in a singly linked list.
4. Reverse a singly linked list.
5. Implement a doubly linked list.
6. Implement a circular linked list.
7. Implement a stack using an array.
8. Implement a stack using a linked list

UNIT – III: STACKS AND QUEUES

Stacks: Stack ADT, Push, pop and peek operations, Stack using arrays, Stack using linked lists, Applications of stacks- parentheses matching, Infix, prefix and postfix expressions, Infix-to-postfix conversion, Postfix expression evaluation

Queues: Queue ADT, Queue operations, Queue using arrays, Queue using linked lists, Circular queues, Applications of queues

Experiments using C:

1. Implement a stack using an array.
2. Implement a stack using a linked list.
3. Implement a queue using an array.
4. Implement a queue using a linked list.
5. Implement a circular queue.
6. Check balanced parentheses using a stack.
7. Convert an infix expression to postfix.
8. Evaluate a postfix expression

UNIT – IV: TREES AND HEAPS

Introduction to non-linear data structures, Tree terminology, Root, parent, child, leaf, level and height, Binary trees, Binary tree representation, Tree traversals- Preorder, Inorder, Postorder, Binary Search Trees- BST insertion, BST searching, BST deletion,

Introduction to heaps, Min heap, Max heap, Heap insertion and deletion, Heapify, Heap sort, Applications of trees and heaps

Experiments using C:

1. Create a binary tree using structures and pointers.
2. Implement preorder traversal.
3. Implement inorder traversal.
4. Implement postorder traversal.
5. Implement a Binary Search Tree.
6. Implement insertion and searching in a BST.
7. Implement deletion in a BST.
8. Implement a min heap.
9. Implement a max heap.
10. Implement heap sort.

UNIT – V: GRAPHS, HASHING

Graphs: Introduction to graphs, Graph terminology, Directed and undirected graphs, Weighted and unweighted graphs, Adjacency matrix, Adjacency list, Breadth First Search, Depth First Search, Applications of graphs

Hashing: Introduction to hashing, Hash functions, Hash tables, Collision handling, Linear probing, Quadratic probing, Separate chaining

Experiments using C:

1. Represent a graph using an adjacency matrix.
2. Represent a graph using an adjacency list.
3. Implement Breadth First Search.
4. Implement Depth First Search.
5. Implement hashing using linear probing.

TEXT BOOKS:

1. Reema Thareja, Data Structures Using C, 3rd Edition, Oxford University Press, 2023
2. Michael T. Goodrich, Roberto Tamassia and Michael H. Goldwasser, *Data Structures and Algorithms in Python*, 1st Edition, Wiley, 2013.
3. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.

REFERENCE BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, 3rd/4th Edition, MIT Press.
2. Brad Miller and David Ranum, Problem Solving with Algorithms and Data Structures Using Python, Franklin, Beedle & Associates.
3. Wing, J. M. (2006). Computational thinking. Communications of the ACM, 49(3), 33–35. https://doi.org/10.1145/1118178.1118215

A2620012 – Design Thinking & Innovation

B. Tech. (II Sem.)

L	T	P	Cr.
0	1	3	2.5

Course Objectives:

- Introduce students to the principles, mindset and methodologies of **Design Thinking and human-centered problem solving.**
- Develop students' ability to **observe, empathize, analyze user needs and formulate well-defined engineering and societal problems**.
- Develop students' **creative and innovative thinking abilities** through systematic ideation, concept generation and evaluation techniques.
- Enable students to **develop, prototype, test and iteratively improve solutions** using user feedback and appropriate physical/digital tools.
- Develop students' ability to **identify innovation opportunities, create value propositions, understand basic IPR and communicate innovative solutions effectively.**

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

CO1: Explain the principles, processes and mindset of Design Thinking for engineering problem-solving and innovation (K2)

CO2: Apply empathy, observation and problem-framing techniques to identify user needs and define engineering problems (K3).

CO3: Apply creative and systematic ideation techniques to generate and select innovative solution concepts. (K3)

CO4: Analyze solution concepts and prototypes using user feedback and appropriate design criteria for iterative improvement. (K4)

CO5: Analyze the innovation potential of solutions considering value proposition, feasibility, sustainability, societal impact and basic IPR aspects. (K4)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	1	–	–	1	–	–	1	1	2			
CO2	2	3	3	1	1	3	2	1	2	2	2			
CO3	1	2	3	1	2	1	1	–	3	2	2			
CO4	3	3	3	2	3	2	2	1	3	2	2			
CO5	1	2	3	1	2	3	3	2	2	3	3			

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT – I: Design Thinking Foundations & Empathy

Introduction to Design Thinking; Design thinking mindset and principles; Design thinking vs. conventional engineering problem-solving; Human-centered design; Five-stage design thinking process; Creativity, curiosity and observation; Understanding users and stakeholders; Empathy and user research; Interviews, observation and contextual inquiry; Empathy mapping; Personas and user journeys; Identifying explicit and latent/unarticulated needs; Ethical considerations in user research.

Practical Activities

- Observation of a real-life problem Conducting
- user interviews Preparing an empathy map
- Developing a persona
- Preparing a user journey map

Unit Outcome
Students will be able to **understand users, identify their needs and translate observations into meaningful design opportunities.**

UNIT – II: Problem Definition, Analysis & Opportunity Identification
From observations to insights; Data synthesis and affinity mapping; Identifying patterns and pain points; Problem statements; Point-of-View (POV) statements; "How Might We" (HMW) questions; Stakeholder mapping; 5 Whys and root-cause analysis; Problem prioritization; Need Opportunity mapping; Problem validation; Design constraints and specifications; Social, environmental and sustainability considerations; Identifying opportunities for innovation.

Practical Activities
- Affinity mapping of interview data
- Develop three alternative problem statements Prepare POV and HMW statements
- Stakeholder map
- Root-cause analysis
- Select and validate one problem/opportunity

Unit Outcome: Students will be able to **analyze user research, identify root causes, frame well-defined problems and recognize opportunities for innovative solutions**

UNIT – III: Creativity, Ideation & Concept Development
Creativity and innovation mindset; Divergent and convergent thinking; brainstorming and brainwriting; SCAMPER; Mind mapping; Reverse brainstorming; Analogical thinking; Biomimicry; Lateral thinking; Forced connections; Morphological analysis; TRI basic principles; Individual and collaborative ideation; AI-assisted ideation: opportunities and limitations; Idea clustering and screening; Impact feasibility matrix; Concept selection; Design criteria and decision matrix.

Practical Activities
- Generate 20 30 ideas for a selected problem SCAMPER exercise
- Brainwriting exercise Biomimicry-based ideation
- AI-assisted idea generation and critical evaluation Prepare an idea-selection matrix
- Select the top 2 3 concepts

Unit Outcome
Students will be able to **generate diverse solution concepts using creative techniques and systematically select promising ideas based on defined criteria**.

UNIT – IV: Prototyping, Experimentation & Validation
Concept development; Prototype mindset; Types of prototypes: Paper prototype, Physical prototype, Digital prototype, Storyboard, Roleplay, Service prototype; Low-fidelity and high-fidelity prototypes; Rapid prototyping; "Fail fast, learn fast"; Minimum Viable Prototype (MVP); Design experimentation; Prototype evaluation; User testing; Think-aloud method; Feedback collection; Usability and functionality testing; Iterative design; Design critique; Documentation of iterations; Use of CAD, simulation and AI-assisted visualization tools.

Practical Activities
- Develop a low-fidelity prototype
- Prepare a storyboard
- Build a physical/digital prototype
- Conduct user testing
- Collect structured feedback
- Modify the prototype
- Prepare an iteration log

UNIT – V:

Innovation, Value Creation & Communication

Innovation: meaning, characteristics and importance: Invention vs. innovation ; Incremental, disruptive and radical innovation; Product, process, service and social innovation ; Technology-driven vs. need-driven innovation ; Sustainable and frugal innovation ; Innovation opportunities and emerging technologies ; From prototype to innovation ; Desirability, feasibility and viability ; Value Proposition ; Value Proposition Canvas ; Introduction to Business Model Canvas ; Customer segments and stakeholder value; Innovation validation; Market/user validation

Intellectual Property Rights introduction; Patents, copyright, trademarks and design protection; Responsible innovation; Inclusive and sustainable innovation; Innovation ecosystem and entrepreneurship; Communicating innovative ideas; Innovation pitch.

Practical Activities

1. Classify existing products/services as incremental, disruptive or radical innovations.
2. Identify three innovation opportunities from a campus/community problem.
3. Prepare a **Value Proposition Canvas**.
4. Validate the proposed innovation with potential users.
5. Prepare an introductory **Business Model Canvas**.
6. Identify possible IPR protection.

Prepare and deliver a **3-minute Innovation Pitch**.

TEXT BOOKS:

1. Chandan Adhikari, Prabir Kumar Das & Tanay Pramanik, Textbook of Design Thinking and Innovation, S. Chand Publishing, 2026.
2. Shalini Rahul Tiwari & Rohit Rajendra Swarup, Design Thinking: A Comprehensive Textbook, Wiley India, 2024

REFERENCE BOOKS:

1. Soni, Pavan, Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving, Penguin Random House India.
2. Jauhari, Vinnie & Sudhanshu Bhushan, Innovation Management, Oxford University Press India.

WEB REFERENCES:

1. Atal Innovation Mission, NITI Aayog Innovation and Design Thinking Resources. https://aim.gov.in/
2. Institution's Innovation Council (IIC), Ministry of Education, Government of India, https://iic.mic.gov.in/
3. Startup India, Government of India Innovation and Entrepreneurship Ecosystem, https://www.startupindia.gov.in/
4. National Innovation Foundation India Grassroots and Frugal Innovation, https://nif.org.in/
5. Stanford school Design Thinking Bootleg and Design Thinking Resources, https://dschool.stanford.edu/resources/design-thinking-bootleg
6. IDEO.org Human-Centered Design and Social Innovation Resources, https://www.ideo.org/
7. IDEOU Design Thinking and Innovation Resources, https://www.ideou.com/pages/design-thinking
8. NPTEL Online Courses on Design, Innovation, Creativity and Entrepreneurship, https://nptel.ac.in/
9. SWAYAM Online Courses on Innovation, Entrepreneurship and Design Thinking, https://swayam.gov.in/

A2620403 – Electronic Devices and Circuits

B. Tech. (II Sem.)

L	T	P	Cr.
3	0	0	3

COURSE OBJECTIVES:

- To learn and understand the basic concepts of semiconductor physics.
- To learn and understand the application of diodes as rectifiers with their operation and characteristics with and without filters are discussed.
- To acquire the knowledge about the principle of working and operation of Bipolar Junction Transistor and Field Effect Transistor and their characteristics.
- To learn and understand the purpose of transistor biasing and its significance.
- To learn the small signal equivalent circuit analysis of BJT and FET amplifiers and compare different configurations.

COURSE OUTCOMES:

At the end of this course the student will able to:

CO 1: Recall the fundamentals of semiconductor physics necessary for electronic devices and circuits. **(Remember – L1)**

CO 2 Illustrate the structure and operation of Diodes, BJTs, FETs and biasing of Transistors. **(Understand – L2)**

CO 3: Apply the knowledge of Diodes, Transistors and Filters for designing the Rectifiers, Regulators and Amplifier circuits using basic components. **(Apply – L3)**

CO 4: Analyze the characteristics of Diodes, BJTs, FETs and their equivalent models using V-I Characteristics. **(Analyze – L4)**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	-	-	3	1	-	-	-	1	2	1	1	-
CO2	2	1	2	1	-	3	1	-	-	-	-	1	1	1	-
CO3	3	1	1	-	-	-	1	-	-	-	-	-	2	2	-
CO4	1	3	-	-	-	-	-	-	-	-	1	1	2	2	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT-I: Review of Semiconductor Physics: Mobility and Conductivity, Intrinsic and extrinsic semiconductors**, C**ontinuity Equation, Law of Junction. **(Text book: 1)**

Junction Diode Characteristics: Open circuited p-n junction, Biased p-n junction, p-n junction diode, current components in p-n junction Diode, Diode equation, V-I Characteristics, temperature dependence on V-I characteristics, Diode resistance, Diode capacitance. **(Text book: 1)**

Special Semiconductor Devices: Zener Diode, Breakdown Mechanisms, Zener Diode Applications, Varactor Diode and UJT- Construction, Operation and V-I Characteristics. **(Text book: 1)**

UNIT-II: Diode Circuits: Basic Rectifier Setup**,** Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, Derivations of Characteristics of Rectifiers, Filters, Inductor Filter, Capacitor Filter, π-Section Filter, Comparison of various Filter Circuits in terms of Ripple Factors. The Diode as a circuit element, The Load-Line concept, The Piecewise Linear Diode Model, Clipping (limiting) Circuits, Clipping at Two Independent Levels, Peak Detector, Clamping circuits, Comparators, Sampling Gate, **(Text book: 1, 2)**

UNIT- III: Transistor Characteristics: Junction transistor, transistor current components, transistor equation in CB configuration, transistor as an amplifier, characteristics of transistor in Common Base, Common Emitter and Common Collector configurations, Ebers-Moll model of a transistor, punch through/ reach through. **(Text book: 1)**

Transistor Biasing and Thermal Stabilization: Need for biasing, operating point, load line analysis, BJT biasing- methods, basic stability, fixed bias, collector to base bias, self-bias, Stabilization against variations in V_{BE}, Ic, and β, Stability factors, (S, S', S''), Bias compensation, Thermal runaway, Thermal stability. **(Text book: 1)**

UNIT- IV: FET:

MOSFET: FET types, Comparison of Characteristics, MOSFET Structure, Operation of MOSFET, operation in triode region, operation in saturation, MOSFET as a variable resistor, derivation of V-I characteristics of MOSFET, Channel length modulation, MOS trans-conductance, MOS device models: MOS small signal model, PMOS Transistor, CMOS Technology, Comparison of Bipolar and MOS devices with respect to their characteristics, advantages, and applications. **(Text book: 3)**

UNIT-V: CMOS amplifiers:

Amplifiers: General Considerations, Common Source Stage, Common Gate Stage, Source Follower, comparison of FET amplifiers. NMOS and PMOS comparison, CMOS technology, CMOS inverter, CMOS voltage transfer characteristics, CMOS power dissipation, static and dynamic power, noise margins. **(Text book: 3)**

TEXT BOOKS:

1. Millman's Electronic Devices and Circuits- J. Millman, C. C. Halkias and Satyabrata Jit, Mc-Graw Hill Education, 4th edition, 2015.
2. Millman's Integrated Electronics-J. Millman, C. Halkias, and Ch. D. Parikh, Mc-Graw Hill Education, 2nd Edition, 2009.
3. Fundamentals of Microelectronics-Behzad Razavi, Wiley, 3rd edition, 2021.

REFERENCE BOOKS:

1. Basic Electronics-Principles and Applications, Chinmoy Saha, Arindam Halder, Debarati Ganguly, Cambridge University Press, 1st edition, 2018.
2. Electronics devices & circuit theory- Robert L.Boylestad and Louis Nashelsky, Pearson, 11th edition, 2015.
3. Electronic Devices and Circuits - David A. Bell, Oxford University Press, 5th edition, 2008.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108112
2. https://nptel.ac.in/courses/108101091
3. https://nptel.ac.in/courses/108102095

A2620404 – Electronic Devices and Circuits Lab

B. Tech. (II Sem.)

L	T	P	Cr.
0	0	3	1.5

Note: The students are required to perform the experiment to obtain the V-I characteristics and to determine the relevant parameters from the obtained graphs.

COURSE OBJECTIVES:

- To know the characteristics of Diode, BJT, FET, and UJT.
- To design the rectifiers, filters, and Transistor circuits.
- To analyze the device parameters of Diodes, BJT, and FET ampliofiers.

COURSE OUTCOMES:

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

CO1: Demonstrate the characteristics of BJT, FET, UJT and applications of diode. (**Apply-L3**)
CO2: Model the Rectifiers, filters and Amplifiers used in electronic circuits**.** (**Apply-L3**)
CO3: Analyze the device parameters of Diodes, BJTs, and FETs using VI characteristics. (**Analyze – L4)**.
CO4: Adapt effective Communication, presentation and report writing skills. (**Apply-L3**)

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	1	-	-	-	-	-	-	-	-	1	1	-	2	-
CO3	3	1	1	-	-	-	-	-	-	-	-	-	-	2	-
CO4	-	-	-	-	-	-	-	-	3	2	-	-	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2**-Moderate(Medium), **3**-Substantial (High).

LIST OF EXPERIMENTS: (Minimum of Ten Experiments has to be performed)

1. Characteristics of a p-n junction diode
2. Characteristics of a Zener diode
3. Estimation of ripple factor and regulation of Half-wave rectifier without and with LC filter.
4. Estimation of ripple factor and regulation of Full-wave rectifier without and with LC filter.
5. Design of Clipper circuit using diode
6. Design of Clamping circuit using diode
7. UJT Characteristics
8. Characteristics of a BJT in CE configuration
9. Designing of a transistor self-biasing circuit for a given stability factor.
10. Frequency response of BJT-CE Amplifier
11. MOSFET Characteristics
    Part A: Drain Characteristics
    Part B: Transfer Characteristics
12. Frequency response of MOSFET-CS Amplifier

EQUIPMENT REQUIRED:

1. Regulated Power supplies
2. Digital Storage Oscilloscopes
3. Analog/ Digital Function Generators
4. Digital Multi-meters
5. Active& Passive Electronic Components.

ONLINE LEARNING RESOURCES:

1. https://nptel.ac.in/courses/108108112
2. https://nptel.ac.in/courses/108101091

A2620008 – AI Tools & Applications

B. Tech. (II Sem.)

L	T	P	Cr.
0	1	3	2.5

Course Outline:

- This course introduces first-year engineering students to the practical use of Artificial Intelligence tools across problem-solving, data analysis, content creation, and coding.
- Students gain hands-on experience with generative AI, prompt engineering, AI-assisted data visualization, and productivity/coding copilots through weekly lab practice.
- The course emphasizes responsible and ethical AI use alongside technical competence and serves as a foundation for AI-assisted work in higher-semester courses across all branches.
- By the end, students will be able to independently select, apply, and evaluate AI tools for academic and engineering tasks.

Course Objectives: The main objectives of the course are to

1. To familiarize students with the landscape of AI tools and their underlying working principles.
2. To develop competence in prompt engineering for effective interaction with generative AI systems.
3. To enable students to apply AI tools for data analysis, visualization, and interpretation.
4. To train students in using AI-assisted tools for coding, writing, and productivity tasks.
5. To instill awareness of ethical, legal, and societal considerations in AI tool usage.

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

CO	Course Outcome Description	Knowledge Level (K)#
CO1	Recall the categories, capabilities, and limitations of major AI tools (text, image, code, data).	K1
CO2	Explain the principles of prompt engineering and how generative AI models process instructions.	K2
CO3	Apply AI tools to solve first-year engineering problems in analysis, writing, and coding tasks.	K3
CO4	Analyze AI-generated outputs for accuracy, bias, and reliability before use.	K4
CO5	Evaluate the ethical, academic-integrity, and societal implications of AI tool use, justifying appropriate usage choices.	K5

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	–	–	–	3	1	1	–	–	–	1	2	2	2
CO2	2	2	–	–	3	1	–	1	–	2	1	2	2	2
CO3	3	3	2	2	3	1	1	–	1	2	2	3	2	3
CO4	2	3	2	3	3	2	2	3	1	2	2	2	3	2
CO5	1	2	2	2	2	3	3	3	2	3	2	2	2	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

UNIT – I:

Introduction to AI and the AI Tools Landscape

What is AI, Machine Learning, and Generative AI — basic definitions and how they relate to one another.

Core categories of AI tools: conversational/text, code assistants, data-analysis tools, image-generation tools, and writing/productivity tools.
Large language models process and generate responses : conceptual, non-mathematical overview.
Criteria for selecting the right AI tool for a given task — accuracy needs, cost, data sensitivity, and output format.
Setting up accounts and workspaces: understanding free-tier versus paid-tier capabilities and limitations.
Widely Used AI Tools by Application:

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 Outcome(s):

1. Identify the categories of AI tools available and select an appropriate tool for a given academic or engineering task.

Teacher Practical Examples (for classroom demonstration):

1. Live comparison of the same general engineering query (e.g., "explain the engineering design process") answered by two different AI chatbots, highlighting differences in response style and accuracy.
2. Walkthrough of an AI tool's interface — settings, conversation history, file upload, and model selection — using a common platform.

Student Exercise Problems (for practice):

1. Create accounts on two AI platforms and compare their responses to a simple engineering question (e.g., "explain the difference between analysis and design").
2. Prepare a one-page comparison chart of five AI tools by category and primary use case.
3. Write a short reflection identifying one task in your daily academic life where an AI tool could help.

UNIT – II:
Prompt Engineering and Generative AI Tools
Anatomy of a good prompt — context, clear instruction, desired format, and constraints.
Types of prompt Techniques:
Zero-shot, few-shot, and chain-of-thought prompting techniques and when to use each.
Role-based and context-setting prompts (e.g., asking the AI to respond as a reviewer, tutor, or domain expert).

Iterative prompt refinement — diagnosing a poor AI response and rewriting the prompt to fix it.
Using generative AI ----for brainstorming, summarizing, and drafting technical content.

Unit Outcome(s):

1. Construct clear, well-structured prompts using zero-shot, few-shot, and chain-of-thought techniques to obtain reliable AI output.

Teacher Practical Examples (for classroom demonstration):

1. Refine a vague prompt (e.g., "explain project scheduling") into a precise one step-by-step, showing output improvement at each stage.
2. Demonstrate few-shot prompting by providing examples to guide the AI toward a specific output format (e.g., a formatted comparison table).

Student Exercise Problems (for practice):

1. Write three versions of a prompt (basic, detailed, role-based) for the same task and compare outputs.
2. Use an AI tool to summarize a one-page technical article and verify the summary against the original.
3. Draft a chain-of-thought prompt to solve a multi-step numerical/logical problem (e.g., a unit-conversion or estimation problem) and check the reasoning.

UNIT – III:

AI Tools for Data Analysis and Visualization

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

Unit Outcome(s):

1. Use AI tools to clean, summarize, and visualize a dataset via natural-language commands, and identify errors in AI-generated analysis.

Teacher Practical Examples (for classroom demonstration):

1. Upload a small dataset (e.g., class attendance or survey data) to an AI tool and generate a summary-statistics report and chart using natural-language commands.
2. Show an example where an AI tool misinterprets data (e.g., treats a numeric code as text), and demonstrate how to verify and correct it.

Student Exercise Problems (for practice):

1. Use an AI tool to clean and summarize a small sample dataset (e.g., class attendance or marks data).
2. Generate three different chart types from the same dataset using AI prompts and justify which is most appropriate.
3. Cross-check one AI-generated statistical claim manually and report any discrepancy found.

UNIT – IV:

AI Tools for Coding, Writing, and Productivity

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

Unit Outcome(s):

1. Apply AI coding assistants and writing tools to complete and refine a simple technical task.
2. Integrate multiple AI tools into a coherent workflow.

Teacher Practical Examples (for classroom demonstration):

1. Use an AI coding assistant to generate a simple program (e.g., a temperature converter), then intentionally introduce a bug and have the AI debug it.
2. Generate a presentation outline and speaker notes from a topic prompt using an AI writing/productivity tool.

Student Exercise Problems (for practice):

1. Use an AI coding tool to write and debug a simple program for a given problem statement.
2. Draft a formal email or short report using an AI writing assistant, then manually edit it for accuracy and tone.
3. Generate a slide outline for a 5-minute seminar topic using an AI tool and refine it.

UNIT – V:

Ethics, Reliability, and Emerging Trends

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

Unit Outcome(s):

1. Evaluate AI-generated output for hallucination, bias, and copyright concerns, and apply ethical and data-privacy principles to AI tool use.

Teacher Practical Examples (for classroom demonstration):

1. Show a documented case of AI hallucination (a fabricated fact or citation) and demonstrate how to fact-check it.
2. Walk through an example of properly citing AI assistance in an academic submission per institutional guidelines.
3. Walk through a worked example of checking whether AI-generated text or image output raises a copyright/IP concern (e.g., close paraphrasing of a source).

Student Exercise Problems (for practice):

1. Identify and document a hallucination or bias instance produced by an AI tool on a factual query.
2. Draft an "AI usage declaration" for a hypothetical assignment, citing tools and extent of use appropriately.
3. Review the data-handling/privacy policy of one AI tool used in this course and identify one DPDP Act, 2023 compliance consideration relevant to student data.

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.
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.

Review Questions

1. Explain the difference between AI, Machine Learning, and Generative AI with a suitable example.
2. Describe the anatomy of a good prompt and illustrate zero-shot versus few-shot prompting with an example.
3. Discuss two ways AI tools support data analysis and visualization, with an example of each.
4. What is meant by hallucination in AI-generated output? Explain how it can be detected and verified.
5. Discuss the ethical, academic-integrity, and data-privacy considerations relevant to using AI tools for coursework, referencing the DPDP Act, 2023.

Practical Applications

1. Using AI tools to accelerate literature review and topic understanding for mini-projects and seminars.
2. Applying AI-assisted data analysis to quickly clean, summarize, and visualize experimental or survey data.
3. Using AI coding assistants to write, explain, and debug simple programs across engineering assignments.
4. Leveraging AI writing assistants to draft clear reports, emails, and presentations for academic and professional communication.
5. Applying responsible AI-usage practices — verification, citation, and privacy awareness — in everyday academic work.

A2620405 – Applied Chemistry Lab

B. Tech. (II Sem.)

L	T	P	Cr.
0	0	3	1.5

Pre-requisite: Concurrent with Chemistry for Electrical Systems (Theory).

Course Objective

- To develop basic skills in qualitative and quantitative chemical analysis.
- To apply spectroscopic, electrochemical, and physicochemical techniques in laboratory investigations.
- To analyze experimental data and evaluate polymers, batteries, and electrochemical systems.
- To promote safe laboratory practices, accurate measurements, scientific reporting, and awareness of emerging applications.

Course Outcomes (COs): ***At the end of the course, students will be able to***

CO	Course Outcome Statement	Knowledge Level (K)#
CO1	Estimate fundamental physical constants such as Planck's constant and analyze the quantized energy states of a particle confined in a one-dimensional box using quantum mechanical principles.	**K3** (Apply)
CO2	Analyze and interpret UV-Visible and IR spectroscopic data to determine molecular properties and correlate spectral features with molecular structure.	**K4** (Analyze)
CO3	Evaluate the performance and properties of polymers, electrochemical cells, batteries and corrosion systems by comparing experimental observations with theoretical principles.	**K3** (Apply)
CO4	Apply electrochemistry principles in electroanalytical techniques (potentiometry, conductometry and pH-metry) and synthesize, characterize nanomaterials using green methods.	**K4** (Analyze)
CO5	Conduct experiments safely following laboratory protocols, and record, interpret and report data working individually and in teams.	**K3** (Apply)

#Based on suggested Revised BTL

Mapping of course outcomes with program outcomes:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2	–	2	3	1	1	–	L	–	2
CO2	3	3	1	3	3	1	–	–	2	–	3
CO3	3	3	2	3	2	3	1	1	2	1	2
CO4	2	2	–	2	3	3	3	3	2	3	1
CO5	3	3	3	3	3	3	2	2	3	2	3

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

LIST OF EXPERIMENTS

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

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

1. Calculate and plot allowed energy levels of an electron confined in a one-dimensional box of varying length using the particle-in-a-box model. (virtual Lab)
2. Determine the value of Planck's constant using a set of LEDs of different colors (or a photoelectric effect apparatus).
3. Verify Beer–Lambert's law and determine the molar absorptivity of a colored solution (e.g., $KMnO_4$ or $CuSO_4$) using a UV-Visible spectrophotometer.
4. To determine the concentration of Fe^{2+}/Fe^{3+} in a given water or leach liquor sample by colorimetry.

5. Identify functional groups present in a given organic or mineral-bound sample from its IR spectrum. (virtual lab)
6. Determine the average molecular weight of a given polymer sample using an Ostwald/Ubbelohde viscometer.
7. Determination of strength of an acid in Pb-Acid battery.
8. Determine the concentration of an acid solution by conductometric titration.
9. Determination of a strong acid against a strong base by using pH meter.
10. Determination of a strong acid against a strong base by using potentiometer.
11. Redox titration by using potentiometer.
12. Synthesize polyaniline by oxidative polymerization and qualitatively test its conductivity.
13. Construct a Zn–Cu galvanic cell and measure its EMF, comparing it with the theoretical value from standard electrode potentials.
14. Determine the corrosion rate of a mild steel coupon immersed in simulated mine water (acidic solution).
15. Assemble a simple Zn–carbon (or lead-acid) cell and measure its voltage and approximate capacity.
16. Synthesize silver nanoparticles using a plant extract (green synthesis route) and confirm formation via the surface plasmon resonance (SPR) peak.
17. Adsorption capacity of a nanomaterial (e.g., activated carbon nanoparticles or nano-iron oxide) for removal of a dye or metal ion from water.
18. Particle Size Estimation of Colloidal Nanoparticles (Tyndall Effect and Color-Based Study)

References:

1. Vogel, A. I. (2012). Vogel's textbook of quantitative chemical analysis (6th ed.). Pearson Education.
2. Ahluwalia, V. K., & Dhingra, S. (2017). Comprehensive practical organic chemistry. Universities Press.
3. Virtual Labs, Ministry of Education, Government of India. https://vlab.co.in

A2620014 – IT and Electronics Workshop

B. Tech. (II Sem.)

L	T	P	Cr.
0	0	2	1

Pre-requisites: NIL

Course Objectives (CO):

- Familiarize students with computer hardware, operating systems, peripheral devices and software installation.
- Develop practical skills in computer networking, internet technologies and collaborative platforms.
- To develop basic skills in MS Word, MS Excel, and MS PowerPoint for creating documents, working with data, and preparing presentations
- Develop hands-on skills in basic electronics, circuit assembly, soldering, and measurement, testing and troubleshooting.
- Develop an industry-oriented mini hardware prototype by integrating basic electronics, sensors, embedded software and appropriate documentation.

Course Outcomes (CO): *After successful completion of the course, the student will be able to*:

CO1: Assemble, configure and troubleshoot computer hardware, operating systems and software systems (K3).

CO2: Configure wired and wireless networks and use internet, cloud collaboration and related digital tools (K3).

CO3: Apply practical skills in Linux, MS Word, MS Excel, and MS PowerPoint to manage files, create documents, analyze data, and prepare presentations. (K3).

CO4: Apply practical skills to identify, test, assemble, solder, and measure basic electronic components and circuits. (K3).

CO5: Develop troubleshooting and problem-solving skills through the construction and demonstration of simple electronic circuits and mini projects (K5).

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1-Slight(Low), **2-**Moderate(Medium), **3-**Substantial (High).

List of Experiments:

1. PC Hardware Component Identification and Testing
2. Desktop Computer Assembly
3. Windows/Linux Installation and Basic Troubleshooting
4. LAN Configuration and Network Cable Testing
5. Wi-Fi Router Configuration
6. Basic Linux Commands and File Management
7. Using MS Word, create a comprehensive document that integrates certificate creation, project abstract writing, and newsletter design while demonstrating all major formatting, layout, and editing features.
8. Using MS Excel, prepare a scheduler and GPA sheet applying formatting, formulas, charts, and multiple worksheets. Extend the project with data analysis using LOOKUP/VLOOKUP, sorting, logical operators, conditional formatting, and pivot tables.

9. Using MS PowerPoint, create an interactive presentation that demonstrates layouts, WordArt, multimedia insertion, hyperlinks, master layouts, views, backgrounds, and design templates.
10. Identification and Testing of Basic Electronic Components
11. Basic Electronic Circuit Assembly Using Breadboard
12. Soldering and Desoldering Practice
13. Measurement and Testing Using a Digital Multimeter
14. Construction and Troubleshooting of a Simple Electronic Circuit
15. Mini Project Development and Demonstration

Learning Resources:

Text Books:

1. V. K. Mehta and Rohit Mehta, Principles of Electronics, S. Chand & Company.
2. B. S. Raghuwanshi, A Course in Workshop Technology, Dhanpat Rai & Sons.
3. Vishnu P. Singh, Computer Hardware Course, Asian Publishers/Computech Publications.

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. IIT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition
3. Electronic Principles, Albert Malvino & David J. Bates,8th Edition, Components, breadboard circuits, measurements, troubleshooting.
4. Electronic Devices and Circuit Theory, Robert L. Boylestad & Louis Nashelsky,11th Edition, Basic electronic components, diode/transistor testing, simple circuits.

Online Resources:

1. **NPTEL – Computer Networks** – for networking fundamentals and practical concepts.
2. **NPTEL – Computer Networks and Internet Protocol, IIT Kharagpur** – for TCP/IP and Internet fundamentals.
3. **Ubuntu Official Documentation** – for Linux installation, file management, networking and system administration.
4. **NPTEL – Basic Electronics, IIT Bombay** – for basic electronic circuits and components.
5. **NPTEL – Basic Electronics and Lab, IIT Madras** – particularly useful for the practical electronics component.
6. **Tinkercad Circuits** – for virtual breadboard and circuit prototyping.
7. **Arduino Documentation** – for the mini-project/embedded-prototyping component.

A2620013 – Sports and Yoga or NSS/NCC

B. Tech. (II Sem.)

L	T	P	Cr.
0	0	2	0

Course Objectives:

The main objective of introducing this course is to make the students maintain their mental and physical wellness by balancing emotions in their life. It mainly enhances the essential traits required for the development of the personality.

Course Outcomes: After completion of the course the student will be able to

CO1: Understand the importance of yoga and sports for Physical fitness and sound health. **(Understand)**

CO2: Demonstrate an understanding of health-related fitness components. **(Apply)**

CO3: Compare and contrast various activities that help enhance their health.**(Understand)**

CO4: Assess current personal fitness levels. **(Apply)**

CO5: Develop Positive Personality **(Apply)**

UNIT – I:

Concept of health and fitness, Nutrition and Balanced diet, basic concept of immunity Relationship between diet and fitness, Globalization and its impact on health, Body Mass Index(BMI) of all age groups.

Activities:

i) Organizing health awareness programmes in community
ii) Preparation of health profile
iii) Preparation of chart for balance diet for all age groups

UNIT – I I:

Concept of yoga, need for and importance of yoga, origin and history of yoga in Indian context, classification of yoga, Physiological effects of Asanas- Pranayama and meditation, stress management and yoga, Mental health and yoga practice.

Activities:

Yoga practices – Asana, Kriya, Mudra, Bandha, Dhyana, Surya Namaskar

UNIT – I I I:

Concept of Sports and fitness, importance, fitness components, history of sports, Ancient and Modern Olympics, Asian games and Commonwealth games.

Activities:

i) Participation in one major game and one individual sport viz., Athletics, Volleyball, Basketball, Handball, Football, Badminton, Kabaddi, Kho-kho, Table tennis, Cricket etc. Practicing general and specific warm up, aerobics
ii) Practicing cardiorespiratory fitness, treadmill, run test, 9 min walk, skipping andrunning.

REFERENCE BOOKS:

1. Gordon Edlin, Eric Golanty. Health and Wellness, 14th Edn. Jones & Bartlett Learning,2022
2. T. K. V. Desikachar. The Heart of Yoga: Developing a Personal Practice
3. Archie J. Bahm. Yoga Sutras of Patanjali, Jain Publishing Company, 1993
4. Wiseman, John Lofty, SAS Survival Handbook: The Ultimate Guide to Surviving Anywhere Third Edition, William Morrow Paperbacks, 2014
5. The Sports Rules Book/ Human Kinetics with Thomas Hanlon. -- 3rd ed. Human Kinetics, Inc.2014