A.Y 26-27

I-I

Induction Programme

S.No.	Course Name	Category	L-T-P-C
1	Physical Activities -- Sports, Yoga and Meditation, Plantation	MC	0-0-6-0
2	Career Counselling	MC	2-0-2-0
3	Orientation to all branches -- career options, tools, etc.	MC	3-0-0-0
4	Orientation on admitted Branch -- corresponding labs, tools and platforms	EC	2-0-3-0
5	Proficiency Modules & Productivity Tools	ES	2-1-2-0
6	Assessment on basic aptitude and mathematical skills	MC	2-0-3-0
7	Remedial Training in Foundation Courses	MC	2-1-2-0
8	Human Values & Professional Ethics	MC	3-0-0-0
9	Communication Skills -- focus on Listening, Speaking, Reading, Writing skills	BS	2-1-2-0
10	Concepts of Programming	ES	2-0-2-0

B. Tech I Year I Semester (I Semester)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	HSM		English for Technical Communication	3	0	0	3
2	BSC		Physics for advanced computing	3	0	0	3
3	BSC		Linear Algebra and Calculus	3	0	0	3
4	ESC		Computational Thinking and Problem Solving using Python	3	0	0	3
5	HSM		English for Technical Communications and MOODLES laboratory	0	0	3	1.5
6	BSC		Physics for Advanced Computing Lab	0	0	3	1.5
7	ESC		IT and Electronics Workshop	0	0	3	1.5
8	ESC		Design Thinking and Innovation	0	1	3	2.5
9	ESC		Computational Thinking and Problem Solving using Python Lab	0	0	3	1.5
10	MNC		NSS/NCC	0	0	2	0
			Total	**12**	**1**	**17**	**20.5**

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	ENGLISH FOR TECHNICAL COMMUNICATIONS						

Pre-requisites: NIL

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

CO4: Evaluate the content, limitations and ethical aspects of AI tools in communication and language learning, and apply them to create concise, accurate essays/summaries. (K5)

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

CO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	L	M	–	–	L	M	–	–	L	H	L			
CO2	L	L	L	–	L	H	M	M	H	H	M			
CO3	L	M	L	L	L	M	L	L	H	H	M			
CO4	M	H	M	M	H	L	L	H	M	H	H			
CO5	L	M	L	L	L	M	L	L	H	H	H			

Unit 1 : Effective Communication: Exploring Channels and Methods
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 2: Eco-Consciousness: Negotiating for a Sustainable Future
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 3: Disruptive Technologies: Ethical Implications and Future Prospects 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 4: Entrepreneurship and Start-Up Culture: Emerging Trends
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 Wrtiting
Listening : Listening to debates and discussions.
Speaking: Power Point Presentations by Individuals and Teams.

Unit 5: Ethical Leadership: Integrating Social Responsibility and Core Values
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

Learning Resources:

Textbook:

1. Chekuri, T., & Perumalla, R. K. (2026). NextGen 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 Blackswan 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/

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**PHYSICS FOR ADVANCED COMPUTING (FOR CSE AND ALLIED BRANCHES OF ENGINEERING)**						

Pre-requisites: NIL

Course Objectives:

1. To equip students the concepts of interference, diffraction and polarization and their applications in optics and communication systems.
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 explain various electron theories and interpret the effect of temperature on Fermi-Dirac distribution function and provide basic knowledge of quantum mechanics for quantum computing applications.
4. To familiarize students with semiconductors and magnetic materials and their applications.
5. To impart knowledge on low temperature physics and superconductivity and their applications.

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

CO1: Apply the principles of interference, diffraction and polarization to analyze optical systems and engineering applications.(K3)

CO2: Analyze the operation of various laser systems as well as the working principle of optical fibers in relation to communication applications.(K4)

CO3: Interpret the effects of temperature on Fermi energy and Apply the concepts of quantum mechanics to explain modern computational systems like Quantum Computing.(K3)

CO4: Analyse semiconductor characteristics and magnetic material behaviour for engineering and electronic applications.(K4)

CO5: Apply the concepts of low-temperature physics and superconductivity in modern technological applications and intelligent systems.(K3)

COs / POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO 1	H	M	–	–	M	–	–	–	–	L	M			
CO 2	H	M	M	L	H	–	–	–	L	L	M			
CO 3	H	H	M	M	H	–	–	–	L	L	M			
CO 4	M	H	M	M	M	L	–	–	L	L	M			

UNIT – I: APPLIED WAVE OPTICS **10**Hrs

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

Diffraction and Optical Surveying: Fresnel and Fraunhofer diffraction – Fraunhofer's diffraction due to single slit, double slit & N-slits (qualitative) – Diffraction Grating and grating spectrum – Dispersive and Resolving power of a grating.

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

UNIT – II: QUANTUM PHOTONICS **9**Hrs

Lasers: Principles of Absorption – Spontaneous and Stimulated Emission – Population Inversion – Three level and Four level laser systems – Construction and working of Ruby and He-Ne Laser – Applications (qualitative). **Fiber Optics:** Propagation mechanism – Numerical Aperture – Acceptance angle – Types of optical fibres – Classifications and Modes of optical fibres.

UNIT – III: FREE ELECTRON THEORY & QUANTUM MECHANICS **10**Hrs

Classical free electron theory – merits and demerits – Quantum free electron theory – equation for electrical conductivity – Fermi-Dirac statistics – Fermi level and variation with temperature.

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

UNIT – IV: SEMICONDUCTORS & MAGNETIC MATERIALS **10**Hrs

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.

Magnetic Materials: Introduction and classification - Dia, Para, Ferro, Ferri, and Anti-ferro; Hysteresis and Eddy current losses in electrical machines – Skin effect; Soft & Hard magnetic materials.

UNIT – V: LOW TEMPERATURE PHYSICS & SUPERCONDUCTIVITY **9**Hrs

Low Temperature Physics: Introduction – Low temperature and its importance – Properties of materials at low temperatures – Liquefaction of gases (basic concept only) – Liquid Nitrogen and liquid Helium (basic properties and uses).

Superconductors: Properties – Critical parameters – Meissner effect – Type-I and Type-II superconductors – BCS theory – Cooper pairs and energy gap – DC and AC Josephson effect – Applications (qualitative only): SQUIDs, magnetic levitation and lossless power transmission.

Learning Resources:

Textbooks

1. Avadhanulu, M.N., Kshirsagar, P.G., & Murthy, T.V.S.A., A textbook of engineering physics, S. Chand Publishing (2019)
2. P.K. PalaniSamy, Engineering Physics, SciTech Publications (2019)

Reference Books

1. D. K. Bhattacharya & Poonam Tandon, Engineering Physics, Oxford Press, 2015
2. Nielsen & Chuang, Quantum Computation & Quantum Information, Cambridge (2010)

Online Resources:

- NPTEL – nptel.ac.in
- MIT OpenCourseWare – ocw.mit.edu
- HyperPhysics – hyperphysics.phy-astr.gsu.edu
- PhET Simulations – phet.colorado.edu
- Library of Congress – loc.gov/rr/scitech/selected-internet/physics.html

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**LINEAR ALGEBRA AND CALCULUS**						

Pre-requisite: Mathematics of 10+2 / Intermediate level (algebra, matrices and basic calculus)

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

CO1: Apply matrix algebra and numerical techniques to determine the rank, inverse, eigenvalues and eigenvectors of matrices, solve homogeneous and non-homogeneous systems of linear equations using direct and iterative methods, and analyze their applications in engineering and scientific problems (K2, K3, K5).
CO2: Analyze and solve engineering problems by applying matrix diagonalization, Singular Value Decomposition (SVD), the Cayley-Hamilton Theorem for matrix inverses and powers, and orthogonal transformations to classify and reduce quadratic forms to canonical forms (K2, K3, K5).
CO3: Find the mean value of a given function and use it to estimate the bounds of a given function (K2, K3, K5). CO4: Compute change in the dependent variable with respect to many independent variables and Jacobians. Apply the knowledge in optimizing functions of several variables (K2, K3, K5).
CO5: Compute double and triple integrals of functions of several variables and must be able to change the coordinate systems from Cartesian to polar, spherical and cylindrical coordinates (K2, K3, K5).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	M											
CO2	H	H	M											
CO3	H	H	M											
Co4	H	H	M											
CO5	H	H	M											

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

Partial Differentiation and Applications (Multi Variable Calculus): Functions of several variables: Continuity and Differentiability, Partial derivatives, Total derivatives, Chain rule, Euler's Theorem, Taylor's and Maclaurin's series expansion of functions of two variables. Jacobians, Functional dependence, Maxima and Minima of functions of two variables without constraints and with Constraints-Method of Lagrange multipliers.

UNIT-V

Multiple Integrals: Double integrals, Change of order of integration, Triple integrals, Change of variables from Cartesian to polar, Cylindrical and Spherical coordinates. Finding areas (by double integrals) and volumes (by double integrals and triple integrals).

Learning Resources:

Text Books:

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

Reference Books:

1. Ramana, B.V. (2017). Higher Engineering Mathematics. McGraw Hill Education.
2. James, G. (2018). Advanced Modern Engineering Mathematics. 5th Edition Pearson publishers.
3. Dass, H.K. (2022). Advanced Engineering Mathematics, 22nd Edition. S. Chand Publications.

Web Resources:

- https://en.wikipedia.org/wiki/System_of_linear_equations
- https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
- https://www.math.hmc.edu/calculus/tutorials/eigenstuff/
- https://en.wikipedia.org/wiki/Quadratic_form
- https://en.wikipedia.org/wiki/Calculus
- https://en.wikipedia.org/wiki/Partial_derivative
- https://www.whitman.edu/mathematics/calculus_online/section14.03.html
- https://en.wikipedia.org/wiki/Multiple_integral
- http://tutorial.math.lamar.edu/Classes/CalcIII/MultipleIntegralsIntro.aspx

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**COMPUTATIONAL THINKING AND PROBLEM SOLVING USING PYTHON**						

Pre-requisite: NIL

Course Objectives: At the end of the course, the teacher should be able to:

- Establish computational thinking , decomposition, pattern recognition, abstraction, and algorithmic reasoning as the foundation for problem-solving, with strong grounding in algorithm design and flowchart construction.
- Develop proficiency in Python control structures while explicitly linking conditionals to abstraction and loops to pattern recognition.
- Build competence in selecting Python data structures (strings, lists, tuples, dictionaries) as an exercise in abstraction and pattern-based organization of information.
- Train students to decompose problems into functions and recursive sub-problems, reason informally about algorithmic efficiency, and use AI coding assistants responsibly.
- Equip students with file handling, exception handling, and basic data analysis/visualization skills framed as decomposing a larger data workflow into manageable, robust steps and to integrate these skills in a capstone mini-project.

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

CO1: Explain the principles of computational thinking and interpret algorithms and flowcharts that represent problem-solving logic.(K2)
CO2: Apply pattern recognition and abstraction, via Python control structures, to implement step-by-step algorithmic solutions (K3)
CO3: Analyze problems to select and manipulate appropriate data structures (strings, lists, tuples, dictionaries) as an abstraction and organization exercise (K4)
CO4: Evaluate the correctness and efficiency of decomposed, modular algorithms and Python programs through tracing, testing, debugging, and exception handling (K5)
CO5: Create modular, well-structured Python programs by decomposing problems into functions, recursion, file handling, and data analysis, culminating in an integrative capstone project (K6)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	L	L	M	-	-	-	L	-	M
CO2	H	H	M	M	H	-	-	L	L	-	M
CO3	H	H	M	M	H	-	-	L	L	-	M
CO4	H	H	M	H	H	-	L	L	M	-	H
CO5	H	H	H	H	H	L	L	M	H	L	M

UNIT – 1: Computational Thinking, Algorithm Design & Flowcharting Computational thinking pillars - decomposition, pattern recognition, abstraction, algorithmic thinking, and the problem-solving process. Algorithm design - characteristics of a good algorithm, stepwise refinement, pseudocode. Flowcharts - standard symbols, construction rules, and manual tracing for verification. Translating algorithms and

flowcharts into Python code - variables, data types, operators, and input/output. Introduction to good coding practice - docstrings, inline comments, and print-based debugging, threaded through every unit from here on

UNIT – 2: Control Structures Conditional statements - as abstraction over multiple cases. Loops (for, while) - as pattern recognition of repetition. Nested loops and loop control (break, continue, pass) - as decomposition of complex repetitive logic.

UNIT – 3: Data Structures — Strings, Lists, Tuples & Dictionaries Strings - pattern matching and abstraction of text as a sequence. Lists - abstraction of ordered, mutable collections. Tuples and dictionaries - abstraction of ixed and key-based data

UNIT – 4: Functions & Modular Programming Functions - decomposition of a program into independent, reusable sub-problems. Recursion - algorithmic thinking applied to self-similar sub-problems. Basic algorithmic efficiency - informal comparison of iterative vs. recursive approaches and their time trade-offs. Modules and built-in libraries, including responsible AI-assisted coding practices.

UNIT – 5: File Handling, Exception Handling, Data Analysis & Capstone Project File handling - decomposition of a data workflow into read/process/write stages. Exception handling - abstraction of error cases into predictable, manageable patterns. Introduction to data analysis and visualization (NumPy/Pandas/Matplotlib basics) - pattern recognition in real datasets. Capstone integration - combining all prior units into one end-to-end project.

Learning Resources:

Text Books:

1. Downey, A. B. (2015). Think Python: How to think like a computer scientist (2nd ed.). O'Reilly Media.
2. Guttag, J. V. (2021). Introduction to computation and programming using Python: With application to computational modeling and understanding data (3rd ed.). MIT Press.

Reference Books:

1. Sweigart, A. (2025). Automate the boring stuff with Python: Practical programming for total beginners (3rd ed.). No Starch Press.
2. McKinney, W. (2022). Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter (3rd ed.). O'Reilly Media.
3. Wing, J. M. (2006). Computational thinking. Communications of the ACM, 49(3), 33–35. https://doi.org/10.1145/1118178.1118215

Web References:

1. Python Software Foundation. (n.d.). The Python tutorial. https://docs.python.org/3/tutorial/
2. W3Schools. (n.d.). Python tutorial. https://www.w3schools.com/python/
3. NPTEL. (n.d.). Programming, data structures and algorithms using Python. https://nptel.ac.in

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**ENGLISH FOR TECHNICAL COMMUNICATIONS AND MOODLES LABORATORY**						

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 reading 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.

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**–**	**M**	**–**	**–**	**L**	**M**	**–**	**M**	**M**	**H**	**–**
CO2	**L**	**H**	**–**	**M**	**M**	**M**	**–**	**–**	**–**	**M**	**M**
CO3	**–**	**M**	**–**	**–**	**M**	**M**	**–**	**H**	**H**	**H**	**M**
CO4	**–**	**M**	**–**	**–**	**M**	**M**	**–**	**M**	**M**	**H**	**M**
CO5	**–**	**M**	**–**	**–**	**L**	**M**	**–**	**H**	**H**	**H**	**M**
CO6	**–**	**M**	**–**	**–**	**H**	**M**	**–**	**M**	**M**	**M**	**H**
CO7	**–**	**M**	**L**	**M**	**H**	**M**	**M**	**H**	**H**	**H**	**H**

List of Experiments for the subject English for Technical Communication Lab

(Any 10 experiments in Part A)

1. Phonetics & Accent Neutralisation
   - Sound Lab Drills — Students record minimal pairs (/p/–/b/, /t/–/d/) and compare waveforms 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. Audio-based Note Taking & Narrating Events
   - Event Reconstruction — Play an audio describing an incident; students reconstruct the event in 5–6 bullet points.
   - Timeline Creation — Students listen to a process or story and create a chronological timeline.
   - Peer Narration — One student listens to an audio; narrates it to a partner who writes notes.

6. 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.

7. 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.

8. 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.

9. Explaining Concepts – Technical Text-based
- Concept Simplification — Students take a technical paragraph and rewrite it for a layperson.
- Peer Teaching — Each student teaches a concept from their discipline to a partner from another discipline.
- Diagram Explanation — Provide a technical diagram; students explain it verbally.

10. 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).

11. 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.

12. 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

(Any 4 Experiments in Part B)

Moodle Learning Management System: Digital learning an

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, CultureWizard, 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 schedules

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
- Resubmission and revision

4. Digital Communication and Collaboration

- Moodle forums and discussions
- Academic email etiquette
- Online communication and netiquette
- Group activities and peer learning
- Collaborative learning tools
- Digital presentation skills

5. Academic Skills for Engineering Students

- Effective note-taking
- Reading and understanding technical material
- Time management and study planning
- Problem-solving and critical thinking
- Basic research and information-search skills
- Preparing reports and presentations
- Introduction to citations and referencing

6. Academic honesty

- Plagiarism and how to avoid it
- Copyright and fair use
- Responsible use of AI tools
- Digital privacy and cybersecurity
- Evaluating reliable online information
- Professional behavior in online environments
- Practical Activities

7. Students can complete activities such as:

- Create and update a Moodle profile.
- Download course material and organize it into folders.
- Submit an assignment through Moodle.
- Attempt an online quiz.
- Participate in a Moodle discussion forum.
- Upload a revised assignment after receiving feedback.
- Prepare a short technical presentation.

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**PHYSICS FOR ADVANCED COMPUTING LAB (For CSE and Allied Branches of Engineering)**						

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

References:

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

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**C AND DATA STRUCTURES LAB**						

Pre-requisites: Theory Course

Course Objectives: *The course is designed to*

- Develop problem-solving and algorithmic thinking skills through the implementation of fundamental data structures and algorithms using C.
- Apply appropriate linear and non-linear data structures such as linked lists, stacks, queues, trees, heaps and graphs to solve computational problems.
- Analyze the time and space complexity of searching, sorting, traversal and other fundamental algorithms for different input conditions.
- Evaluate and compare alternative data structures and algorithms based on their efficiency, suitability and applicability to engineering problems.
- Develop practical skills in implementing, testing, debugging, simulating and verifying algorithms, including the use of appropriate programming and development tools.

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

CO1: Apply C programming constructs, control statements, functions, and recursion to solve computational problems. CO2: Apply arrays, strings, pointers, and dynamic memory allocation for efficient data manipulation.
CO3: Design programs using structures, unions, and file handling for organized and persistent data storage. CO4: Implement and analyze linear data structures such as stacks, queues, and linked lists.
CO5: Select, implement, and evaluate trees, graphs, searching, and sorting algorithms based on efficiency requirements.

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	H	M	M	L	L	–	–	–	–	–	L	H	L
CO2	H	H	M	M	M	–	–	–	–	–	L	H	M
CO3	H	M	H	M	M	–	–	–	–	L	L	H	M
CO4	H	H	H	M	M	–	–	–	–	–	L	H	M
CO5	H	H	H	H	M	–	–	–	–	–	M	H	H

List of Experiments:

1. Implementation of Basic C Programming Constructs Using Data Types, Operators, Input/ Output and Control Statements
2. Implementation of Modular C Programs Using Functions and Recursion
3. Implementation of Data Processing Operations Using One-Dimensional and Two-Dimensional Arrays
4. Implementation of String Processing Operations Using Arrays and String Functions

5. Implementation of Pointer Operations and Dynamic Memory Allocation in C
6. Implementation of Record Management Using Structures, Nested Structures and Unions
7. Implementation of Persistent Record Management Using File Handling in C
8. Implementation of Stack Using Arrays and Linked Lists
9. Implementation of Stack Applications for Parenthesis Matching and Infix-to-Postfix Conversion
10. Implementation of Queue and Circular Queue Using Arrays
11. Implementation of Queue Using Linked Lists for Dynamic Request Processing
12. Implementation of Singly Linked List Operations Using Dynamic Memory Allocation
13. Implementation of Doubly and Circular Linked List Operations
14. Implementation of Binary Search Tree with Insertion, Deletion, Searching and Traversals
15. Implementation of Graph Representations Using Adjacency Matrix and Adjacency List
16. Implementation and Analysis of Linear Search and Binary Search Algorithms
17. Implementation and Comparative Analysis of Bubble, Selection and Insertion Sort
18. Implementation and Performance Analysis of Merge Sort and Quick Sort

Textbooks:

1. Kernighan, B. W., & Ritchie, D. M. The C Programming Language, 2nd Edition, Prentice Hall, 1988.
2. Horowitz, E., Sahni, S., & Anderson-Freed, S. Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.
3. Kanetkar, Y. Data Structures Through C, 3rd Edition, BPB Publications, 2020.

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**IT AND ELECTRONICS WORKSHOP**						

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.
- Introduce students to the Linux command-line environment, shell scripting and version control systems.
- Develop hands-on skills in basic electronics, circuit assembly, soldering, 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: Use Linux commands, shell utilities and Git/GitHub for basic software development and collaboration workflows (K3).
CO4: Identify electronic components and instruments, assemble basic electronic circuits, perform soldering, make electrical measurements and troubleshoot simple circuits (K3).
CO5: Develop and demonstrate a working mini hardware prototype integrating electronic components, sensors and embedded software while following basic testing, documentation and presentation practices (K5).

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	-	-	H	-	-	-	M	L	L
CO2	M	H	-	M	H	-	-	-	M	M	L
CO3	M	M	M	-	H	-	-	-	M	M	M
CO4	H	H	H	M	H	-	-	-	M	M	M
CO5	H	H	H	H	H	L	L	M	H	H	H

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. Bash Scripting Basics
8. Git Repository Creation and Basic Version Control
9. GitHub Collaboration
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.

Online Resources:

- **NPTEL – Computer Networks** – for networking fundamentals and practical concepts.
- **NPTEL – Computer Networks and Internet Protocol, IIT Kharagpur** – for TCP/IP and Internet fundamentals.
- **Ubuntu Official Documentation** – for Linux installation, file management, networking and system administration.
- **NPTEL – Basic Electronics, IIT Bombay** – for basic electronic circuits and components.
- **NPTEL – Basic Electronics and Lab, IIT Madras** – particularly useful for the practical electronics component.
- **GitHub Learning Resources** – for Git/GitHub workflows.
- **GitHub Skills** – for hands-on Git/GitHub exercises.
- **Official Git Documentation** – as a reference for version control.
- **Tinkercad Circuits** – for virtual breadboard and circuit prototyping.
- **Arduino Documentation** – for the mini-project/embedded-prototyping component.

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	1	3	50	50	100	2.5
SUB CODE :	**DESIGN THINKING AND INNOVATION**						

Pre-requisites: NIL

Course Objectives: At the end of the course, the teacher should be able to:

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

1. Explain the principles, processes and mindset of Design Thinking for engineering problem-solving and innovation (K2)
2. Apply empathy, observation and problem-framing techniques to identify user needs and define engineering problems (K3)
3. Apply creative and systematic ideation techniques to generate and select innovative solution concepts (K3)
4. Analyze solution concepts and prototypes using user feedback and appropriate design criteria for iterative improvement (K4)
5. Analyze the innovation potential of solutions considering value proposition, feasibility, sustainability, societal impact and basic IPR aspects (K4)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	L	–	–	L	–	–	L	L	M
CO2	M	H	H	L	L	H	M	L	M	M	M
CO3	L	M	H	L	M	L	L	–	H	M	M
CO4	H	H	H	M	H	M	M	L	H	M	M
CO5	L	M	H	L	M	H	H	M	M	H	H

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 ; TRIZ — 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, Role-play, 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.
7. Prepare and deliver a **3-minute Innovation Pitch**.

Learning Resources:

Textbook:

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 Resources:

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 d.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. IDEO U – 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/

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**COMPUTATIONAL THINKING AND PROBLEM SOLVING USING PYTHON LAB**						

Pre-requisite: NIL

Course Objectives: *At the end of the course, the teacher should be able to*:

- Establish computational thinking, decomposition, pattern recognition, abstraction, and algorithmic reasoning as the foundation for problem-solving, with strong grounding in algorithm design and flowchart construction.
- Develop proficiency in Python control structures while explicitly linking conditionals to abstraction and loops to pattern recognition.
- Build competence in selecting Python data structures (strings, lists, tuples, dictionaries) as an exercise in abstraction and pattern-based organization of information.
- Train students to decompose problems into functions and recursive sub-problems, reason informally about algorithmic efficiency, and use AI coding assistants responsibly.
- Equip students with file handling, exception handling, and basic data analysis/visualization skills framed as decomposing a larger data workflow into manageable, robust steps and to integrate these skills in a capstone mini-project.

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

CO1: Explain the principles of computational thinking and interpret algorithms and flowcharts that represent problem-solving logic (K2)
CO2: Apply pattern recognition and abstraction, via Python control structures, to implement step-by-step algorithmic solutions (K3)
CO3: Analyze problems to select and manipulate appropriate data structures (strings, lists, tuples, dictionaries) as an abstraction and organization exercise (K4)
CO4: Evaluate the correctness and efficiency of decomposed, modular algorithms and Python programs through tracing, testing, debugging, and exception handling (K5)
CO5: Create modular, well-structured Python programs by decomposing problems into functions, recursion, file handling, and data analysis, culminating in an integrative capstone project (K6)

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	L	L	M	-	-	-	L	-	M
CO2	H	H	M	M	H	-	-	L	L	-	M
CO3	H	H	M	M	H	-	-	L	L	-	M
CO4	H	H	M	H	H	-	L	L	M	-	H
CO5	H	H	H	H	H	L	L	M	H	L	M

Week 1 (Unit 1):

(1) Find the largest of three numbers.

(2) Check whether a given year is a leap year.

Week 2 (Unit 1):

(1) Compute simple interest given principal, rate, and time.
(2) Compute the area and perimeter of a rectangle from user input.
(3) Swap two numbers without using a third variable.
(1) Determine whether a number is positive, negative, or zero.
(2) Check if a given number is prime
(3) Convert temperature between Celsius and Fahrenheit based on user choice
(4) Determine BMI category (underweight/normal/overweight/obese) using elif.
(5) Classify a triangle as equilateral, isosceles, or scalene.

Week 4 (Unit 2):

(1) Print all Armstrong numbers between 1 and 1000.
(2) Generate the Fibonacci series up to n terms using a loop
(3) Find the GCD and LCM of two numbers using a while loop
(4) Simulate a simple ATM PIN-entry system allowing a maximum of 3 attempts.
(5) Find the first n prime numbers using nested loops with break.

Week 5 (Unit 3):

(1) Encrypt a message using a Caesar cipher.
(2) Check if two given strings are anagrams of each other.
(3) Check whether a given string is a palindrome using slicing and string methods
(4) Count vowels, consonants, digits, and spaces in a given string

Week 6 (Unit 3):

(1) Find the second-largest element in a list of exam scores.
(2) Merge two sorted lists of student roll numbers into a single sorted list.
(3) Generate squares of all even numbers from 1 to 50 using list comprehension.
(4) Store and retrieve student records using a dictionary (roll number as key, tuple of name/marks as value)

Week 7 (Unit 3):

(1) Store coordinates (x, y) as tuples in a list and compute the distance between consecutive points.
(2) Count the frequency of each word in a paragraph using a dictionary
(3) Maintain an inventory system (item name as key, tuple of price and quantity as value) that updates stock after each transaction.

Week 8 (Unit 4):

(1) Using a function, check if a number is "perfect," and list all perfect numbers up to 10,000.
(2) Using *args, compute the total resistance of resistors in series or parallel.
(3) Define a function with default/keyword arguments to compute the area of different shapes based on shape type and use it.
(4) Write a function that returns the mean, median, and mode of a list of numbers

Week 9 (Unit 4):

(1) Compute the GCD of two numbers recursively using the Euclidean algorithm.
(2) Compute factorial using recursion
(3) Solve the Tower of Hanoi problem for n disks recursively and count the number of moves.
(4) Compute the range and maximum height of a projectile given initial velocity and angle, using the math module.

Week 10 (Unit 5):

(1) Count the words, lines, and characters in a given text file.
(2) Read a log file of sensor readings and append a new set of readings with a timestamp.
(3) Read a text file of daily temperature readings and write the maximum, minimum, and average to an output file

Week 11 (Unit 5):

(1) Build a simple calculator that gracefully handles ZeroDivisionError, ValueError, and invalid operators.
(2) Safely compute the roots of a quadratic equation using try-except-finally, abstracting invalid input and division-by-zero into predictable, handled error patterns.
(3) Read a CSV of student marks and write the names of students scoring above 75% to a new file
(4) Validate user input for a unit-conversion tool and raise a custom exception for out-of-range values.
(5) Using Pandas, read a CSV of daily electricity consumption and plot a line graph over a month, recognizing weekday/weekend consumption patterns.

Week 12 (Unit 5):

(1) Capstone Mini-Project: "Dataset Health-Check & Insights Tool" — decompose the workflow into read → validate → clean → analyze → visualize → report stages, using exception handling and NumPy/Pandas/Matplotlib, submitted with a one-page reflection.

Learning Resources:

Text Books:

1. Downey, A. B. (2015). Think Python: How to think like a computer scientist (2nd ed.). O'Reilly Media.
2. Guttag, J. V. (2021). Introduction to computation and programming using Python: With application to computational modeling and understanding data (3rd ed.). MIT Press.

Reference Books:

4. Sweigart, A. (2025). Automate the boring stuff with Python: Practical programming for total beginners (3rd ed.). No Starch Press.
5. McKinney, W. (2022). Python for data analysis: Data wrangling with pandas, NumPy, and Jupyter (3rd ed.). O'Reilly Media.
6. Wing, J. M. (2006). Computational thinking. Communications of the ACM, 49(3), 33–35. https://doi.org/10.1145/1118178.1118215

Web References:

1. Python Software Foundation. (n.d.). The Python tutorial. https://docs.python.org/3/tutorial/
2. W3Schools. (n.d.). Python tutorial. https://www.w3schools.com/python/
3. NPTEL. (n.d.). Programming, data structures and algorithms using Python. https://nptel.ac.in

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	0	100	100	0
SUB CODE :	**NSS / NCC**						

The objective of introducing this course is to impart discipline, character, fraternity, teamwork, social consciousness among the students and engaging them in selfless service.

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

CO1: Understand the importance of discipline, character and service motto.
CO2: Solve some societal issues by applying acquired knowledge, facts, and techniques.
CO3: Explore human relationships by analyzing social problems.
CO4: Determine to extend their help for the fellow beings and downtrodden people.
CO5: Develop leadership skills and civic responsibilities.

UNIT I Orientation

General Orientation on NSS/NCC/ Scouts & Guides/Community Service activities, career guidance.

Activities:

i. Conducting –ice breaking sessions-expectations from the course-knowing personal talents and skills
ii. Conducting orientations programs for the students –future plans-activities-releasing road map etc.
iii. Displaying success stories-motivational biopics- award winning movies on societal issues etc.
iv. Conducting talent show in singing patriotic songs-paintings- any other contribution.

UNIT II Nature &

Care Activities:

i. Best out of waste competition.
ii. Poster and signs making competition to spread environmental awareness.
iii. Recycling and environmental pollution article writing competition.
iv. Organising Zero-waste day.
v. Digital Environmental awareness activity via various social media platforms.
vi. Virtual demonstration of different eco-friendly approaches for sustainable living.
vii. Write a summary on any book related to environmental issues.

UNIT III Community

Service Activities:

i. Conducting One Day Special Camp in a village contacting village-area leaders- Survey in the village, identification of problems- helping them to solve via media- authorities-experts-etc.
ii. Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,
iii. Conducting consumer Awareness. Explaining various legal provisions etc.
iv. Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.
v. Any other programmes in collaboration with local charities, NGOs etc.

Reference Books:

1. Nirmalya Kumar Sinha & Surajit Majumder, *A Text Book of National Service Scheme* Vol; I, Vidya Kutir Publication, 2021 (ISBN 978-81-952368-8-6)
2. *Red Book - National Cadet Corps* – Standing Instructions Vol I & II, Directorate General of NCC, Ministry of Defence, New Delhi
3. Davis M. L. and Cornwell D. A., "Introduction to Environmental Engineering", McGraw Hill, New York 4/e 2008
4. Masters G. M., Joseph K. and Nagendran R. "Introduction to Environmental Engineering and Science", Pearson Education, New Delhi. 2/e 2007
5. Ram Ahuja. *Social Problems in India*, Rawat Publications, New Delhi.

General Guidelines:

1. Institutes must assign slots in the Timetable for the activities.
2. Institutes are required to provide instructor to mentor the students.

Evaluation Guidelines:

- Evaluated for a total of 100 marks.
- A student can select 6 activities of his/her choice with a minimum of 01 activity per unit. Each activity shall be evaluated by the concerned teacher for 15 marks, totalling to 90 marks.
- A student shall be evaluated by the concerned teacher for 10 marks by conducting viva voce on the subject.

A.Y 26-27

I-II

B. Tech I Year II Semester (II Semester)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	BSC		Differential Equations and Vector Calculus	3	0	0	3
2	ESC		Digital Logic Design	3	0	0	3
3	ESC		C and Data Structures	4	0	0	4
4	ESC		Basic Electrical and Electronics Engineering	3	0	0	3
5	BSC		Applied Chemistry for Emerging Technologies	3	0	0	3
6	ESC		C and Data Structures Lab	0	0	3	1.5
7	ESC		AI Tools and Applications	0	1	3	2.5
8	BSC		Applied Chemistry for Emerging Technologies Lab	0	0	3	1.5
9	MNC		Universal Human Values-II	2	0	0	0
			Total	**18**	**1**	**9**	**21.5**

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS						

Pre-requisite: Mathematics of 10+2 / Intermediate level (algebra, matrices and basic calculus)

Course Objectives:

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

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

CO1: Model simple physical problems involving rate as first order differential equations and solve the resulting equation (K2, K3, K5).

CO2: Apply differential equation techniques to formulate and solve homogeneous and non-homogeneous differential equations, solve simultaneous linear differential equations, and apply these methods to model and analyze L-C-R circuit problems and simple harmonic motion (K2, K3, K5).

CO3: Solve partial differential equations that model physical processes (K2, K3, K5).

CO4: Apply the knowledge of gradient, divergence and curl and interpret the physical meaning of different operators (K2, K3, K5).

CO5: Compute the work done against a field, circulation and flux using vector calculus methods (K2, K3, K5).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	M											
CO2	H	H	M											
CO3	H	H	M											
Co4	H	H	M											
CO5	H	H	M											

UNIT-I

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

UNIT-II

Linear Differential Equations of Higher Order (Constant Coefficients): Definitions, Homogeneous and non-homogeneous, Complementary function, Particular integral, General solution, Method of variation of parameters-Wronskian. Simultaneous linear equations, Applications to L-C-R Circuit problems and Simple Harmonic motion.

UNIT-III

Partial Differential Equations: Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, Solutions of first order linear equations using Lagrange's method, Non-linear partial differential equations using Charpit's Method. 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.

Learning Resources:

Text Books:

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

Reference Books:

1. Ramana, B.V. (2017). Higher Engineering Mathematics. McGraw Hill Education.
2. James, G. (2018). Advanced Modern Engineering Mathematics. 5th Edition Pearson publishers.
3. Dass, H.K. (2022). Advanced Engineering Mathematics, 22nd Edition. S. Chand Publications.

Web Resources:

- https://mathworld.wolfram.com/First-OrderOrdinaryDifferentialEquation.html
- https://en.wikipedia.org/wiki/Differential_equation
- https://en.wikipedia.org/wiki/Partial_differential_equation
- https://en.wikipedia.org/wiki/Vector_calculus
- https://en.wikipedia.org/wiki/Vector_calculus

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	DIGITAL LOGIC DESIGN						

Pre-requisites: NIL

Course Objectives: *The course is designed to*

- Understand number systems, digital codes, Boolean algebra, logic operations, and Boolean function minimization.
- Analyze and design combinational logic circuits using standard logic gates and combinational building blocks.
- Understand and design sequential logic circuits, including latches, flip-flops, registers, and counters.
- Understand finite state machines and their analysis and design using appropriate state representation and flip-flop realization.
- Understand programmable logic devices and their basic structures, including PROM, PAL, PLA, CPLD, and FPGA.
- Apply Verilog HDL for modeling, simulation, and design of combinational and sequential digital circuits.

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

CO1: Explain number systems, digital codes, Boolean algebra, logic operations, and the principles of Boolean function minimization.
CO2: Apply Karnaugh map and Quine–McCluskey methods to simplify Boolean functions and realize logic circuits. **CO3:** Analyze and design combinational logic circuits including adders, subtractors, comparators, multiplexers, demultiplexers, decoders, encoders, and code converters.
CO4: Analyze and design sequential logic circuits using latches, flip-flops, registers, and synchronous and asynchronous counters.
CO5: Analyze and design finite state machines and explain the basic structures and applications of PROM, PAL, PLA, CPLD, and FPGA.
CO6: Model, simulate, and verify combinational and sequential digital circuits using Verilog HDL.

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	M	L	–	L	–	–	–	–	L	–			
CO2	H	H	H	L	M	–	–	L	–	L	–			
CO3	H	H	H	M	M	–	–	L	L	L	L			
CO4	H	H	H	M	M	–	–	L	L	L	L			
CO5	H	H	H	M	H	L	L	L	L	L	M			
CO6	H	H	H	H	H	L	L	M	M	M	M			

UNIT I: NUMBER SYSTEMS, CODES AND BOOLEAN LOGIC

Number systems and codes; representation of unsigned and signed integers; floating-point representation of real numbers; code conversions; basic error-detection and error-correction concepts; Boolean algebra; laws and theorems of Boolean algebra; De Morgan's theorems; logic operations and logic gates; switching functions; canonical forms of Boolean functions; Sum-of-Products (SOP) and Product-of-Sums (POS) forms; realization of Boolean functions using logic gates; minimization of Boolean functions using Karnaugh maps; Quine–McCluskey algorithm.

UNIT II: COMBINATIONAL LOGIC CIRCUITS

Combinational logic circuits; representation and analysis of combinational logic; design procedure using basic logic gates; adders; half adder and full adder; 4-bit binary adder/subtractor; BCD adder; carry look-ahead adder; subtractors; magnitude comparator; multiplexers; demultiplexers; decoders; encoders; priority encoders; code converters; implementation of combinational logic using multiplexers, decoders, and other combinational building blocks.

UNIT III : SEQUENTIAL LOGIC CIRCUITS

Basic distinction between combinational and sequential circuits; latches; SR, JK, D and T flip-flops; truth tables and excitation tables; level triggering and edge triggering; timing considerations; conversion of flip-flops; design procedure for sequential circuits; registers; shift registers; universal shift register; asynchronous and synchronous counters; modulo counters; ring counter; Johnson counter.

UNIT IV: FINITE STATE MACHINES AND PROGRAMMABLE LOGIC DEVICES

Finite State Machines (FSMs); types of FSMs; state diagrams and state tables; state assignment; reduction of state tables using partition technique; realization of FSMs using flip-flops; Mealy and Moore models; conversion between Mealy and Moore machines; design of sequence detectors; analysis and design of synchronous sequential systems; programmable logic devices; PROM, PAL and PLA; basic structure of CPLD; basic structure of FPGA; advantages of FPGA-based implementation.

UNIT V: VERILOG HDL FOR DIGITAL SYSTEM DESIGN

Introduction to Verilog HDL; gate-level, structural-level and behavioural-level modelling; specification and modelling of digital logic circuits; Verilog operators; hierarchical Verilog design; Verilog modelling of combinational circuits; conditional operator; if-else statement; case statement; for loop; Verilog constructs for storage elements; blocking and non-blocking assignments; modelling of flip-flops with clear capability; modelling of registers and counters; testbench concepts; simulation and verification of adders, multiplexers, demultiplexers, flip-flops, counters, and other combinational and sequential circuits.

Learning Resources:

Text Books

1. M. Morris Mano, **Digital Design**, 3rd Edition, Prentice Hall of India.
2. Stephen Brown and Zvonko Vranesic, **Fundamentals of Digital Logic with Verilog Design**, 3rd Edition, McGraw-Hill.
3. Thomas L. Floyd, **Digital Fundamentals**, 11th Edition, Pearson Education.

Reference Books

1. Tocci, R. J., Neal S. Widmer, **Digital Systems: Principles and Applications**, 12th Edition, Pearson Education.
2. Zvi Kohavi and Niraj K. Jha, **Switching and Finite Automata Theory**, 3rd Edition, Cambridge University Press.
3. Samir Palnitkar, **Verilog HDL: A Guide to Digital Design and Synthesis**, 2nd Edition, Prentice Hall PTR.
4. D. P. Leach and Albert Paul Malvino, **Digital Principles and Applications**, 7th Edition, Tata McGraw Hill.

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	4	0	0	40	60	100	4
SUB CODE :	**C AND DATA STRUCTURES**						

Pre-requisite: NIL

Course Objectives: *The course is designed to*

- Understand the fundamental concepts of algorithms, structured programming, and abstract data types using the C programming language.
- Apply programming constructs and basic data structures to organize and manipulate data efficiently.
- Develop problem-solving skills by implementing linear and non-linear data structures using C.
- Analyze the performance of searching, sorting, and traversal algorithms using basic complexity measures.
- Apply appropriate data structures to solve computational problems encountered in engineering applications.

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

CO1: Explain the concepts of algorithms, structured programming, abstract data types, and basic complexity analysis (K2)
CO2: Develop C programs using functions, arrays, pointers, dynamic memory allocation, recursion, and user-defined data types (K3)
CO3: Implement linear and non-linear data structures and perform their basic operations using C (K3)
CO4: Analyze the performance of searching, sorting, and graph traversal algorithms for different computational problems (K4)

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	H	M	–	–	M	–	–	–	–	L	M			
CO2	H	M	M	L	H	–	–	–	L	L	M			
CO3	H	H	M	M	H	–	–	–	L	L	M			
CO4	M	H	M	M	M	L	–	–	L	L	M			

UNIT-I

Programming Fundamentals and Algorithmic Thinking: Programming Fundamentals: Problem-solving methodology; Algorithms; Flowcharts; Characteristics of algorithms; Introduction to C programming; Structure of a C program; Data types; Operators; Input and Output; Control statements; Functions; Arrays; Strings; Pointers (basics); Structures; Introduction to Abstract Data Types (ADT); Need and classification of Data Structures; Introduction to algorithm analysis; Time and space complexity (basic concepts).

UNIT-II

Linear Data Structures: Linear Data Structures: Dynamic memory allocation; Recursion; Linked Lists—Singly, Doubly, and Circular Linked Lists; Basic operations (creation, insertion, deletion, traversal); Applications of Linked Lists; Stacks—Array and Linked List implementations; Basic applications (parenthesis matching, expression conversion and evaluation); Queues—Simple Queue, Circular Queue, Priority Queue; Applications of Queues.

UNIT-III

Trees: Introduction and terminology; Binary Trees; Tree representation; Tree traversals; Binary Search Trees—Insertion, Deletion, Searching; Heap—Min Heap and Max Heap; Introduction to Priority Queue using Heap; Applications of Trees.

UNIT-IV

Graphs: Graph terminology; Graph representations (Adjacency Matrix and Adjacency List); Graph traversals—Breadth First Search (BFS) and Depth First Search (DFS); Introduction to Minimum Spanning Trees (Prim's Algorithm); Applications of Graphs.

UNIT-V

Searching, Sorting and Hashing: Linear Search; Binary Search; Bubble Sort; Selection Sort; Insertion Sort; Merge Sort; Quick Sort; Introduction to Hashing; Hash Functions; Collision Resolution (basic concepts); Comparative analysis of searching and sorting algorithms; Engineering applications and case studies.

Learning Resources:

Text Books:

1. Balagurusamy, E. (2025). Data Structures Using C (2nd ed.). McGraw Hill Education India.
2. Thareja, R. (2023). Data Structures Using C (3rd ed.). Oxford University

Press India. Reference Books:

1. Deshpande, P. S., &Kakde, O. G. C and data structures. Dreamtech Press.
2. Shukla, R. K. Data structures using C and C++.

Wiley India. Web Resources:

- National Programme on Technology Enhanced Learning. (2026). Introduction to Programming in C. IIT Kanpur. https://nptel.ac.in/courses/106104128
- National Programme on Technology Enhanced Learning. (2026). Programming, Data Structures and Algorithms using C. IIT Madras. https://nptel.ac.in/courses/106106127
- National Programme on Technology Enhanced Learning. (2026). Problem Solving Through Programming in C. IIT Kharagpur. https://onlinecourses.nptel.ac.in
- Virtual Labs: https://ds1-iiith.vlabs.ac.in/
- Programiz. Data Structures. https://www.programiz.com/dsa
- Visualgo. Data Structure and Algorithm Visualizations. https://visualgo.net/en

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**						

Pre-requisite: NIL

Course Objectives:

- To introduce fundamental electrical circuit laws, elements, and network theorems and develop the ability to analyze DC circuits.
- To develop an understanding of single-phase and three-phase AC circuits, phasors, impedance, power factor, and electrical power.
- To explain the operating principles, basic equations, speed-control methods, and applications of transformers, DC and AC machines.
- To familiarize students with semiconductor devices, rectifiers, Zener regulators, BJTs, and their basic electronic applications.
- To introduce operational amplifiers and electricity billing and safety.

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

CO1: apply Ohm's law, Kirchhoff's laws, and network theorems to analyze and simplify DC electrical circuits. (K3)

CO2: analyze single-phase and three-phase AC circuits using phasor concepts, impedance, and electrical power calculations. (K4)

CO3: explain the operating principles, basic equations of transformers and DC and AC machines. (K2)

CO4: apply the operating principles of semiconductor devices, rectifiers, Zener regulators, and BJTs in basic electronic circuits. (K3)

CO5: analyze basic operational-amplifier circuits, electricity billing, and electrical safety measures.(K4)

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	-	L	M	-	-	-	-	-	-			
CO2	H	H	-	L	M	-	-	-	-	-	-			
CO3	H	M	-	-	L	-	-	-	-	-	-			
CO4	H	H	-	L	M	-	-	-	-	-	-			
CO 5	H	H	-	L	H	-	-	-	-	-	-			

UNIT-I

DC Circuits and Network Theorems: Electrical circuit elements and terminology; Ohm's law; Kirchhoff's Current Law (KCL) and Voltage Law (KVL); series-parallel DC circuits; mesh and nodal analysis; Thevenin's theorem; Norton's theorem; Superposition theorem.

UNIT-II

AC Circuits: Generation of alternating EMF; peak, average, RMS values, form factor and peak factor; Voltage and current relationship with phasor diagrams in R, L, and C series circuits only, concept of reactance and impedance, concept of power factor, active power, reactive power and apparent power; Introduction to three-phase systems; star and delta connections(line and phase relations only).

UNIT-III

Electrical Machines: DC machines: Principle of operation of DC Generator, Principle of operation of DC Motor, Torque Equation, types of DC motors, speed control using flux control and armature voltage control methods; Transformers: working principle, EMF equation, losses, and efficiency; Three-phase induction motor: principle of operation and applications; Principle of operation of Stepper Motor and DC Servo motor.

UNIT-IV

Semiconductor Devices and Electronic Circuits: Semiconductor basics: intrinsic and extrinsic semiconductors; PN junction diode and its V-I characteristics; Operation of half-wave and full-wave bridge rectifiers without filters; Zener diode and voltage regulation; BJT: operation, input and output characteristics of CE Configurations.

UNIT-V

Operational Amplifier, Energy Billing and Safety: Operational Amplifiers: Ideal operational amplifier, IC741 op-amp & its features, inverting, non-inverting amplifiers; Electricity Bill: Power rating of household appliances including air conditioners, PCs, Laptops, Printers, etc. Types of Tariff, Calculation of electricity bill for domestic consumers;

Equipment Safety Measures**:** Working principle of Fuse and Miniature Circuit Breaker (MCB), Electric Shock, Safety Precautions to avoid shock.

Learning Resources:

Textbooks

1. Ed Hughes. (2016). Electrical & Electronic Technology (12th edition). Pearson Education.
2. Vincent Del Toro. (2015). Electrical Engineering Fundamentals (2nd edition). Pearson Education.

Reference Books

1. Mehta, V. K., & Mehta, R. (2008). Principles of electrical engineering and electronics. S. Chand Publishing.
2. Charles K. Alexander and Mathew N.O. Sadiku. (2017). Fundamentals of Electrical Circuits (6th edition). Mc Graw-Hill Education, India.
3. V. K. Mehta, Rohit Mehta, (2022). Principles of Power Systems. S. Chand Publishing.

Web Resources

1. https://nptel.ac.in/courses/108105112
2. https://nptel.ac.in/courses/108101091
3. https://nptel.ac.in/courses/108105113

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**APPLIED CHEMISTRY FOR EMERGING TECHNOLOGIES** (For CSE and Allied Branches of Engineering)						

Pre-requisite: NIL

Course Objectives

- Understand the fundamentals of quantum chemistry, including wave-particle duality, quantum numbers, and molecular orbital theory relevant to computing materials.
- Comprehend the chemistry and electronic properties of semiconductor and superconductor materials and the chemical processes involved in semiconductor-device fabrication.
- Evaluate electrochemical principles governing batteries, supercapacitors, and fuel cells as energy-storage technologies for computing systems.
- Design sensors and biosensors and utilize them in computer applications.
- Explore the chemistry, synthesis methods, and properties of nanomaterials used in nanoelectronics, quantum computing, and sustainable electronics.

Course Outcomes (COs)

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

CO1: Apply quantum chemistry principles to analyze molecular systems and explain molecular orbital theory for computing materials. (K3, K4)

CO2: Analyze semiconductor materials, doping chemistry and fabrication processes used in modern electronic devices. (K3, K4)

CO3: Evaluate energy-storage technologies including batteries, super capacitors and fuel cells for computing and data-centre applications. (K3, K4)

CO4: Design sensors and utilize smart materials for modern devices. (K3, K4)

CO5: Design advanced materials solutions using nanotechnology principles and AI-assisted tools for Nano electronics. (K5, K6)

CO/POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	H	M	L	M	L	-	-	-	-	-	M			
CO2	H	H	M	M	M	-	-	-	-	-	M			
CO3	H	H	M	M	M	M	L	-	-	L	M			
CO4	M	H	H	M	M	M	L	-	-	L	M			
CO5	H	M	H	H	H	M	L	L	-	L	H			

UNIT-1 Quantum Chemistry **9hrs**

Fundamentals of quantum chemistry: black-body radiation, photoelectric effect, wave-particle duality, de Broglie wave equation, Heisenberg's uncertainty principle; Fundamentals of quantum mechanics: Schrödinger wave equation, significance of Ψ and Ψ^2; quantum numbers; particle in a one-dimensional box. Molecular orbital theory: bonding in homonuclear and heteronuclear diatomic molecules; energy-level diagrams of O_2, N_2, CO and HF; π-molecular orbitals of butadiene and benzene; calculation of bond order.

UNIT II Chemistry of Semiconductors and Superconductors **10 hrs**

- Band theory of semiconductors, Intrinsic and extrinsic semiconductors, Preparation of pure and doped semiconductor material, silicon dioxide (SiO_2) formation and properties, Chemistry of compound semiconductors (GaAs, InP, SiC), Advanced semiconductor materials (Organic semiconductors, Perovskite semiconductors)
  Photolithography: Basic principle, applications
- Superconductors: Characteristics, Type-I and Type-II, Low temperature and high temperature superconductors, superconducting materials (NbTi, Nb_3Sn), applications
- Ion-trap materials: Basic concept, applications

UNIT III: Triad of Electrochemical Power **9 hrs**

- Galvanic and electrolytic cells, redox reactions, electrode potential, Nernst equation and problems;
- Primary batteries: Dry cell, Lithium battery, sodium-air batteries (construction, working and applications), zinc-air battery, secondary batteries: lead-acid, Ni-Cd, 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 for energy harvesting, applications

UNIT IV: Sensors, Biosensors and smart materials **9 hrs**

- E -Waste and Recycling: Recovery of metals, Battery recycling, Safe disposal, Reuse of electronic materials, Reducing environmental contamination
- Sensors: Basic Working Principle, Types of Sensors (Gas sensors, Temperature sensors, Pressure sensors, pH sensors, Humidity sensors, Chemical sensors)
- Biosensors: Components of a Biosensor, Applications
- Smart materials: Types and applications (Shape-memory alloys, Piezoelectric materials, Electrochromic materials, Self-healing polymers)

UNIT V: Chemistry of nanomaterials **9 hrs**

- Introduction to Nanochemistry
- Carbon nanomaterials: Fullerenes, carbon nanotubes (CNTs), graphene; synthesis method [chemical vapor deposition (CVD)], Applications.
- Quantum dots: Synthesis, properties, applications in displays and real time applications.
- Metallic nanoparticles: Preparation (sol-gel process) and applications of gold, silver, and copper nanoparticles. Applications in nanoelectronics, interconnects, sensors (optical and biosensors), memory devices.
- Spintronics materials: Magnetic nanoparticles, topological insulators.

Learning Resources

Textbooks

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

Reference Books (APA Format)

1. Linden, D., & Reddy, T. B. (Eds.). (2001). Handbook of batteries (3rd ed.). McGraw-Hill.
2. Rao, C. N. R., Müller, A., & Cheetham, A. K. (Eds.). (2007). The chemistry of nanomaterials: Synthesis, properties and applications (Vols. 1–2). Wiley-VCH.
3. Sharma, B. K., & Gaur, H. (2019). Engineering chemistry. Krishna Prakashan Media.

Web Resources (APA Format)

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

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**C AND DATA STRUCTURES LAB**						

Pre-requisites: Theory Course

Course Objectives: *The course is designed to*

- Develop problem-solving and algorithmic thinking skills through the implementation of fundamental data structures and algorithms using C.
- Apply appropriate linear and non-linear data structures such as linked lists, stacks, queues, trees, heaps and graphs to solve computational problems.
- Analyze the time and space complexity of searching, sorting, traversal and other fundamental algorithms for different input conditions.
- Evaluate and compare alternative data structures and algorithms based on their efficiency, suitability and applicability to engineering problems.
- Develop practical skills in implementing, testing, debugging, simulating and verifying algorithms, including the use of appropriate programming and development tools.

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

CO1: Apply C programming constructs, control statements, functions, and recursion to solve computational problems. CO2: Apply arrays, strings, pointers, and dynamic memory allocation for efficient data manipulation.
CO3: Design programs using structures, unions, and file handling for organized and persistent data storage. CO4: Implement and analyze linear data structures such as stacks, queues, and linked lists.
CO5: Select, implement, and evaluate trees, graphs, searching, and sorting algorithms based on efficiency requirements.

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	H	M	M	L	L	–	–	–	–	–	L	H	L
CO2	H	H	M	M	M	–	–	–	–	–	L	H	M
CO3	H	M	H	M	M	–	–	–	–	L	L	H	M
CO4	H	H	H	M	M	–	–	–	–	–	L	H	M
CO5	H	H	H	H	M	–	–	–	–	–	M	H	H

List of Experiments:

1. Implementation of Basic C Programming Constructs Using Data Types, Operators, Input/ Output and Control Statements
2. Implementation of Modular C Programs Using Functions and Recursion
3. Implementation of Data Processing Operations Using One-Dimensional and Two-Dimensional Arrays
4. Implementation of String Processing Operations Using Arrays and String Functions
5. Implementation of Pointer Operations and Dynamic Memory Allocation in C
6. Implementation of Record Management Using Structures, Nested Structures and Unions
7. Implementation of Persistent Record Management Using File Handling in C
8. Implementation of Stack Using Arrays and Linked Lists
9. Implementation of Stack Applications for Parenthesis Matching and Infix-to-Postfix Conversion
10. Implementation of Queue and Circular Queue Using Arrays
11. Implementation of Queue Using Linked Lists for Dynamic Request Processing
12. Implementation of Singly Linked List Operations Using Dynamic Memory Allocation
13. Implementation of Doubly and Circular Linked List Operations
14. Implementation of Binary Search Tree with Insertion, Deletion, Searching and Traversals
15. Implementation of Graph Representations Using Adjacency Matrix and Adjacency List
16. Implementation and Analysis of Linear Search and Binary Search Algorithms
17. Implementation and Comparative Analysis of Bubble, Selection and Insertion Sort
18. Implementation and Performance Analysis of Merge Sort and Quick Sort

Textbooks:

4. Kernighan, B. W., & Ritchie, D. M. The C Programming Language, 2nd Edition, Prentice Hall, 1988.
5. Horowitz, E., Sahni, S., & Anderson-Freed, S. Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2008.
6. Kanetkar, Y. Data Structures Through C, 3rd Edition, BPB Publications, 2020.

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	1	3	50	50	100	2.5
SUB CODE :	**AI TOOLS AND APPLICATIONS**						

Pre-requisites: NIL

Course Objectives: To familiarize students with the landscape of AI tools and their underlying working principles.

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

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

1. Recall the categories, capabilities, and limitations of major AI tools (text, image, code, data). (K1)
2. Explain the principles of prompt engineering and how generative AI models process instructions. (K2)
3. Apply AI tools to solve first-year engineering problems in analysis, writing, and coding tasks. (K3)
4. Analyze AI-generated outputs for accuracy, bias, and reliability before use. (K4)
5. Evaluate the ethical, academic-integrity, and societal implications of AI tool use, justifying appropriate usage choices. (K5)

CO\PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3
CO1	M	–	–	–	H	L	L	–	–	–	L			
CO2	M	M	–	–	H	L	–	L	–	M	L			
CO3	H	H	M	M	H	L	L	–	L	M	M			
CO4	M	H	M	H	H	M	M	H	L	M	M			
CO5	L	M	M	M	M	H	H	H	M	H	M			

Unit 1: 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. How 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 (for classroom coverage):

Category	Example Tools	Typical Application
Conversational / General-Purpose AI	ChatGPT, Claude, Gemini, Perplexity	Writing, research, coding help, file/data analysis, cited web search
AI Coding Assistants	GitHub Copilot, Cursor, Claude Code	In-IDE code completion, AI-native editing, multi-file agentic coding
Data Analysis Tools	ChatGPT (Advanced Data Analysis), Microsoft Copilot in Excel, Julius AI	Upload a dataset, generate statistics/charts, spreadsheet formulas via natural language
Image Generation	Midjourney, DALL·E 3, Stable Diffusion / Flux	Illustrations, concept art, design mockups
Writing & Productivity	Grammarly, Gamma, Fathom, Notion AI	Grammar/style checking, slide generation, meeting summaries, task automation
Audio, Video & Presentation (optional)	ElevenLabs, Runway/Sora, Synthesia	Text-to-speech, AI video generation, script-to-video presentations

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 2: Prompt Engineering and Generative AI Tools

Anatomy of a good prompt — context, clear instruction, desired format, and constraints. 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.

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 3: 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.

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 4: 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 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 5: 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.

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.

Learning Resources:

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

2. Google. (n.d.). Google AI essentials. Grow with Google. https://grow.google/ai-essentials/
3. OpenAI. (n.d.). OpenAI documentation and guides. https://platform.openai.com/docs
4. Anthropic. (n.d.). Prompt engineering overview. Claude Docs. https://docs.claude.com/en/docs/build-with-claude/prompt-engineering/overview
5. UNESCO. (2023). Guidance for generative AI in education and research. https://unesdoc.unesco.org/
6. AICTE. (2025). AICTE inputs on Artificial Intelligence — Year of AI initiative. https://www.aicte.gov.in/downloads/initiatives/AICTE%20inputs%20on%20Artificial%20Intelligence%2 0-compre hensive.pdf
7. Ministry of Electronics and Information Technology, Government of India. (2023). Digital Personal Data Protection Act, 2023. https://www.meity.gov.in/content/digital-personal-data-protection-act-2023

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**APPLIED CHEMISTRY FOR EMERGING TECHNOLOGIES LAB**						

Pre-requisite: NIL

Course Objectives:

- To provide hands-on experience in determining fundamental constants and semiconductor band-gap energy through optical and photoelectric experiments.
- To train students in conductometric, potentiometric and cell-based electrochemical measurement techniques.
- To familiarize students with the performance evaluation of batteries, supercapacitors and biosensors.
- To develop skills in the preparation and characterisation of nanomaterials and in safe laboratory practice, data analysis and technical reporting.

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

CO1: Estimate fundamental physical quantities such as Planck's constant and the band-gap energy of a semiconductor from photoelectric and optical absorption measurements. (K3).

CO2: Determine electrochemical parameters including EMF, specific and equivalent conductance, and pH using conductometric, potentiometric and cell-based methods. (K3)

CO3: Analyse the charge-discharge characteristics and performance of batteries and supercapacitors used in computing devices. **(**K4)

CO4: Synthesize and examine nanomaterials and evaluate their optical and adsorption properties for engineering applications. (K4)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	M	L	H	M	-	-	M	L	-	M			
CO2	H	M	-	H	M	-	-	M	L	-	M			
CO3	H	H	M	H	M	-	-	M	L	-	M			
CO4	H	H	M	H	M	M	-	M	L	-	M			

LIST OF EXPERIMENTS

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

1. Verification of the photoelectric effect and estimation of Planck's constant.
2. Study of the emission spectrum of a hydrogen/mercury-vapour Lamp using a spectrometer.
3. Determination of the band-gap energy of a semiconductor sample from its optical absorption edge.
4. Determination of a strong acid against a strong base by using a conductometer.
5. Determination of the EMF of a Daniel cell and verification of the Nernst equation.
6. Determination of the charge–discharge characteristics of a lithium-ion battery/supercapacitor cell.
7. Determination of the specific and equivalent conductance of an electrolyte solution.

8. Assemble a simple Zn-carbon (or lead-acid) cell and measure its voltage and approximate capacity.
9. Construction and performance evaluation of a simple enzyme based electrochemical biosensor for glucose detection (demo)
10. Preparation and observation of colloidal gold/silver nanoparticles (size-dependent colour- change)
11. Determination of the viscosity of a polymer/nanomaterial-dispersion solution using an Ostwald viscometer.
12. Determination of the pH of an electronic-grade (deionized) water sample used in wafer/PCB cleaning.
13. Determination of strong acid against a strong base by using potentiometer.
14. Determination of conductivity of an electronic-grade (deionized) water sample used in wafer/PCB cleaning.
15. Redox titration by using potentiometer.
16. Determination of strength of an acid in Pb-Acid battery.
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. Study of galvanic corrosion using a zinc–iron electrochemical couple.

References:

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

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	2	0	0	0	100	100	0
SUB CODE :	**UNIVERSAL HUMAN VALUES – II UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT**						

Pre-requisites: NIL

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes: *After successful completion, student will be able to*

1. Describe the terms like Natural Acceptance, Happiness and Prosperity (K2)
2. Identify one's self, and one's surroundings (family, society nature) (K2)
3. Apply what they have learnt to their own self in different day-to-day settings in real life (K3)
4. Relate human values with human relationship and human society. (K4)
5. Justify the need for universal human values and harmonious existence (K5)
6. Develop as socially and ecologically responsible engineers (K6)

COs\POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	–	–	–	–	–	M	M	H	L	L	–
CO2	–	L	–	–	–	H	H	H	M	M	–
CO3	L	M	M	L	L	H	H	H	M	M	L
CO4	–	L	L	–	–	H	H	H	H	M	L
CO5	–	M	L	L	–	H	H	H	M	H	L
CO6	L	M	M	M	L	H	H	H	H	M	M

UNIT I: Introduction to Value Education: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education); Understanding Value Education; Practice Session PS1 Sharing about Oneself; self-exploration as the Process for Value Education; Continuous Happiness and Prosperity – the Basic Human Aspirations; Practice Session PS2 Exploring Human Consciousness; Happiness and Prosperity – Current Scenario; Method to Fulfill the Basic Human Aspirations; Practice Session PS3 Exploring Natural Acceptance

UNIT II: Harmony in the Human Being: Understanding Human being as the Co-existence of the self and the body.; Distinguishing between the Needs of the self and the body; Practice Session PS4 Exploring the difference of Needs of self and body; The body as an Instrument of the self; Understanding Harmony in the self; Practice Session PS5 Exploring Sources of Imagination in the self; Harmony of the self with the body; Programme to ensure self-regulation and Health; Practice Session PS6 Exploring Harmony of self with the body

UNIT III: Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction; 'Trust' – the Foundational Value in Relationship; Practice Session PS7 Exploring the Feeling of Trust; 'Respect' – as the Right Evaluation; Practice Session PS8 Exploring the Feeling of Respect; Other Feelings, Justice in Human-to-Human
Relationship; Understanding Harmony in the Society; Vision for the Universal Human Order; Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV: Harmony in the Nature/Existence: Understanding Harmony in the Nature; Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature; Practice Session PS10 Exploring the Four Orders of Nature; Realizing Existence as Co-existence at All Levels; The Holistic Perception of Harmony in Existence; Practice Session PS11 Exploring Co-existence in Existence.

UNIT V: Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values; Definitiveness of (Ethical) Human Conduct; Practice Session PS12 Exploring Ethical Human Conduct; A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order; Competence in Professional Ethics; Practice Session PS13 Exploring Humanistic Models in Education; Holistic Technologies, Production Systems and Management Models-Typical Case Studies; Strategies for Transition towards Value-based Life and Profession; Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education; PS1 Sharing about Oneself; PS2 Exploring Human Consciousness; PS3 Exploring Natural Acceptance
Practice Sessions for UNIT II – Harmony in the Human Being; PS4 Exploring the difference of Needs of self and body; PS5 Exploring Sources of Imagination in the self; PS6 Exploring Harmony of self with the body
Practice Sessions for UNIT III – Harmony in the Family and Society; PS7 Exploring the Feeling of Trust; PS8 Exploring the Feeling of Respect; PS9 Exploring Systems to fulfil Human Goal
Practice Sessions for UNIT IV – Harmony in the Nature (Existence); PS10 Exploring the Four Orders of Nature; PS11 Exploring Co-existence in Existence
Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics; PS12 Exploring Ethical Human Conduct; PS13 Exploring Humanistic Models in Education; PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

R R Gaur, R Asthana, G P Bagaria, *A Foundation Course in Human Values and Professional Ethics*, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

b. The Teacher's Manual

R R Gaur, R Asthana, G P Bagaria,*Teachers' Manual for A Foundation Course in Human Values and Professional Ethics,* 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. *JeevanVidya: EkParichaya*, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.
6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements. In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview