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	ESC-3		Basic Electrical and Electronics Engineering	3	0	0	3
2	BSC-4		Chemistry for Mechanical Engineers	3	0	0	3
3	BSC-1		Linear Algebra And Calculus	3	0	0	3
4	ESC-1		Computational Thinking and Problem Solving Using Python	3	0	0	3
5	ESC- 2 Lab		AI Tools and Applications	0	1	3	2.5
6	BSC-2 Labs		Chemistry for Mechanical Engineers Lab	0	0	3	1.5
7	ESC-3 Labs		Basic Electrical and Electronics Engineering Lab	0	0	3	1.5
8	ESC-2		Engineering Graphics	0	1	3	2.5
9	ESC- 1 Lab		Computational Thinking and Problem Solving Using Python Lab	0	0	3	1.5
10	MNC-1		Environmental Science for Engineers	2	0	0	0
			Total	**14**	**2**	**15**	**21.5**

I B.TECH I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**Basic Electrical and Electronics Engineering (ME, CE & Pharmaceutical Engineering Only)**						

Pre-requisite: NIL

Course Objectives:

- To introduce the fundamental laws, circuit elements, and network theorems used in the analysis of DC electrical circuits.
- To develop an understanding of single-phase AC circuits using phasor concepts, impedance, and power calculations, and the basic concepts of three-phase systems.
- To explain the construction, operating principles, basic equations, characteristics, and applications of DC and AC machines.
- To familiarize students with semiconductor devices and basic electronic circuits, including diodes, rectifiers, Zener regulators, BJTs, and operational amplifiers.
- To introduce the fundamentals of digital electronics and electricity billing, and electrical safety measures including fuse, MCB, and electric shock protection.

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 AC circuits using phasor concepts, impedance, and power calculations, and the basic concepts of three-phase systems. **(K4)**

CO3: understand the construction, operating principles, basic equations, speed-control methods, and applications of DC and AC machines. **(K2)**

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

CO5: analyze basic digital logic circuits, electricity billing, and electrical safety measures including fuse, MCB, and electric shock protection. (K4)

COs / Pos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PSO 2	PSO3
CO1	H	H	-	L	M	-	-	-	-	-	-			
CO2	H	H	-	L	M	-	-	-	-	-	-			
CO3	H	2	-	-	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 and applications, speed control using flux control & 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; Operation of PNP and NPN junction transistors, CE Configuration - input and output characteristics; Operational amplifiers: inverting and non-inverting amplifiers

UNIT-V

Digital Electronics, Electricity Billing & Safety : Overview of Number Systems, Logic gates including Universal Gates, BCD codes, Boolean Algebra, Basic Theorems and properties of Boolean Algebra, Truth Tables and Functionality of Logic Gates: NOT,OR,AND,NOR,NAND,XOR and XNOR; 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 I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**CHEMISTRY FOR MECHANICAL ENGINEERS(For Mechanical and Allied Branches of Engineering)**						

Pre-requisite: NIL

Course Objectives

1. To understand corrosion mechanisms and surface engineering in mechanical systems.
2. To analyze fuels, combustion, and energy-conversion processes.
3. To study lubrication chemistry and material behavior under friction.
4. To explore engineering materials including metals, polymers, and composites.
5. Explore the chemistry, synthesis methods, and properties of nanomaterials.

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

CO1: Analyze corrosion mechanisms in mechanical components and recommend appropriate protection and surface-treatment methods. (K4)

CO2: Evaluate fuel properties and combustion processes for engines and boilers, and assess alternative fuels for automotive applications. (K3, K4)

CO3: Apply lubrication principles to select appropriate lubricants for mechanical systems based on operating conditions. (K3)

CO4: Analyze engineering materials and composites, relating their chemical composition and processing to mechanical properties. (K3, K4)

CO5: Evaluate advanced materials and nanomaterials relevant to mechanical engineering applications. (K5, K6)

CO/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	M	M	L	M	L	L	-	M	M	L			
CO2	H	H	H	M	H	L	L	M	L	L	M			
CO3	M	M	M	L	M	L	L	-	M	M	L			
CO4	H	H	H	M	H	L	L	M	M	L	M			
CO5	H	M	H	H	H	M	L	L	-	L	H			

UNIT-1: Corrosion Chemistry and Protective Methods 9hrs

Chemical and electrochemical theories of corrosion, galvanic series, Types of corrosion (galvanic, pitting, intergranular, stress corrosion), Corrosion prevention: cathodic protection; Anodic protection

Protective coatings: Galvanizing (hot-dip galvanizing, electro-galvanizing, sherardizing).

Electroplating (copper and nickel plating), Anodizing: aluminium anodizing, hard anodizing, colouring; surface hardening: carburizing, nitriding, carbonitriding, flame hardening; conversion coatings: phosphating and chromating.

UNIT II: Energy Chemistry (Fuels and Combustion) 10hrs

Classification, calorific value, HCV and LCV, Dulong's formula, problems; calorific-value determination using a bomb calorimeter, problems.

- Solid fuels (coal): Classification (anthracite, bituminous, lignite, peat), analysis (proximate, ultimate),
- Liquid fuels (petroleum oil): Composition, refining processes, fractional distillation, cracking — thermal and catalytic- fixed and fluid bed); synthetic fuels (Fischer-Tropsch synthesis)
- Green fuels: Green hydrogen, hythane.
- Knocking in petrol engines: Octane number, anti-knock additives (TEL, MTBE, ethanol); knocking in diesel engines: cetane number, ignition quality, anti-knock additives.
- Combustion — problems.
- Fuel cell: Introduction, types of fuel cells, applications.

UNIT III: Chemistry of Lubricants and refractories 9hrs

- Lubricants: Functions of lubricants - mechanism [fluid-film (hydrodynamic) lubrication, boundary-film (thin-film) lubrication, extreme-pressure lubrication], classification (solid, semisolid, liquid), Properties of lubricants — viscosity, viscosity index, flashpoint, fire point, cloud point, pour point, aniline point, saponification.
- Refractories: Characteristics, classification, properties (refractoriness, refractories under load, thermal spalling, porosity) - factors affecting the refractory materials -applications

UNIT IV: Engineering Materials and composites 10hrs

- Ferrous alloys: Composition and applications of carbon steels, alloy steels, stainless steels, cast irons; heat treatment — annealing, normalizing, hardening, tempering, age hardening.
- Polymer chemistry: Types of polymerization, mechanical properties of polymers, thermoplastics, thermosets; engineering properties and applications of ABS, Bakelite; polymer processing (injection moulding, extrusion moulding, compression moulding, blown film moulding)
- Elastomers: Natural rubber, vulcanization, synthetic rubbers (BUNA-S and BUNA-N).
- Ceramics: Alumina, silicon carbide, silicon nitride, zirconia and applications;

- Composite materials: Classification and applications.
- Solid waste management: Classification, treatment, recycling relevant to manufacturing and machine-shop operations

UNIT-V Advanced Materials & Nanochemistry **10hrs**

- Carbon nanomaterials: Fullerenes, carbon nanotubes (CNTs), graphene; synthesis by chemical vapor deposition (CVD) method, sol-gel process (metal oxides nanoparticles), applications.
- Nanomaterials for Mechanical Engineering: Graphene and Graphene-Based Composites, Nanocomposites for Wear and Friction Reduction
- High-Entropy Alloys (HEAs), Smart Materials and Shape-Memory Alloys (Definition, properties, applications).
- Self-Healing Materials: Types, working, applications.

Learning

Resources

Textbooks (APA

Format)

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. Shikha, A., & Sharma, R. K. (2019). Engineering Chemistry. Krishna Prakashan Media.
2. Payal B. Joshi & Shashank Deep (2019). Engineering Chemistry, Oxford University Press.

Web Resources (APA Format)

- Society of Tribologists and Lubrication Engineers. (n.d.). Tribology and lubrication resources. https://www.stle.org
- ASM International. (n.d.). Materials information and education. https://www.asminternational.org
- Society of Automotive Engineers. (n.d.). Automotive engineering standards. https://www.sae.org
- American Society of Mechanical Engineers. (n.d.). Mechanical engineering resources. https://www.asme.org
- National Association of Corrosion Engineers. (n.d.). Corrosion prevention and control. https://www.nace.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 :	**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 fixed 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
	2	0	0	40	60	100	0
SUB CODE :	**ENVIRONMENTAL SCIENCE FOR ENGINEERS**						

Pre-requisite: NIL

Course Objectives:

- To provide core foundational knowledge on natural resources, ecosystems, and their functional balances.
- To understand the causes, effects, and mitigation strategies of various environmental pollutions.
- To evaluate the socio-economic, ethical, and legal frameworks governing environmental protection.
- To mainstream sustainable development, green engineering practices, and climate action into technical designs.

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

CO1: Understand the structure, function, and interdependence of ecosystems and natural resources for their sustainable utilization. (K2)
CO2: Analyze the sources, effects, and control/mitigation measures of air, water, soil, and noise pollution. (K3). CO3: Evaluate the significance of biodiversity and assess threats to ecosystems along with applicable conservation strategies. (K4)
CO4: Interpret environmental policies, legislation, and Environmental Impact Assessment (EIA) procedures relevant to engineering projects. (K4)
CO5: Apply principles of sustainability, climate change science, and environmental ethics to engineering decision-making and social responsibility. (K5)

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	M	M	L	L	L	H	L	--	L	--	M			
CO2	M	H	M	M	M	H	L	L	M	--	M			
C03	L	M	L	L	L	H	M	L	M	--	M			
CO4	L	M	M	L	L	H	H	--	M	L	M			
CO5	L	M	H	L	M	H	H	M	H	L	H			

UNIT-I

Ecosystems and Natural Resources: Concept, structure, and function of an ecosystem; biotic and abiotic components; Energy flow, food chains, food webs, ecological pyramids;
Biogeochemical cycles: carbon, nitrogen, phosphorus, sulphur, hydrological cycle; Types of ecosystems: forest, grassland, desert, aquatic (pond, lake, estuarine);
Natural resources: forest, water, mineral, food, energy and land resources — use and over-exploitation; Renewable vs. non-renewable resources; concept of carrying capacity; Role of an individual/engineer in conservation of natural resources

UNIT-II

Environmental Pollution and Control:

Air pollution: sources, classification of pollutants, effects, control equipment (ESP, scrubbers, cyclones).
Water pollution: point/non-point sources, water quality parameters (BOD, COD, DO), wastewater treatment overview.
Soil pollution: causes (pesticides, industrial waste), degradation, remediation approaches.
Noise pollution: sources, measurement (dB), health effects, control measures.

Solid and hazardous waste management: 3R principle, e-waste, biomedical waste, landfill/incineration basics. Introduction to Air Quality Index (AQI) and Central/State Pollution Control Board monitoring framework/

UNIT-III

Biodiversity and Conservation: Levels and values of biodiversity (consumptive, productive, social, ethical, aesthetic); India as a mega-biodiversity nation; biodiversity hotspots; Threats to biodiversity: habitat fragmentation, poaching, human-wildlife conflict, invasive/alien species; In-situ conservation: national parks, wildlife sanctuaries, biosphere reserves; Ex-situ conservation: seed banks, botanical/zoological gardens, gene banks; IUCN Red List categories; endangered and endemic species of India.

UNIT-IV

Environmental Policy, Law, and Impact Assessment: Overview of Indian environmental legislation: Environment (Protection) Act 1986, Water Act 1974, Air Act 1981, Wildlife Protection Act 1972, Forest (Conservation) Act 1980

Environmental Impact Assessment (EIA): concept, process, screening, scoping, public hearing, EMP Role of MoEFCC, CPCB/SPCB, and National Green Tribunal (NGT);
International agreements: Stockholm Conference, Rio Summit, Kyoto Protocol, Paris Agreement, SDGs (overview); Environmental clearance process for industrial/infrastructure projects; Engineer's professional and ethical responsibility in environmental compliance.

UNIT-V

Sustainability, Climate Change, and Global Environmental Issues: Concept of sustainable development; UN Sustainable Development Goals (SDGs) overview; Greenhouse effect, global warming, climate change causes and impactsl Ozone layer depletion; acid rain; sea-level rise; Renewable energy sources: solar, wind, biomass, hydro — engineering relevance; Green building concepts, cleaner production, circular economy, carbon footprint/net-zero concepts; Environmental ethics, sustainable lifestyle, and role of engineers/technologists as change agents; Disaster management basics: natural and man-made disasters (overview).

Learning Resources:

Text Books:

1. Bharucha, E. — Textbook of Environmental Studies for Undergraduate Courses, Universities Press.
2. Rajagopalan, R. — Environmental Studies: From Crisis to Cure, Oxford University Press.

Reference Books:

1. Kaushik, A. & Kaushik, C.P. — Perspectives in Environmental Studies, New Age International Publishers.
2. Miller, G.T. & Spoolman, S. — Environmental Science, Cengage Learning.

Web Resources:

- Central Pollution Control Board (CPCB) — Official reports, AQI Bulletins, and standards (cpcb.nic.in)
- Ministry of Environment, Forest and Climate Change (MoEFCC) — EIA Notification and policy documents (moefcc.gov.in)
- UNEP / IPCC Assessment Reports — climate change and sustainability data (unep.org, ipcc.ch)
- NPTEL/SWAYAM course: "Environmental Studies" — for supplementary video lectures

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 :	**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	PO10	PO11	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

1. Google. (n.d.). Google AI essentials. Grow with Google. https://grow.google/ai-essentials/
2. OpenAI. (n.d.). OpenAI documentation and guides. https://platform.openai.com/docs
3. Anthropic. (n.d.). Prompt engineering overview. Claude Docs. https://docs.claude.com/en/docs/build-with-claude/prompt-engineering/overview
4. UNESCO. (2023). Guidance for generative AI in education and research. https://unesdoc.unesco.org/
5. AICTE. (2025). AICTE inputs on Artificial Intelligence — Year of AI initiative. https://www.aicte.gov.in/downloads/initiatives/AICTE%20inputs%20on%20Artificial%20Intelligence %20-compre hensive.pdf

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 I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**CHEMISTRY FOR MECHANICAL ENGINEERS LAB**						

Pre-requisite: NIL

Course Objectives:

- To determine the thermal and physical properties of fuels and lubricating oils (calorific value, flash/fire point, viscosity, viscosity index, acid value, saponification value) relevant to engineering applications.
- To familiarize students with electroanalytical techniques (conductometry, potentiometry) for acid-base and redox titrations.
- To develop skills in evaluating corrosion behaviour of metals and determining electroplated coating thickness.
- To introduce photocatalytic degradation as a chemistry-based technique for environmental remediation of dye pollutants.

Course Outcomes (COs)

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

CO1: Determine the calorific value, viscosity, and flash/fire point of fuels and lubricating oils using bomb calorimeter, Ostwald/Redwood viscometer, and Pensky-Martens apparatus.

CO2: Perform quantitative analysis of fuel and construction material quality — proximate analysis of coal, iron content in cement, and acid/saponification value of lubricants.

CO3: Apply electroanalytical techniques (conductometry, potentiometry, pH-metry) to determine concentration, acid strength, and battery electrolyte characteristics.

CO4: Evaluate corrosion behavior of metals (weight-loss method, galvanic coupling) and determine electroplated coating thickness using Faraday's law.

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

2. Determination of the calorific value of a solid/liquid fuel using a bomb calorimeter.

3. Preparation and observation of colloidal gold/silver nanoparticles (size-dependent colour- change).

4. Determination of the viscosity of a polymer/nanomaterial-dispersion solution using an Ostwald viscometer.

5. Determination of the flash point and fire point of a lubricating oil using a Pensky-Martens / Abel apparatus.

6. Determination of a strong acid against a strong base by using conductometer.

7. Determination of the corrosion rate of a mild-steel specimen by the weight-loss method.

8. Study of galvanic corrosion using a zinc–iron electrochemical couple.

9. Determination of percentage of iron in cement sample by colorimeter

10. Preparation and study of a urea-formaldehyde/phenol-formaldehyde resin sample.

11. Determination of the thickness of an electroplated coating (copper / nickel) using Faraday's law.

12. Proximate analysis of a coal sample - determination of moisture, volatile matter, ash and fixed carbon.

13. Determination of the viscosity and viscosity index of a lubricating oil using a Redwood viscometer.

14. Determination of the acid value of a lubricating oil.

15. Determination of the saponification value of a lubricating oil.

16. Photocatalytic degradation of dye.

17. Redox titration by using potentiometer.

18. Determination of strength of an acid in Pb-Acid battery.

19. Determination of pH of water and soil samples using a pH meter.

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 I SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1.5	0	0	50	50	100	1.5
SUB CODE :	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB (ME, CE &Pharmaceutical Sciences Only)**						

Pre-requisite: NIL

Course Objectives:

- To develop practical skills in measuring voltage, current, power, and power factor in DC and AC electrical circuits and in experimentally verifying basic circuit laws and analysis methods.
- To develop practical understanding of the operation, speed-control methods of DC shunt motors and domestic energy consumption.
- To familiarize students with the characteristics and applications of semiconductor devices, rectifier and transistor circuits, and basic digital logic gates.

Course Outcomes: After successful completion of this course, the student will be able to:
CO1: **Apply** electrical measuring instruments and circuit analysis methods to measure electrical quantities and verify circuit laws, theorems, mesh, and nodal analysis. **(K3)**
CO2: Analyze the speed-control methods of DC shunt motorand analyze the characteristics of PN junction, Zener diodes and determine domestic electrical energy consumption.(K4)
CO3: **Analyze** the operation of rectifier and transistor circuits, and basic &universal digital logic gates. **(K4)**

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

List of Experiments

(Any 10 of the following experiments are to be conducted)

1. Verification of Kirchhoff's Laws in a DC circuit.
2. Measurement of voltage, current, and power in a DC circuit.
3. Measurement of voltage, current, power and power factor in a AC circuit.
4. Verification of Superposition theorem for a linear DC network containing multiple independent sources.
5. Measurement of voltages and currents using mesh and nodal analysis in a circuit.
6. Verification of Thevenin's theorem and determine its equivalent parameters.

7. Verification of Norton's theorem and determine its equivalent parameters.
8. Speed control of DC shunt motor using armature voltage method.
9. Speed control of DC shunt motor using field control method.
10. Determination of Electrical Energy Consumption in Domestic Premises.
11. Investigate the characteristics of a Zener Diode as voltage regulator.
12. Plot the V-I characteristics of a PN junction diode.
13. Analyze the Input and Output waveforms of Half-Wave Rectifier.
14. Analyze the Input and Output waveforms of Full-Wave Rectifier.
15. Analyze the Input and Output characteristics of BJT in CE configuration.
16. Investigate logic behaviour of AND, OR, NAND, NOR, EX-OR and universal NAND gates.

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://bes-iitr.vlabs.ac.in/List%20of%20experiments.html
2. https://be-iitkgp.vlabs.ac.in/List%20of%20experiments.html

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 :	**ENGINEERING GRAPHICS** (Common to all branches of Engineering)						

Note: Students shall carry out all the practical exercises of

Sections A and B. Pre-requisites: NIL

Course Objectives: *The course aims to*

- **Develop spatial visualization and graphical communication skills** for representing engineering objects, components, structures and systems.
- **Introduce the principles, conventions and standards of engineering graphics**, including geometrical constructions, scales, dimensioning, projections and sectional representation.
- **Develop the ability to visualize and represent three-dimensional engineering entities** through orthographic, isometric, sectional and surface-development techniques.
- **Develop proficiency in computer-aided engineering graphics**, including 2D drafting, 3D modelling, visualization and generation of engineering drawings.
- **Enable students to communicate engineering design information effectively** through freehand sketches, conventional drawings and digital CAD models across different engineering disciplines.

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

CO	Course Outcome
CO1	Apply standard engineering graphics principles and conventions to prepare accurate sketches and engineering drawings.
CO2	Visualize and represent three-dimensional objects and systems using appropriate projection, orthographic, isometric, sectional, and surface-development techniques.
CO3	Interpret and transform engineering representations by converting between 2D drawings, 3D views, and physical objects.
CO4	Use CAD tools to create, modify, and communicate 2D drawings and 3D models with appropriate dimensions, annotations, symbols, and features.
CO5	Communicate engineering design information effectively through graphical representations, CAD models, and engineering drawings for multidisciplinary engineering applications.

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

SECTION A – Manual Engineering Drawing

Exp.	Practical Exercise
1	**Fundamentals of Engineering Drawing:** Lines, lettering, dimensioning, geometrical constructions, symbols and standard drawing conventions
2	**Engineering Curves:** Construction and applications of ellipse, parabola, hyperbola, cycloid, involute and other commonly used engineering curves
3	**Scales:** Construction and application of plain and diagonal scales for representing engineering dimensions
4	**Projection of Points and Straight Lines:** Projection of points in different quadrants and straight lines in different orientations
5	**Projection of Planes:** Projection of simple planes parallel, perpendicular and inclined to reference planes
6	**Projection of Solids and Engineering Objects:** Projection of basic solids and simple engineering objects in different orientations
7	**Orthographic and Isometric Views:** Conversion between orthographic and isometric representations of simple engineering objects and systems
8	**Sections of Solids and Engineering Objects:** Sectional views and true shapes of simple solids and objects
9	**Development of Surfaces:** Development of surfaces of prismatic, cylindrical, pyramidal, conical and other developable forms
10	**Freehand Engineering Sketching:** Freehand sketching, proportioning and dimensioning of simple engineering components, objects, assemblies and systems

SECTION B – Computer-Aided Engineering Graphics (CAD)

Exp.	Practical Exercise
11	**Introduction to 2D CAD:** Drawing setup, basic drawing and editing commands, layers, dimensions, text, symbols and hatching

12	**CAD Geometrical Constructions and Curves:** Construction of polygons, circles, arcs, ellipse and other engineering curves using CAD
13	**2D CAD – Orthographic Views:** Preparation of front, top, side and other appropriate views of simple engineering objects
14	**Basic 3D CAD Modelling:** Creation of simple three-dimensional engineering objects using basic modelling features
15	**3D CAD Modelling of Engineering Components:** Modelling of representative engineering components, structures and functional objects using basic modelling features
16	**3D CAD Modelling with Features:** Creation and modification of 3D models using features such as hole, fillet, chamfer, mirror, pattern and other appropriate tools
17	**CAD Sectional Views:** Creation of sectional views of 3D engineering objects and generation of corresponding 2D drawings
18	**CAD Surface Development:** Development of cylindrical, conical, prismatic and other developable surfaces using CAD
19	**3D Model to Engineering Drawing:** Generation of orthographic, isometric and sectional views with dimensions, annotations and symbols from a 3D CAD model
20	**CAD Modelling of Physical Engineering Objects:** Measurement and interpretation of a physical engineering object, recreation of its geometry in CAD, and preparation of its engineering drawing

Learning Resources Text Books:

- Bhatt, N. D., & Panchal, V. M. (2023). Elementary engineering drawing (53rd ed.). Charotar Publishing House.
- Narayana, K. L., Kannaiah, P., & Reddy, K. V. (2020). Engineering graphics (2nd ed.). Scitech Publications.

Reference Books:

- Venugopal, K., & Prabhu Raja, V. (2019). Engineering drawing and graphics (5th ed.). New Age International.
- Gopalakrishna, K. R. (2018). Engineering drawing (Vols. 1–2). Subhas Stores

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.

Week 3 (Unit 2):

(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:

3. Downey, A. B. (2015). Think Python: How to think like a computer scientist (2nd ed.). O'Reilly Media.
4. 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:

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

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-3		Differential Equations and Vector Calculus	3	0	0	3
2	HSM-1		English for Technical Communication	3	0	0	3
3	BSC-2		Physics for Mechanical Systems	3	0	0	3
4	ESC-4		Engineering Mechanics	3	0	0	3
5	ESC-5		Design Thinking and Innovation	0	1	3	2.5
6	ESC-5 Labs		Workshop Practice	0	0	3	1.5
7	BSC- 1 Lab		Physics for Mechanical Systems Lab	0	0	3	1.5
8	ESC-4 Labs		Engineering Mechanics Lab	0	0	3	1.5
9	HSM-1 Lab		English for Technical Communications and MOODLES lab	0	0	3	1.5
10	MNC-2		NCC / NSS	0	0	2	0
			Total	**12**	**1**	**17**	**20.5**

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	**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**
CO 1	H	H	M											
CO 2	H	H	M											
CO 3	H	H	M											
Co4	H	H	M											
CO 5	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:

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

Reference Books:

3. Ramana, B.V. (2017). Higher Engineering Mathematics. McGraw Hill Education.
4. James, G. (2018). Advanced Modern Engineering Mathematics. 5th Edition Pearson publishers.
5. 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 :	**ENGLISH FOR TECHNICAL COMMUNICATIONS**						

Pre-requisites: *Intermediate English*

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

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

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

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

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

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/

Read Theory. (n.d). Adaptive reading comprehension practice. https://readtheory.org/

I B.TECH II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	3	0	0	40	60	100	3
SUB CODE :	**PHYSICS FOR MECHANICAL SYSTEMS (For Mechanical and Allied Branches of Engineering)**						

Course Objectives

1. To provide students with a strong foundation in wave optics concepts such as interference, diffraction and polarization along with their applications in optical measurements.
2. To introduce the fundamentals of crystallography and X-ray diffraction methods for understanding crystal structures and material characterization.
3. To equip students the basic principles of quantum mechanics and quantum computing, including quantum states, tunneling, superposition and secure communication.
4. To familiarize students with oscillations, vibration control systems, lasers and precision engineering applications in modern industries.
5. To impart knowledge on the principles of ultrasonics and non-destructive testing methods for defect detection and quality inspection.

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

CO1: Examine the principles of interference, diffraction and polarization and utilize optical analysis techniques in engineering applications(K3).

CO2: Analyze crystal structures, diffraction patterns and material characterization using X-ray diffraction methods (K4).

CO3: Interpret the concepts of quantum mechanics and quantum computing and apply for secure communication system (K3).

CO4: Analyze oscillatory systems, vibration control mechanisms and laser-based metrology techniques (K4).

CO5: Evaluate ultrasonic testing and non-destructive testing methods for defect identification and quality assessment (K5).

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: APPLIED WAVE OPTICS **10Hrs**

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

Diffraction 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: CRYSTALLOGRAPHY AND MATERIAL CHARACTERIZATION **9Hrs**

Crystallography: Space lattice – Basis – Unit cell – Lattice parameters – Crystal systems and Bravais lattices, Co-ordination number and packing fraction of SC, BCC and FCC structures.

Material Characterization: Miller indices – Inter-planar spacing between successive (h k l) planes – Bragg's law – X-ray Diffractometer – Crystal structure determination by Laue's method.

UNIT - III: INTRODUCTION TO QUANTUM MECHANICS & QUANTUM COMPUTING **10Hrs**

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

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

UNIT – IV: OSCILLATIONS AND LASER-BASED METROLOG **10Hrs**

Oscillations: Oscillations of springs – Series and parallel combination of springs (quantitative) – Stiffness factor and its significance – Damping and resonance: over-, under- and critical damping (qualitative) – Forced oscillations and resonance – Sharpness of resonance – Quality factor (Q).

Lasers and Precision Engineering: 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): Role of high-power lasers in CNC Laser Cutting and Welding.

UNIT – V: ULTRASONICS AND NON-DESTRUCTIVE TESTING **9Hrs**

Ultrasonics: Introduction – Characteristics of ultrasonic waves – Production of ultrasonic waves by magnetostriction and piezoelectric methods – Detection - Acoustic grating – Applications.

Non-Destructive Testing (NDT): Introduction - pulse echo system through transmission and reflection modes – Applications.

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. Palaniswamy, Engineering physics, Scitech Publications (2015)

Reference Books:

1. Pandey, B.K., & Chaturvedi, S., Engineering physics, Cengage Learning (2021)
2. Bhattacharya, D.K., & Tandon, P., Engineering physics, Oxford University Press (2015)

Online Resources:

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

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

Pre-requisite: NIL

Course Objectives:

- To introduce the fundamental principles of statics and dynamics applicable to engineering systems.
- To develop the ability to analyze force systems and equilibrium conditions in structures and mechanisms.
- To enable students to determine centroids, moments of inertia, and friction effects in engineering components.
- To build competence in analyzing the motion of particles and rigid bodies using kinematics and kinetics.
- To familiarize students with AI-assisted tools for solving, verifying, and visualizing mechanics problems.

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

CO1: Understand the basic concepts of force systems, free body diagrams, and conditions of equilibrium of rigid bodies. (K2)
CO2: Apply the principles of friction and determine centroids and moments of inertia of engineering sections. (K3)
CO3: Analyze the kinematics of particles undergoing rectilinear and curvilinear motion, including projectile motion. (K4)
CO4: Apply Newton's laws, work-energy, and impulse-momentum principles to solve kinetics problems of particles. (K3)
CO5: Evaluate the motion and forces on rigid bodies undergoing plane motion, including through AI-assisted simulation tools. (K5)

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO 3
CO1	H	H	M	L	L	--	--	--	L	L	--			
CO2	H	M	H	M	L	--	L	--	L	L	--			
CO3	H	H	M	L	L	--	--	--	L	L	--			
CO4	H	M	H	M	M	--	L	--	L	L	--			
CO5	M	H	H	M	H	--	L	--	L	M	L			

UNIT-I

Force Systems and Equilibrium of Rigid Bodies: Introduction to Engineering Mechanics — basic concepts and idealizations (particle, rigid body, continuum); Force systems: coplanar and non-coplanar, concurrent and non-concurrent forces; Resolution and composition of forces; Principle of transmissibility; Moment of a force; Varignon's theorem; Couples; Free body diagrams (FBD) of engineering components; Conditions of equilibrium; two-force and three-force members; Equilibrium of coplanar force systems — graphical and analytical methods.

UNIT-II

Friction: Laws of friction; coefficient of friction; angle of friction and angle of repose; Friction in wedges, ladders, and belt drives.

Centroids: Centroid of plane figures and composite areas — first principles and standard formulae; Centroid of composite bodies (lines, areas, volumes).

Moment of Inertia: Moment of inertia of plane areas; parallel axis and perpendicular axis theorems; Radius of gyration; moment of inertia of composite sections.

UNIT-III

Kinematics of Particles: Rectilinear motion: displacement, velocity, and acceleration; Motion under uniform and variable acceleration; Curvilinear motion: rectangular and normal-tangential components; Projectile motion; Relative motion of particles; Motion (s–t, v–t, a–t) diagrams and their interpretation.

UNIT-IV

Kinetics of Particles: Newton's second law of motion; equations of motion for particles; D'Alembert's principle; Work-energy principle for particles; conservation of energy; Impulse-momentum principle; conservation of momentum; Direct central impact; coefficient of restitution.

UNIT-V

Kinematics and Kinetics of Rigid Bodies (Plane Motion): Types of rigid body motion: translation, rotation about a fixed axis, general plane motion; Instantaneous centre of rotation; velocity analysis using the instantaneous centre method; Relative velocity and relative acceleration methods for plane motion; D'Alembert's principle applied to rigid bodies; equations of motion for plane motion; Introduction to the principle of virtual work and its application to the equilibrium of mechanisms

Learning Resources:

Text Books:

5. Hibbeler, R. C. (2016). Engineering mechanics: Statics and dynamics (14th ed.). Pearson.
6. Shames, I. H., & Rao, G. K. M. (2006). Engineering mechanics: Statics and dynamics (4th ed.). Pearson Education.

Reference Books: (Maximum – 2 to 3 Books)

6. Timoshenko, S., & Young, D. H. (1956). Engineering mechanics. McGraw-Hill.
7. Rajasekaran, S., & Sankarasubramanian, G. (2015). Engineering mechanics: Statics and dynamics (3rd ed.). Vikas Publishing House.
8. Bhavikatti, S. S. (2016). Engineering mechanics (4th ed.). New Age International Publishers.

Web Resources:

- National Programme on Technology Enhanced Learning. (n.d.). Engineering mechanics [Video lecture series]. NPTEL. https://nptel.ac.in
- Massachusetts Institute of Technology. (n.d.). Engineering mechanics I. MIT OpenCourseWare. https://ocw.mit.edu
- Khan Academy. (n.d.). Forces and Newton's laws of motion. https://www.khanacademy.org

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 :	**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 II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	3	50	50	100	1.5
SUB CODE :	**WORKSHOP PRACTICE**						

Pre-requisites: NIL

Course Objectives:

1. Familiarize students with workshop tools, equipment, materials, and safety practices used in basic engineering activities.
2. Develop hands-on skills in wood working, sheet metal working, fitting, foundry, welding, and plumbing operations.
3. Provide practical experience in basic electrical wiring, soldering, and electrical circuit connections.
4. Introduce students to basic tinkering, sensors, actuators, microcontrollers, and IoT applications.
5. Develop students' practical problem-solving, fabrication, assembly, maintenance, and troubleshooting skills through hands-on activities.

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

CO	Course Outcome
CO1	Apply safety practices and identify appropriate workshop tools, equipment, materials, and measuring instruments for basic engineering activities.
CO2	Perform basic fabrication and manufacturing operations using carpentry, sheet metal, fitting, foundry, welding, and plumbing techniques.
CO3	Apply workshop practices for the assembly, disassembly, maintenance, and repair of simple engineering components and systems.
CO4	perform basic electrical wiring, circuit connections, soldering, and testing using appropriate electrical practices.
CO5	Develop simple sensors, actuator, microcontroller, and IoT-based applications through hands-on tinkering and experimentation.

SYLLABUS

1. **Demonstration**: Safety practices and precautions to be observed in workshop.
2. **Wood Working:** Familiarity with different types of wood and tools used in wood working and make following joints.

a) Half – Lap joint b) Mortise and Tenon joint c) Corner Dovetail joint or Bridle joint

3. **Sheet Metal Working**: Familiarity with different types of tools used in sheet metal working, Developments of following sheet metal job from GI sheets.

a) Tapered tray b) Conical funnel c) Elbow pipe d) Brazing

4. **Fitting:** Familiarity with different types of tools used in fitting and do the following fitting exercises.

a) V-fit b) Dovetail fit c) Semi-circular fit

5. **Electrical Wiring**: Familiarity with different types of basic electrical circuits and make the following connections.
   a) Parallel and series b) Two-way switch c) Godown lighting
   d) Soldering of wires.

6. **Foundry Trade:** Demonstration and practice on Moulding tools and processes, Preparation of Green Sand Moulds for given Patterns.

7. **Welding Shop**: Demonstration and practice on GTAW. Preparation of Lap joint and Butt joint.

8. **Plumbing:** Demonstration and practice of Plumbing tools, Preparation of Pipe joints with coupling for same diameter and with reducer for different diameters.

9. Assembly and dis assembly of Two-wheeler electric vehicle.

10. **Tinkering Lab experiments:**
    a) Build and demonstrate automatic street light using LDR.
    b) Simulate the AURDINO LED blinking activity in Tinkercad
    c) Interface a basic sensor and actuator with a microcontroller.

Textbooks:

1. Basic Workshop Technology: Manufacturing Process, Felix W.; Independently Published,2019. Workshop Processes, Practices and Materials; Bruce J. Black, Routledge publishers, 5th Edn. 2015.
2. A Course in Workshop Technology Vol I. & II, B.S. Raghuwanshi, Dhanpath Rai & Co., 2015 & 2017.

Reference Books:

1. Elements of Workshop Technology, Vol. I by S. K. Hajra Choudhury & Others, Media Promoters and Publishers, Mumbai. 2007, 14th edition
2. Workshop Practice by H. S. Bawa, Tata-McGraw Hill, 2004.
3. Wiring Estimating, Costing and Contracting; Soni P.M. & Upadhyay P.A.; Atul Prakashan, 2021-22.
4. https://aim.gov.in/pdf/equipment-manual-pdf.pdf - For Tinkering Lab

Program Outcomes:

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

Mapping notation: H = High, M = Medium, L = Low, – = No correlation.

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 :	**PHYSICS FOR MECHANICAL SYSTEMS LAB (For Mechanical 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 II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	1.5	0	0	50	50	100	1.5
SUB CODE :	**ENGINEERING MECHANICS LAB**						

Course Objectives: *The students completing the course are expected to*

- Verify the Law of Parallelogram and Triangle of Forces.
- Determine the coefficients of friction of Static and Rolling friction and Centre of gravity of different plane Lamina.
- Analyse the system of Pulleys and Moment of Inertia of Compound Pendulum and Flywheel.

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

CO	Course Outcome
CO1	Determine the coefficients of static and rolling friction for different surfaces and configurations.
CO2	Verify the laws of forces and moments using appropriate experimental apparatus and force systems.
CO3	Determine the centre of gravity and moment of inertia of different bodies and configurations using experimental methods.
CO4	Analyze and verify the equilibrium conditions of rigid bodies subjected to different force systems using experimental techniques.

CO\ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	H	H	M	H	M	–	–	M	M	M	–			
CO2	H	H	H	H	M	–	–	M	M	M	–			
CO3	H	H	H	H	M	–	–	M	M	M	–			
CO4	H	H	H	H	M	M	–	H	H	M	M			

Mapping notation: H = High, M = Medium, L = Low, – = No correlation.

Students have to perform any 10 of the following Experiments:

List of Experiments:

1. Verification of Law of Parallelogram of Forces.
2. Verification of Law of Triangle of Forces.
3. Verification of the Law of polygon for coplanar-concurrent forces acting on a particle in equilibrium and to find the value of unknown forces considering particle to be in equilibrium using universal force table.

4. Determination of coefficient of Static and Rolling Frictions
5. Determination of Centre of Gravity of different shaped Plane Lamina.
6. Verification of the conditions of equilibrium of a rigid body under the action of coplanar non-concurrent, parallel force system with the help of a simply supported beam.
7. Study of the systems of pulleys and draw the free body diagram of the system.
8. Determine the acceleration due to gravity using a compound pendulum.
9. Determine the Moment of Inertia of the compound pendulum about an axis perpendicular to the plane of oscillation and passing through its centre of mass.
10. Determine the Moment of Inertia of a Flywheel.
11. Verification of Law of Moment using Rotation Disc Apparatus and Bell Crank Lever.

References:

1.S. Timoshenko, D. H. Young, J.V. Rao, S. Pati., Engineering Mechanics, 5th Edition, McGraw Hill Education.

2. Hibbeler R.C., Engineering Mechanics: Statics and Dynamics, 14th Edition, Pearson Education, Inc., New Delhi, 2022

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 :	**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.

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 II SEMESTER	L	T	P	INTERNAL MARKS	EXTERNAL MARKS	TOTAL MARKS	CREDITS
	0	0	2	50	50	100	0
SUB CODE :	**NSS / NCC**						

Course Objectives:

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.

i Conducting awareness programs on Health-related issues such as General Health, Mental health, Spiritual Health, HIV/AIDS,

ii Conducting consumer Awareness. Explaining various legal provisions etc.

iii Women Empowerment Programmes- Sexual Abuse, Adolescent Health and Population Education.

iv 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.