JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY: KAKINADA

(Established by Andhra Pradesh Act No.30 of 2008)

Kakinada – 533 003, Andhra Pradesh (India)

Course Structure for B. Tech (Electronics and Communication Engineering)

B.Tech. – I Year I Semester (5 Theory 4 laboratory, 01 MNC)

S. No.	Course Category	Course Code	Title	L	T	P	Credits
1	HSM		English for Technical Communications	3	0	0	3
2	BSC		Linear Algebra and Calculus	3	0	0	3
3	BSC		Applied Physics	3	0	0	3
4	ESC		Computational Thinking and Problem Solving using 'C'	3	0	0	3
5	ESC		Principles of Electrical and Mechanical Engineering	3	0	0	3
6	HSM		English for Technical Communications and MOODLES laboratory	0	0	3	1.5
7	BSC		Applied Physics Laboratory	0	0	3	1.5
8	ESC		Computational Thinking and Problem Solving using 'C' Laboratory	0	0	3	1.5
9	ESC		Principles of Electrical and Mechanical Engineering Laboratory	0	0	3	1.5
10	MNC-1		Universal Human Values -2 (No credits)	2	0	0	0
		Total		17	0	12	21

B.Tech (I year - II Semester) – II semester (4 Theory & 5 Laboratories & 01 MNC)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	BSC		Differential Equations and Vector Calculus	3	0	0	3
2	BSC		Applied Chemistry	3	0	0	3
3	ESC		Data Structures and Algorithms using 'C' and 'Python'	0	1	3	2.5
4	PCC		Network Analysis	3	0	0	3
5	ESC		Foundations of Quantum Technologies	3	0	0	3
6	ESC		AI Tools and Applications	0	1	3	2.5
7	PCC		Network Analysis Laboratory	0	0	3	1.5
8	ESC		IT and Electronic Workshop Laboratory	0	0	2	1.0
9	BSC		Applied Chemistry Laboratory	0	0	3	1.5
10	MNC-2		NSS/NCC/Scouts & Guides/Community Service/Sports (No Credits)	0	0	2	0
		Total		12	2	16	21

B.Tech.– II Year I Semester (III Semester) (04 Theory, 04 Laboratories, 01 MNC)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	BSC		Complex Variables & Statistical Methods	3	0	0	3
2	BSC		Random Variables and Stochastic Processes	3	0	0	3
3	PCC		Electronic Devices and Circuits	3	0	0	3
4	ESC		Design Thinking and Innovation	0	1	3	2.5
5	PCC		Signals and Systems	3	0	0	3
6	PEC		Professional Elective Course-1 1. CAD lab for ECE Applications Laboratory 2. Quantum Computing Laboratory 3. Object Oriented Programming Laboratory 4. Any on-line laboratory course approved by University	0	1	3	2.5
7	PCC		Electronic Devices and Circuits Laboratory	0	0	3	1.5
8	PCC		Signals and Systems Laboratory	0	0	3	1.5
9	MNC-3		Indian Knowledge System (No credits)	2	0	0	0
Total				14	02	12	20

B.Tech. II Year II Semester (IV Semester) (05 Theory, 04 Laboratories, 01 MNC)

S.No	Course category	Course Code	Title	L	T	P	Credits
1	PCC		Electronic Circuit Analysis	3	0	0	3
2	PCC		Electro Magnetic Waves and Transmission Lines	3	0	0	3
3	PCC		Switching Theory and Logic Design	3	0	0	3
4	PCC		Linear and Digital Integrated Circuits	3	0	0	3
5	HSM		Engineering Economics and Financial Accountancy	3	0	0	3
6	PEC		Professional Elective Course-2 (through virtual lab / off-line) 1. PCB Design and Hardware Prototyping Laboratory 2. Digital Systems Design Through HDL Laboratory 3. Machine Learning Algorithms using Python Laboratory 4. Any on-line laboratory course approved by University	0	1	3	2.5
7	PCC		Electronic Circuit Analysis Laboratory	0	0	3	1.5
8	PCC		Switching Theory and Logic Design Laboratory	0	0	3	1.5
9	PCC		Linear and Digital Integrated Circuits Laboratory	0	0	3	1.5
10	MNC-4		Environmental Sciences (No Credits)	2	0	0	0
Total				17	01	12	22
	Mandatory Community Service Project /Industry Internship / Mini Project of 06 - 08 weeks duration during summer vacation						

III B.Tech I Semester (V Semester) (05 Theory, 01 Open Elective, 01 Internship /mini project, 02 Laboratories)

S. No.	Course Category	Course Code	Title	L	T	P	Credits
1	PCC		VLSI Design	3	0	0	3
2	PCC		Analog and Digital Communications	3	0	0	3
3	PCC		Control Systems	3	0	0	3
4	PEC		Professional Elective Course-3 1. Digital System Design 2. Electronic Measurements and Instrumentation 3. AI Algorithms for Communication Engineering. 4. Computer Networks and Protocols 5. Any on-line course approved by University	3	0	0	3
5	PEC		Professional Elective Course-4 1. Analog IC Design 2. Intelligent Instrumentation 3. Optical Communication & Networks 4. Data Analytics 5. Any on-line course approved by University	3	0	0	3
6	PCC		VLSI Design Laboratory	0	0	3	1.5
7	PCC		Analog and Digital Communication Laboratory	0	0	3	1.5
8	OEC-1		Open Elective-1	1	0	0	1
9	Internship / Project work		Evaluation of Community Service Project /industry Internship / Mini Project*	-	-	-	2*
10	MNC-5		Research Methodology (No Credits)	2	0	0	0
Total				18	0	6	21

- Internship / mini project should be performed in summer vacation, i.e., between II year and III year.
- Internship / mini project must be in the Industry / application of IT /AI in domain knowledge
- The period of internship / mini project should be between 6 – 8 weeks.

III B.Tech II Semester (VI Semester) (05 Theory, 03 Laboratories, 01 Open Elective)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	PCC		Microprocessors and Microcontrollers (with emphasis on ARM processor)	3	0	0	3
2	PCC		Digital Signal Processing	3	0	0	3
3	PCC		Antennas & Wave Propagation	3	0	0	3
4	PEC		Professional Elective-5 1. Digital IC Design 2. MEMS and Sensors 3. Information theory and Coding Techniques 4. Cyber Security 5. Any on-line course approved by University	3	0	0	3
5	PEC		Professional Elective-6 1. FPGA and ASIC Design 2. Embedded System Design 3. RADAR Engineering & Global Position Information System 4. Cloud Computing 5. Any on-line course approved by University	3	0	0	3
6	OEC-2		Open Elective-2 – (Preferably Soft skills laboratory)	0	1	2	2
7	PCC		Digital Signal Processing Laboratory	0	0	3	1.5
8	PCC		Microprocessors and Microcontrollers Laboratory (with emphasis on ARM processor)	0	0	3	1.5
9	OEC-3		Open Elective-3	1	0	0	1
10	MNC-6		Indian Constitution (No credits)	2	0	0	0
			Total	18	1	8	21

- Internship / mini project should be performed in summer vacation, i.e., between II year and III year.
- Internship / mini project must be in the Industry / application of IT /AI in domain knowledge
- The period of internship / mini project should be between 6 – 8 weeks

(Student may consider 3 credit Open Elective Course in place of OEC-2 & OEC-3)

B.Tech (IV year – I Semester) (VII Semester)

(05 Theory, 01 PEC laboratory, 01 Open Elective (Theory), 01 Open Elective (Lab), 01 Internship / mini Project)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	PCC		Cellular and Mobile Communications	3	0	0	3
2	PCC		Computer Organization and Architecture	3	0	0	3
3	PEC		Professional Elective-7 1. System on Chip 2. Intelligent Controllers 3. Detection and Estimation Theory 4. DSP Processors and Architecture 5. Any on-line course approved by University	3	0	0	3
4	PEC		Professional Elective-8 1. Low Power VLSI Design 2. Internet of Things 3. Artificial Intelligence 4. Digital Image Processing 5. Any on-line course approved by University	3	0	0	3
5	PEC		Professional Elective-9 1. VLSI Architectures 2. Microwave Engineering 3. Speech Processing 4. Satellite Communication and Navigational Aids 5. Any on-line course approved by University	3	0	0	3
6	PEC		Professional Elective-10 1. Soft Computing Laboratory 2. Antennas Simulations and Microwave Engineering Laboratory 3. Embedded Systems Design & IOT Laboratory 4. Virtual Instrumentation & Communication Engineering Laboratory 5. Any on-line course approved by University	0	1	3	2.5
7	OEC-4		Open Elective-4	0	0	3	1.5
8	Internship / Project work		Evaluation of Industry Internship / Mini Project	-	-	-	2*
			Total	15	1	6	21

- Internship / mini project should be performed summer vacation, i.e., between III year to IV year.
- Internship / mini project must be in the Industry / application of IT /AI in domain knowledge
- The period of internship / mini project should be between 6 – 8 weeks.

B.Tech (IV B.Tech. II Semester)

(02 Open Electives, 01 Project work / Industry Internship)

S.No.	Course Category	Course Code	Title	L	T	P	Credits
1	OEC		Open Elective 5	3	0	0	3
2	OEC		Open Elective 6	2	0	0	2
3	Project		Project work / Industry Internship			24	12
			Total	5	0	24	17

- Student shall have the option to choose open electives (as approved by the University),to consider Theory / Practical, but it should be total 05 credits
- Open Electives can be completed in advance, before one semester

Credits Distribution – Based on Category

	I year		II year		III year		IV year			
Category/ Semester	I	II	III	IV	V	VI	VII	VIII		
BSC	7.5	7.5	6	0	0	0	0	0	21	
HSM	4.5	0	0	3	0	0	0	0	7.5	
ESC	9	9	2.5	0	0	0	0	0	20.5	
PCC	0	4.5	9	16.5	12	12	6	0	60	
PEC	0	0	2.5	2.5	6	6	11.5	0	28.5	
OEC	0	0	0	0	1	3	1.5	5	10.5	
Internship & Project work	0	0	0	0	2	0	2	12	16	
MNC	*	*	*	*	*	*	0	0	0	
Total	21	21	20	22	21	21	21	17	164	

BSC : Basic Science Courses (21 credits)
HSM : Humanities, Social Sciences including Management (7.5)
ESC : Engineering Science Courses (20.5)
PCC : Professional Core Courses (60)
PEC : Professional Elective Courses (including Industry oriented course) (28.5)
OEC : Open Elective Courses (including 1 credit courses) (10.5)
MNC : Mandatory Non-Credit Courses
Project/ Internship: 16 credits

Number of Credits Semester wise

S.No	Year and Semester	Semester Number	Number of Credits
1	I Year (I Semester)	I	21
2	I Year (II Semester)	II	21
3	II Year (I Semester)	III	20
4	II Year (II Semester)	IV	22
5	III Year (I Semester)	V	21
6	III Year (II Semester)	VI	21
7	IV Year (I Semester)	VII	21
8	IV Year (II Semester)	VIII	17
Total			164

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	English for Technical Communications	CATEGORY HSM	L-T-P-C 3-0-0-3

Pre-requisite: NIL

Course Objectives:

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

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

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

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

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

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

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

COs / POs	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			

Unit I

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 II

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 III

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.

Non-Detailed Text

1. Coelho, P. (2020). The alchemist. HarperCollins.

Reference Books

1. Raman, M., & Sharma, S. (2012). Technical communication (2nd ed.). Oxford University Press.
2. Rizvi, M. A. (2005). Effective technical communication. Tata McGraw-Hill.
3. Orient Blackswan. (2010). English for engineers and technologists (Combined ed., Vols. 1–2).
4. Seely, J. (2004). The Oxford guide to writing and speaking. Oxford University Press.
5. Mahadevan, B., Bhat, V. R., & Bhat, N. P. R. N. (2022). Introduction to Indian knowledge system: Concepts and applications. PHI Learning.

Web Resources

- eGyanKosh. (n.d.). National digital repository. https://egyankosh.ac.in/
- ReadTheory. (n.d.). Adaptive reading comprehension practice. https://readtheory.org/

Assessment Criteria:

Internal: 40%,Unit-wise assessment: 5 x10=50 marks,Mid-term assessments: 2 x 25=50 marks
External assessment: 60% 5 units x 12 marks=60

1. Reading comprehension- unseen passages 2 x5=10 marks (tests vocabulary and reading sub skills)
2. Writing- 2 tasks 2x5=10 marks
3. Listening 2 texts =10 marks
4. Speaking- completing conversations and matching expressions as per context 10 marks
5. Grammar- editing passages with errors – 10 marks
6. Information transfer 10 marks

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Linear Algebra and Calculus	CATEGORY BSC	L-T-P-C 3-0-0-3

Pre-requisite: NIL

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**:** Compute the rank and inverse of a matrix and hence solve linear systems of equations, both homogeneous and non-homogeneous (K2, K3, K5).
CO2: Calculate eigenvalues and eigenvectors, orthogonalize the given matrix, and represent a given quadratic form in canonical form (K2, K3, K5).
CO3: Find the mean value of a given function and use it to estimate the bounds of a given function (K2, K3, K5).
CO4: Compute the change in the dependent variable with respect to multiple independent variables and Jacobians, and apply the knowledge in optimizing functions of several variables (K2, K3, K5).
CO5: Compute double and triple integrals of functions of several variables and change 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, Eigen values, Eigen vectors:

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

Textbooks

1. Grewal, B. S. (2017). Higher engineering mathematics (44th ed.). Khanna Publishers.
2. Kreyszig, E. (2018). Advanced engineering mathematics (10th ed.). 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

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

Course Code	Applied Physics	CATEGORY BSC	L-T-P-C 3-0-0-3

Pre-requisite: NIL

Course Objectives

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

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

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

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

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

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

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

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
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			
CO5	H	M	–	–	M	–	–	–	–	L	M			

UNIT – I

Applied Wave Optics

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

UNIT – II

Quantum Photonics & Advanced Sensing

Lasers: Principles of Absorption – Spontaneous and Stimulated Emission – Population Inversion – Three level and Four level laser systems – Construction and working of Ruby and He-Ne Laser – Applications (qualitative).

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

UNIT – III

Electrical Properties Of Metals & Semiconductors

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

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

UNIT - IV

Introduction to Quantum Mechanics & Quantum Computing

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 - V

Introduction To EM Theory

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

Textbooks

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

Reference Books

1. Nielsen & Chuang, Quantum Computation & Quantum Information, Cambridge (2010)
2. D. J. Griffiths, Introduction to Electrodynamics, Cambridge (2023)

Web Resources & NPTEL Links

- NPTEL – nptel.ac.in
- MIT OpenCourseWare – ocw.mit.edu
- HyperPhysics – hyperphysics.phy-astr.gsu.edu
- Feynman Lectures – feynmanlectures.caltech.edu
- PhET Simulations – phet.colorado.edu

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Computational Thinking and Problem Solving using 'C'	CATEGORY ESC	L-T-P-C 3-0-0-3

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

Course Objectives

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

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

CO1: Apply computational thinking techniques (decomposition, abstraction, pattern recognition) to design algorithms and flowcharts for a given problem (K3).

CO2: Develop C programs using appropriate operators, expressions, selection statements, and loops to implement a given logic (K3).

CO3: Analyze problems involving arrays, strings, structures, and unions and construct suitable C solutions (K4).

CO4: Apply pointers, recursion, and dynamic memory allocation to solve computational problems efficiently (K3).

CO5: Construct modular C programs using user-defined functions and perform text/binary file input-output operations (K3).

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

UNIT – 1

Computational Thinking and Introduction to C

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

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

Bitwise Operators: Logical Bitwise Operators, Shift Operators.

UNIT – 2

Selection and Decision-Making: Relational and Logical Operators, Two-Way and Multi-Way Selection (if-else, switch), Nested Conditionals.

Repetition: Pre-test and Post-test Loops, Counter- and Event-Controlled Loops, for/while/do-while, break and continue, Nested Loops; Programming Applications combining Selection and Repetition.
Arrays: One-Dimensional and Two-Dimensional Arrays, Multidimensional Arrays, Array-based Problem Solving (searching, sorting, averaging).

UNIT – 3
Strings: String Representation, Standard String-Handling Functions, Arrays of Strings, String-to-Data Conversion.
User-Defined Types: typedef, Enumerated Types, Structures, Unions, and Nested Structures; Programming Applications using Structures and Arrays of Structures.
Programming Applications: Applications combining sections and repetitions

UNIT – 4
Pointers: Pointer Fundamentals, Pointer-to-Pointer, Pointer Arithmetic, Pointers and Arrays, Array of Pointers, Compatibility and l-value/r-value concepts. Dynamic Memory Allocation: malloc, calloc, realloc, free.
Functions: Designing Structured/Modular Programs, Function Declaration and Definition, Parameter Passing (by value, by reference using pointers), Passing Arrays and Pointers to Functions, Standard Library Functions, Inter-Function Communication.
Recursion: Recursive vs. Iterative Solutions, Designing Recursive Algorithms, Recursion with Arrays and Pointers, Efficiency Considerations.

UNIT – 5
Preprocessor: Directives and Macros.
File I/O: Streams, Text vs. Binary Files, Standard Library File Functions, formatted and Character I/O, Sequential File Processing.

Textbooks

1. Forouzan, B. A., & Gilberg, R. F. (2007). Computer science: A structured programming approach using C (3rd ed.). Cengage Learning.
2. Kernighan, B. W., & Ritchie, D. M. (1988). The C programming language (2nd ed.). Prentice Hall.

Reference Books

1. Das, S. (2018). Computer fundamentals and programming (18th ed.). McGraw Hill Education.
2. Kamthane, A. N., & Kamthane, A. A. (2025). Programming in C (4th ed.). Pearson Education.
3. Dey, P., & Ghosh, M. (2013). Computer fundamentals and programming in C (2nd ed.). Oxford University Press.

Web References

- NPTEL. (n.d.). Programming in C. https://onlinecourses.nptel.ac.in/noc21_cs81/preview
- GeeksforGeeks. (n.d.). C programming language. https://www.geeksforgeeks.org/c-programming-language/
- Programiz. (n.d.). Learn C programming. https://www.programiz.com/c-programming
- Cplusplus.com. (n.d.). C standard library reference. https://cplusplus.com/reference/clibrary/
- TutorialsPoint. (n.d.). C programming. https://www.tutorialspoint.com/cprogramming/index.html
- W3Schools. (n.d.). C tutorial. https://www.w3schools.com/c/

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Principles of Electrical and Mechanical Engineering	CATEGORY ESC	L-T-P-C 3-0-0-3

PART-A
Principles of Electrical Engineering

Pre-requisite: NIL

Course Objectives:

- To introduce the fundamentals of electricity billing, electrical safety, shock protection, fuse and MCB operation, and the construction and operating principles and performance of DC machines.
- To provide knowledge of the construction, operation, losses, efficiency, and testing of single-phase transformers.
- To develop an understanding of the operating principles, types of three-phase induction motors, BLDC motors, stepper motors, and DC servo motors.

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

CO1: Explain the fundamentals of electricity billing, electrical safety, shock protection, fuse and MCB operation, and the construction, operating principles, and performance of DC machines (K2).
CO2: Analyze the construction, operation, losses, efficiency, and performance of single-phase transformers using OC and SC tests and determine their efficiency and voltage regulation (K4).
CO3: Analyze the operating principles and types of three-phase induction motors, BLDC motors, stepper motors, and DC servo motors (K4)

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

UNIT - I

Electricity Billing, Safety and DC Machines

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;DC Machines:Principle of operation of DC generator; Principle of operation of DC motor, types, torque equation, applications ofDC Motors, losses and efficiency, Swinburne's test, speed control methods – simple numerical problems.

UNIT - II

Transformers

Construction and Principle of operation of single phase transformer, EMF equation, Losses, OC & SC tests – predetermination of efficiency and regulations- simple numerical problems.

UNIT – III

Motors

Three Phase Induction Motor: Production of Rotating Magnetic field, Principle of operation of three phase induction motor, Types: slip ring and squirrel cage motors;

BLDC Motor:Principle of operation of BLDC motor, Types of constructions, Surface mounted and interior type permanent magnet DC Motors, Electronic Commutation-Principle of operation of Stepper Motor and DC Servo motor.

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. K.Venkataraman, (2008), Special Electrical Machines, Universities Press (India) Private Limited.
3. V. K. Mehta, Rohit Mehta, (2022), Principles of Power Systems, S. Chand Publishing.

Web Resources:

1. https://nptel.ac.in/courses/108105155
2. https://nptel.ac.in/courses/108105131

PART B

Basic Mechanical Engineering For Electronics Engineers

Pre-requisite: NIL

Course Objectives

The students after completing the course are expected to:

- Understand the basic principles of mechanical motion, sensors, actuators, robotics and industrial automation relevant to Electronics and allied engineering applications.
- Understand the fundamentals of thermodynamics, thermal management, 3D printing and additive manufacturing and their engineering applications.
- Familiarize themselves with automotive electronics, electric and hybrid vehicles, energy sources and energy management in modern engineering systems

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

CO1: Explain the basic principles of kinematics, sensors, actuators, robotics, and PLC-based automation and their applications in electronic and automated systems.

CO2: Explain the basic principles of thermodynamics, heat transfer, thermal management, heat sinks, 3D printing, and additive manufacturing and their applications.

CO3: Describe the role of electronics in automobiles, electric and hybrid vehicles, and explain the basic concepts of energy sources, energy conservation, and energy management.

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														
CO5														

UNIT I

Mechanical Systems, Sensors, Actuators and Robotics

Kinematics of Machinery :Basic concepts of links, joints and mechanisms; types of motion; degrees of freedom; basic applications in machines and robotics.

Sensors and Transducers: Basic principles and applications of temperature, pressure, force, displacement, proximity, speed and vibration sensors; basic sensor characteristics.

Actuators: Basic principles and applications of DC motors, stepper motors and servo motors; introduction to pneumatic and hydraulic actuators.

Basic Principles of Robotics: Introduction to robotics; basic components of a robot; links, joints, degrees of freedom and robot configurations; end-effectors; applications in electronics and automation.

PLC and Ladder Logic: Introduction to PLC; basic architecture and working; input/output devices; sensors and actuators; basic ladder logic, timers and counters; simple industrial applications.

UNIT II

Thermal Management And Additive Manufacturing

Basic Thermodynamics: Basic concepts of temperature, heat, work and thermodynamic systems; Zeroth, First and Second Laws of Thermodynamics; simple engineering applications.

Heat Transfer and Thermal Management: Basic concepts of conduction, convection and radiation; heat generation and cooling of electronic components.

Heat Sinks: Principle and types of heat sinks; thermal interface materials; natural and forced cooling; applications in processors, LEDs, power electronics and batteries.

3D Printing and Additive Manufacturing : Basic principles and working of 3D printing; basic additive manufacturing processes, advantages, limitations and applications.

UNIT III

Automotive Electronics And Energy

Automotive Electronics: Basic principles of electric and hybrid vehicles ,Role of electronics in automobiles; Electronic Control Unit (ECU), automotive sensors and actuators; ABS, airbags and basic vehicle monitoring systems.

Energy Sources: Conventional and renewable energy sources; solar, wind, hydro, biomass, nuclear and fossil fuels; basic energy conversion concepts, Energy Management: Energy conservation and efficiency.

Note : The subject is intended to provide only basic knowledge of Mechanical Engineering and its applications relevant to Electronics engineering discipline. The evaluation shall be intended to test only the basic knowledge and fundamental understanding of engineering concepts.

Textbooks

1. Wicker, J., & Lewis, K. (n.d.). An introduction to mechanical engineering. Cengage Learning India Pvt. Ltd.
2. Kuttan, A. K. K. (n.d.). Robotics. I.K. International Publishing House Pvt. Ltd.
3. Gibson, I., Rosen, D., & Stucker, B. (n.d.). Additive manufacturing technologies. Springer.

Reference Books

1. Rattan, S. S. (n.d.). Theory of machines. McGraw Hill Education.
2. Groover, M. P. (n.d.). Automation, production systems, and computer-integrated manufacturing. Pearson.
3. Rajput, R. K. (n.d.). Engineering thermodynamics. Laxmi Publications.
4. Holman, J. P. (n.d.). Heat transfer. McGraw Hill.
5. Denton, T. (n.d.). Automobile electrical and electronic systems. Routledge.
6. Twidell, J., & Weir, T. (n.d.). Renewable energy resources. Routledge.

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	English for Technical Communications and MOODLES laboratory	CATEGORY HSM	L-T-P-C 0-0-3-1.5

Pre-requisite: NIL

Part – A
English for Technical Communication and MOODLES - Lab
B.Tech I.II, All Branches

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: *After successful completion of this course, the student 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.

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

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.

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Applied Physics Laboratory	CATEGORY BSC	L-T-P-C 0-0-3-1.5

Pre-requisite: NIL

Course Objectives:

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

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														
CO5														

List of Experiments

(Any 10 of the following listed experiments)
(Out of which any **TWO** experiments may be conducted in virtual mode)

1. Determination of thickness of thin object by wedge method.
2. Determination of radius of curvature of a given plano convex lens by forming Newton's rings.
3. Determination of wavelengths of different spectral lines in mercury spectrum using diffraction grating in normal incidence configuration.
4. Determination of resolving power of telescope.
5. Determination of dielectric constant of given capacitor by 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 wavelength of Laser and grating element.
9. Estimation of Planck's constant using photoelectric effect.
10. Determination of the Resistivity of semiconductor by four probe method.
11. Determination of the energy gap of a semiconductor using p-n junction diode.
12. Study the variation of magnetic field along the axis of a current carrying circular coil by Stewart & Gee's Method
13. Determination of Hall voltage and Hall coefficient of a given semiconductor using Hall Effect.
14. Determination of Acceleration due to gravity and Radius of gyration using Compound pendulum.
15. Determination of magnetic susceptibility by Kundt's 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

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Computational Thinking and Problem Solving using 'C' Laboratory	CATEGORY ESC	L-T-P-C 0-0-3-1.5

Course Objectives

- 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: *After successful completion of this course, the 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

Experiment 1

(1) Find the largest of three numbers.

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

Experiment 2

(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.

Experiment 3

(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.

Experiment 4

(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.

Experiment 5

(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

Experiment 6

(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)

Experiment 7

(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.

Experiment 8

(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

Experiment 9

(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.

Experiment 10

(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

Experiment 11

(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.

Experiment 12

(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.

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:

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

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE I Semester	Principles of Electrical and Mechanical Engineering Laboratory	CATEGORY ESC	L-T-P-C 0-0-3-1.5

PART – A
Principles of Electrical Engineering Lab

Pre-requisite: NIL

Course Objectives:

- To develop practical skills in obtaining the magnetization characteristics of a DC shunt generator and implementing armature-voltage and flux-control methods for DC-shunt-motor speed regulation.
- To develop the ability to determine DC-machine efficiency using Swinburne's test and evaluate the efficiency and voltage regulation of a single-phase transformer using OC and SC test results.
- To develop practical competence in analyzing the performance characteristics of three-phase induction motors and determining the voltage regulation of three-phase alternators using the synchronous-impedance method

Course Outcomes: *After successful completion of this course, the student will be able to:*
CO1: Identify electrical wiring components and determine domestic electrical energy consumption (K3).
CO2: Determine the efficiency of a DC machine using Swinburne's test and implement armature-voltage and flux-control methods for speed control of a DC shunt motor (K3).
CO3: Evaluate the efficiency and voltage regulation of a single-phase transformer using OC and SC test results and simulate BLDC motor speed control using Hall-effect sensors and analyze the motor response under different operating conditions (K4).

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

List of Experiments
(Any 5 of the following experiments are to be conducted)

1. Study various types of electrical cables/conductors, switches, sockets, fuses,MCBsand Energy meter with their specifications and applications.
2. Determination of Electrical Energy Consumption in Domestic Premises.
3. Speed control of DC shunt motor by armature voltage method.
4. Speed control of DC shunt motor by flux control method.
5. Predetermination of efficiency of a DC Machine by conducting Swinburne's test
6. Predetermination of efficiency, regulation of a single-phase transformer by conducting OC & SC tests.

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. K.Venkataraman, (2008), Special Electrical Machines, Universities Press (India) Private Limited.
3. V. K. Mehta, Rohit Mehta, (2022), Principles of Power Systems, S. Chand Publishing.

Web Resources

- https://em-coep.vlabs.ac.in/List%20of%20experiments.html
- https://nptel.ac.in/courses/108105155
- https://nptel.ac.in/courses/108105131

PART – B
Principles of Mechanical Engineering Laboratory

Pre-requisite: NIL

Course Objectives:

- Develop basic hands-on skills in mechanical systems, sensors, actuators, robotics and PLC-based automation relevant to Electronics and allied engineering applications.
- Gain practical knowledge of thermal management, heat sinks, 3D printing and additive manufacturing through laboratory experiments.
- Develop basic practical skills in automotive electronics and energy monitoring/management through hands-on experiments.

Course Outcomes: *After successful completion of this course, the student will be able to:*
CO1: Demonstrate and apply basic mechanical, sensor, actuator, robotics, and PLC concepts through practical experiments (K3).
CO2: Perform basic experiments related to thermal management, heat sinks, 3D modelling, and 3D printing (K3).
CO3: Identify and demonstrate basic automotive sensors and actuators and perform simple energy monitoring and management experiments (K4).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1														
CO2														
CO3														
CO4														

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

1. **Study of Basic Mechanical Components and Mechanisms**
   Identification and demonstration of links, joints, gears, bearings, shafts and simple mechanisms.
2. **Study of Kinematics of a Simple Mechanism**
   Demonstration of different types of motion, degrees of freedom and measurement of displacement/velocity of a simple mechanism.
3. **Temperature Measurement Using Sensors**
   Measurement of temperature using a thermocouple, RTD and thermistor and comparison of their responses.
4. **Temperature Sensor Response at Different Temperatures**
   Study the response of a temperature sensor at low, room and elevated temperatures.
5. **Measurement of Distance/Displacement Using a Sensor**
   Interface and test a proximity/displacement sensor and study its response with distance.
6. **Measurement of Force Using a Sensor**
   Demonstration and measurement of force using a load cell or force sensor.
7. **Measurement of Speed Using a Sensor**
   Measurement of rotational speed using an IR, Hall-effect or optical sensor.
8. **DC Motor as an Actuator**
   Control of speed and direction of a DC motor and study its application as an actuator.

9. **Stepper Motor and Servo Motor as Actuators**
   Demonstration and control of stepper and servo motors for precise position control.
10. **Basic Robot Operation**
    Study the components of a robotic system and demonstrate basic movements of a robot or robotic arm.
11. **Basic Robot Kinematics**
    Demonstration of robot joint movement, degrees of freedom and basic forward kinematics using a simple robotic arm or simulation.
12. **PLC Input–Output Interfacing**
    Interface basic sensors and actuators with a PLC and study digital input and output operation.
13. **PLC Ladder Logic – Basic Control**
    Develop and test simple ladder programs using switches, sensors, timers and counters.
14. **PLC-Based Motor Control**
    Develop a basic ladder program for ON/OFF, direction or sequential control of a motor.
15. **Study of Heat Transfer and Thermal Management**
    Demonstrate conduction, convection and radiation and observe temperature variation using suitable sensors.
16. **Performance of a Heat Sink**
    Study the temperature of an electronic component with and without a heat sink and compare the cooling performance.
17. **3D Modelling for 3D Printing**
    Create a simple component such as an electronic enclosure, sensor holder or robotic component using CAD software.
18. **3D Printing of an Engineering Component**
    Generate a 3D-printed component from a digital model and study basic printing parameters and print quality.
19. **Study of Automotive Sensors and Actuators**
    Demonstration and identification of sensors and actuators used in automobiles, such as temperature, speed, position and proximity sensors.
20. **Energy Monitoring and Management**
    Measure electrical energy consumption of selected loads using an energy meter/smart energy meter and study energy efficiency and conservation.

R-26 B.Tech -I YEAR -I SEMESTER SYLLABUS

COURSE CODE	Universal Human Values -2	CATEGORY MNC-1	L-T-P-C 2-0-0-0

Pre-requisite: NIL

Course Objectives:

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

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

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

UNIT I:

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

UNIT II:

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

the body; Programme to ensure self-regulation and Health; Practice Session PS6 Exploring Harmony of self with the body

UNIT III

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

UNIT IV

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

UNIT V

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

Practice Sessions for UNIT I – Introduction to Value Education; PS1 Sharing about Oneself; PS2 Exploring Human Consciousness; PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being; PS4 Exploring the difference of Needs of self and body; PS5 Exploring Sources of Imagination in the self; PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society; PS7 Exploring the Feeling of Trust; PS8 Exploring the Feeling of Respect; PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence); PS10 Exploring the Four Orders of Nature; PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics; PS12 Exploring Ethical Human Conduct; PS13 Exploring Humanistic Models in Education; PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

Reference Books

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

Mode of Conduct:

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

Tutorial hours are to be used for practice sessions.

While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.

In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

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

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

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf
4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
9. https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Differential Equations and Vector Calculus	CATEGORY BSC	L-T-P-C 3-0-0-3

Pre-requisite: NIL

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: Model electrical circuit problems or vibrating system problems as linear higher-order ordinary differential equations and solve them (K2, K3, K5).
CO3: Solve partial differential equations that model physical processes (K2, K3, K5).
CO4: Apply the knowledge of gradient, divergence, and curl and interpret the physical meaning of different operators (K2, K3, K5).
CO5: Compute the work done against a field, circulation, and flux using vector calculus methods (K2, K3, K5).

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	H	H	M										
CO2	H	H	M										
CO3	H	H	M										
CO4	H	H	M										
CO5	H	H	M										

UNIT I

Differential equations of first order and first degree

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

UNIT II

Linear differential equations of higher order (Constant Coefficients)

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

UNIT III

Partial Differential Equations

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order linear equations using Lagrange's method, non-linear partial differential equations using Charpit's Method. Homogeneous Linear Partial differential equations with constant coefficients.

UNIT IV

Vector differentiation

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

UNIT V

Vector integration

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

Textbooks

1. Grewal, B. S. (2017). Higher engineering mathematics (44th ed.). Khanna Publishers.
2. Kreyszig, E. (2018). Advanced engineering mathematics (10th ed.). John Wiley & Sons.

Reference Books

1.
2. Ramana, B.V. (2017). Higher Engineering Mathematics. McGraw Hill Education.
3. James, G. (2018). Advanced Modern Engineering Mathematics. 5th Edition Pearson publishers.
4. 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

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Applied Chemistry For ECE and Allied Branches of Engineering	CATEGORY BSC	L-T-P-C 3-0-0-3

Pre-requisite: NIL

Course Objectives

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

Course Outcomes: *After successful completion of this course, the student will be able to:*
CO1: Apply quantum chemistry principles to analyze electronic systems and predict molecular-orbital properties (K3, K4).
CO2: Analyze spectroscopic techniques for material characterization and interpret spectral data for molecular identification (K3, K4).
CO3: Evaluate semiconductor materials and chemical fabrication processes relevant to electronic-device manufacturing.
CO4: Analyze energy-storage systems and electrochemical principles for communication-device power management (K3, K4).
CO5: Design advanced materials solutions using nanotechnology principles and AI-assisted tools for nanoelectronics (K4, K4).

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

UNIT I Quantum Chemistry

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

Molecular orbital theory: Bonding in homo- and hetero-nuclear diatomic molecules; energy-level diagrams of O2, N2, HF and CO.

π-molecular orbitals of butadiene and benzene; calculation of bond order.

UNIT II Spectroscopy-Instrumental methods and applications

Electromagnetic spectrum,
UV-Visible spectroscopy: Beer-Lambert law, principle, instrumentation, chromophore, auxochrome, bathochromic shift, hypsochromic shift, applications.

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

Microwave spectroscopy: Introduction, principle, instrumentation and applications.

MRI: Working principle, applications.

UNIT III Chemistry of Electronic materials (metals and polymers)

Band theory of semiconductors, Intrinsic and extrinsic semiconductors, Preparation of pure and doped semiconductors, photoconductors (Se)-working principle of Xerox machine, silicon dioxide (SiO_2) formation and properties.Chemistry of compound semiconductors: GaAs, InP, SiC. Photolithography: Basic principle, applications

Superconductors: Characteristics, types, applications.

Polymers: Thermoplastics and Thermosetting Plastics, PTFE, Bakelite, Compounding of plastics, Conducting polymers: p and n type conducting polymers, photoresist polymers (definition, applications), structure and applications of PMMA (Poly methyl methacrylate), Polyimide, BCB (Benzocyclobutene), PBO (Polybenzoxazole)

UNIT IV Electrochemistry and Energy storage devices

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

Primary batteries: Dry cell, Lithium battery, sodium-air batteries (construction, working and applications), zinc-air battery, secondary batteries: lead-acid, Ni-Cd, Ni-hydride, lithium-ion, sodium-ion batteries (construction, charging-discharging reactions and applications). Battery management systems (main functions, basic working, Battery protection).

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

Supercapacitors: EDLC, pseudo-capacitors, hybrid supercapacitors.

UNIT V Chemistry of nanomaterials

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

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

Metallic nanoparticles: Preparation (sol-gel process) and applications of gold, silver, and copper nanoparticles. Applications in nanoelectronics, interconnects, sensors (optical and biosensors), memory devices.Materials of Spintronics: Magnetic nanoparticles, ferromagnetic materials, topological insulators.

Textbooks

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

Reference Books

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

Web Resources

- IEEE Electron Devices Society. (n.d.). IEEE EDS resources. https://eds.ieee.org
- SEMI. (n.d.). Semiconductor manufacturing standards. https://www.semi.org
- NPTEL. (n.d.). Engineering chemistry courses. https://nptel.ac.in
- IEEE Photonics Society. (n.d.). IEEE Photonics Society resources. https://www.photonicssociety.org

• U.S. Department of Energy. (n.d.). Energy storage database. https://www.energy.gov

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Data Structures and Algorithms using 'C' and 'Python'	CATEGORY ESC	L-T-P-C 0-1-3-2.5

Pre-requisite: Basic knowledge of Problem Solving and Programming in C

Course Objectives

The main objectives of the course are to

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

Develop the ability to analyze algorithms using time and space complexity and compare alternative solutions

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

CO1: Explain and implement fundamental programming constructs, functions, recursion, and basic data structures using Python (K2).

CO2: Explain and apply arrays, linked lists, stacks, and queues to solve computational problems (K3).

CO3: Implement and analyze trees, heaps, graphs, and hashing techniques using C and Python (K3).

CO4: Implement searching and sorting algorithms and analyze their time and space complexity (K3).

CO5: Select and apply suitable data structures and algorithms to solve practical engineering problems (K5).

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

Unit -1

Introduction to Python Programming:

Features and applications of Python, Python interpreter and execution environment, Variables, constants and data types, Operators and expressions, Input and output statements, Conditional statements, for and while loops, Nested loops, Strings and string operations, Lists, tuples, sets and dictionaries, Functions and parameter passing, Recursion, Modules and packages, Basic exception handling, Introduction to classes and objects, Introduction to built-in data structures.

Lab Experiments

1. Write a Python program to demonstrate variables, data types and operators.
2. Write a Python program to find the largest and smallest among given numbers.
3. Write a Python program to check prime numbers and generate Fibonacci series.
4. Write a Python program to find factorial using iteration and recursion.
5. Write a Python program to reverse a number and check whether it is a palindrome.
6. Write a Python program to perform list operations.
7. Write a Python program to perform matrix addition and multiplication.
8. Write a Python program demonstrating strings, tuples, sets and dictionaries.

9. Write a Python program using user-defined functions.
10. Write a Python program demonstrating recursion

UNIT – 2

ARRAYS, ALGORITHM ANALYSIS AND LINKED LISTS

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

Introduction to algorithms, Time and space complexity, Big-O, Omega and Theta notations, Arrays and their representation, Array traversal, Insertion and deletion, Searching and updating, Two-dimensional arrays, Sparse matrices

Introduction to linked lists, Singly linked lists, Linked-list operations, Applications of linked lists

Experiments using C

1. Implement array traversal, insertion, deletion and updating.
2. Implement sparse matrix representation.
3. Implement a singly linked list.
4. Perform insertion and deletion in a singly linked list.
5. Search for an element in a singly linked list.
6. Reverse a singly linked list.

Experiments using Python

1. Implement array/list traversal, insertion, deletion and updating
2. Implement sparse matrix representation using lists.
3. Implement a singly linked list using a class.
4. Perform insertion and deletion in a singly linked list.
5. Search for an element in a linked list
6. Reverse a singly linked list.

UNIT – 3

Linked Lists, Stacks And Queues

Linked Lists: Doubly linked lists, Circular linked lists, Insertion and deletion operations, Applications of linked lists

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

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

Experiments using C

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

Experiments using Python

1. Implement a doubly linked list using classes.
2. Implement a circular linked list.
3. Implement a stack using a list.
4. Implement a stack using a user-defined class.
5. Implement a queue using a list/class.
6. Implement a circular queue.
7. Check balanced parentheses using a stack.
8. Convert an infix expression to postfix.
9. Evaluate a postfix expression

UNIT – 4

Trees and Heaps

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

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

Applications of trees and heaps

Experiments using C

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

Experiments using Python

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

UNIT – 5

Graphs, Hashing, Searching And Sorting

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

Hashing: Introduction to hashing, Hash functions, Hash tables, Collision handling, Linear probing, Quadratic probing, Separate chaining
Searching: Linear search, Binary search, Comparison of searching algorithms
Sorting: Bubble sort, Selection sort, Insertion sort, Merge sort, Quick sort, Comparison of sorting algorithms

Experiments using C

1. Represent a graph using an adjacency matrix.
2. Represent a graph using an adjacency list.
3. Implement Breadth First Search.
4. Implement Depth First Search.
5. Implement hashing using linear probing.
6. Implement linear search
7. Implement binary search.
8. Implement bubble sort.
9. Implement selection sort.
10. Implement insertion sort.
11. Implement merge sort.
12. Implement quick sort.

Experiments using Python

1. Represent a graph using an adjacency matrix.
2. Represent a graph using an adjacency list.
3. Implement Breadth First Search.
4. Implement Depth First Search.
5. Implement hashing using linear probing.
6. Implement hashing using separate chaining.
7. Implement linear search.
8. Implement binary search.
9. Implement bubble sort.
10. Implement selection sort.
11. Implement insertion sort.
12. Implement merge sort.
13. Implement quick sort

Text Books:

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

Reference Books:

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

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

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Network Analysis	CATEGORY PCC	L-T-P-C 3-0-0-3

Prerequisites: Basic Electrical Engineering, Engineering Mathematics

Course Objectives

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

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

CO1: Understand basic electrical circuits with nodal and mesh analysis (K2).

CO2: Analyse the circuit using network simplification theorems (K5).

CO3: Find transient response and steady-state response of a network (K3).

CO4: Analyse electrical networks in the Laplace domain (K4).

CO5: Compute the parameters of a two-port network (K3).

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

UNIT I

Introduction

Types of circuit components, Types of Sources and Source Transformations, Mesh analysis and Nodal analysis, problem solving with resistances only including dependent sources also. Principal of Duality with examples. Network Theorems: Thevenin's, Norton's, Milliman's, Reciprocity, Compensation, Subsitution, Superposition, Max Power Transfer, Tellegens - problem solving using dependent sources also.

UNIT II

Transients & Laplace Transform

Transients: First order differential equations, Definition of time constants, R-L circuit, R-C circuit with DC excitation, evaluating initial conditions procedure, second order differential equations, homogeneous, non-homogenous, problem-solving using R-L-C elements with DC excitation and AC excitation, Response as related to s-plane rotation of roots. Laplace transform: introduction, Laplace transformation, basic theorems, problem solving using Laplace transform, partial fraction expansion, Heaviside's expansions, problem solving using Laplace transform

UNIT III

Steady State Analysis of A.C Circuits

Impedance concept, phase angle, series R-L, R-C, R-L C circuits problem solving. Complex impedance and phasor notation for R-L, R-C, R-L-C problem solving using mesh and nodal analysis, Star-Delta conversion, problem solving using Laplace transforms also.

UNIT IV

Resonance

Introduction, Definition of Q, Series resonance, Bandwidth of series resonance, Parallel resonance, general case-resistance present in both branches, anti-resonance at all frequencies. Coupled Circuits: Coupled Circuits: Self-inductance, Mutual inductance, Coefficient of coupling, analysis of coupled circuits, Natural current, Dot rule of coupled circuits, conductively coupled equivalent circuits- problem solving.

UNIT V

Two-Port Networks

Two-port Networks: Relationship of two port networks, Z-parameters, Y-parameters, Transmission line parameters, h- parameters, Relationships Between parameter Sets, Parallel & series connection of two port networks, cascading of two port networks, problem solving using dependent sources also. Textbooks: Reference Books: Image and iterative impedances. Image and iterative transfer constants. Insertion loss. Attenuators and pads. Lattice network and its parameters. Impedance matching networks.

Text book

1. Van Valkenburg M.E., Network Analysis, Revised 3rd Edition, Prentice Hall of India, 2019.
2. Hayt W.H., Kemmerly J., and Durbin S.M., Engineering Circuit Analysis, 9th Edition, McGraw-Hill, 2020

Reference Books

1. Roy Choudhury D., Networks and Systems, New Age International Publications, 2013.
2. Edminister J. and Nahvi M., Electric Circuits, Schaum's Outline Series, 7th Edition, Tata McGraw Hill, 2017.
3. Ryder J.D., Network Lines and Fields, 2nd Edition, PHI.
4. Alexander C.K. and Sadiku M.N.O., Fundamentals of Electric Circuits, McGraw-Hill Education.

Web Resources & NPTEL Links

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

Recommended Free & Open-Source AI/Computational Tools

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

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Foundations of Quantum Technologies	CATEGORY ESC	L-T-P-C 3-0-0-3

Pre-requisite: NIL

Course Objectives

- Introduce the fundamental concepts of classical and quantum mechanics, including Hamiltonian mechanics, phase space, quantum postulates, operators, state vectors, and time evolution.
- Develop an understanding of quantum phenomena such as superposition, entanglement, spin, angular momentum, quantum statistics, and their applications to fundamental physical systems.
- Familiarize students with statistical physics, quantum information concepts, entropy, decoherence, noise, and basic quantum information formalisms.
- Introduce the principles of computational complexity and quantum computing complexity classes, with an overview of their relevance to quantum information and post-quantum cryptography.

Course Outcomes: *After successful completion of this course, the student will be able to:*
CO1: Explain the principles of Hamiltonian mechanics and the historical development, postulates, and mathematical foundations of quantum mechanics (K2).
CO2: Apply quantum mechanical operators, state-vector formalism, and time-evolution principles to analyze fundamental systems such as the particle in a box, harmonic oscillator, and hydrogen atom (K3).
CO3: Analyze quantum phenomena including superposition, entanglement, spin, angular momentum, coherent states, and quantum statistics of bosons and fermions (K4).
CO4: Evaluate basic computational complexity concepts and quantum complexity classes, and relate them to quantum information processing and post-quantum cryptography (K4).
CO5: Evaluate basic computational complexity concepts and quantum complexity classes, and relate them to quantum information processing and post-quantum cryptography (K5).

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

UNIT – I

Brief overview of classical physics (This segment is meant for the student to understand what a Hamiltonian is, which will feature later in quantum mechanics) : Hamiltonian function and Hamilton's equations, Phase-space description of a system, Connection and Equivalence with Newton's laws for simple systems – free particle, particle moving in a conservative potential, examples of Harmonic oscillator, hydrogen atom

Historical evolution of quantum mechanics: Planck's quantum hypothesis, Photo electric effect, Atomic spectra, Bohr's quantisation principle, De Broglie's Wave particle duality

UNIT – II

Postulates of Quantum Mechanics: State vectors and Hilbert Space, Dirac Bra-Ket notation, Measurables and Hermitian Operators, Unitary Transformations, Schrodinger Equation and Time evolution of quantum states, Measurement Postulate, Schrodinger, Heisenberg and Interaction pictures, Eigen values, Expectation values and Matrix elements, Heisenberg's Uncertainty principle

UNIT – III

Density operator formalism of quantum mechanics – pure and mixed states; Superposition and Entanglement in quantum mechanics; No cloning theorem; Applications of postulates –Particle in a box, Hydrogen atom, Harmonic Oscillator

Number states, ladder operators and Coherent states of a harmonic oscillator; Spin and Angular momentum – spin half particles; Rabi problem of a spin-half particle in a rotating magnetic field; Bosons and Fermions

UNIT – IV

Statistical Physics: Quick review of first and second laws of thermodynamics, Thermal Equilibrium and Gibbs principle, Applying Gibbs principle to Classical and Quantum harmonic oscillators, Bosons and Fermions and Quantum statistics – Fermi-Dirac and Bose-Einstein distributions

UNIT – V

Digital communication and information: Quantifying information in terms of Shannon entropy; Basic ideas of quantum information; Decoherence and noise; Introductory ideas of Kraus operators

Brief overview of Computational Complexity: Qualitative ideas of a Turing machine: Types of Turing machines; Time and Space complexity – P vs NP, PSPACE; Quantum complexity classes – Q, EQP, BQP, BPP, QMA; Post Quantum Cryptography (PQC)

Text Books:

1. Introduction to Quantum Mechanics, Griffiths D. J., 3rd Edition, Cambridge University Press (2024)

Reference Books:

1. Introduction to Electrodynamics, Griffiths D. J., 4th edition, Cambridge University Press (2020)
2. Principles of Quantum Mechanics, Shankar, R., 2nd edition, Springer (2014)
3. Quantum Information Science – Manenti R., Motta M., 1st Edition, Oxford University Press (2023)
4. Quantum computation and quantum information – Nielsen M. A., and Chuang I. L., 10th Anniversary edition, Cambridge University Press (2010)
5. A Pathak, Elements of Quantum Computation and Quantum Communication, Boca Raton, CRC Press (2015)
6. Information Theory, Robert B. Ash, Dover Publications (2003)
7. Introduction to the Theory of Computation, Michael Sipser, 3rd edition, Cengage India Pvt. Ltd. (2014)
8. Statistical Mechanics, Pathria R. K., Paul D. Beale, 4th edition, Academic Press, (2021)

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	AI Tools and Applications	CATEGORY ESC	L-T-P-C 0-1-3-2.5

Pre-requisite: NIL

Course Objectives:

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

Course Outcomes: *After successful completion of this course, the student will be able to:*
CO1: Recall the categories, capabilities, and limitations of major AI tools (text, image, code, data) (K2)
CO2: Explain the principles of prompt engineering and how generative AI models process instructions (K3)
CO3: Apply AI tools to solve first-year engineering problems in analysis, writing, and coding tasks (K3)
CO4: Analyze AI-generated outputs for accuracy, bias, and reliability before use (K4)
CO5: Evaluate the ethical, academic-integrity, and societal implications of AI tool use, justifying appropriate usage choices (K5).

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	-	-	-	H	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	L	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
6. Ministry of Electronics and Information Technology, Government of India. (2023). Digital Personal Data Protection Act, 2023. https://www.meity.gov.in/content/digital-personal-data-protection-act-2023

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Network Analysis Laboratory	CATEGORY PCC	L-T-P-C 0-0-3-1.5

Pre-requisite: NIL

Course Objectives

- To provide hands-on experience in analyzing electrical circuits using KCL, KVL, mesh analysis, nodal analysis, and network theorems through hardware and simulation tools.
- To develop skills in analyzing transient and steady-state responses of first-order and second-order electrical circuits.
- To familiarize students with frequency response, resonance, Q-factor, bandwidth, and the effects of circuit parameters on network performance.
- To develop practical knowledge of two-port network parameters, including Z, Y, H, and ABCD parameters, and their applications.
- To develop the ability to design and analyze passive low-pass and high-pass filters for specified cutoff frequencies using hardware and simulation software.

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

CO1: Apply KCL, KVL, mesh analysis, nodal analysis, and network theorems to analyze and verify electrical circuits using hardware and simulation tools (K3).

CO2: Analyze the transient and steady-state responses of first-order and second-order RL, RC, and RLC circuits for different circuit parameters (K4).

CO3: Analyze the frequency response, resonance characteristics, Q-factor, and bandwidth of series and parallel RLC circuits (K4).

CO4: Determine and analyze Z, Y, H, and ABCD parameters of two-port networks and evaluate their frequency response (K4).

CO5: Design and evaluate first-order and second-order passive low-pass and high-pass filters for specified cutoff frequencies using hardware and simulation software (K6).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	M				L	L	
CO2	H	H	M	H	M				L	L	
CO3	H	H	M	H	M				L	L	
CO4	H	H	M	H	M				L	L	
C05	H	H	H	H	H		L		M	L	L

List of Experiments

At least ten experiments need to be performed using both Hardware and Simulation Software and the result need to be verified.

1. To Study of components of a circuit and Verification of KCL and KVL.
2. To Verification of mesh and nodal analysis for AC circuits
3. To Verify the Superposition, Thevenin's & Norton theorems for AC circuits
4. To Verify of maximum power transfer theorem for AC circuits
5. To Verify of Tellegan's theorem for two networks of the same topology.

2. To Study of DC transients in RL, RC and RLC circuits
3. To study frequency response of various 1st order RL & RC networks
4. To study the transient and steady state response of a 2nd order using RLC Components by varying its various parameters and studying their effects on responses
5. To Find the Q Factor and Bandwidth of a Series and Parallel Resonance circuit.
6. To Determination of open circuit (Z) and short circuit (Y) parameters
7. To Determination of hybrid (H) and transmission (ABCD) parameters
8. To measure two port parameters of a twin-T network and study its frequency response.
9. To design the first order low pass ,High pass filters using passive components for different cutoff frequencies.
10. To design the second order low pass and High pass filters using passive componets for different cutoff frequencies.

Hardware Requirements:

Regulated Power supplies, Analog/Digital Function Generators, Digital Multimeters, Decade Resistance Boxes/Rheostats, Decade Capacitance Boxes, Ammeters (Analog or Digital),

Voltmeters (Analog or Digital), Active & Passive Electronic Components

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	IT and Electronic Workshop Laboratory	CATEGORY ESC	L-T-P-C 0-0-2-1

Pre-requisite:NIL

Course Objectives

- To introduce the internal parts of a computer, peripherals, I/O ports, and connecting cables.
- To demonstrate configuring the system as dual boot with Windows and other operating systems such as Linux and BOSS.
- To teach basic command-line interface commands on Linux.
- To teach the usage of the Internet for productivity and self-paced lifelong learning.
- To introduce compression, multimedia, antivirus tools, and office tools such as word processors, spreadsheets, and presentation tools.

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

CO1: Perform hardware troubleshooting (K3).
CO2: Understand hardware components and interdependencies (K3).
CO3: Safeguard computer systems from viruses and worms (K4).
CO4: Prepare documents and presentations (K6).
CO5: Perform calculations using spreadsheets (K4).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	H				L	M	M
CO2	H	H	M	H	M				L	L	M
CO3	H	M	M	H	H			M	L	L	M
CO4	M	M	H	M	H				M	H	M
C05	M	H	M	M	H				L	M	L

Part -A
List of Experiments

PC Hardware & Software Installation

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

Task 5: Every student should install BOSS on the computer. The system should be configured as dual boot (VMWare) with both Windows and BOSS. Lab instructors should verify the installation and follow it up with a Viva

Internet & World Wide Web

Task1: Orientation & Connectivity Boot Camp: Students should get connected to their Local Area Network and access the Internet. In the process they configure the TCP/IP setting. Finally students should demonstrate, to the instructor, how to access the websites and email. If there is no internet connectivity preparations need to be made by the instructors to simulate the WWW on the LAN.
Task 2: Web Browsers, Surfing the Web: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Also, plug-ins like Macromedia Flash and JRE for applets should be configured.
Task 3: Search Engines & Netiquette: Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google. This should be demonstrated to the instructors by the student.
Task 4: Cyber Hygiene: Students would be exposed to the various threats on the internet and would be asked to configure their computer to be safe on the internet. They need to customize their browsers to block pop ups, block active x downloads to avoid viruses and/or worms.

LaTeX and WORD

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

EXCEL

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

LOOKUP/VLOOKUP

Task 3: Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting

POWER POINT

Task 1: Students will be working on basic power point utilities and tools which help them create basic power point presentations. PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows in PowerPoint.

Task 2: Interactive presentations - Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts.

Task 3: Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), and Inserting – Background, textures, Design Templates, Hidden slides.

AI TOOLS – ChatGPT

Task 1: Prompt Engineering: Experiment with different types of prompts to see how the model responds. Try asking questions, starting conversations, or even providing incomplete sentences to see how the model completes them.

• Ex: Prompt: "You are a knowledgeable AI. Please answer the following question: What is the capital of France?"

Task 2: Creative Writing: Use the model as a writing assistant. Provide the beginning of a story or a description of a scene, and let the model generate the rest of the content. This can be a fun way to brainstorm creative ideas

• Ex: Prompt: "In a world where gravity suddenly stopped working, people started floating upwards. Write a story about how society adapted to this new reality."

Task 3: Language Translation: Experiment with translation tasks by providing a sentence in one language and asking the model to translate it into another language. Compare the output to see how accurate and fluent the translations are.

• Ex:Prompt: "Translate the following English sentence to French: 'Hello, how are you doing today?'"

Reference Books:

1. Comdex Information Technology course tool kit, Vikas Gupta, WILEY Dream tech, 2003
2. The Complete Computer upgrade and repair book, Cheryl A Schmidt, WILEY Dream tech, 2013, 3rd edition
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education, 2012, 2nd edition
4. PC Hardware - A Handbook, Kate J. Chase, PHI (Microsoft)
5. LaTeX Companion, Leslie Lamport, PHI/Pearson.
6. IT Essentials PC Hardware and Software Companion Guide, David Anfins on and Ken Quamme. – CISCO Press, Pearson Education, 3rd edition
7. IT Essentials PC Hardware and Software Labs and Study Guide, Patrick Regan– CISCO Press, Pearson Education, 3rd edition

Part -B
Electronic Workshop

Course Objectives

- To familiarize students with electronic components, their specifications, symbols, packages, applications, and identification methods.
- To develop practical skills in using electronic testing instruments and commonly used tools for measurement, testing, soldering, and troubleshooting.
- To provide hands-on experience in circuit diagram preparation, data-sheet interpretation, estimation, costing, and the use of EDA tools.
- To develop practical skills in PCB design, fabrication, soldering, crimping, interconnection, and SMT-based circuit assembly.
- To enable students to assemble, test, analyze, and demonstrate basic electronic circuits and measure electrical parameters using CRO and other laboratory instruments.

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

CO1: Identify and interpret the specifications, symbols, packages, and applications of various electronic components and select suitable components for a given circuit (K2).

CO2: Use electronic testing instruments and tools to test components, measure electrical parameters, and troubleshoot basic electronic circuits (K3).

CO3: Design and fabricate basic printed circuit boards and demonstrate appropriate soldering, crimping, interconnection, and SMT assembly techniques (K3).

CO4: Analyze electronic circuits using CRO and other measurement instruments and determine parameters such as phase difference from Lissajous figures (K4).

CO5: Assemble, test, and demonstrate basic electronic circuits and use EDA tools for circuit design, simulation, and documentation (K3).

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	H				L	L	
CO2	H	H	M	H	H				M	L	M
CO3	H	H	H	M	H		M		M	L	M
CO4	H	H	M	H	H				M	H	
C05	H	H	M	H	H				L	M	M

LIST OF EXPERIMENTS

Any Eight experiments shall be performed from the above list.

1. Familiarization and identification of electronic components with specifications, including functionality, type, size, colour coding, package, symbol, cost, etc. [Active, Passive, Electrical, Electronic, Electro-mechanical, Wires, Cables, Connectors, Fuses, Switches, Relays, Crystals, Displays, Fasteners, Heat sinks, etc.].
2. Study of CRO and use of CRO to generate ligiguous figures there by calculating thhe pahse between 2 sinusoildal signal of same frequency
3. Drawing of electronic circuit diagrams using BIS/IEEE symbols and introduction to EDA tools such as Dia or XCircuit. Interpretation of data sheets of discrete components and ICs, estimation, and costing.
4. Familiarization and application of testing instruments and commonly used tools such as multimeter, function generator, power supply, DSO, soldering iron, de-soldering pump, pliers, cutters, wire strippers, screwdrivers, tweezers, crimping tool, hot-air soldering and de-soldering station, etc.
5. Testing of electronic components such as resistors, capacitors, diodes, transistors, and JFETs using a multimeter.

6. Study and practice of interconnection methods and soldering techniques using breadboard, wire wrapping, crimping, and soldering. Study of soldering types, selection of materials, safety precautions, and soldering practice on connectors and general-purpose PCBs.
7. Study of Printed Circuit Boards (PCB), including types, single-sided, double-sided, PTH, and processing methods. Design and fabrication of a single-sided PCB for a simple circuit using manual etching with ferric chloride and drilling.
8. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
9. Study of CRO and use of CRO to generate Lissajous figures, thereby calculating the phase difference between two sinusoidal signals of the same frequency.
10. Assembly, testing, and demonstration of electronic circuits on general-purpose PCBs. Any two circuits from the following:

- Fixed voltage power supply using transformer, rectifier diode, capacitor filter, and Zener/IC regulator.
- Square-wave generation using IC 555 timer.
- Sine-wave generation using IC 741 op-amp.
- RC-coupled amplifier using BC107 transistor.

11. Assembling of electronic circuits using SMT (Surface Mount Technology) stations.
12. Introduction to EDA tools such as KiCad or XCircuit.

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	Applied Chemistry Laboratory (For ECE and Allied Branches of Engineering)	CATEGORY BSC	L-T-P-C 0-0-3-1.5

LIST OF EXPERIMENTS

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

1. Verify Beer–Lambert's law and determine the molar absorptivity of a colored solution (e.g., $KMnO_4$ or $CuSO_4$) using a UV-Visible spectrophotometer.
2. To determine the concentration of Fe^{2+}/Fe^{3+} in a given water or leach liquor sample by colorimetry.
3. Identify functional groups present in a given organic or mineral-bound sample from its IR spectrum. (virtual lab)
4. Determine the value of Planck's constant using a set of LEDs of different colors (or a photoelectric effect
5. apparatus).
6. Calculate and plot allowed energy levels of an electron confined in a one-dimensional box of varying length using the particle-in-a-box model. (virtual Lab)
7. Synthesize polyaniline by oxidative polymerization and qualitatively test its conductivity.
8. Determine the average molecular weight of a given polymer sample using an Ostwald/Ubbelohde viscometer.
9. Construct a Zn–Cu galvanic cell and measure its EMF, comparing it with the theoretical value from standard electrode potentials.
10. Determine the corrosion rate of a mild steel coupon immersed in simulated mine water (acidic solution).
11. Assemble a simple Zn–carbon (or lead-acid) cell and measure its voltage and approximate capacity.
12. Determine the concentration of an acid solution by conductometric titration.
13. Synthesize silver nanoparticles using a plant extract (green synthesis route) and confirm formation via the surface plasmon resonance (SPR) peak.
14. Adsorption capacity of a nanomaterial (e.g., activated carbon nanoparticles or nano-iron oxide) for removal of a dye or metal ion from water.
15. Particle Size Estimation of Colloidal Nanoparticles (Tyndall Effect and Color-Based Study)
16. Determination of a strong acid against a strong base by using potentiometer.
17. Determination of a strong acid against a strong base by using pH meter.
18. Redox titration by using potentiometer.
19. Determination of strength of an acid in Pb-Acid battery.

R-26 B.Tech -I YEAR -II SEMESTER SYLLABUS

COURSE CODE	NSS/NCC/Scouts & Guides/Community Service/Sports (No Credits)	CATEGORY MNC-2	L-T-P-C 0-0-2-0

Pre-requisite: NIL

Course Objectives

- Inculcate the spirit of volunteerism, patriotism, and social responsibility among students.
- Enable students to understand the structure, objectives, and working of NSS, NCC, Scouts & Guides.
- Develop leadership, communication, teamwork, and crisis-management skills through experiential learning.
- Equip students with basic first-aid and disaster-preparedness competencies.
- Promote community engagement and sustainable development values through organised service activities.

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

CO1: Understand the philosophy, history, and objectives of NSS/NCC/Scouts & Guides and community service programmes (K1, K2).
CO2: Demonstrate leadership, teamwork, and organisational skills through camp/parade/drill activities (K3).
CO3: Plan and execute community service projects addressing social issues like health, hygiene, literacy, and environment (K3, K4).
CO4: Apply first aid, disaster-preparedness, and civic responsibilities in real-world scenarios (K3).
CO5: Develop civic sense, national integration, and sustainable community-development values (K5).

CO / PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	H	M	–	–	–	H	H	M	M	–	–	–	M	–
CO2	–	–	H	–	–	H	M	H	H	–	–	–	M	M
CO3	–	–	M	H	M	H	H	M	H	–	–	–	–	–
CO4	–	–	H	M	–	M	M	H	H	–	–	–	–	–
CO5	–	–	–	–	H	H	H	M	M	–	–	–	–	–

UNIT 1 Foundation of NSS, NCC, Scouts & Guides and Community Service

Introduction to NSS – history, objectives, badge, motto, pledge
Introduction to NCC – ranks, uniforms, aims, NCC Act 1948
Scouts & Guides – Baden-Powell legacy, Bharat Scouts & Guides Act
Community Service – concept, importance and types

Citizenship, civic sense and social responsibility
Volunteerism: global and Indian perspective (NYKS, NSS, Red Cross)
Legal & ethical framework for community service

UNIT2 Leadership, Skill Development, Camping and Disaster Management
Leadership development – theories and models (situational, transformational)
Team building, communication & conflict resolution
Parade, drill & physical training basics
Map reading, navigation and field craft (NCC)
Camp organisation – planning, logistics, safety protocols
Adventure activities: trekking, rock-climbing, swimming (awareness)
Disaster management – concepts, types, roles of NSS/NCC volunteers
First Aid – CPR, wound management, fractures, snake bite, burn

UNIT3 Community Projects, Social Awareness and Service Documentation
Community needs assessment – participatory methodology
Project planning: Swachh Bharat, Pulse Polio, Blood Donation camps
Literacy campaigns and awareness drives (Padhna Likhna Abhiyan)
Environmental conservation – plantation, solid waste, water conservation
Gender sensitisation and women empowerment programmes
Digital literacy and e-governance outreach
Documentation and reporting of service-learning activities
Reflection, portfolio preparation and field report writing

AI Integration

S.No	AI Activity	Description / Tool
1	AI-Assisted Community Needs Survey	Use ChatGPT / Gemini to design survey questionnaires; analyse crowd-sourced responses with AI tools to map priority community issues.
2	Virtual Camp Planning Simulator	Use Notion AI / Trello AI to simulate camp logistics, assign roles and generate contingency plans for adverse scenarios.
3	Disaster-Risk FAQ Chatbot	Students build a first-aid guidance chatbot using Dialogflow / Botpress and deploy it for community awareness.
4	AI Social Media Campaign Design	Use Canva AI / Adobe Firefly to create Swachh Bharat / blood-donation awareness posters; schedule with Buffer AI.
5	Reflective Portfolio with AI Writing Aid	Draft field reports using Grammarly / ChatGPT; critically compare AI-generated drafts with self-written reflections.