MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act,1956

B.Tech – Electrical and Electronics Engineering
COURSE STRUCTURE (MLRS-BT25)
Applicable From 2025-26 Admitted Batch

I YEAR I SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2510001	Matrices and Calculus	BS	3	1	0	4	40	60	100
2	2510008	Advanced Engineering Physics	BS	3	0	0	3	40	60	100
3	2510501	Programming for Problem Solving	ES	3	0	0	3	40	60	100
4	2510221	Electrical Circuits-I	PC	2	0	0	2	40	60	100
5	2510010	English for Skill Enhancement	ES	3	0	0	3	40	60	100
		Laboratory								
6	2510371	Engineering Workshop	ES	0	0	2	1	40	60	100
7	2510071	Advanced Engineering Physics Lab	BS	0	0	2	1	40	60	100
8	2510571	Programming for Problem Solving Lab	ES	0	0	2	1	40	60	100
9	2510073	English Language and Communications Skills Lab	HSMC	0	0	2	1	40	60	100
10		Foreign Language*	MC	0	0	0	0	-	-	-
11		Induction Program	-	-	-	-	-	-	-	-
Total Credits				**14**	**1**	**8**	**19**	**360**	**540**	**900**

Students can choose any one of the foreign languages from given list

1.25X0FL1-French
2. 25X0FL1-German
3. 25X0FL1-Spanish
4. 25X0FL1-Korean

I YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2520002	Ordinary Differential Equations and Vector Calculus	BS	3	0	0	3	40	60	100
2	2520009	Engineering Chemistry	BS	3	0	0	3	40	60	100
3	2520401	Electronic Devices and Circuits	ES	3	0	0	3	40	60	100
4	2520507	Object Oriented Programming through Java	ES	3	0	0	3	40	60	100
5	2520222	Electrical Circuits-II	PC	3	0	0	3	40	60	100
		Laboratory								
6	2520072	Engineering Chemistry Laboratory	BS	0	0	2	1	40	60	100
7	2520578	Object Oriented Programming through Java Lab	ES	0	0	2	1	40	60	100
8	2520276	Electrical Circuits Lab	ES	0	0	2	1	40	60	100
9	2520301	Engineering Drawing and Computer Aided Drafting	ES	2	0	2	3	40	60	100
10	2530279	Design of Electrical Systems using Auto CAD	SD	0	0	2	1	40	60	100
11	2520026	Yoga and Inner Engineering	MC	0	0	0	0	-	-	-
Total Credits				**17**	**0**	**10**	**22**	**360**	**540**	**900**

II YEAR I SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
1	2530223	Electro Magnetic Fields	PC	3	0	0	3	40	60	100
2	2530224	Electrical Machines-I	PC	3	0	0	3	40	60	100
3	2530504	Data Structures	PC	3	0	0	3	40	60	100
4	2530225	Power Systems-I	PC	2	0	0	2	40	60	100
5	2540460	Digital Electronics	ES	2	0	0	2	40	60	100
6	2530Exl3	Innovation and Entrepreneurship	HSMC	2	0	0	2	40	60	100
		Laboratory								
7	2530277	Electrical Machines-I Lab	PC	0	0	2	1	40	60	100
8	2540486	Electronic Devices & Digital Electronics Lab	PC	0	0	2	1	40	60	100
9	2530574	Data Structures Lab	ES	1	0	2	2	40	60	100
		Skill Development Course								
10	2530576	Applied Python Programming Lab	SD	0	1	2	2	40	60	100
		Mandatory Course								
11	2530021	Environmental Science	HSMC	1	0	0	1	40	60	100
Total Credits				**17**	**0**	**8**	**22**	**440**	**660**	**1100**

II YEAR II SEMESTER

S. No.	Course Code	Course Name	Course Area	Hours per week			Credits	Scheme of Examination Maximum Marks		
				L	T	P		Internal (CIA)	External (SEE)	Total
		Theory								
11	2540003	Numerical Methods and Complex Variables	BS	3	0	0	3	40	60	100
2	2540227	Electrical Machines-II	PC	3	0	0	3	40	60	100
3	2540228	Power Systems-II	PC	3	0	0	3	40	60	100
4	2540229	Control Systems	PC	3	0	0	3	40	60	100
5	2530226	Electrical Measurements and Sensors /Digital Electronics	PC	3	0	0	3	40	60	100
		Laboratory								
6	2540075	Computational Mathematics Lab	PC	0	0	2	1	40	60	100
7	2540280	Electrical Machines-II Lab	PC	0	0	2	1	40	60	100
8	2540281	Control Systems Lab	PC	0	0	2	1	40	60	100
9	2530278	Electrical Measurements and Sensors Lab	PC	0	0	2	1	40	60	100
		Skill Development Course								
10	2540487	PCB Design	SD	0	0	2	1	40	60	100
Total Credits				**15**	**0**	**10**	**20**	**400**	**600**	**1000**

I-I

2510001: MATRICES AND CALCULUS
(CSE, CSD, CSM, ECE, EEE, MECH, CIVIL)

	L	T	P	C
I Year B.Tech. I Sem	**3**	**1**	**0**	**4**

Prerequisites: Mathematics courses of 10+2 year of study.

Course Objectives: The student will try to learn

- Types of matrices and their properties, concept of a rank of the matrix and applying this concept to know the consistency and solving the system of linear equations.
- Concept of eigen values, eigen vectors and reduction of quadratic form to canonical form by orthogonal transformation.
- Geometrical approach to the mean value theorems and their application to the mathematical problems. Evaluation of improper integrals using Beta and Gamma functions.
- Partial differentiation, concept of total derivative and finding maxima and minima of function of two and three variables.
- Evaluation of multiple integrals and their applications.

Course Outcomes: After successful completion of the course, students should be able to

- Recall the concepts of rank, Echelon form, Normal form, and the properties of non singular matrices.
- Explain the process of finding eigenvalues and eigenvectors of a matrix and their role in diagonalization.
- Relate Beta and Gamma functions to standard integrals and solve related problems.
- Apply Euler's theorem and compute total derivatives for multivariable functions.
- Understand the methods for changing variables in double and triple integrals, including transformations to polar, spherical, and cylindrical coordinates.

UNIT-I: Matrices

Rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method, System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations, L-U decomposition method.

UNIT-II: Eigen values and Eigen vectors

Eigen values, Eigen vectors and their properties (without proof), 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.

UNIT-III: Calculus

Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem, Taylor's Series (without proofs). Beta and Gamma functions and their applications (properties without proof).

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications)

Partial Differentiation: Euler's Theorem, Total derivative, Jacobian, Functional dependence-independence. Applications: Maxima and minima of functions of two variables and three variables using method of Lagrange multipliers.

UNIT-V: Multivariable Calculus (Integration)

Evaluation of Double Integrals (Cartesian and polar coordinates), change of order of integration (only Cartesian form), Evaluation of Triple Integrals, Change of variables (Cartesian to polar) for double and triple integrals (Cartesian to Spherical and Cylindrical polar coordinates). Applications: Areas (by double integrals) and volumes (by triple integral).

TEXT BOOKS:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, "Advanced Engineering Mathematics", Narosa Publications, 5thEditon, 2016.

REFERENCE BOOKS:

1. Erwin kreyszig, "Advanced Engineering Mathematics", 9thEdition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney," Calculus and Analytic geometry", 9thEdition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2008.
4. H. K. Dassand Er. Rajnish Verma, "Higher Engineering Mathematics", S Chand and Company Limited, New Delhi.

2510008: ADVANCED ENGINEERING PHYSICS

(CIVIL, EEE, MECH, ECE, CSE, CSM & CSD**)**

I Year B.Tech. I Sem

L	T	P	C
3	0	0	3

Pre- requisites: 10+2 Physics.

Course Objectives: The student will try to

- Understand fundamental concepts of quantum mechanics and their applications in solids.
- Study the basics of quantum computing, quantum gates and quantum algorithms.
- Classify the crystal structures, defects and material characterization techniques like XRD and SEM.
- Learn the properties and applications of magnetic as well dielectric materials.
- Explore the working likewise applications of lasers and fibre optics in modern technology.

Course Outcomes: After successful completion of the course, students should be able to

- Illustrate the concepts of quantum mechanics for explaining particle behavior and energy band formation in solids.
- Understand quantum computing concepts, quantum gates and basic quantum algorithms.
- Identify crystal structures, defects and XRD and SEM techniques for material characterization.
- Classify magnetic and dielectric materials and their applicability in engineering contexts.
- Explain the principles of lasers and fibre optics and their applications across various fields in scientific practices.

UNIT-I: Quantum Mechanics

Introduction to quantum physics, Blackbody radiation (Qualitative), Photoelectric effect, de-Broglie Hypothesis, Matter waves, Heisenberg uncertainty principle, Eigen values and Eigen functions, Schrödinger's time independent wave equation, Physical significance of wave function, Particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative),Effective mass of electron.

UNIT-II: Quantum Computing

Introduction, Concept of quantum computer, Linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Classical bits, Qubits: single and multiple Qubit system, Bloch's sphere, Entanglement, Quantum gates, Evolution of quantum systems, Quantum measurements, Challenges and advantages of quantum computing over classical computation, Quantum computing system for information processing, Quantum algorithms: Deutsch-Jozsa, Grover.

UNIT-III: Crystallography &Materials Characterization

Introduction, Unit cell, space lattice, basis, lattice parameters, Crystal structures, Bravais lattices, Packing factor: SC, BCC, FCC; Miller indices, Inter-planar distance, Defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects.

Bock diagram and working principle of X-ray diffraction (XRD), Scanning Electron Microscopy (SEM).

UNIT-IV: Magnetic and Dielectric Materials

Introduction to magnetic materials, Origin of magnetic moment, Classification of magnetic materials, Hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, Magneto Resistance, Synthesis of magnetic materials using sol-gel method, Applications: Magnetic hyperthermia for cancer treatment, Magnets for EV, Giant Magneto Resistance (GMR) device.

Introduction to dielectric materials, Types of polarization (qualitative): Electronics, ionic & orientation, Ferroelectric, Piezoelectric, Pyro electric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM)and fire sensor.

UNIT-V: Laser and Fibre Optics

Introduction to Laser, three quantum processes - Stimulated Absorption, Spontaneous emission, Stimulated Emission Characteristics of laser, Einstein coefficients and their relations, Meta stable state, Population inversion, Pumping, Lasing action, Ruby laser, He-Ne laser, Semiconductor diode laser, Applications: Bar code scanner.

Introduction to fibre optics, Total internal reflection, Construction of optical fibre, Acceptance angle, Numerical aperture, Classification of optical fibres, Losses in optical fibre, Applications: Optical fibre for communication system, Sensor for structural health monitoring.

TEXT BOOKS:

1. TVS Arun Murthy & MN Avadhanulu,"Advanced Engineering Physics", S. Chand Publications.
2. B.K.Pandey and S .Chaturvedi ,"Engineering Physics, Cengage Learning", 2nd Edition, 2022.
3. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson Publication,2019.
4. A.P. Siva Kumar, Y Subba Reddy, "Introduction to Quantum Technologies and applications".
5. M. N. Avadhanulu, P. G. Kshirsagar& TVS Arun Murthy "A Text book of Engineering Physics", S. Chand Publications, 11th Edition 2019.
6. S O Pillai "Solid State Physics", New Age International Private Limited, 8th Edition, 2018.

REFERENCE BOOKS:

1. Quantum Physics, H.C.Verma, TBS Publication, 2nd Edition 2012.
2. Elementary Solid-State Physics, S.L.Gupta and V.Kumar, Pragathi Prakashan, 2019.
3. A.K. Bhandhopadhya -Nano Materials, NewAgeInternational,1st Edition,2007.
4. Engineering Physics, S P Basavaraj, 2005 Edition.
5. Engineering Physics by Gupta and Gour, Dhanpat Rai Publications, 2016 (Reprint).
6. Vishal Sahani, Quantum Computing, McGraw Hill Education, 2007 Edition.

E-sources

1. https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fiber-communications-principles-and-pr.pdf
2. https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
3. https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharles-Kittel.pdf
4. https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
5. https://www.fi.muni.cz/usr/gruska/qbook1.pdf
6. https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-and-quantum-information-nielsen-chuang.pdf

2510501: PROGRAMMING FOR PROBLEM SOLVING

I Year B. Tech EEE–I Sem

L	T	P	C
3	0	0	3

Course Objectives:

1. To learn the fundamentals of computers.
2. To understand the various steps in program development.
3. To learn he syntax and semantics of the C programming language.
4. Tolearntheusageofstructuredprogrammingapproachesinsolvingproblems.

Course Outcomes: The student will be able to

1. Illustrate the fundamental elements as variables, control structures, loops, and functions to interpret program flow in solving engineering problem statements.
2. Develop programs using arrays, strings, and modular programming, recursive functions, structures concepts to implement data processing tasks in business applications.
3. Summarize the concepts of pointers, scope of variables, and parameter passing mechanisms in the role of system-level programming.
4. Demonstrate file handling techniques, searching, and sorting algorithms to manage real-time database operations.
5. Organize multidimensional arrays, string operations, and user-defined data types in multidisciplinary applications.

UNIT - I:

Overview of C:C Language Elements, Variable Declarations and Data Types, Executable Statements, General Form of a C Program, Arithmetic Expressions, Formatting Numbers in Program Output.

Selection Structures: Control Structures, Conditions, if Statement, if Statements with Compound Statements, Decision Steps in Algorithms.

Repetition and Loop Statements: Repetition in Programs, Counting Loops and the while Statement, Computing a Sum or Product in a Loop, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement.

UNIT - II:

Top-Down Design with Functions: Building Programs from Existing Information, Library Functions, Top Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments. Pointers and Modular Programming: Pointers and the Indirection Operator, Functions with Output Parameters, Multiple Calls to a Function with Input/ Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

UNIT -III:

Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Searching and Sorting an Array, Parallel Arrays and Enumerated Types, Multidimensional Arrays

Strings: String Basics, String Library Functions: Assignment and Substrings, Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of Pointers.

UNIT-IV:

Recursion: The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters Structure and Union Types: User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.

UNIT - V:

Text and Binary File Pointers: Input/ Output Files - Review and Further Study, Binary Files, Searching a Database. Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms).

TEXTBOOKS:

1. Jeri R. Hanly and Elliot B. Koffman, "Problem solving and Program Design in C" 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg "C Programming and Data Structures", Cengage Learning, (3rd Edition).

REFERENCEBOOKS:

1. Brian W. Kernighan and DennisM. Ritchie, "The C Programming Language", Prentice Hall of India.
2. E. Balagurusamy, "Computer fundamentals and C ",2nd Edition,McGraw-Hill.
3. Yashavant Kanetkar,Let Us C, 18th Edition,BPB.
4. R.G.Dromey, "Howtosolveitby Computer,Pearson "(16th Impression).
5. "gramming in C", Stephen G.Kochan, Fourth Edition, Pearson Education.
6. "Herbert Schildt, C".TheCompleteReference,McGrawHill, 4th Edition.
   Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

2510221: ELECTRICAL CIRCUITS - I

I Year B. Tech EEE–I Sem

L	T	P	C
2	0	0	2

Prerequisite: Mathematics

Course Objectives:

- To understand the basic network elements and analyze circuits using fundamental laws.
- To develop analytical skills to study single-phase AC circuits.
- To learn to analyze three-phase circuits under balanced and unbalanced loads.
- To apply network theorems to simplify and solve complex AC and DC circuits.
- To understand magnetic coupling and analyze circuits involving self and mutual inductance.

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

- Analyze electrical circuits using network elements and network simplification methods.
- Elucidate steady-state analysis of single-phase AC circuits and resonance characteristics.
- Evaluate three-phase circuits and measure power under various loading conditions.
- Apply network theorems for electric circuits simplification.
- Examine the behavior of magnetically coupled coils by applying concepts of self and mutual inductance and appropriate dot conventions.

MODULE–I

Network Elements & Laws: Active elements- Independent and dependent sources, Passive elements- R, Land C, Energy stored in Inductance and Capacitance, Kirchhoff's laws, Source transformation, Star-Delta transformation, Node voltage method, and Mesh current method.

MODULE–II

Single-Phase Circuits: RMS and average values of periodic sinusoidal and non-sinusoidal waveforms, Phasor representation, j-Notation, Steady-state analysis of series, parallel circuits. Impedance, Admittance, Active and Reactive Powers, Complex Power. Resonance: Series and parallel circuits, Bandwidth and Q-factor.

MODULE–III

Three-phase Circuits: Analysis of balanced and unbalanced three-phase circuits, Star and delta connections, Measurement of three-phase power for balanced and unbalanced loads.

MODULE –IV

Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorems, Maximum power transfer theorem, Tellegen's theorem, Compensation theorem, Millman's theorem and Reciprocity theorem.(AC & DC).

MODULE –V

Magnetic Coupled circuits: Concept of self and mutual inductance, Dot convention, Coefficient of coupling, Analysis of circuits with mutual inductance.

TEXT BOOKS:

1. Van Valkenburg M.E, "Network Analysis", Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, "Network Analysis and Synthesis", McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, “Electric Circuit Analysis”, Dream tech Press & Wiley, 2021.
2. James W.Nilsson, Susan A.Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5thEdition, 2017.
4. Jagan N.C, Lakshrninarayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, Mc Graw Hill,6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/

2510010: ENGLISH FOR SKILL ENHANCEMENT
(Common to B. Tech I Year I Sem
Civil, EEE, Mech, ECE, CSM & CSD)

I Year B. Tech EEE–I Sem

L	T	P	C
3	0	0	3

Introduction

The course, aligned with the National Education Policy 2020, aims to develop students' proficiency in English by focusing on Listening, Speaking, Reading, and Writing (LSRW) skills. It emphasizes clear and effective communication for academic, personal, and professional needs while promoting cultural and value-based learning. Through a structured syllabus, interactive teaching methods, and authentic learning materials, students will enhance vocabulary, grammar, comprehension, and writing skills for lifelong learning.

Prerequisites: Language Comprehension

Course Objectives: This course will enable the students to: Improve their vocabulary. Use appropriate sentence structures in their oral and written communication. Develop their reading and study skills. Equip students to write paragraphs, essays, précis and draft letters. Acquire skills for technical report writing.

Course Outcomes: After successful completion of the course, students should be able to:
Identify appropriate vocabulary in their oral and written communication. Demonstrate their understanding of the rules of functional grammar and sentence structures. Develop comprehension skills from known and unknown passages. **Construct paragraphs, essays, précis, and draft letters. Utilize** abstracts and reports in various contexts

MODULE–I
Theme: Perspectives
Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.
Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms
Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison
Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.
Writing: Sentence Structures and Types -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for Writing Precisely –Nature and Style of Formal Writing.

MODULE–II

Theme: Digital Transformation

Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs

Grammar:Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas –

Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

MODULE–III

Theme: Attitude and Gratitude

Poems on '*Leisure'* by William Henry Davies and '*Be Thankful'* - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

MODULE–IV

Theme: Entrepreneurship

Lesson on '*Why a Start-Up Needs to Find its Customers First*' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.

Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts - Exercises for Practice

Writing: Writing Practices- Note Making-Précis Writing.

MODULE–V

Theme: Integrity and Professionalism

Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.

Grammar: Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)

Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice

Writing: Report Writing - Technical Reports- Introduction – Characteristics of a Report – Categories of Reports Formats- Structure of Reports (Manuscript Format) -Types of Reports - Writing a Technical Report.

Note: *Listening and Speaking skills which are given under Unit-6 in AICTE Model Curriculum are covered in the syllabus of ELCS Lab Course.*

(Note: As the syllabus of English given in AICTE *Model Curriculum-2018 for B.Tech First Year is Open-ended,* besides following the prescribed textbook, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning in the class.)

Prescribed Textbook

Board of Editors*. 2025. English for the Young in the Digital World.* Orient Black Swan Pvt. Ltd.

References:

- Swan, Michael. (2016). *Practical English Usage.* Oxford University Press. New Edition.
- *Karal, Rajeevan. 2023. English Grammar Just for You.* Oxford University Press. New Delhi
- 2024. *Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi
- Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook.* Oxford Univeristy Press. New Delhi
- Wood,F.T. (2007). *Remedial English Grammar.* Macmillan.
- Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students.* Mc Graw-Hill Education India Pvt. Ltd.

Useful Links

- https://owl.purdue.edu/owl/general_writing/grammar/index.html?utm_source=chatgpt.com
- https://www.ego4u.com/?utm_source=chatgpt.com
- https://www.eslfast.com/?utm_source=chatgpt.com
- https://learnenglish.britishcouncil.org/skills/reading?utm_source=chatgpt.com

2510371: ENGINEERING WORKSHOP

I Year B.Tech. I Sem **L T P C**
0 0 2 1

Course Objectives:

1. To Study of different hand operated power tools, uses and their demonstration.
2. Togainagoodbasicworkingknowledgerequiredfortheproductionofvarious engineering products.
3. To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
4. To develop arightattitude, team working, precision and safetyat work place.
5. It explains the construction, function, use and application of different working tools, Equipment and machines.

Course Outcomes:

1. Explain the design and model different prototypes in the carpentry trade such as Cross lap joint, Dove tail joint.
2. Demonstrate the design and model various basic prototypes in the trade of fitting such as Straight fit, V- fit.
3. UnderstandtomakevariousbasicprototypesinthetradeofTinsmithysuchasrectangular tray, and open Cylinder.
4. Demonstrate the design and model various basic prototypes in the trade of Welding.
5. Explain to make various basic prototypes in the trade of Black smithy such as J shape, and S shape.
6. Understand to perform various basic House Wiring techniques such as connecting one lamp with one switch, connecting two lamps with one switch, connecting a fluorescent tube, Series wiring, Go down wiring.

UNITI- CARPENTRY & FITTING

- **Carpentry** – Introduction, Carpentry tools, sequence of operations and applications (T- Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
- **Fitting**–Introduction, fittingtools, sequence of operations and applications (V-Fit, Dovetail Fit & Semi-circular fit)

Learning Outcomes: Students should be able to,

- Understand the trade of carpentry and fitting.
- Explain the tools involved in manufacturing operations.
- Evaluate the applications of carpentry and fitting.

UNIT II -TIN SMITHY AND BLACKSMITHY

- **Tin-Smithy**– Introduction, Tinsmithy tools, sequence of operations and applications (Square Tin, Rectangular Tray & Conical Funnel).
- **Blacksmith**-Introduction, Blacksmith tools, sequence of operations and applications (Round to Square, Fan Hook and S-Hook)

Learning Outcomes: Students should be able to,

- Understand the oldest manufacturing methods.
- Describe the sequence of operations involved.
- Explain the safety precautions and tools usage.

UNITIII-HOUSEWIRINGANDWELDING

- **House-wiring**–Introduction, Electrical wiring tools, sequence of operations and applications (Parallel & Series, Two-way Switch and Tube Light)
- **Welding Practice**–Introduction, electrode, welding tools, and sequence of operations. Advantages and applications (Arc Welding)

Learning Outcomes:

- Students should be able to,
- Discuss the topic of House Wiring
- Explain Safety precautions of welding

Text Books:

1. Workshop Practice /B. L. Juneja /Cengage
2. Workshop Manual/K. Venugopal /Anuradha.

References:

1. Workshop Manual–P. Kannaiah /K. L. Narayana/SciTech Workshop Manual/Venkat Reddy/BSP

2510071: ADVANCED ENGINEERING PHYSICS LAB

(Civil, EEE, Mech, ECE,CSE, CSM & CSD**)**

	L	T	P	C
I Year B.Tech. I Sem	**0**	**0**	**2**	**1**

Pre-requisites:10+2 Physics

Course Objectives: The student will try to

1. Capable of handling instruments related to the Hall effect Experiment and their measurements.
2. Understand the characteristics of various devices such as solar cell, lasers and optical fiber.
3. Apply the analytical techniques & graphical analysis for Stewart Gees, B-H curve.
4. Synthesizeandstudythephysicalpropertiesofmaterialslikesemiconductors ferromagnetic and ferroelectric substances.
5. Develop intellectual communication skills through discussion on basic principles of scientific concepts in a group.

Course Outcomes: After successful completion of the course, students should be able to

CO1: Demonstrate the Planck's constant using Photo electric effect and Apply the Hall effect and band gap measurement techniques to examine semiconductor properties.

CO2: Determine key electrical, magnetic and optical properties of semiconductors and other functional materials.

CO3: Describe the steps involved in the Synthesis of magnetic nano materials using chemical methods.

CO4: Compare the variation of magnetic and electric field and the behaviors of hysteresis curve. Interpret data analysis.

CO5: Demonstrate working of laser systems, optical fiber and solar cell parameters through experimental study.

List of Experiments:(Any 8 experiments are to be performed)

1. Determination of work function and Planck's constant using photo electric effect
2. Determination of Hall coefficient and carrier concentration of a given semiconductor
3. Determination of energy gap of a semiconductor
4. Synthesis of magnetic (Fe_3O_4) nanoparticles using sol-gel method.
5. Study of B-H curve of a ferromagnetic material
6. Determination of magnetic field induction along the axis of a current carrying coil.
7. Determination of dielectric constant of a given material.
8. Study of V-I and P-I characteristics of solar cell.
9. Determination of wavelength of a laser using diffraction grating and to study of V-I &

55L-I characteristics of a given laser diode

10. Determination of numerical aperture of a given optical fibre and to determination of bending losses of a given optical fibre.

Open Ended Experiments: (Any 2 experiments are to be performed)

1. To calculate the concentration of charge carriers in the sample using Hall effect -NITK, SurathkalVirtual Lab.
2. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss-IIT Kanpur Virtual Lab.
3. To calculate the beam divergence and spot size of the given laser beam- Amritha ViswaVidya Peetham Virtual Lab
4. To study various crystals structures-Amritha Viswa Vidya Peetham Virtual Lab

References/E-sources:

1. Kittel, Charles, and Paul McEuen. Introduction to solid state physics. John Wiley & Sons, 2018.https://ph1-nitk.vlabs.ac.in/exp/hall-effect/references.html.
2. Kasap S O., Principles of Electronic Materials and Devices, 3rd Ed, Mcgraw Hill,2006).https://bop2-iitk.vlabs.ac.in/exp/hysteresis-loss/references.html.
3. Koechner, Walter. Solid-State Laser Engineering. Berlin: Springer, 2006. https://lo-amrt.vlabs.ac.in/exp/laser-beam-divergence/references.html.
4. Pillai, SO. Solid State Physics, City: New Age Publications (Academic), India, 2005. https://ssp-amrt.vlabs.ac.in/exp/crystal-structure/references.html.

2510571: PROGRAMMING FOR PROBLEM SOLVING LAB

I Year B.Tech. I Sem

L	T	P	C
0	0	2	1

Course Objectives: The students will earn the following:

1. To work with an IDE to create, edit, compile, run and debug programs
2. To analyze the various steps in program development.
3. Todevelopprogramstosolvebasicproblemsbyunderstandingbasicconceptsin Clike operators, control statements etc.
4. To develop modular, reusable and readable C Programs using the concept slike functions, arrays etc.
5. To Write programs using the Dynamic Memory Allocation concept.
6. To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:

1. Implement C programs using control structures and loops to solve real-time numerical and logical problems.
2. Develop modular programs with functions, arrays, and strings to handle structured data in application development.
3. Apply the use of pointers, parameter passing, and file operations to design system-level solutions for data storage and retrieval.
4. Demonstrate searching and sorting algorithms on arrays to perform efficient database operations.
5. Make use of recursive programming techniques and user-defined data structures to address computational problems in scientific applications.

PRACTICESESSIONS:

Simple numeric problems:

a) Write a program for finding the max and min from the three numbers.
b) Write the program for the simple, compound interest.
c) Write a program that print multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:

   5x1=5
   5x2=10
   5x3=15

d) Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:

a) Write a C program which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch Statement).
b) Write a program that finds if a given number is a prime number.
c) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
d) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

Arrays, Pointers and Functions:

a) Write a C program to find the minimum, maximum and average in an array of integers.
b) Write a C program that uses functions toper form the following:
    I. Addition of Two Matrices
    II. Multiplication of Two Matrices
c) Write a program for reading elements using a pointer into an array and display the values using the array.
d) Write a program for display values reverse order from an array using a pointer.

Files:

a) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings:

a) Write a C program that uses functions to perform the following operations:
    I. To insert a sub-string into a given main string from a given position.
    II. To delete n Characters from a given position in a given string.
b) Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
c) Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.
d) Write a C program to count the lines, words and characters in a given text.

Sorting and Searching:

a) Write a C program that uses non-recursive function to search for a Key value in a given list of integers using linear search method.
b) Write a C program that uses non-recursive function to search for a Key value in a given sorted list of integers using binary search method.
c) Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
d) Write a C program that sorts the given array of integers using selection sort in descending order
e) Write a C program that sorts the given array of integers using insertion sort in ascending order
f) Write a C program that sorts a given array of names.

TEXTBOOKS:

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson.
2. B. A. Forouzan and R.F. Gilberg C Programming and Data Structures, C engage Learning, (3rd Edition).

REFERENCEBOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hallof India
2. E. Balagurusamy, Computer fundamentals and C,2ndEdition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C,18thEdition, BPB
4. R.G.Dromey, How to solve it by Computer, Pearson(16th Impression)
5. Programming in C, Stephen G.Kochan, Fourth Edition, Pearson Education.
6. HerbertSchildt,C:TheCompleteReference,McGrawHill,4th Edition Byron Gottfried, Schaum's Outline of Programming with C McGraw-Hill

2510073 ENGLISH LANGUAGE AND COMMUNICATION SKILLS (ELCS)LAB
(Common to Civil, EEE, Mech, ECE, CSM & CSD)

I Year B.Tech I Sem **L T P C**
0 0 2 1

The English Language and Communication Skills (ELCS) Lab focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives: This course will enable the students to:

- Enable students, develop their active listening skills
- Equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds
- Improve their pronunciation and neutralize accent
- Enable students express themselves fluently and appropriately
- Practice speaking in social and professional contexts

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

- **Identify** key information while listening to spoken texts.
- **Interpret** the speaker's intention from the speech.
- **Apply** pronunciation techniques to improve intelligibility.
- **Demonstrate** fluency, clarity, and confidence while speaking.
- **Use** English effectively in real-life situations.

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

Computer Assisted Language Learning (CALL) Lab which focusses on listening skills
Interactive Communication Skills (ICS) Lab which focusses on speaking skills
The following course content is prescribed for the English Language and Communication Skills Lab.

Exercise – I
CALL Lab:
Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) - Testing Exercises
ICS Lab:
Diagnostic Test – Activity titled 'Express Your View'
Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

Exercise – II
CALL Lab:
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations –Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III
CALL Lab:
Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI)
Practice: Differences between British and American Pronunciation –Listening Comprehension Exercises
ICS Lab:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events (A wide range of Materials / Handouts are to be made available in the lab.)

Exercise – IV
CALL Lab:
Instruction: Techniques for Effective Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - Listening Comprehension Exercises
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: How to Tell a Good Story - Story Star- Sequencing-Creativity
Practice: Activity on Telling and Retelling Stories - Collage

Exercise – V
CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises
(It is essential to identify a suitable passage with exercises for practice.)
ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity
Post-Assessment Test on 'Express Your View'

Minimum Requirement of infrastructural facilities for ELCS Lab:
Computer Assisted Language Learning (CALL) Lab:
The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self- study by students.
System Requirement (Hardware component):
Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:
i) Computers with Suitable Configuration
ii) High Fidelity Headphones

Interactive Communication Skills (ICS) Lab:
The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.
Note: English Language Teachers are requested to prepare Materials / Handouts for each Activity for the Use of those Materials in CALL & ICS Labs.

Suggested Software:
Cambridge Advanced Learners' English Dictionary with CD.
Grammar Made Easy by Darling Kindersley.
Punctuation Made Easy by Darling Kindersley.
Oxford Advanced Learner's Compass, 10th Edition.
English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.

English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

References:

- Shobha, KN &Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
- Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient Black Swan Pvt. Ltd.
- Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press
- (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
- Ur, Penny and Wright, Andrew. 2022. Five Minute Activities – A Resource Book for Language Teachers. Cambridge University Press.

25100FL: FOREIGN LANGUAGE-GERMAN

(CSE, CSD, CSM, ECE, EEE, MECH & CIVIL)

I Year B.Tech. II Sem **L T P C**
0 0 0 0

Pre-requisites: English courses of 10+2 year of study.

Course Objectives: The student will try to learn

- Basic Conversations in a supermarket, ask and buy groceries. Dealing with German currency and Years.
- Converse with others about actions they wish to do, and ask if they need anything to eat or drink.
- Country names and introduce a third person.
- Understand an advertisement and apply for a job.
- Introduce a person and their lifestyle.
- Understand advertisements for rent/lease, and describe their requirements.

UNIT-I: Im Supermarkt : Numbers and Genitive Case
Numbers from 100 to 1000, Specify Price and Quantities of Groceries, German Currency,year numbers, Life dates, Genitive usage of Proper nouns.

UNIT-II:WoherkommenSie?: Conjugations, Country name

Sounds with sandz, verb: möchtenandhaben, their usage with Conversations, Country names, third person introduction and their origins and Professions.

UNIT-III:Arbeitund Hobby : Filling an application
Understanding an advertisement, filling and Application, applying to a Job & Vocabulary, Countries and Nationalities and their Demonyms, Hobbies.

UNIT-IV: Akkusativ:Accusative case
Introduction to Accusative case: Masculine, Feminine, Neutral and Plurals : Definite, Indefinite, and Negative Articles.
Things used in daily life, understanding the usage and conjugation of verbs : suchen and brauchen,

UNIT-V: Personenund Lebenstile: People and their Lifestyles

Daily activities and Interests, Accusative sentence structures with subject and accusative object, building accusative sentences with and without articles.

UNIT-VI: Anzeigevon Wohnungen: Accusative pronouns and Fragepronomen

Advertisements: Apartments and Furniture, rentingan Apartment and purchasing Furniture and Household items. Usage of Fragepronomen for Things and Person.

UNIT-VII: Eine Wohnungbeschreiben: Describing an Apartment

Vowel sounds: short and long, indefinite pronoun, negative pronoun, Emphasisina Sentence, Requesting things, usage of verb: find en, Ask for missing things. Concept of „Es gibt''.

TEXT BOOKS:

1. Lagune1,Kursbuch,Deutschals Fremdsprache,Harmut Aufderstraße,JuttaMüller,Thomas Storz
Lagune1,Arbeitsbuch,Deutschals Fremdsprache,Harmut Aufderstraße ,JuttaMüller, Thomas Storz

I-II

2520002: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS
(CSE, CSD, CSM, ECE, EEE, MECH, CIVIL)

I Year B.Tech. II – Sem

L	T	P	C
3	0	0	3

Pre-requisites: Mathematics courses of 10+2 year of study.

Course Objectives: The student will try to learn

- Methods of solving the differential equations of first order and first degree.
- Concept of higher order liner differential equations.
- Concept, properties of Laplace transforms, solving ordinary differential equations by using Laplace transforms techniques.
- The physical quantities involved in engineering field related to vector valued functions.
- The basic properties of vector valued functions and their applications to line, surface and volume integrals.

Course Outcomes: After successful completion of the course, students should be able to

- Utilize the methods of differential equations for solving Newton's law of cooling and Law of Natural growth and decay.
- Understand the solutions of linear differential equations with constant coefficients.
- Explain the concept of the Laplace transforms and its significance in solving differential equations and evaluating integrals.
- Interpret the vector differential operators and their relationships for solving engineering problems.
- Apply the integral transformations to line, surface and volume of different geometrical models.

UNIT-I: First Order ODE

Exact differential equations, equations reducible to exact differential equations, linear and Bernoulli's equations, Orthogonal Trajectories (only in Cartesian Coordinates). Applications: Newton's law of cooling, Law of natural growth and decay.

UNIT-II: Ordinary Differential Equations of Higher Order

Second order linear differential equations with constant coefficients: Non-Homogeneous terms of the type e^{ax}, sin ax, cos ax, polynomials in x, e^{ax} V(x) and x V(x), method of variation of parameters, Equations reducible to linear ODE with constant coefficients: Cauchy-Euler equation, Legendre's equation.

UNIT-III: Laplace transforms

Laplace Transforms: Laplace Transform of standard functions, First shifting theorem, Second shifting theorem, Unit step function, Dirac delta function, Laplace transforms of functions when they are multiplied and divided by 't', Laplace transforms of derivatives and integrals of function (All without proof), Evaluation of integrals by Laplace transforms, Laplace transform of periodic functions, Inverse Laplace transform by different methods, convolution theorem (without proof). Applications: solving Initial value problems by Laplace Transform method.

UNIT-IV: Vector Differentiation

Vector point functions and scalar point functions, Gradient, Divergence and Curl, Directional derivatives, Vector Identities, Scalar potential functions, Solenoidal and Irrotational vectors.

UNIT-V: Vector Integration

Line, Surface and Volume Integrals, Theorems of Green's, Gauss and Stokes's (without proof) and their applications.

TEXT BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. R.K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
4. H. K. Dassand Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

2520009: ENGINEERING CHEMISTRY

B.Tech. I Year II Sem. **L T P C**
3 0 0 3

Course Objectives:

1. To develop adaptability to new advances in Engineering Chemistry and acquire the essential skills to become a competent engineering professional.
2. To understand the industrial significance of water treatment, fundamental principles of battery chemistry, and the impact of corrosion, along with its control methods for structural protection.
3. To impart foundational knowledge of various energy sources and their practical applications in engineering.
4. To equip student switch an understanding of smart materials, bio sensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:

CO1: Understand the fundamental properties of water and its applications in both domestic and industrial purposes.

CO2: Acquire the knowledge of electro chemical processes and their relevance to corrosion and its control methods.

CO3: Determine the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.

CO4: Understand the basic concepts and properties of polymers and other engineering materials.

CO5: Apply the medicinal values in daily life

UNIT-I: Water and its treatment:

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and break- point chlorination.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion-exchange processes. Desalination of brackish water – Reverse osmosis.

UNIT-II: Electro chemistry and Corrosion:

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, EMF of cell - Numerical problems. Types of electrodes, reference electrodes – Primary reference electrode- Standard Hydrogen Electrode(SHE),Secondary reference electrode- Calom elelectrode. Construction, working and determination of pH of unknown solution using SHE and the Calomel electrode.

Corrosion: Introduction- Definition, causes and effects of corrosion.Theories of corrosion, chemical electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion-Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT–III: Energy sources:

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium-ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

Fuels: Introduction and characteristics of a good fuel, Calorific value–Units-HCV,LCV-Du longs formula-Numerical problems.

Fossil fuels: Introduction, Classification , Petroleum-Refining of Crude oil, Cracking-Types of cracking

-Moving bed catalytic cracking. LPG and CNG composition and uses.

Synthetic Fuels:Fischer-Tropschprocess,IntroductionandapplicationsofHythaneandGreen Hydrogen.

UNIT-IV: Polymers:

Definition-Classification of polymers: Based on origin and tacticity with examples–Types of poly merization - Addition (free radical addition mechanism) and condensation polymerization.

Plastics, Elastomers and Fibers: Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between thermoplastics and thermo setting plastics, Fiber reinforced plastics (FRP).

Conducting polymers: Definition and Classification with examples-Mechanism of conduction intrans- poly-acetylene and applications of conducting polymers.

Bio degradable polymers: Polyl actic acidand its applications.

UNIT-V-Advanced Functional Materials:

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, Piezoelectric materials – quartz and their engineering applications.Biosensor-Definition, Amperometry Glucose monitor sensor.Cement: Port land cement, its composition, setting and hardening.

Lubricants:Definition and characteristics of a good lubricant thin film mechanism of lubrication,propertiesoflubricants-viscosity,cloudandpourpoint,flashandfirepoint.

TEXT BOOKS:

1. EngineeringChemistrybyP.C.JainandM.Jain,DhanpatraiPublishingCompany,2010.
2. EngineeringChemistrybyRamaDevi,Dr.P.AparnaandRath,Cengagelearning,2025.

REFERENCE BOOKS:

1. EngineeringChemistry:byThirumalaCharyLaxminarayana&Shashikala,PearsonPublications (2020)
2. EngineeringChemistrybyShashiChawla,DhanpatraiandCompany(P)Ltd.Delhi2011.
3. EngineeringChemistrybyShikhaAgarwal,CambridgeUniversityPress,Delhi2015.
4. EngineeringAnalysisofSmartMaterialSystemsbyDonaldJ.Leo,Wiley,2007.
5. Challenges and Opportunities inGreen Hydrogen byEditors: Paramvir Singh, AvinashKumar Agarwal, Anupma Thakur, R.K Sinha.

2520401: ELECTRONIC DEVICES AND CIRCUITS

I Year B.Tech. II – Sem. **L T P C**

3 0 0 3

COURSE OVERVIEW:

The course contain fundamental semiconductor devices and their behavior, including diodes, BJTs, and FETs. It covers their characteristics, applications, and the analysis of basic electronic circuits. The course also explores rectifiers, voltage regulation, amplifier design, and advanced semiconductor technologies like FinFETs and CNTFETs. Emphasis is placed on developing a strong foundation for analog circuit design and understanding modern device technologies in electronics.

Pre-requisites: Knowledge on Basic Electrical Engineering and Semiconductor Device Physics

Course Objectives:

The students will try to learn

- Characteristics of semiconductor diodes, their models, and applications
- Structure, operation, and characteristics of Bipolar Junction Transistors (BJT) in various configurations, along with the determination of h-parameters
- Need for transistor biasing, load line analysis, operating point selection, and various biasing techniques with emphasis on stabilization and prevention of thermal runaway
- The design and analysis of transistor-based small-signal amplifiers using h-parameters in CE, CB, and CC configurations with approximate models
- Principles, operation, and characteristics of special-purpose diodes, FET devices, and advanced transistors like FinFETs and CNTFETs

Course Outcomes:

After successful completion of the course, students shall be able to

- Analyze the electrical characteristics and models of semiconductor diodes and apply them in rectifier and clipping circuits
- Evaluate the operation and configurations of Bipolar Junction Transistors (BJTs) and analyze their input and output characteristics
- Design appropriate biasing networks for BJTs and determine the operating point for amplifier applications
- Analyze transistor amplifier circuits using h-parameter models and assess performance for various configurations
- Analyze the structure, working, and characteristics of JFETs, MOSFETs, and advanced devices like FinFETs and CNTFETs, and compare modern device technologies.

Module – I: Diode Characteristics and Applications

pn junction diode – I-V characteristics, Diode resistance and capacitance, Diode models (Ideal, Simplified, Piecewise Linear), Rectifiers – Half-wave, Fullwave (Center-tap and bridge), Capacitor filter for rectifiers, Clippers and clampers, Zener diode – I-V characteristics and voltage regulation.

Module – II: Bipolar Junction Transistor (BJT)

Structure and working principle of BJT, Current components and transistor action, Configurations: Common Base (CB), Common Emitter (CE), Common Collector (CC), Input and output characteristics, Determination of h-parameters from transistor characteristics.

Module – III: BJT Biasing

Need for biasing and stabilization, Load line and operating point, Biasing techniques: Fixed bias, Collector-to-base bias, Voltage divider bias, Stability factors and thermal runaway

Module – IV: Transistor Amplifiers

Transistor as a small-signal amplifier, h-parameter equivalent circuit, CE, CB, CC amplifier analysis using h-parameters, Approximate CE model – with and without emitter bypass capacitor.

Module – V: Special Purpose Diodes, Field Effect Transistors and Advanced Devices

Special Purpose Diodes: Principle of Operation of – SCR, Tunnel Diode, Varactor Diode, Photo Diode, Solar Cell, LED and Schottky Diode.

Field Effect Transistors and Advanced Devices: JFET: Structure, operation, and characteristics, MOSFET: Enhancement and Depletion modes – Structure, operation, and characteristics, Advanced Devices: FinFETs - 3D structure, Scaling advantages, CNTFETs - Structure, ballistic transport, fabrication, Comparison: CMOS vs. FinFET vs. CNTFET.

TEXT BOOKS:

1. Millman, Jacob, and Christos C. Halkias. Electronic Devices and Circuits. 3rd edition, Tata McGraw-Hill, 2010.
2. Boylestad, Robert L., and Louis Nashelsky. Electronic Devices and Circuit Theory, 11th edition, Pearson, 2013.

REFERENCES:

1. Bell, David A. Electronic Devices and Circuits. Oxford University Press, 5th ed., 2008.
2. Neamen, Donald A. Electronic Circuit Analysis and Design. McGraw-Hill, 2nd ed., 2001.
3. Salivahanan, S., and N. Suresh Kumar. Electronic Devices and Circuits. McGraw-Hill Education, 4th ed., 2017.

2520507 : OBJECT ORIENTED PROGRAMMING THROUGH JAVA

	L	T	P	C
I Year B.Tech. II – Sem.	**3**	**0**	**0**	**3**

Course Objectives:

1. To Understand the basic object-oriented programming concepts and apply them in problem solving.
2. To Illustrate inheritance concepts for reusing the program.
3. To Demonstrate multitasking by using multiple there ads and event handling
4. To Develop data-centric applications using JDBC.
5. To Understand the basics of java console and GUI based programming

Course Outcomes:

1. Demonstratethebehaviorofprogramsinvolvingthebasicprogrammingconstructslikecontrol structures, constructors, string handling and garbage collection.
2. Demonstrate the implementation of inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords
3. Use multithreading concepts to develop inter process communication.
4. Understand the process of graphical user interface design and implementation using AWT or swings.
5. Developappletsthatinteractabundantlywiththeclientenvironmentanddeployontheserver.

UNIT-I

Object oriented thinking and Java Basics- Need for oop paradigm, summary of oop concepts, coping with complexity, abstraction mechanisms. History of Java, Java buzzwords, data types, variables, scope and life time of variables ,arrays, operators, expressions ,control statements, type conversion and casting, simple java program ,concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring String class.

UNIT-II

Inheritance, Packages and Interfaces—Hierarchical abstractions ,Base class object, sub class, subtype, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super keyword uses, using final keyword with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASS PATH ,importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT-III

Exception handling and Multithreading-- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multi threading and multitasking, thread lifecycle ,creating threads, thread priorities, synchronizing threads, interthread communication, thread groups, daemon threads.

UNIT-IV

Exploring String class, Object class, Exploring java. Util package, Exploring java .io package Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling mouse and keyboard events, Adapter classes. graphics, layout manager – layout manager types—border, grid, flow, card and grid bag.

UNIT- V

Swing—Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing- JFrame and J Component, J Label, Image Icon, J Text Field, J Button, J Check Box, J Radio Button, J List, J Combo Box, Tabbed Panes, Scroll Panes, Trees, and Tables. Menu Basics, Menu related classes – J menu Bar ,J Menu, J Menu Item, J Check Box Menu Item, J Radio Button Menu Item, J Separators. Creating a popup menu

TEXTBOOKS:

1. Javathecompletereference,13thedition, Herberts childt ,Dr. Denny Coward, McGrawHill.
2. Understanding OOP with Java, updated edition ,T. Budd ,Pearson education.

REFERENCEBOOKS:

1. An Introduction to programming and design using Java, J. Nino and F. A. Hosch ,John Wiley & sons.
2. An Introduction to OOP, third edition, T. Budd, Pearson education.
3. Introduction to Java programming, Y. Daniel Liang, Pearson education.
4. An introduction to Java programming and object-oriented application development ,R.A. Johnson- Thomson.
5. CoreJava2,Vol1,Fundamentals,Cay.S.HorstmannandGaryCornell,eighthEdition, Pearson Education.
6. Core Java 2, Vol 2, Advanced Features, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education
7. Object Oriented Programming with Java, R. Buyya, S.T.Selvi,X.Chu,TMH.
8. Java and Object Orientation, an introduction, JohnHunt, second edition, Springer.

2520222: ELECTRICAL CIRCUITS – II

I Year B.Tech II Sem **L T P C**

3 0 0 3

Prerequisite: Matrices and Calculus and Electrical Circuits - I

Course Objectives:

- To understand the transient behavior of R, L, and C elements and analyze series and parallel circuits using integro-differential methods.
- To apply the Laplace Transform technique to solve transient responses for different input signals.
- To develop knowledge of network topology and use matrix methods for efficient network analysis.
- To understand and analyze two-port networks using different parameters and their interrelationships.
- To classify and analyze filters, focusing on constant-k and m-derived filter designs for frequency selection.

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

- Analyze transient responses of RL, RC and RLC circuits under DC and AC excitations.
- Determine transient behavior of circuits using the Laplace Transform method for various inputs.
- Apply graph theory and use Tie-set and Cut-set matrices for network analysis.
- Analyze two-port networks using Z, Y, h and ABCD parameters.
- Evaluate low pass, high pass, band pass and band elimination filters—using constant-k and m-derived techniques.

MODULE–I

Transient analysis:

Significance of Initial conditions of R, L and C elements Transient response of series RL, RC and RLC circuits using inte gro-differential approach for DC and Sinusoidal excitations. Transient response of parallel RL, RC and RLC circuits using inte gro-differential approach for DC and Sinusoidal excitations.

MODULE–II

Electrical circuit Analysis using Laplace Transforms:

Laplace Transforms of step, ramp, exponential, impulse functions (inputs) Transient response of series RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations. Transient response of parallel RL, RC and RLC circuits using Laplace Transforms approach for DC and Sinusoidal excitations.

MODULE–III

Network Topology

Graph, tree, chord, Tie-set, cut-set, incident matrices, Problems on Tie-set and cut-set matrices.

MODULE –IV

Two port network parameters: Open circuit impedance, short-circuit admittance, Transmission, Hybrid parameters & inter-relationships, Series, parallel and cascade connection of two port networks.

MODULE –V

Filters: Classification of filters – Low pass, High pass, Band pass and Band Elimination, Elementary treatment of Constant-k and M-derived filters-Low pass and High pass Filters, Band pass and Band elimination filters

TEXT BOOKS:

1. Van Valkenburg M.E, “Network Analysis”, Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, “Network Analysis and Synthesis”, McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, “Electric Circuit Analysis”, Dream tech Press & Wiley, 2021.
2. James W. Nilsson, Susan A.Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5th
Edition, 2017.
4. Jagan N.C, Lakshrni narayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, Mc Graw Hill,
6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://www.digimat.in/nptel/courses/video/108105159/L01.html
4. https://www.digimat.in/nptel/courses/video/108102042/L01.html

2520072: ENGINEERING CHEMISTRY LAB

I Year B.Tech II Sem. **L T P C**
0 0 2 1

Course Description: The course includes experiments based on fundamental principles of chemistry essential for engineering students, aiming to develop practical skills and reinforce theoretical concepts.

Course Objectives

1. Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
2. Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
3. Students will acquire the ability to perform acid–base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
4. Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon–6,6 in the laboratory.
5. Students will learn to determine the unknown concentration of potassium permanganate ($KMnO_4$) using a calibration curve.

Course Outcomes

- **CO1:** Develop practical skills through hands-on chemistry experiments relevant to engineering applications.
- **CO2:** Determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
- **CO3:** Apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid–base reactions.
- **CO4:** Synthesize polymers such as Bakelite and Nylon–6,6.
- **CO5:** Determine the unknown concentration of a strong acid with a strong base by potentiometry using quinhydrone.

List of Experiments

I. Volumetric Analysis

- Estimation of hardness of water by EDTA complexometric method.

II. Conductometry

1. Estimation of the concentration of a strong acid by conductometry.
2. Estimation of the concentration of strong and weak acids in an acid mixture by conductometry.

III. Potentiometry

1. Estimation of concentration of Fe^{2+} ion by potentiometry using $KMnO_4$.
2. Estimation of concentration of a strong acid with a strong base by potentiometry using quinhydrone.

IV. pH Metry

- Determination of an acid concentration using a pH meter.

V. Preparations

1. Preparation of Bakelite.
2. Preparation of Nylon–6,6.

VI. Corrosion

- Determination of the rate of corrosion of mild steel in the presence and absence of an inhibitor.

VII. Lubricants

1. Estimation of acid value of a given lubricating oil.
2. Estimation of viscosity of lubricating oil using Ostwald's viscometer.

VIII. Virtual Lab Experiments

1. Construction of a fuel cell and its working.
2. Smart materials for biomedical applications.
3. Batteries for electrical vehicles.
4. Functioning of a solar cell and its applications.

Open Ended Experiments

1. Aspirin.
2. Paracetamol.

Reference Books

1. *Lab Manual for Engineering Chemistry* – B. Ramadevi and P. Aparna, S. Chand Publications, New Delhi (2022).
2. *Vogel's Textbook of Practical Organic Chemistry* – 5th Edition.
3. *Inorganic Quantitative Analysis* – A. I. Vogel, ELBS Publications.
4. *College Practical Chemistry* – V. K. Ahluwalia, Narosa Publications Ltd., New Delhi (2007).

2520578 : OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

	L	T	P	C
I Year B.Tech II Sem	**0**	**0**	**2**	**1**

Course Objectives

1. To write programs using abstract classes.
2. To write programs for solving real-world problems using the Java Collection Framework.
3. To write multithreaded programs.
4. To write GUI programs using Swing controls in Java.
5. To introduce the Java compiler and Eclipse platform.
6. To impart hands-on experience with Java programming.

Course Outcomes

1. Able to write programs for solving real-world problems using the Java Collection Framework.
2. Able to write programs using abstract classes.
3. Able to write multithreaded programs.
4. Able to write GUI programs using Swing controls in Java.

Note

1. Use LINUX and MySQL for the lab experiments. Though not mandatory, encourage the use of the Eclipse platform.
2. The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

List of Experiments

1. Use Eclipse or NetBeans platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. Explore auto suggestions and auto fill. Try code formatter and code refactoring such as renaming variables, methods, and classes. Debug step by step with a small program of about 10–15 lines containing at least one if–else condition and a for loop.
2. Write a Java program that works as a simple calculator. Use a Grid Layout to arrange buttons for digits and for the operations +, −, *, and %. Add a text field to display the result. Handle possible exceptions such as division by zero.
3. A) Develop an applet in Java that displays a simple message. B) Develop an applet in Java that receives an integer in one text field and computes its factorial value, returning it in another text field when the button named "Compute" is clicked.
4. Write a Java program that creates a user interface to perform integer division. The user enters two numbers in the text fields Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 is not an integer, the program throws a Number Forma tException. If Num2 is zero, the program throws an Arithmetic Exception. Display the exception in a message dialog box.
5. Write a Java program that implements a multithreaded application with three threads. The first thread generates a random integer every 1 second. If the value is even, the second thread computes and prints the square of the number. If the value is odd, the third thread prints the cube of the number.
6. Write a Java program to create a doubly linked list of elements. Delete a given element from the list and display the contents of the list after deletion.

7. Write a Java program that simulates a traffic light. The program lets the user select one of three lights—red, yellow, or green—using radio buttons. On selecting a button, an appropriate message ("Stop", "Ready", or "Go") appears above the buttons in the selected color. Initially, no message is shown.
8. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle, and Circle, each extending the Shape class. Each class implements the printArea() method to print the area of the respective shape.
9. Suppose a table named Table.txt is stored in a text file. The first line of the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas.
10. Write a Java program to display the table using Labels in a GridLayout.
11. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (use Adapter classes).
12. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record is separated by a tab (\t). The program takes a name or phone number as input and prints the corresponding value from the hash table (hint: use hash tables).
13. Write a Java program that correctly implements the Producer–Consumer problem using the concept of inter-thread communication.
14. Write a Java program to list all the files in a directory, including the files present in all its subdirectories.

Text Books:

1. Java for Programmers – P. J. Deitel and H. M. Deitel, 10th Edition, Pearson Education.
2. Thinking in Java – Bruce Eckel, Pearson Education.

Reference Books:

1. Java Programming – D. S. Malik and P. S. Nair, Cengage Learning.
2. Core Java, Volume I – 9th Edition, Cay S. Horstmann and Gary Cornell, Pearson Education.

2520276: ELECTRICAL CIRCUITS LAB

I Year B.Tech II Sem **L T P C**

0 0 2 1

Prerequisite: Electrical Circuits - I

Course Objectives:

- To understand the behavior of RLC circuits and resonance characteristics through simulation-based experiments.
- To examine the transient and steady-state responses of first-order RL and RC circuits for different input signals.
- To analyze network parameters and coupled circuits to understand interrelationships between electrical quantities.
- To evaluate performance characteristics of electrical networks and filters in frequency and time domains using simulation tools.
- To investigate power measurement techniques in balanced three-phase systems and validate network theorems using software simulations.

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

- Analyze resonance phenomena in series and parallel RLC circuits using circuit simulation software.
- Determine time-domain response parameters of first-order RL and RC circuits for non-sinusoidal inputs.
- Evaluate two-port network parameters and magnetic coupling characteristics experimentally.
- Interpret frequency-domain behavior of low-pass, high-pass, band-pass, and band-stop filters using simulation tools.
- Measure active and reactive power in three-phase systems and verify network theorems through circuit simulation.

The following experiments are required to be conducted compulsorily:

1. Verification of Series and Parallel Resonance using digital simulation.
2. Determination of Time response of first order RL and RC circuit for periodic non – sinusoidal inputs- Time Constant and Steady-state error using digital simulation.
3. Determination of Two port network parameters – Z, Y, Transmission and Hybrid parameters.
4. Measurement of 3-phase power in Balanced Star connected load using Two-Wattmeter method.
5. Determination of Co-efficient of coupling, self and mutual inductance in magnetic Coupled Circuits.
6. Frequency domain analysis of Low-pass filter and High-pass filters using digital simulation.
7. Verification of Superposition and Maximum Power Transfer theorems using digital simulation.
8. Verification of Thevenin's and Norton's theorems using digital simulation.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Measurement of Active Power for Delta connected balanced loads.
2. Measurement of Reactive Power for Star and Delta connected balanced loads.
3. Frequency domain analysis of Band-pass filters.
4. Frequency domain analysis of Band-stop filters.
5. Determination of Time response of first order RL, RC circuit for periodic non – sinusoidal inputs – Time Constant and Steady state error.
6. Verification of Compensation theorem.

Proposed open ended experiments:

1. Verification of active and reactive power measurements in EV Microgrid using digital simulation

TEXT BOOKS:

1. Van Valkenburg M.E, “Network Analysis”, Prentice Hall of India, 3rd Edition, 2000.
2. Ravish R Singh, “Network Analysis and Synthesis”, McGraw Hill, 2nd Edition, 2019.

REFERENCE BOOKS:

1. B. Subramanyam, “Electric Circuit Analysis”, Dreamtech Press & Wiley, 2021.
2. James W.Nilsson, Susan A. Riedel, “Electric Circuits”, Pearson, 11th Edition, 2020.
3. A Sudhakar, Shyammohan S Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 5th
Edition, 2017.
4. Jagan N.C, Lakshrninarayana C., “Network Analysis”, B.S. Publications, 3rd Edition, 2014.
5. William Hayt H, Kimmerly Jack E. and Steven Durbin M, “Engineering Circuit Analysis”, McGraw Hill,
6th Edition, 2002.
6. Chakravarthy A., “Circuit Theory”, Dhanpat Rai & Co., First Edition, 1999.

Online Recourses:

1. https://nptel.ac.in/courses/108/104/108104139/
2. https://nptel.ac.in/courses/108/106/108106172/
3. https://ocw.mit.edu/search/ocwsearch.htm?q=laboratory

2520301: ENGINEERING DRAWING AND COMPUTER AIDED DRAFTING

I Year B.Tech II Sem **L T P C**

2 0 2 3

Course Overview:

Engineering Drawing and Computer Aided Drafting is a fundamental subject that trains studentsinthevisualizationandrepresentationofengineeringobjectsusingbothconventional methods and modern CAD tools. It begins with geometrical constructions, scales, and engineering curves such as conic sections and cycloidal curves. Students then progress to orthographic projections of points, lines, planes, and solids, including auxiliary and sectional views.The subjectal so introduces development of surfaces and isometric projections, enabling conversion between 2D and 3D representations. Overall, it builds essential skills in technical drawing, spatial visualization, and CAD, preparing learners for advanced design applications.

Prerequisite: Nil

Course Objective

The students will try to learn:

- To introduce the fundamentals of engineering drawing and projection systems.
- To develop skills in constructing orthographic, isometric, and sectional views.
- To train students in interpreting and creating technical drawings using CAD tools.
- To familiarize students with dimensioning standards and drafting conventions.
- To bridge manual drafting techniques with computer-aided drafting practices.

Course Outcomes

After successful completion of the course, students should be able to:

- Understand and apply the principles of orthographic and isometric projections.
- Create sectional views and dimensioned drawings using BIS standards.
- Use CAD software to generate 2D engineering drawings.
- Visualize and construct solid models from 2D views.
- Interpret and produce engineering drawings of mechanical components and assemblies for practical and industrial applications.

Module – I: Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their significance, geometrical constructions, scales (plain and diagonal), conic sections (ellipse, parabola, and hyperbola – general method only), cycloid, epicycloid, and hypocycloid.

Module – II: Orthographic Projections (Conventional and Computer Aided)

Principles of orthographic projections, conventions, projections of points and lines, projections of plane regular geometric figures, planes inclined to one plane. Computer-aided orthographic projections of points, lines, and planes. Introduction to computer-aided drafting, views, and commands.

Module – III: Projections of Regular Solids (Conventional and Computer Aided)

Auxiliary views, sections or sectional views of right regular solids such as prism, cylinder, pyramid, and cone. Computer-aided projections of solids and sectional views.

Module – IV: Development of Surfaces (Conventional)

Development of surfaces of prism, cylinder, pyramid, and cone.

Module – V: Isometric Projections (Conventional and Computer Aided)

Principles of isometric projection, isometric scale, isometric views, conventions, isometric views of lines and plane figures. Conversion of isometric views to orthographic views and vice versa. Conversion of orthographic projections into isometric views.

Note

1. The End Semester Examination will be in conventional mode.
2. CIE – I will be in conventional mode.
3. CIE – II will be using computer.

Text Books

1. *Engineering Drawing* – N. D. Bhatt, Charotar Publications, 54th Edition, 2023.
2. *Engineering Drawing and Graphics Using AutoCAD* – T. Jeyapoovan and Vikas, S. Chand & Company Ltd., 3rd Edition, 2010.

Reference Books

1. *Engineering Drawing* – Basant Agrawal and C. M. Agrawal, McGraw Hill, 3rd Edition, 2019.
2. *Engineering Graphics and Design* – John Wiley & Sons Inc., Wiley, 3rd Edition, 2020.
3. *Engineering Drawing* – M. B. Shah and B. C. Rane, Pearson, 2nd Edition, 2009.
4. *Engineering Drawing* – N. S. Parthasarathy and Vela Murali, Oxford, 1st Edition, 2015.
5. *Computer Aided Engineering Drawing* – K. Balaveera Reddy, CBS Publishers, 2nd Edition, 2015

2520279: DESIGN OF ELECTRICAL SYSTEMS USING AUTOCAD

I Year B.Tech II Sem **L T P C**
0 0 2 1

Prerequisite:

Course Objectives:

- To develop the ability, identify and draw standard electrical symbols and components used in circuits, wiring, and machines.
- To provide knowledge of preparing wiring layouts for residential, commercial and industrial electrical installations.
- To familiarize students with internal constructional details of electrical machines through sectional views and drawings.
- To enable understanding of single line diagrams of substations and renewable energy systems.
- To impart practical knowledge of transmission line supports and various methods of earthing.

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

- Recall standard symbols of electrical components, machines and fixtures.
- Explain the purpose and working principle of wiring layouts, machine sections and substation diagrams.
- Prepare wiring diagrams and layouts for residential, commercial and industrial installations.
- Differentiate between various machine cores, transformer designs and substation configurations through drawings.
- Evaluate electrical layouts, transmission line supports and earthing systems as per standards.

The following experiments are required to be conducted as compulsory experiments and are performed using software.

1. Creating simple electrical circuit diagrams using AutoCAD.
2. Use of layers and blocks for electrical layouts using AutoCAD.
3. Preparation of residential wiring layout using AutoCAD.
4. Switchboard and lighting plan for 1BHK/2BHK house using AutoCAD.
5. Design and drafting of distribution system for a small commercial building using AutoCAD.
6. Electrical room layout with control panels using AutoCAD.
7. Drawing of 11kV/440V substation SLD using AutoCAD.
8. Panel wiring diagram for DOL motor starter using AutoCAD.

In addition to the above eight experiments, At least any two of the experiments from the following list are required to be conducted using software:

1. Panel wiring diagram for Star-Delta motor starter using AutoCAD.
2. Design and documentation of single phase core type transformer sectional elevation and endview using AutoCAD.
3. Drawing of 33kV/11kV substation SLD using AutoCAD.
4. Draw the transmission tower diagram for the given dimensions using AutoCAD.

Proposed open ended experiments:

1. Design and documentation of electrical system for a factory setup / Godown wiring with three lamps using AutoCAD.
2. Design the armature windings of a given DC Machine data and draw the winding diagrams machine with the given dimensions using AutoCAD.

TEXT BOOKS:

1. K,B, Raina and S.K, Bhattacharya “Electrical Design Estimating and Costing” New Age International.
2. Prof. Sham Tickoo “AutoCAD Electrical 2023 for Electrical Control Designers” CADCIM Technologies.
3. Surjit Singh “Basic Electrical Engineering Drawing” Dhanpat Rai & Co.

REFERENCE BOOKS:

1. Frederic P. Hartwell and Herbert P. Richter “Practical Electrical Wiring” Park Publishing.
2. James A. Leach and Shawna Lockhart “AutoCAD 2023 Instructor” SDC Publications,
3. Ray C. Mullin and Phil Simmons “Electrical Wiring Residential” Cengage Learning.
4. IS 732: Code of Practice for Electrical Wiring Installations.
5. National Electrical Code (NEC) – India.

II-I

2530223: ELECTRO MAGNETIC FIELDS

II Year B.Tech I Sem **L T P C**
3 0 0 3

Prerequisite: Mathematics & Physics

Course Objectives:

- Understand the fundamental principles of static electric fields.
- Describe the properties of conductors and dielectrics influence electric field behavior.
- Apply the principles of the Biot-Savart Law and Ampere's Circuital Law.
- Analyze the relationship between time-varying electric and magnetic fields.
- Understand the generation, propagation, and characteristics of electromagnetic waves in different media.

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

- Apply Coulomb's law, Gauss's law, and the electric potential concept to solve for electric field intensity for various charge distributions.
- Explain the physical basis for the boundary conditions at conductor-dielectric interfaces.
- Determine the forces and magnetic boundary conditions governing the field behavior.
- Analyze field interactions and distinguish between static and time-varying field behavior in practical electromagnetic systems.
- Justify wave behavior under various material conditions.

MODULE-I

Static Electric Field: Review of conversion of a vector from one coordinate system to another coordinate System, Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

MODULE-II

Conductors, Dielectrics and Capacitance: Current and current density, Ohms Law in Point form, Continuity equation, Boundary conditions of conductors and dielectric materials. Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation.

MODULE-III

Static Magnetic Fields and Magnetic Forces: Biot-Savart Law, Ampere Circuital Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors. Force on a moving charge, Force on a differential current element, Force between differential current elements, Magnetic boundary conditions.

MODULE-IV

Time Varying Fields and Maxwell's Equations: Faraday's laws of Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces.

MODULE-V

Electromagnetic Waves: Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane wave in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors. Poynting theorem.

Text Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Reference Books:

1. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
2. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
3. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
4. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
5. E. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge University Press, 1966.
6. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
7. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

2530224: ELECTRICAL MACHINES - I

II Year B.Tech I Sem.

L	T	P	C
3	0	0	3

Prerequisite: Electrical Circuits -I & II

Course Objectives:

- To understand the construction, operation, and characteristics of D.C. generators, including windings, EMF equation, armature reaction, commutation, excitation methods, and applications.
- To understand the principle, operation, characteristics, speed control, losses, efficiency, and testing methods of various D.C. motors.
- To understand the construction, working principles, EMF equation, losses, phasor diagrams, and applications of single-phase transformers.
- To understand the equivalent circuit, losses, efficiency, regulation, all-day efficiency, and testing methods of transformers.
- To understand the parallel operation, auto-transformers, poly-phase connections, equivalent circuits, and applications of transformers.

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

- Explain the operation and performance of shunt, series, and compound D.C. generators.
- Apply their knowledge to speed control and efficiency of shunt, series, and compound D.C. motors.
- Analyze the working and performance of single-phase transformers.
- Evaluate the performance, efficiency, and regulation of transformers using various tests.
- Examine operation, connections, and performance of parallel and poly-phase transformers**.**

MODULE- I

D.C. Generators: Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings (elementary treatment only) – EMF Equation. Concept of Armature reaction and commutation – Cross magnetizing and de-magnetizing AT/pole. Methods of Excitation – separately excited and self-excited generators – build-up of EMF - critical field resistance and critical speed. Performance Characteristics of shunt, series and compound generators and applications.

MODULE-II

DC Motors: Principle of operation – Back EMF. - Torque equation – characteristics and application of shunt, series and compound motors. 3-point starter, Speed control of DC shunt and series motors - Armature voltage and field flux control methods. Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency. Testing of DC Machines: Methods of Testing – Direct, Indirect, and Regenerative Testing – Brake Test – Swinburne's Test – Hopkinson's Test.

MODULE-III

Single Phase Transformers: Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no-load and on load - phasor diagrams and Applications.

MODULE-IV

Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses. Testing of Transformers: Open Circuit and Short Circuit tests - Sumpner's Test - predetermination of efficiency and regulation-separation of losses test.

MODULE-V:
Parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Y, Δ/Δ and open Δ, Scott connection and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, Revised Edition, 2021.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.
4. A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105155/
2. https://nptel.ac.in/courses/108/105/108105017/
3. https://nptel.ac.in/courses/108/106/108106071/

2530504 : DATA STRUCTURES

II Year B.Tech I Sem.

L	T	P	C
3	0	0	3

Prerequisites: A course on **Programming for Problem Solving**.

Course Objectives

- Explore basic data structures such as stacks and queues.
- Introduce a variety of data structures such as hash tables, search trees, tries, heaps, and graphs.
- Introduce sorting and pattern matching algorithms.

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

1. Make use of linear data structures such as lists, stacks, and queues in algorithmic problem formulation.
2. Implement binary trees and balanced trees to support efficient database indexing operations.
3. Interpret heap structures and searching methods used in memory allocation techniques.
4. Develop programs using graph representations and traversal algorithms for network routing applications.
5. Utilize hashing methods and file organization techniques to construct solutions for information retrieval systems.

UNIT – I

Introduction to Data Structures:

Basic terminology, classification of data structures, operations on data structures, abstract data types (ADT), selecting a data structure. Linear lists – introduction, singly linked lists, circular linked lists, doubly linked lists.

Stacks: Operations, stack algorithms, stack ADT, applications of stacks.

Queues: Operations, queue algorithms, queue ADT, applications of queues.

UNIT – II

Trees:

Introduction, types of trees, creation of a binary tree from a general tree, traversal of a binary tree. Binary Search Trees (BST): searching, insertion, and deletion operations, BST ADT, applications. Threaded binary trees, AVL trees, Red–Black trees, and splay trees.

UNIT – III

Multi-way Search Trees:

Introduction, B-trees, B-tree ADT, 2–3 trees, 2–3–4 trees, B* trees, B+ trees.

Heaps:

Binary heaps, binomial heaps, Fibonacci heaps, comparison of various heaps, applications.

Searching:

Introduction, interpolation search, jump search.

UNIT – IV

Graphs: Introduction, directed graphs, bi-connected components, representation of graphs, graph traversal algorithms, graph ADT, applications of graphs.

Sorting: Radix sort, heap sort, shell sort, tree sort.

UNIT – V

Hashing and Collision Resolution:

Introduction, hash tables, hash functions. Division method, multiplication method, mid-square method, folding method. Collision resolution techniques: open addressing and chaining.

Files and Their Organization:

Introduction, data hierarchy, file attributes, text and binary files, basic file operations, file organization, and indexing.

Text Books

1. *Data Structures: A Pseudocode Approach with C* – R. F. Gilberg and B. A. Forouzan, 2nd Edition, Cengage Learning.
2. *Data Structures Using C* – Reema Thareja, 3rd Edition, Oxford University Press.

Reference Book

1. *Data Structures Using C* – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI / Pearson Education.

2530225: POWER SYSTEM–I

II Year B.Tech I Sem. **L T P C**

2 0 0 2

Pre requisite: Electrical Circuits-I & II

Course Objectives:

- To explain the operation of various conventional and renewable energy power plants.
- To analyze the economic aspects of power generation and load management.
- To describe the layout and components of air-insulated substations.
- To compare the construction and performance of gas-insulated substations with air-insulated substations.
- To calculate voltage drops in AC distribution systems under different loading conditions.

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

- Explain the operation of various conventional and renewable energy power plants.
- Analyze the economics of power generation considering load and cost factors.
- Identify the components and layouts of air-insulated substations.
- Compare air-insulated and gas-insulated substations in terms of design and performance.
- Calculate voltage drops in AC distribution systems under different load conditions.

MODULE-I

Generation of Electric Power: Operation of Hydel, Thermal, Nuclear and Gas Power plant with layouts – Description of components – Choice of site - advantages and disadvantages, Introduction and description of components- renewable energy sources and plants (solar and wind).

MODULE-II

Economics of Power Generation: Introduction, definitions of connected load, maximum demand, demand factor, load factor, diversity factor, Load curve, Load duration curve, number and size of generator units. Base load and peak load plants. Cost of electrical energy-fixed cost, running cost, Tariffs.

MODULE-III

Air Insulated Substations (AIS): Indoor & Outdoor substations: Substations layout showing the location of all the substation equipment. Bus bar arrangements in the Sub-Stations: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.

MODULE-IV

Gas Insulated Substations (GIS): Advantages of Gas insulated substations, different types of gas insulated substations, single line diagram of gas insulated substations, bus bar, construction aspects of GIS, Installation and maintenance of GIS, Comparison of Air insulated substations and Gas insulated substations.

MODULE-V

AC Distribution: Introduction, AC distribution, Single phase, 3-phase3 wire, 3-phase4 wire system, bus bar arrangement, Selection of site for substation. Voltage Drop Calculations (Numerical Problems) in AC Distributors for the following cases: Power Factors referred to receiving end voltage and with respect to respective load voltages.

TEXT BOOKS:

1. C. L. Wadhwa, "Generation, Distribution and Utilization of Electrical Energy", 2nd Edition, New Age International, 2009.
2. A.Chakrabarti, M.L. Soni, P.V. Gupta,U.S. Bhatnagar, "A Textbook on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
3. J.B.Gupta, A Course in Power Systems" Katson Books, 11th Edition, 2016.

REFERENCE BOOKS:

1. C.L.Wadhwa, "Electrical Power Systems", 5th Edition, New Age International, 2009.
2. M.V.Deshpande, "Elements of Electrical Power Station Design", 3rd Edition, Wheeler Pub.1998.
3. H.Cotton & H.Barber, "The Transmission and Distribution of Electrical Energy", 3rd Edition, 1970.
4. W.D.Stevenson, "Elements of Power System Analysis",4th Edition, Mc Graw Hill,1984.
5. V. K. Mehta and Rohit Mehta, "Principles of Power Systems", S. Chand & Company Ltd, New Delhi, 2004.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://nptel.ac.in/content/storage2/courses/108105053/pdf/L-2(TB)(ET)((EE)NPTEL).pdf
3. https://onlinecourses.nptel.ac.in/noc20_ee67/preview

2530460: DIGITAL ELECTRONICS

II Year B.Tech. I – Sem. **L T P C**

2 0 0 2

Course Overview:

This course introduces the fundamentals of digital systems, including number systems, logic gates, and Boolean algebra. It covers the design and analysis of combinational and sequential logic circuits. Students will also explore semiconductor memories and programmable logic devices used in modern digital design.

Prerequisites: Electronic Devices and Circuits

Course Objectives: The students will try to learn

- Fundamental concepts of digital system design and common forms of number representations and their conversions.
- Implementation and design logical operations using combinational logic circuits and sequential logic circuits.
- Semiconductor memories and programmable logic devices
- Logical expressions using Boolean algebra and Karnaugh maps for efficient circuit design
- Various types of semiconductor memories and the architecture of programmable logic devices

Course Outcomes: After successful completion of the course, students shall be able to

- Understand the working of logic families and logic gates.
- Design and implement Combinational and Sequential logic circuits.
- Implement the given logical problems using programmable logic devices
- Simplify and optimize logical functions using Boolean algebra and K-map techniques for hardware implementation
- Acquire knowledge of memory organization and the functionality of programmable logic devices used in digital system design

Module – I: Fundamentals of Digital Systems and Logic Families

Digital signals, Digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, Examples of IC gates, Number systems-binary, Signed binary, Octal hexadecimal number, Binary arithmetic, One's and Two's complements arithmetic.

Module – II: Combinational Circuits-I

Standard representation for logic functions, K-map representation and simplification of logic functions using K- map, Minimization of logical functions, Don't care conditions, Multiplexer, De-Multiplexer

Module – III: Combinational Circuits-II

Adders, Subtractors, Carry look ahead adder, Digital comparator, Parity checker/generator, Code converters, Priority encoders, Decoders/Drivers for display devices, Q-M method of function realization

Module – IV: Sequential Circuits

Introduction to flip-flops, SR, JK, T and D type's flip-flops, Shift registers, Conversion of flip-flops, Ring counter, Ripple (Asynchronous) counters, Synchronous counters

Module – V: Semiconductor Memories and Programmable Logic Devices

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read-only memory (ROM), ROM types, Read and write memory (RAM) types, Programmable logic array, Programmable array logic, Field Programmable Gate Array (FPGA).

TEXT BOOKS:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016

REFERENCES:

1. R.S. Sedha, “A Textbook of Digital Electronics”, S. Chand, 2005
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009

Introduction to Switching Theory and Logic Design – Fredriac J. Hill, Gerald R. Peterson, 3rd Ed,John Wiley & Sons Inc

2530Exl3: INNOVATION AND ENTREPRENEURSHIP

B.Tech. II Year I Sem.

L	T	P	C
2	0	0	2

Course Objectives:

1. To familiarize on the basic concepts of innovation, entrepreneurship and its importance.
2. To Identify and analyze the process of problem-opportunity identification, market segmentation, and idea generation techniques.
3. To initiate prototype development and understand minimum viable product.
4. To develop initial Business and financial planning and Go-to-Market strategies
5. To impart knowledge on establishing startups, venture pitching and IPR

Course Outcomes: After Completion of the Course, Students Should be able to:

1. Understand innovation concepts, types of innovations, entrepreneurial mindset, leadership attributes, and the role of entrepreneurship in economic development.
2. Analyze real-world problems, customer needs, market segmentation, competition, industry trends, and opportunity identification using structured frameworks.
3. Apply opportunity assessment techniques, market sizing methods, and prototype or MVP development practices for solution validation.
4. Develop business models, lean canvas representations, financial plans, unit economics analysis, and go-to-market strategies for startup ventures.
5. Examine startup formation processes, funding mechanisms, pitching readiness, legal frameworks, and intellectual property rights within national and international contexts.

Unit I: Fundamentals of Innovation and Entrepreneurship

Innovation: Introduction, need for innovation, Features, Types of innovations, innovations in manufacturing and service sectors, fostering a culture of innovation, planning for innovation.

Entrepreneurship: Introduction, types of entrepreneurship attributes, mindset of entrepreneurial and intrapreneurial leadership, Role of entrepreneurs in economic development. Woman Entrepreneurship, Importance of on-campus startups. Understanding to build entrepreneurial mindset, attributes and networks individuals while on campus.

Core Teaching Tool: Simulation, Game, Industry Case Studies (Personalized for students — 16 industries to choose from), Venture Activity.

Unit II: Problem and Customer Identification

Identification of gap, problem, analyzing the problem from a industry perspective, real-world problems**,** market and customer segmentation, validation of customer problem fit, Iterating problem-customer fit, Competition and Industry trends mapping and assessing initial opportunity, Porter's Five Force Model. Idea generation, Ideation techniques: Brainstorming, Brain writing, Round robin, and SCAMPER, Design thinking principles, Mapping of solution to problem.

Core Teaching Tool: Several types of activities including: Class, game, Gen AI, 'Get out of the Building' and Venture Activity.

Unit III: Opportunity assessment and Prototype development

Identify and map global competitors, review industry trends, and understand market sizing: TAM, SAM, and SOM. Assessing scope and potential scale for the opportunity.

Understanding prototyping and Minimum Viable Product (MVP). Developing a prototype: Testing, and validation.

Core Teaching Tool: Venture Activity, no-code Innovation tools, Class activity

Unit IV: Business & Financial Models

Introduction to Business Model and types, Lean Canvas Approach: 9-block lean canvas model, building lean canvas for your startup. Business planning: components of Business plan- Sales plan, People plan and financial plan, Financial Planning: Types of costs, preparing a financial plan for profitability using a financial template, understanding the basics of Unit economics, Economies of Scale and analyzing financial performance. Go-To-Market (GTM) approach – Selecting the Right Channel, creating digital presence, and building customer acquisition strategy.

Core Teaching Tool: Founder Case Studies – Sama and Securely Share; Class activity and discussions; Venture Activities.

Unit V: Startups and IPR

Startup requirements, building founding team members and mentors, pitch preparation, start-up registration process, funding opportunities and schemes, institutional support to entrepreneurs, startup lifecycle, documentation, legal aspects in startup, venture pitching readiness, National Innovation Startup Policy (NISP) and its features.

Patents, Designs, Patentability, Procedure for grants of patents. Indian Scenario of Patenting, International Scenario: International cooperation on Intellectual Property. Patent Rights: Scope of Patent Rights. Copyright, trademark, and GI. Licensing and transfer of technology.

Core Teaching Tool: Expert talks; Cases; Class activity and discussions; Venture Activities.

Suggested Readings:

1. John R Bessant, Joe Tidd, Innovation and Entrepreneurship, 4E, Wiley, Latest Edition.
2. Ajay Batra, The Stratup Launch Book- A Practical Guide for Launching Customer Centric Ventures, Wiley, 2020. (For Core Teaching Tool).
3. Entrepreneurship Development and Small Business Enterprises, Poornima M Charantimath, 3E, Pearson, 2018.
4. D.F. Kuratko and T.V. Rao, Entrepreneurship: A South-Asian Perspective, Cengage Learning, 2013.
5. Robert D. Hisrich, Michael P. Peters, Dean A. Shepherd, Sabyasachi Sinha (2020). Entrepreneurship, McGrawHill, 11th Edition.
6. NISP -Brochure inside pages - startup_policy_2019.pdf

2530277: ELECTRICAL MACHINES - I LAB

II Year B.Tech I Sem **L T P C**
0 0 2 1

Co requisite: Electrical Machines – I

Course Objectives:

- To understand and identify the procedures for performing magnetization, load, Hopkinson's, Swinburne's, and brake tests on DC machines and OC/SC tests on transformers.
- To understand and explain the magnetization characteristics, load performance, and efficiency determination of DC generators and motors.
- To develop the ability to apply test methods for determining performance curves, efficiency, and characteristics of DC machines.
- To develop skills to analyze experimental data for performance evaluation and efficiency calculations of DC machines and single-phase transformers.
- To acquire the ability to evaluate the relationships between voltages, currents, and efficiency in three-phase transformers and assess their operational correctness.

Course Outcomes: After going through this lab the student will be able to

- Identify the procedures for performing magnetization, load, Hopkinson's, Swinburne's, and brake tests on DC machines and OC/SC tests on transformers.
- Explain the magnetization, load characteristics, and efficiency predetermination methods of DC machines.
- Apply test procedures for determine the performance and efficiency of DC shunt, series, and compound machines.
- Analyze the performance curves, efficiency, and characteristics of DC machines and single-phase transformers using experimental data.
- Evaluate the relationships between voltages and currents in three-phase transformers and assess their operational correctness.

The following experiments are required to be conducted as compulsory experiments:

1. Magnetization characteristics of DC shunt generator (Determination of critical field resistance and critical speed)
2. Load test on DC shunt generator (Determination of characteristics)
3. Load test on DC series generator (Determination of characteristics)
4. Hopkinson's test on DC shunt machines (Predetermination of efficiency)
5. Swinburne's test (Predetermination of efficiency)
6. Brake test on DC compound motor (Determination of performance curves)
7. OC and SC Test on Single Phase Transformer
8. Three Phase Transformer: Verification of Relationship between Voltages and Currents (Star-Delta, Delta- Delta, Delta-star, Star-Star)

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

1. Brake Test on DC shunt motor (Determination of performance curves)
2. Load Test on DC compound generator (Determination of characteristics).
3. Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single-Phase Transformer
4. Load Test on Single Phase Transformer (Calculate Efficiency and Regulation)
5. Speed control of DC shunt motor
6. Modeling of DC Machine using simulation tools.
7. Equivalent circuit of Transformer using simulation tools.

Proposed open ended experiment:

1. Design and analysis performance of a DC Motor Drive with Chopper Control using digital Simulation.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.

A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

2530486: ELECTRONIC DEVICES & DIGITAL ELECTRONICS LABORATORY

II Year B.Tech. II – Sem. **L T P C**

0 0 2 1

Couse Overview:
This course offers hands-on experience in both analog and digital electronics through hardware and simulation-based experiments. Students will study the characteristics and applications of diodes, transistors, and amplifiers, along with the design of fundamental digital circuits. Emphasis is placed on circuit analysis, implementation, and verification using both practical and software tools.

Prerequisites: Electronic Devices and Circuits and Digital Electronics

Course Objectives: The students will try to learn

- The characteristics and applications of semiconductor devices such as diodes and transistors.
- Designing and analyzing basic rectifiers, regulators, amplifiers, and switching circuits
- Implementation and verification of digital logic functions using basic and universal logic gates
- Designing of combinational and sequential digital circuits
- Practical skills in circuit construction, testing, troubleshooting, and simulation of electronic systems.

Course Outcomes: After successful completion of the course, students shall be able to

- Analyze and interpret the characteristics of electronic devices like diodes and BJTs
- Capable of designing and evaluating rectifier, regulator, and amplifier circuits
- Demonstrate the ability to implement and simplify logic functions using various logic gates
- Design, construct, digital circuits such as adders, converters, and shift registers
- Gain hands-on proficiency in using simulation software and electronic instruments for circuit analysis and verification

List of Experiments:

PART-A: Electronic Devices and Circuits experiments

Hardware-Based Experiments:

1. Study the I–V characteristics of a PN junction diode in forward and reverse bias to determine cut-in voltage and dynamic resistance.
2. Examine the reverse bias characteristics of a Zener diode and demonstrate its application as a voltage regulator under varying conditions.
3. Design and analyze half-wave and full-wave rectifiers (center-tap) with and without capacitor filters to evaluate ripple factor and output voltage.
4. Implement clipper and clamper circuits to observe waveform shaping through positive, negative, and biased configurations.
5. Plot the input and output characteristics of a BJT in common emitter configuration to determine input/output resistance current gain.

Construct and analyze a Common Base (CB) configuration of a BJT to study input-output characteristics and determine current gain (α) and input/output resistance.

Software-Based Simulation Experiments

6. Simulate a Zener diode-based voltage regulator to study voltage stabilization against varying supply voltages.
7. Simulate a common emitter amplifier with and without emitter bypass capacitor to analyze the effect on voltage gain and signal amplification.

Hardware Requirements:

1. Regulated DC Power Supply (0–30V)
2. Function Generator
3. Digital Multimeter
4. Cathode Ray Oscilloscope (CRO) or DSO
5. Breadboards and Connecting Wires
6. Resistors, Capacitors, Diodes (1N4007, Zener Diodes)
7. BJTs (e.g., BC107, 2N2222), JFETs (e.g., J201), MOSFETs (e.g., IRF540N)
8. Trainer Kits (optional but preferred for ease)

Software Requirements (Any one of the listed tools or equivalent):

1. LTSpice (Free from Analog Devices)
2. NI Multisim (Academic License or Student Version)
3. Proteus Design Suite (Simulation and PCB Design)
4. TINA-TI (Free from Texas Instruments)
5. PSPICE for TI or OrCAD Lite
6. Windows PC or Laptop with minimum 4GB RAM and i3 processor or better

PART-B. Digital Electronics Experiments

1. Realization of Boolean Expressions using Gates
2. Design and realization logic gates using universal gates
3. Generation of clock using NAND/NOR gates
4. Design a 4 – bit Adder / Subtractor
5. Design and realization a 4 – bit gray to Binary and Binary to Gray Converter
6. Design and realization of an 8-bit parallel load and serial out shift register using flip-flops.
7. Design and realization 8x1 using 2x1 mux
8. Design and realization 4-bit comparator.

NOTE: Minimum 6 experiments to be conducted from each PART.

2530574 : DATASTRUCTURES LAB

II Year B.Tech. I – Sem.

L	T	P	C
1	0	2	2

Prerequisites:1. A Course on "Programming for problem solving".

Course Objectives:

1. It covers various concepts of C programming language
2. It introduces searching and sorting algorithms
3. It provides an understanding of data structures such as stack sand queues.

Course Outcomes:

1. Implement linear data structures (lists, stacks, and queues) **in** real-time data processing problems**.**
2. Develop tree and balanced tree operations to handle database indexing tasks**.**
3. Construct heap structures and apply searching algorithms to design memory management solutions**.**
4. Use graph representations and traversal techniques to build network path-finding applications**.**
5. Illustrate hashing and file organization methods in information storage and retrieval**.**

List of Experiments

1. Write a program that uses functions to perform the following operations on singly linked list.:
   i) Creation ii)Insertion iii)Deletion iv)Traversal
2. Write a program that uses functions to perform the following operations on doubly linked list.:
   i) Creation ii)Insertion iii)Deletion iv)Traversal
3. Write a program that uses functions to perform the following operations on circular linked list.:
   i) Creation ii)Insertion iii)Deletion iv)Traversal
4. Write a program that implement stack(its operations)using
   i) Arrays ii) ADT
5. Write a program that implement Queue (its operations) using
   i) Arrays ii) ADT
6. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
   i) Radix Sort,ii)Heapsort, iii)Shell Sort, iv)TreeSort
7. Write a program to implement the tree traversal methods(Recursive and Non-Recursive).
8. Write a program to implement
   i) Binary Search tree ii)B Trees iii)B+ Trees iv)AV L trees v) Red – Black trees
9. Write a program to implement the graph traversal methods.
10. Writea program to implement the following Hash Functions: i) Division Method, ii) Multiplication Method, iii) Mid-square Method, iv) Folding Method

TEXTBOOKS:

1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A. Forouzan, Cengage Learning.

2530576 : APPLIED PYTHON PROGRAMMING LAB

II Year B.Tech.I – Sem. **LT P C**
0 1 2 2

Course Outcomes: Up on completing this course, the students will be able to

1. Develop structured and modular Python programs in efficient problem-solving techniques.
2. Implement programs using Python's built-in data structures as lists, tuples, dictionaries, sets for data storage and manipulation tasks.
3. Illustrate the use of Python libraries and modules through experiments in scientific and business applications.
4. Develop programs incorporating file handling, exception handling, and object-oriented features in robust software solutions.
5. Construct Python-based applications for automation, data processing, and real-world problem-solving.

LIST OF EXPERIMENTS:

Cycle-1

1. Downloading and Installing Python and Required Modules

a) Python 3 on Linux

Follow the instructions given at:

- https://docs.python-guide.org/starting/install3/linux/

b) Python 3 on Windows

Follow the instructions given at:

- https://docs.python.org/3/using/windows.html
  (Please remember that installation of Python on Windows is comparatively harder.)

c) pip3 on Windows and Linux

Install the Python package installer by following the instructions at:

- https://www.activestate.com/resources/quick-reads/how-to-install-and-use-pip3/

d) Installing NumPy and SciPy

You can install any Python 3 package using the command:

pip3 install <package-name>

e) Installing Jupyter Lab

Install from pip using the command:

pip install jupyter lab

2. Introduction to Python 3

1. Printing your bio-data on the screen.
2. Printing all the prime numbers less than a given number.
3. Finding all the factors of a number and showing whether it is a perfect number (i.e., the sum of all its factors excluding the number itself is equal to the number)

3. Defining and Using Functions

1. Write a function to read data from a file and display it on the screen.
2. Define a Boolean function isPalindrome(<input>).
3. Write a function collatz(x) which performs the following:
    - If x is odd, x = 3x + 1
    - If x is even, x = x / 2
    - Return the number of steps it takes for x to become 1.
4. Write a function $N(m, s) = \frac{e^{-(x-m)^2/(2s^2)}}{\sqrt{2\pi s^2}}$ that computes the normal distribution

4. The Package NumPy

1. Create a matrix of given order $m \times n$ containing random numbers in the range 1 to 99,999.
2. Write a program that adds, subtracts, and multiplies two matrices. Provide an interface such that, based on user input, the required operation (addition, subtraction, multiplication) is performed.
3. Write a program to solve a system of n linear equations in n variables using matrix inverse.

5. The Packages SciPy and PyPlot

1. Finding whether two sets of data have the same mean value.
2. Plotting data read from a file.
3. Fitting a function through a set of data points using the polyfit() function.
4. Plotting a histogram of a given dataset.

6. The Strings Package

1. Read text from a file and print the number of lines, words, and characters.
2. Read text from a file and return a list of all n-letter words beginning with a vowel.

Cycle – 2

7. Installing OS on Raspberry Pi

1. Installation using Raspberry Pi Imager.
2. Installation using an image file:
    - Downloading an image
    - Writing the image to an SD card
    - Using Linux

- Using Windows
- Booting up

Follow the instructions given at:

- https://www.raspberrypi.com/documentation/computers/getting-started.html

8. Accessing GPIO Pins Using Python

a) Installing GPIO Zero Library

First, update the repository list:

sudo apt update Then install the package for Python 3:
sudo apt install python3-gpiozero

b) Blinking an LED connected to one of the GPIO pins.

c) Adjusting the brightness of an LED.

d) Adjusting the brightness of an LED (0 to 100, where 100 indicates maximum brightness) using the in-built PWM waveform.

9. Collecting Sensor Data

a) DHT Sensor Interface

- Connect the terminals of the DHT sensor to the GPIO pins of the Raspberry Pi.
- Import the DHT library using:

import Adafruit_DHT

- Read sensor data and display it on the screen.

3. Finding a secret message hidden in a paragraph

2530021: ENVIRONMENTAL SCIENCE

B.Tech. II Year I SEM.

L	T	P	C
1	0	0	1

Course Objectives:

- Understanding the importance of ecological balance for sustainable development.
- Understanding the impacts of developmental activities and mitigation measures.
- Understanding the environmental policies and regulations
- Understanding the importance of natural resources
- Understanding the different standards of environmental pollution

Course Outcomes: Based on this course, the Engineering graduate will

- Understand the technologies on the basis of ecological principles
- Apply the environmental regulations which in turn helps in sustainable development.
- Understand the various classifications of ecosystems and natural resources.
- Apply environmental regulations to different acts.
- Evaluate the values of social, ethical and aesthetic.

UNIT-I

Ecosystems: Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains, food webs, and ecological pyramids. Flow of energy, Biogeochemical cycles, Bioaccumulation, Biomagnification, Field visits.

UNIT-II

Natural Resources: Classification of Resources: Living and Non-Living resources, **water resources:** use and over utilization of surface and ground water, floods and droughts, Dams: benefits and problems. **Mineral resources:** use and exploitation, environmental effects of extracting and using mineral resources, **Land resources:** Forest resources, **Energy resources:** growing energy needs, renewable and non renewable energy sources, use of alternate energy source, case studies.

UNIT-III

Biodiversity And Biotic Resources: Introduction, Definition, genetic, species and ecosystemdiversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Field visit. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act.

UNIT-IV

Environmental Pollution and Control Technologies: Environmental Pollution: Classification of pollution, **Air Pollution:** Primary and secondary pollutants, Automobile and Industrial pollution, Ambient air quality standards. **Water pollution:** Sources and types of pollution, drinking water quality standards. **Soil Pollution:** Sources and types, Impacts of modern agriculture, degradation of soil. **Noise Pollution:** Sources and Health hazards, standards, **Solid waste:** Municipal Solid Waste management, composition and characteristics of e-Waste and its management. **Pollution control technologies:** Waste water Treatment methods: Primary, secondary and Tertiary. Overview of air pollution control technologies, Concepts of bioremediation. **Global Environmental Issues and Global Efforts: C**limate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. NAPCC-GoI Initiatives.

UNIT-V

Environmental Policy, Legislation & EIA: Environmental Protection act, Legal aspectsAir Act- 1981, Water Act, Forest Act, Wild life Act, Municipal solid waste management and handling rules, biomedical waste management and handling rules, hazardous waste management and handling rules. EIA: EIA structure, methods of baseline data acquisition. Overview on Impacts of air, water, biological and Socio-economical aspects. Concepts of Environmental Management Plan (EMP). **Towards Sustainable Future:** Concept of Sustainable Development Goals, Population and its explosion, Crazy Consumerism, Environmental Education, Urban Sprawl, Human health, Environmental Ethics, Concept of Green Building.

Learning Outcomes:

- Understand the importance of Environmental Policy, Legislation.
- Explain the various acts.
- Apply to different Environmental Management Plan.
- Analyse the importance of environmental education.
- Evaluate the value of green building.

TEXT BOOKS:

1 Textbook of Environmental Studies for Undergraduate Courses by Erach Bharucha for University Grants Commission.

2 Environmental Studies by R. Rajagopalan, Oxford University Press.

REFERENCE BOOKS:

1. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
2. Environmental Engineering and science by Gilbert M. Masters and Wendell P. Ela. 2008 PHI Learning Pvt. Ltd.

Environmental Studies by Anubha Kaushik, 4th Edition, New age international publishers.

II-II

2540003: NUMERICAL METHODS AND COMPLEX VARIABLES

II Year B.Tech. II Sem

L	T	P	C
3	0	0	3

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: The student will try to learn

- Various numerical methods to find roots of polynomial and transcendental equations and to estimate the value for the given data using interpolation.
- Evaluation of derivatives and integrals using numerical techniques and solving ordinary differential equations of first order using numerical techniques.
- The Fourier series Expansion and Bessel's functions.
- Differentiation and integration of complex valued functions.
- Evaluation of integrals using Cauchy's integral formula and Cauchy's residue theorem and Expansion of complex functions using Taylor's and Laurent's series.

Course Outcomes: After learning the contents of this paper the student must be able to

CO1: Find the root of a given Algebraic and transcendental equations and estimate the value for the given data using interpolation.

CO2: Apply the concept of numerical integration and differentiation to the real-world problems and find the solutions for a given first order ODE's.

CO3: Understand the various Properties of curves through Fourier series expansions.

CO4: Analyze the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems

CO5: Apply the Cauchy's residue theorem for various integrals and write the Taylor's and Laurent's series expansions for complex function.

UNIT-I: Numerical Methods-I

Solution of polynomial and transcendental equations: Bisection method, Iteration Method, Newton-Raphson method and Regula-Falsi method. Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae, Lagrange's method of interpolation.

UNIT-II: Numerical Methods-II

Numerical integration: Trapezoidal rule and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.

Ordinary differential equations: Taylor's series, Picard's method, Euler method, Runge-Kutta method of fourth order for first order ODE

UNIT-III: Fourier series and Fourier Transforms

Fourier series – Dirichlet's Conditions – Half-range Fourier series – Fourier Transforms: Fourier Integral Theorem (Only statements), Fourier Sine and Cosine transforms (Elementary illustrations)

UNIT-IV: Complex Differentiation

Limit, Continuity and Differentiation of Complex functions. Cauchy-Riemann equations (without proof), Milne Thomson methods, analytic functions, harmonic functions, finding harmonic conjugate, Elementary analytic function (exponential, trigonometric, logarithm) and their properties.

UNIT-V: Complex Integration

Line integrals, Cauchy's theorem, Cauchy's Integral formula, zeros of analytic functions, singularities, Taylor's series, Laurent's series, Residues, Cauchy Residue theorem and their properties (all theorems without proof).

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
2. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI, 4th Edition, 2005.

REFERENCEBOOKS:

1. Murray R. Spiegel, Ph.D., Seymour Lipschutz, Ph.D., John J. Schiller, Ph.D., Dennis Spellman, Ph.D., Complex Variables (Schaum's outline).
2. M. K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computations, New Age International Publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.J. W. Brown and R.V. Churchill, Complex Variables and Applications, 7th Edition, MC-Graw Hill, 2004.

2540227: ELECTRICAL MACHINES - II

II Year B.Tech II Sem **L T P C**
3 0 0 3

Prerequisite: Electrical Circuits-I &II and Electrical Machines –I

Course Objectives:

- To understand the construction, operation, torque characteristics, and performance parameters **of** three-phase induction motors.
- To study the equivalent circuit, performance characteristics, starting methods, speed control, and induction generator principle**.**
- To understand the construction, armature windings, EMF equation, harmonics, armature reaction, and synchronous reactance of synchronous generators**.**
- To study regulation methods, phasor diagrams, and parallel operation of synchronous generators**, i**ncluding load sharing and excitation effects**.**

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

- Apply their knowledge to the operation, torque, and performance of cage and wound rotor induction machines**.**
- Examine the performance, starting, and speed control methods of induction machines**.**
- Evaluate the operation, EMF, and phasor characteristics of synchronous generators**.**
- Analyze the regulation, parallel operation, and load sharing of synchronous generators.
- Explain the operation, performance, and applications of synchronous motors and single-phase machines**.**

MODULE-I

Three Phase Induction Machines: Constructional details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor EMF and rotor frequency - rotor reactance, rotor current and Power factor at standstill and during operation. Rotor power input, rotor copper loss and mechanical power developed and their inter relation. Torque equation-expressions for maximum torque and starting torque –torque-slip characteristics.

MODULE-II

Characteristics of Induction Machines: Equivalent circuit - phasor diagram - crawling and cogging, No-load Test and Blocked rotor test –Predetermination of performance-Methods of starting and starting current and Torque calculations, Applications.

Speed Control Methods: Change of voltage, change of frequency, voltage/frequency, injection of an EMF into rotor circuit (qualitative treatment only)-induction generator-principle of operation.

MODULE-III

Synchronous Generator (Alternator): Constructional Features of round rotor and salient pole machines –Armature windings – Integral slot and fractional slot windings; Distributed and concentrated windings –distribution, pitch and winding factors – EMF Equation. Harmonics in generated EMF – suppression of harmonics – armature reaction - leakage reactance – synchronous reactance and impedance – phasordiagram – load characteristics.

MODULE-IV

Regulation of Synchronous Generator: Synchronous impedance method, MMF method, ZPF method and ASA methods – two reaction theory– Determination of Xd and Xq (Slip test) Phasor diagrams – Regulation of salient pole alternators. Parallel Operation of Synchronous Generator: Synchronizing Alternators with infinite bus bars – synchronizing power torque – parallel operation and load sharing - Effect of change of excitation and mechanical power input.

MODULE-V

Synchronous Motors: Theory of operation – phasor diagram – Variation of current and power factor with excitation – synchronous condenser – Mathematical analysis for power developed. Hunting and its suppression – Methods of starting.

Single Phase Machines: Single phase induction motor – Constructional Features-Double revolving field theory – split-phase motors – AC series motor- Universal Motor- Shaded pole motor and Applications.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwiraj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.

A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

2540228: POWER SYSTEMS-II

II Year B.Tech II Sem **L T P C**

3 0 0 3

Prerequisite: Electrical Circuits-I & II and Power Systems–I

Course Objectives:

- **To u***nderstand* the concepts of overhead transmission lines, line parameters, and insulator performance.
- **To e***xplain* the performance characteristics of transmission lines under different loading and line length conditions.
- **To d***escribe* the phenomena of corona, the methods of voltage control and compensation in power systems.
- *To illustrate* the use of per-unit quantities and travelling wave phenomena in transmission line studies.
- **To d***evelop* the ability to compute fault currents using symmetrical component analysis for different types of faults.

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

- Calculate transmission line parameters such as inductance and capacitance considering conductor configuration, GMR, GMD, and earth effects.
- Analyze the performance of short, medium, and long transmission lines using equivalent circuit models.
- Examine corona effects, voltage control methods, and power factor improvement techniques in power transmission systems.
- Apply per-unit representation and travelling wave concepts to power system analysis.
- Determine symmetrical components and fault currents for various fault conditions in power systems.

MODULE-I

Overhead Transmission Lines: Line conductors, Composite conductors transposition, bundled conductors, Inductance and capacitance of single phase and three phase lines with symmetrical spacing, and effect of earth on capacitance, skin and proximity effects.

Overhead Line Insulators: Introduction, types of insulators, Potential distribution over a string of suspension insulators, Methods of equalizing the potential, testing of insulators, Sag and Tension calculations.

MODULE-II

Performance of Lines: Representation of lines, short transmission lines, medium length lines, nominal T and PI- representations, long transmission lines. The equivalent circuit representation of along Line, A, B, C, and D constants, Ferranti Effect.

Corona: Introduction, disruptive critical voltage, corona loss, Factors affecting corona loss and methods of reducing corona loss, Advantages and Disadvantages of corona, interference between power and Communication lines.

MODULE-III

Voltage Control & Power Factor Improvement: Introduction – methods of voltage control, shunt and series capacitors / Inductors, tap changing transformers, synchronous phase modifiers, power factor improvement methods.

Compensation in Power Systems: Introduction - Concepts of Load compensation —Load ability characteristics of overhead lines – Uncompensated transmission line – Symmetrical line.

MODULE-IV

Per Unit Representation of Power Systems: The one-line diagram, impedance and reactance diagrams, per unit quantities, changing the base of per unit quantities, advantages of per unit system.

Travelling Waves on Transmission Lines: Production of travelling waves, open circuited line, short-circuited line, line terminated through a resistance, line connected to a cable, Reflection and Refraction coefficients.

MODULE-V

Symmetrical Components and Fault Calculations: Significance of positive, negative and zero sequence components, Average 3-phase power in terms of symmetrical components, sequence impedances and sequence networks, fault calculations, sequence network equations, single line to ground fault, line to line fault, double line to ground fault, three phase fault, faults on power systems, faults with fault impedance, reactors and their location, short circuit capacity of a bus.

TEXT BOOKS:

1. C.L.Wadhwa, "Generation, Distribution and Utilization of ElectricalEnergy",3rdEdition, New Age International, 2009.
2. D.P. Kothari and I.J.Nagrath, "Modern Power System Analysis", Tata Mc Graw Hill Pub.Co., New Delhi, Fourth edition, 2011.

REFERENCE BOOKS:

1. A.Chakrabarti, M.L. Soni, P.V. Gupta, U.S. Bhatnagar, "ATextbook on Power System Engineering", Dhanpat Rai Publishing Company (P) Ltd, 2008.
2. W.D.Stevenson, "Elements of Power System Analysis", 4th Edition, Mc Graw Hill, 1984.
3. John J.Grainger &W.D.Stevenson, "Power System Analysis", Mc Graw Hill International, 1994.
4. Hadi Sadat, "Power System Analysis", Tata Mc Graw Hill Pub.Co. 2002.

Online Recourses:

1. https://nptel.ac.in/courses/108/102/108102047/
2. https://nptel.ac.in/courses/108/107/108107112/

2540229: CONTROL SYSTEMS

II Year B.Tech II Sem **L T P C**
3 0 0 3

Prerequisite: Electrical Engineering

Course Objectives:

- To understand the fundamental concepts of control systems, including open-loop and closed-loop systems, feedback, and its effects on system performance.
- To mathematically model physical systems and analyze them using transfer functions, block diagrams, and signal flow graphs.
- To analyze the dynamic behavior of systems in both time and frequency domains, including stability assessment and system performance evaluation.
- To design and implement classical controllers such as P, PI, PD, and PID controllers, as well as compensators like lead, lag, and lead-lag.
- To apply state-space techniques for modeling, solving state equations, and analyzing controllability and observability of dynamic systems.

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

- Model mechanical and electrical systems mathematically using transfer function and state-space approaches.
- Analyze transient and steady-state response of first and second-order systems and assess their performance in time domain.
- Evaluate system stability and relative stability using Routh-Hurwitz, Root Locus, Bode, Nyquist, and polar plot techniques.
- Design classical controllers and compensators meeting desired system specifications.
- Determine complete system response, controllability, and observability of systems using state-space techniques.

MODULE-I

Mathematical modelling of physical systems: Open – loop and Closed loop Systems, Concept of Feedback Control, Benefits of Feedback and Effects of feedback, Linear, Non-Linear, Time Variant and Time Invariant systems, Mechanical and Electrical Systems. Transfer function, Block-Diagram Techniques, Signal flow graph, Controller Components: DC Servo motors, AC Servomotors, Synchro's.

MODULE-II

Time-Domain Analysis with Input-Output Models: Time response of first and second order systems for standard test inputs. Analysis of standard Second order systems with step input, Types of System, Error Analysis for Linear time Invariant Systems, Design specifications for second-order systems based on the time response. Concept of Stability: Routh-Hurwitz Criteria. Relative Stability analysis, Root-Locus technique: Construction of Root-loci.

MODULE-III

Frequency Domain Analysis: Introduction to frequency response, Relationship between time and frequency response, Concept of Bode plots and construction. Polar plots, Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin

MODULE-IV

Classical Controllers and Compensators: Proportional, Integral and Derivative Controllers- PI, PD and PID controllers, Lead, Lag and Lead-Lag compensators (elementary treatment only).

MODULE-V

State Variable Analysis: Concept of State, State variables and State model. State Representation, Transformation of State variables, Solution of state equations and Complete response of the Systems. Concept of controllability and observability.

TEXT BOOKS:

1. I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.
2. B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.
3. Norman S Nise, "Control Systems Engineering", Wiley, 2019 8th Edition.

REFERENCE BOOKS:

1. K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.
2. K. R. Varmah, "Control Systems", McGraw Hill Education, 2010.

Online Recourses:

1. https://www.controleng.com
2. https://www.mathworks.com
3. https://nptel.ac.in/courses/108/102/108102043

2540226: ELECTRICAL MEASUREMENTS AND SENSORS/DIGITAL ELECTRONICS

II Year B.Tech II Sem **L T P C**

3 0 0 3

Prerequisite: Electrical Circuits-I & II, Analog Electronics and Electromagnetic Fields.

Course Objectives:

- To understand the working principles of various analog measuring instruments and their torque mechanisms.
- To learn the operation and applications of potentiometers and instrument transformers for accurate measurements.
- To analyze the methods of measuring electrical power and energy using different types of meters.
- To evaluate the performance of DC and AC bridges for measuring resistance, inductance, and capacitance.
- To explore various sensors and smart instrument technologies used in modern measurement systems.

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

- Explain the operation and torque mechanisms of analog measuring instruments.
- Describe the principles and applications of potentiometers and instrument transformers.
- Apply methods for measuring electrical power and energy using wattmeter and energy meter.
- Compare different bridge circuits used for measuring resistance, inductance, and capacitance.
- Identify various sensors and smart instrument systems used in modern measurement applications.

MODULE-I

Introduction to Measuring Instruments: Classification – deflecting, control and damping torques – Ammeters and Voltmeters – PMMC, moving iron type instruments – expression for the deflecting torque and control torque – Errors and compensations, extension of range using shunts and series resistance. Electrostatic Voltmeters-electrometer type and attracted disc type – extension of range of Electrostatic Voltmeters.

MODULE-II

Potentiometers & Instrument Transformers: Principle and operation of DC Crompton's potentiometer – standardization – Measurement of unknown resistance, current, voltage. AC Potentiometers: polar and coordinate type's standardization – applications. CT and PT – Ratio and phase angle errors (Qualitative approach).

MODULE-III

Measurement of Power & Energy: Single phase dynamometer wattmeter, LPF and UPF, Double element and three element dynamometer wattmeter, expression for deflecting and control torques – Extension of range of wattmeter using instrument transformers – Measurement of active and reactive powers in balanced and unbalanced systems. Single phase induction type energy meter – driving and braking torques – errors and compensations – testing by phantom loading using RSS meter. Three phase energy meter – trivector meter, maximum demand meters and net metering.

MODULE-IV

DC & AC Bridges: Method of measuring low, medium and high resistance – sensitivity of Wheat-stone's bridge – Kelvin's double bridge for measuring low resistance, measurement of high resistance – loss of charge method. Measurement of inductance- Maxwell's bridge, Hay's bridge, Anderson's bridge. Measurement of capacitance and loss angle –De Sauty's Bridge - Wien's bridge – Schering Bridge. (Qualitative approach)

MODULE-V

Sensors- Classification of transducers- Temperature sensors- Proximity sensor- Pressure sensor- IR sensors- Motion detection sensors- Ultrasonic sensors- Rotor Position Sensors, Operation of Strain Gauge- Thermocouples, construction and working of LVDT, Piezo electric transducers, photovoltaic, photo conductive cells, and photo diodes-Applications. Smart instruments: Intelligent transducer, self-diagnosis and remote calibration features, HART communication, MEMS, non-linearity compensation; smart energy meter components, working principle; Automatic Meter Reading (AMR), Advanced Metering Infrastructure (AMI) environments.

TEXT BOOKS:

1. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co. Publications, 2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCE BOOKS:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

Online Recourses:

1. https://nptel.ac.in/courses/108/105/108105153/
2. https://www.cdac.in/index.aspx?id=pe_pe_PEG_SMARTENERGY

2540075: COMPUTATIONAL MATHEMATICS LAB

II Year B.Tech. II Sem

L	T	P	C
0	0	2	1

Pre-requisites: Matrices, Ite ratite methods and ordinary differential equations

Course Objectives: By the end of this course, students will be able to:

- Understand the mathematical foundations of numerical methods used for solving systems of equations, root-finding, and differential equations. Also, apply computational tools (Python and relevant libraries) to model, analyze, and solve scientific and engineering problems.
- Develop programs that implement standard numerical algorithms such as LU decomposition, Bisection, and Newton–Raphson methods.
- Analyze and interpret eigenvalue and eigenvector computations for system stability and physical modeling.
- Model real-world phenomena (e.g., population growth, drug decay, cooling, and radioactive decay) using exponential and differential equations.
- Formulate, verify, and solve both exact and non-exact differential equations symbolically and numerically using Python.

Course Outcomes: After completing the experiments, students will be able to:

CO1: Solve non-homogeneous linear systems using LU decomposition and interpret the computational results.

CO2: Compute real and complex eigenvalues and eigenvectors of matrices using Python.

CO3: Apply Bisection and Newton–Raphson methods to determine roots of nonlinear equations with specified accuracy.

CO4: Identify, verify, and solve exact and non-exact differential equations symbolically and numerically. Also, implement homogeneous and non-homogeneous linear ordinary differential equations using analytical and numerical techniques.

CO5: Model and simulate natural processes such as population growth, drug decay, and radioactive half-life using exponential functions and estimate parameters like the cooling constant in Newton's law of cooling and predict system behavior over time.

List of Experiments:

Week-1: Solve a non-homogeneous linear system using LU decomposition in Python.
Input: matrix A and right-hand side vector b.
Output: solution vector x, and the L and U factors (with pivoting if needed).

Week-2: Write a general Python program that accepts a square matrix from the user and returns its eigenvalues (including complex values when they occur).
Input: square matrix.
Output: list of eigenvalues (real and complex).

Week-3: Implement computational tools in Python to compute eigenvectors for a given square matrix.
Input: square matrix (and optionally selected eigenvalues).
Output: corresponding eigenvectors (normalized or not, as specified).

Week-4: Implement the Bisection method in Python to find a root of any continuous function on a given interval.
Input: function f, interval [a, b] with $f(a)f(b) < 0$, tolerance, and max iterations.
Output: approximate root and iteration info.

Week-5: Implement the Newton–Raphson method in Python to find a root of any differentiable function.
Input: function f, its derivative f', initial guess x0, tolerance, and max iterations.
Output: approximate root and iteration info.

Week-6: Detect and solve exact differential equations in Python.
Input: first-order differential equation M(x,y) + N(x,y) y' = 0.
Output: determine if the equation is exact; if so, provide the general solution (implicit or explicit).

Week-7: Solve non-exact first-order differential equations in Python by finding and applying an integrating factor when possible.
Input: M(x,y) + N(x,y) y' = 0.
Output: integrating factor (if found) and the general solution.

Week-8: Write a Python program that models exponential processes, such as population growth, drug decay in blood, or radioactive decay.
Input: model parameters (initial value, rate or half-life, time span).
Output: time series (table or plot) and parameter estimates where applicable.

Week-9: Compute the cooling constant k from two temperature measurements and predict future temperature using Newton's law of cooling in Python.
Input: ambient temperature, two measurements
Output: estimated k and predicted temperature for requested times.

Week-10: Derive and solve homogeneous linear ordinary differential equations in Python.
Input: linear ODE with constant coefficients (specify order).
Output: general solution (analytic where possible) and particular initial/boundary value solutions.

Week-11: Solve non-homogeneous linear ordinary differential equations with constant coefficients in Python.
Input: Linear ODE with constant coefficients and a non-homogeneous term, including initial or boundary conditions if provided.
Output: general solution and particular solution; numeric solution if analytic form is not available.

Week-12: Solve non-homogeneous linear ordinary differential equations with variable coefficients in Python.
Input: Linear ODE with variable coefficients and a non-homogeneous term, including initial or boundary conditions if provided.
Output: general solution and particular solution; numeric solution if analytic form is not available.

Open Ended Experiments:

Week-13: Solve a System of Linear Equations using the Gauss–Jordan Elimination Method in Python
Input: Coefficient matrix *A*and right-hand side vector *b*.
Output: Solution vector *x*; reduced row echelon form of the augmented matrix; verification of results using built-in functions (if desired).

Week-14: Solve a System of Linear Equations using the Gauss–Seidel Iterative Method in Python
Input: Coefficient matrix *A*, right-hand side vector *b*, initial guess x_0, tolerance, and maximum number of iterations.
Output: Approximate solution vector *x*and number of iterations required for convergence.

TEXTBOOKS:

1. KennethA .Lambert,The fundamentals of Python:First Programs,2011,Cengage Learnings.
2. Think Python First Edition,by Allen B.Downey,Orielly publishing.
3. Introduction to Python Programming ,William Mitchell ,Povel Solin, Martin Novaketal .,NC Lab Public Computing, 2012.
4. Introduction to Python Programming, ©JacobFredslund,2007.

REFERENCEBOOKS:

1. An Introduction to Python, JohnC.Lusth,The University of Alabama,2011.
2. IntroductiontoPython,©DaveKuhlman,2008.

2540280: ELECTRICAL MACHINES-II LAB

II Year B.Tech II Sem **L T P C**

0 0 2 1

Prerequisite: Electrical Machines – I

Course Objectives:

- To understand procedures for O.C. and S.C. tests, Sumpner's test, heat run test, parallel operation, vector grouping, Scott connection, and loss separation tests on transformers.
- To understand operating principles, equivalent circuits, regulation methods, losses, and efficiency of transformers, induction motors, alternators, and synchronous machines.
- To apply experimental methods for determining efficiency, regulation, reactances, sequence impedance, and performance characteristics of electrical machines.
- To analyze experimental data for evaluating losses, efficiency, voltage regulation, and operating characteristics of transformers and rotating machines.
- To evaluate operational behavior and performance of transformers, induction motors, alternators, and synchronous motors under various test conditions.

Course Outcomes: After completion of this course the student is able to

- To understand test procedures for transformers, induction motors, alternators, and synchronous motors.
- To apply experimental techniques for obtaining efficiency, regulation, reactances, and equivalent circuit parameters of electrical machines.
- To analyze experimental results for determining losses, efficiency, voltage regulation, and operating characteristics.
- To evaluate performance and operational correctness of transformers and electrical machines using experimental results.
- To correlate theoretical concepts with practical performance of transformers and electrical machines.

The following experiments are required to be conducted as compulsory experiments:

1. O.C. & S.C. Tests on Single phase Transformer
2. Sumpner's test on a pair of single-phase transformers
3. No-load & Blocked rotor tests on three phase Induction motor
4. Regulation of a three –phase alternator by synchronous impedance & m.m.f. methods
5. V and Inverted V curves of a three—phase synchronous motor.
6. Equivalent Circuit of a single-phase induction motor
7. Determination of Xd and Xq of a salient pole synchronous machine
8. Load test on three phase Induction Motor

In addition to the above experiments, at least any two of the following experiments are required to be conducted from the following list:

9. Separation of core losses of a single-phase transformer
10. Efficiency of a three-phase alternator
11. Parallel operation of Single-phase Transformers
12. Regulation of three-phase alternator by Z.P.F. and A.S.A methods
13. Heat run test on a bank of 3 Nos. of single-phase Delta connected transformers
14. Measurement of sequence impedance of a three-phase alternator.

15. Vector grouping of Three Transformer
16. Scott Connection of transformer

Proposed open ended experiments:

1. Verification of torque-speed behavior of an electric motor under varying load conditions using digital simulation.

TEXT BOOKS:

1. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
2. I.J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.

REFERENCE BOOKS:

1. Prithwi raj Purkait, Indrayudh Bandyopadhyay, “Electrical Machines”, Oxford, 2017.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. A. E. Fitzgerald and C. Kingsley, "Electric Machinery”, New York, McGraw Hill Education, 2013.

A. E. Clayton and N. N. Hancock, “Performance and design of DC machines”, CBS Publishers, 2004.

2540281: CONTROL SYSTEMS LAB

II Year B.Tech EEE–II Sem **L T P C**

0 0 2 1

Co requisite: Control systems

Course Objectives:

- To understand the dynamic behavior of first- and second-order systems using time-domain analysis and experimental observations.
- To study and analyze the characteristics of DC and AC servo motors, DC generators, and synchros for practical control applications.
- To design, implement, and analyze classical controllers (P, PI, PD, PID) and compensators (lead, lag, lead-lag) using experimental and simulation techniques.
- To perform stability analysis of linear time-invariant systems using frequency-domain and simulation tools (Bode, Root Locus, Nyquist).
- To model systems in state-space form, analyze multi-variable system behavior, and apply programmable logic controllers for simple control applications.

Course Outcomes: After completion of this course the student is able to

- Analyze time response of first- and second-order systems and interpret transient and steady-state behavior.
- Evaluate characteristics of DC/AC servo motors, DC generators, and synchros for control and instrumentation applications.
- Design classical controllers (P, PI, PD, PID) and compensators (lead, lag, lead-lag) for improved system performance.
- Assess system stability using Bode plots, Root Locus, and Nyquist criteria through simulation tools.
- Model systems in state-space form and implement basic logic control using programmable logic controllers (PLC).

The following experiments are required to be conducted compulsory experiments:

1. Time response of Second order system
2. Characteristics of Synchro's
3. Characteristics of AC servo motor
4. Transfer function of DC motor
5. Transfer function of DC generator
6. Lag and lead compensation – Magnitude and phase plot
7. Stability analysis (Bode, Root Locus, Nyquist) of Linear Time Invariant system using digital simulation.
8. State space model for classical transfer function using digital simulation.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

1. Effect of feedback on DC servo motor
2. Temperature controller using PID
3. Effect of P, PD, PI, PID Controller on a second order systems
4. (a) Simulation of P, PI, PID Controller.
   (b) Linear system analysis (Time domain analysis, Error analysis) using suitable software
5. Programmable logic controller – Study and verification of truth tables of logic gates, simple Boolean expressions, and application of speed control of motor.

6. Design of Lead-Lag compensator for the given system and with specification using suitable software

Proposed open ended experiments:

1. Lead-Lag Compensator Design for EV Motor Drive using digital simulation.

TEXT BOOKS:

1. M. Gopal, “Control Systems: Principles and Design”, McGraw Hill Education, 1997.
2. B. C. Kuo, “Automatic Control System”, Prentice Hall, 1995.

REFERENCE BOOKS:

1. K. Ogata, “Modern Control Engineering”, Prentice Hall, 1991.

I. J. Nagrath and M. Gopal, “Control Systems Engineering”, New Age International, 2009.

2540278: ELECTRICAL MEASUREMENTS AND SENSORS LAB

II Year B.Tech II Sem **L T P C**

0 0 2 1

Co requisite: Electrical Measurements and Sensors

Course Objectives:

- To understand the working principles of various analog measuring instruments and their torque mechanisms.
- To learn the operation and applications of potentiometers and instrument transformers for accurate measurements.
- To analyze the methods of measuring electrical power and energy using different types of meters.
- To evaluate the performance of DC and AC bridges for measuring resistance, inductance, and capacitance.
- To explore various sensors and smart instrument technologies used in modern measurement systems.

Course Outcomes: After completion of this course the student is able to

- Explain the operation and torque mechanisms of analog measuring instruments.
- Describe the principles and applications of potentiometers and instrument transformers.
- Apply methods for measuring electrical power and energy using wattmeter and energy meter.
- Compare different bridge circuits used for measuring resistance, inductance, and capacitance.
- Identify various sensors and smart instrument systems used in modern measurement applications.

The following experiments are required to be conducted as compulsory experiments:

1. Calibration and testing of single-phase energy Meter.
2. Calibration of dynamometer power factor meter.
3. Crompton DC Potentiometer – Calibration of PMMC ammeter and PMMC voltmeter.
4. Kelvin's double Bridge – Measurement of resistance – Determination of Tolerance.
5. Dielectric testing of oil using HT Testing Kit.
6. Schering Bridge & Anderson Bridge.
7. Measurement of 3 - Phase reactive power with single-phase wattmeter.
8. Measurement of displacement with the help of LVDT.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted:

1. Calibration LPF wattmeter – by Phantom testing.
2. Measurement of 3-phase power with single watt meter and two CTs.
3. C.T. testing using mutual Inductor – Measurement of % ratio error and phase angle of given CT by Null method.
4. PT testing by comparison – V. G. as Null detector – Measurement of % ratio error and phase angle of the given PT
5. Resistance strain gauge – strain measurements and Calibration.
6. Transformer turns ratio measurement using AC bridges.
7. Measurement of % ratio error and phase angle of given CT by comparison.
8. Demonstration of different sensors using trainer kit

Proposed open ended experiments:

1. Measurement of wheel speed in an Electric Vehicle using a Proximity Sensor by Digital Simulation.

TEXT BOOKS:

1. A. K. Sawhney, "Electrical & Electronic Measurement & Instruments", Dhanpat Rai & Co.Publications, 2005.
2. Dr. Rajendra Prasad, "Electrical Measurements & Measuring Instruments", Khanna Publishers 1989.

REFERENCE BOOKS:

1. G. K. Banerjee, "Electrical and Electronic Measurements", PHI Learning Pvt. Ltd., 2nd Edition, 2016.
2. R. K. Rajput, "Electrical & Electronic Measurement & Instrumentation", S. Chand and Company Ltd., 2007.
3. S. C. Bhargava, "Electrical Measuring Instruments and Measurements", BS Publications, 2012.
4. Buckingham and Price, "Electrical Measurements", Prentice – Hall, 1988.
5. Reissland, M. U, "Electrical Measurements: Fundamentals, Concepts, Applications", New Age International (P) Limited Publishers, 1st Edition 2010.
6. E.W. Golding and F. C. Widdis, "Electrical Measurements and measuring Instruments", fifth Edition, Wheeler Publishing, 2011.

2540487: PCB DESIGN

II Year B.Tech. EEE II – Sem.	**L**	**T**	**P**	**C**
	0	**0**	**2**	**1**

Couse Overview:
This course provides a comprehensive introduction to Printed Circuit Board (PCB) design, covering schematic creation, component placement, routing, and fabrication processes. Students will gain practical experience using industry-standard EDA tools for PCB development. The course culminates in a mini-project where students design, assemble, and test a functional PCB circuit.

Prerequisites: Basic knowledge of electronic components, circuit theory, and digital/analog electronics.

Course Objectives:
The students will try to learn

- The basics of PCB types, materials, and design standards
- Gain hands-on experience with PCB layout software tools
- Skills in schematic capture, component placement, routing, and Gerber generation
- Fabrication and testing a simple single-layer PCB
- Designing, assembling, and troubleshooting complete electronic circuits through practical PCB design projects

Course Outcomes:
After successful completion of the course, students shall be able to

- Understand the design and fabrication process of PCBs
- Design schematic diagrams and convert them to PCB layouts
- Apply routing and layout techniques using EDA tools
- Generate Gerber files and perform DRC/ERC effectively
- Fabricate, assemble, and test basic single-layer PCBs

Module I: Fundamentals of PCB Design

- Types of PCBs: Single-layer, Double-layer, Multilayer
- PCB materials and manufacturing process
- PCB design rules and standards (IPC standards)
- Introduction to EDA tools (e.g., KiCad, Eagle, Altium, EasyEDA)

Lab Activity:

- Exploring the user interface of PCB design software
- Setting up design rules

Module II: Schematic Design

- Creating circuit schematics using PCB CAD tools
- Component library management
- Electrical rule checking (ERC)
- Netlist generation

Lab Activity:

- Designing a basic power supply or LED flasher circuit

Performing ERC and generating netlist

Module III: PCB Layout and Routing

- Importing netlist to layout editor
- Footprint assignment and component placement
- Manual vs auto-routing
- Design Rule Check (DRC)

Lab Activity:

- Placing components and routing for the schematic designed earlier
- Performing DRC and correcting errors

Module IV: PCB Output Files and Fabrication

- Generating Gerber files, drill files, and BOM
- Understanding layers (Top, Bottom, Soldermask, Silkscreen)
- PCB printing, photoresist method, and etching
- Introduction to SMD and through-hole assembly

Lab Activity:

- Generate Gerber files and preview using Gerber viewer
- Fabricate a basic single-layer PCB (simulations)

Module V: Mini Project and Testing

- Assembling components on fabricated PCB
- Soldering and desoldering techniques
- Continuity testing and troubleshooting
- Mini-project: Design a simple power supply, logic gate trainer, or timer circuit

Lab Activity:

- Complete mini project: From schematic to testing of PCB

TEXT BOOKS:

1. Walter C. Bosshart “Printed Circuit Board Design and Technology” Tata McGraw Hill
2. Clyde F. Coombs “Printed Circuit Boards: Design and Technology”: McGraw-Hill

REFERENCES:

1. Kraig Mitzner “Complete PCB Design Using OrCAD Capture and PCB Editor”
2. James Angus “Electronic Product Design”
3. Peter Dalmaris “PCB Design Using KiCad 6”

IPC Standards:

1. IPC-2221: Generic Standard on Printed Board Design
2. IPC-7351: Generic Requirements for Surface Mount Design

Software Tools (Free/Open Source Recommended):

1. KiCad (Open-source)
2. EasyEDA (Online tool)
3. Eagle CAD (Free for education)
4. LTSpice / Tinkercad for circuit simulation (optional)