JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech. in MECHANICAL ENGINEERING
COURSE STRUCTURE (R25 Regulations)
Applicable from A.Y. 2025-26 Batch
(For University Constituent Colleges only)

I Year **I Semester**

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA101BSC	Matrices and Calculus	3	1	0	4
2	PH102BSC	Engineering Physics	3	0	0	3
3	ME103CS	C Programming and Data Structures	3	0	0	3
4	ME104ES	Classical Engineering Mechanics	3	0	0	3
5	HSC	English for Skill Enhancement	3	0	0	3
6	BSC	Engineering Physics Laboratory	0	0	2	1
7	CSC	C Programming and Data Structures Laboratory	0	0	2	1
8	ME108ES	Engineering Workshop	0	0	2	1
9	HSC	English Language and Communication Skills Laboratory	0	0	2	1
10		Induction Program	-	-	-	-
		Total Credits	**15**	**01**	**08**	**20**

I Year **II Semester**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Ordinary Differential Equations and Vector Calculus	3	0	0	3
2	BSC	Applied Chemistry	3	0	0	3
3	ME203PC	Innovations in Mechanical Engineering	2	0	0	2
4	ESC	Elements of Electrical and Electronics Engineering	3	0	0	3
5	ME205ES	Material Science and Metallurgy	3	0	0	3
6	ME206ES	Engineering Graphics and Computer Aided Drafting	2	0	2	3
7	BSC	Chemistry Laboratory for Engineers	0	0	2	1
8	CSC	Python Programming Laboratory	0	1	2	2
9	ESC	Elements of Electrical and Electronics Engineering Laboratory	0	0	2	1
		Total Credits	**16**	**1**	**08**	**21**

II YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	BSC	Probability, Statistics and Complex Variables	3	0	0	3
2	ME302PC	Fluid Mechanics and Hydraulic Machines	3	0	0	3
3	ME303PC	Mechanics of Solids	3	0	0	3
4	ME304PC	Production Technology	3	0	0	3
5	ME305PC	Thermodynamics	3	0	0	3
6	ME306CS	Computational Mathematics Laboratory	0	0	2	1
7	ME307PC	Production Technology Laboratory	0	0	2	1
8	ME308PC	Material Science and Mechanics of Solids Laboratory	0	0	2	1
9	ME309PC	Fluid Mechanics and Hydraulic Machines Laboratory	0	0	2	1
10	MESDC1	Design Thinking and Ideation (Skill Development Course – 1)	0	0	2	1
		Total Credits	**15**	**0**	**10**	**20**

II YEAR **II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	ME401PC	Kinematics of Machinery	3	0	0	3
2	ME402PC	Thermal Engineering - I	3	0	0	3
3	ME403PC	Design of Machine Elements	3	0	0	3
4	ME404PC	Instrumentation and Control Systems	3	0	0	3
5	ME405PC	Operations Research	3	0	0	3
6	ME406PC	Innovation and Entrepreneurship	2	0	0	2
7	ME407PC	Conventional and Computer Aided Machine Drawing	0	0	2	1
8	ME408PC	Instrumentation and Control Systems Laboratory	0	0	2	1
9	ME409PC	Thermal Engineering-I Laboratory	0	0	2	1
10	MESDC2	Data Analytics and Python for Engineers (Skill Development Course – 2)	0	0	2	1
11	MC410	Indian Knowledge System	1	0	0	0
		Total Credits	**18**	**0**	**8**	**21**

#Note: Students who wish to exit after II Year II Semester has to register for this optional course and acquire the credits allotted by doing 6 weeks Work-based Vocational Course/ Internship or Apprenticeship. Please refer R25 Academic Regulations for more information. (Refer to III Year I Semester Course Structure)

III YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	ME501PC	Design of Transmission Elements	3	1	0	4
2	ME502PC	Thermal Engineering - II	3	0	0	3
3	ME503PC	Metrology and Machine Tools	3	0	0	3
4	ME504PE	Professional Elective-I	3	0	0	3
5	ME505OE	Open Elective-I	2	0	0	2
6	ME506PC	Thermal Engineering - II Laboratory	0	0	3	1
7	ME507PC	Metrology and Machine Tools Laboratory	0	0	3	1
8	ME509PC	Field Based Project/ Internship	0	0	4##	2
9		English for Employability Skills Laboratory	0	0	2	1
10	MESDC3	Modelling and Simulation Tools(Skill Development Course – 3)	0	0	2	1
11	MC510	Gender Sensitization Lab^^/ Human Values and Professional Ethics^^	1	0	0	0
		Total Credits	**15**	**1**	**14**	**21**

^^**Note: For the courses Gender Sensitization Lab and Human Values and Professional Ethics -** one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitization Lab is conducted this week, then a one-hour class for Human Values and Professional Ethics will be conducted in the following week.

Field based only

III YEAR **II SEMESTER**

S. No	Course Code	Course Title	L	T	P	Credits
1	ME601PC	Dynamics of Machinery	3	1	0	4
2	ME602PC	Heat Transfer	3	0	0	3
3		Business Economics and Financial Analysis	3	0	0	3
4	ME604PE	Professional Elective-II	3	0	0	3
5	ME605OE	Open Elective – II	2	0	0	2
6	ME606PC	Heat Transfer Lab	0	0	2	1
7	ME607PC	Applied Manufacturing Laboratory	0	0	2	1
8	ME608PC	Kinematics and Dynamics Laboratory	0	0	2	1
9	HSC	Modelling and Drafting Laboratory	0	0	2	1
10	MESDC4	Troubleshooting of Mechanical Systems (Skill Development Course – 4)	0	0	2	1
11	MC610	Environmental Science	1	0	0	0
		Total Credits	**15**	**1**	**10**	**20**

IV YEAR **I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	ME701PC	Finite Element Methods	3	0	0	3
2	ME702PC	Robotics and Artificial Intelligence	3	0	0	3
3	ME703PC	Industrial Engineering and Management	3	0	0	3
4	ME704PE	Professional Elective - III	3	0	0	3
5	ME705PE	Professional Elective – IV	3	0	0	3
6	ME706OE	Open Elective – III	2	0	0	2
7	ME707PC	Computer Aided Analysis Laboratory	0	0	2	1
8	ME708PC	Robotics and Artificial Intelligence Laboratory	0	0	2	1
9	ME709PC	Industry Oriented Mini Project/ Summer Internship	0	0	4**	2
		Total Credits	**17**	**0**	**08**	**21**

****Summer Internship Field based only

IV YEAR **II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	ME801PE	Professional Elective – V	3	0	0	3
2	ME802PE	Professional Elective – VI	3	0	0	3
3	ME803PC	Project Work	0	0	28	14
		Total Credits	**6**	**0**	**28**	**20**

Professional Elective-I

1	ME511PE	Automobile Engineering
2	ME512PE	Mechanics of Composite Materials and Structures
3	ME513PE	Mechatronic Systems
4	ME514PE	AI/ ML in Mechanical Engineering
	ME515PE	Database Management Systems

Professional Elective-II

1	ME611PE	Power Plant Engineering
2	ME612PE	AI/ML for Design Analysis
3	ME613PE	CAD/ CAM
4	ME614PE	Additive Manufacturing
5	ME615PE	Biomechanical Engineering

Professional Elective-III

1	ME711PE	Computational Fluid Dynamics
2	ME712PE	Mechanical Vibrations
3	ME713PE	Drone Technologies
4	ME714PE	Embedded Systems and Programming
5	ME715PE	Artificial Neural Networks

Professional Elective – IV

1	ME721PE	Refrigeration and Air-Conditioning
2	ME722PE	Hydraulics and Pneumatics
3	ME723PE	MEMS
4	ME724PE	Production Planning and Control
5	ME725PE	Research Methodologies and IPR

Professional Elective-V

1	ME811PE	Electric and Hybrid Vehicles
2	ME812PE	Condition Monitoring and Fault Diagnosis
3	ME813PE	Design for Manufacturing and Assembly
4	ME814PE	Project Management
	ME815PE	Product Design and Development

Professional Elective-VI

1	ME821PE	Renewable Energy Sources
2	ME822PE	Plant Maintenance and Reliability Engineering
3	ME823PE	Micro Manufacturing
4	ME824PE	Total Quality Management
5	ME825PE	Prompt Engineering

OPEN ELECTIVES

Open Elective-I:

1	ME511OE	Optimization Methods for Engineers
2	ME512OE	Fundamentals of Robotic Systems
3	ME513OE	Alternate Fuels
4	ME514OE	Engineering Systems for Quantum Computing

Open Elective-II

1	ME611OE	Artificial Intelligence in Mechanical Engineering
2	ME612OE	Non-Conventional Sources of Energy
3	ME613OE	Quality Management
4	ME614OE	Engineering Materials

Open Elective-III:

1	ME711OE	Energy Conservation and Management
2	ME712OE	Digital Manufacturing
3	ME713OE	Strategic Management
4	ME714OE	Thermal Management of Electronics

I Year **I Semester**

Matrices and Calculus MA101BSC

(Common to All Branches)

L	T	P	C
3	1	0	4

Pre-requisites: Mathematical Knowledge at pre-university level

Objectives:

To learn

- Applying basic operations on 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 and eigen vectors and to reduce the quadratic form to canonical form
- Geometrical approach to the mean value theorems and their application to the mathematical problems
- Finding maxima and minima of functions of two and three variables.
- Evaluation of multiple integrals and their applications.

UNIT-I: Matrices 8 L

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. Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors 10 L

Linear Transformation and Orthogonal Transformation: Eigen values – Eigen vectors and their properties – Diagonalization of a matrix – Cayley-Hamilton Theorem (without proof) – Fnding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms – Reduction of Quadratic form to canonical form by Orthogonal Transformation.

UNIT-III: Single Variable Calculus 10 L

Limit and Continuous of functions and its properties. 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 (All the theorems without proof).

Curve Tracing: Curve tracing in cartesian coordinates.

UNIT-IV: Multivariable Calculus (Partial Differentiation and applications) 10 L

Definitions of Limit and continuity – 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) 10 L

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

Course outcomes:

After learning the contents of this paper, the student must be able to

- Write the matrix representation of a set of linear equations and to analyze the solution of the system of equations
- Find the Eigen values and Eigen vectors
- Reduce the quadratic form to canonical form using orthogonal transformations.
- Solve the applications of the mean value theorems.

- Find the extreme values of functions of two variables with/ without constraints.
- Evaluate the multiple integrals and apply the concept to find areas, volumes.

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 Editon, 2016.

References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, 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, LaxmiPublications, Reprint, 2008.
4. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

Engineering Physics PH102BSC

L	T	P	C
3	0	0	3

Pre-requisites: 10+2 Physics

COURSE OBJECTIVES:

1. To understand the wave nature of light and related phenomena such as interference, diffraction and polarization.
2. To explore the acoustic properties of buildings and the generation, detection and applications of ultrasonic waves.
3. To provide a foundation in quantum mechanics and introduce basic principles of quantum computing.
4. To study the classification, properties, and technological applications of magnetic, dielectric and superconducting materials.
5. To understand the principles, types, and applications of lasers and optical fiber communication systems.

UNIT - I: WAVE OPTICS

Huygens' principle, superposition of waves and interference of light by wave front splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Farunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power. Introduction to polarization, double refraction, Nicol's Prism, quarter and half wave plates.

UNIT - II: ACOUSTICS OF BUILDINGS & ULTRASONICS

Introduction to Acoustics of Buildings, Reverberation, Time of Reverberation, Sabine's Formulae, Basic Requirements of Acoustically good hall, Factors affecting the Architectural Acoustics and their Remedies. Introduction to Ultrasonics, Production of Ultrasonics by Piezoelectric and Magnetostriction Methods, Detection of Ultrasonics by Kund's Tube and Quartz Crystal Methods, Applications of Ultrasonics.

UNIT - III: QUANTUM MECHANICS AND QUANTUM COMPUTING

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of wave function, postulates of quantum mechanics: operators in quantum mechanics, Eigen values and Eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box. Introduction to Quantum Computing, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits.

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, introduction to superconductivity; properties, Type – I and Type –II superconductors. Applications of superconductors. Introduction to dielectric materials, types of polarization, electronic and ionic polarizabilities. Ferroelectric, piezoelectric, pyroelectric materials and their applications.

UNIT - V: LASER AND FIBRE OPTICS

Introduction to laser, characteristics of laser, population inversion, pumping, lasing action, Einstein coefficients and their relations, Ruby laser, He-Ne laser, CO_2 laser, semiconductor diode laser, applications of laser. Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, optical fibre for communication system, applications.

COURSE OUTCOMES:

1. Students will be able to explain and analyze optical phenomena such as interference, diffraction, and polarization using wave theory. *(SDG 9)*
2. Students will demonstrate understanding of architectural acoustics and the generation and detection techniques of ultrasonic waves. *(SDG 4).*

3. Students will apply quantum mechanical concepts like wave functions and Schrödinger's equation and explain the structure of a quantum computer. *(SDG 9).*
4. Students will classify magnetic and dielectric materials and describe their behavior, including superconductivity and various polarization effects. *(SDG 9)*
5. Students will describe laser operation principles and fiber optics fundamentals and apply them in communication and instrumentation systems. *(SDG 9, SDG 7)*

TEXT BOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove

REFERENCE BOOKS:

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

C Programming and Data Structures ME103CS

L	T	P	C
3	0	0	3

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.
Course Outcomes:

1. Understand the various steps in Program development.
2. Explore the basic concepts in C Programming Language.
3. Develop modular and readable C Programs
4. Understand the basic concepts such as Abstract Data Types, Linear and Non-Linear Data structures.
5. Apply data structures such as stacks, queues in problem solving
6. To understand and analyze various searching and sorting algorithms.

UNIT – I

Introduction to Computers – Computer Systems, Computing Environments, Computer Languages, Creating and running programs, Software Development Introduction to C Language – Background, Simple C programs, Identifiers, Basic data types, Variables, Constants, Input / Output Structure of a C Program – Operators, Bit-wise operators, Expressions, Precedence and Associatively, Expression Evaluation, Type conversions, Statements.

UNIT – II

Statements – if and switch statements, Repetition statements – while, for, do-while statements, Loop examples, other statements related to looping – break, continue, go to, Recursion. Designing Structured Programs- Functions, basics, user defined functions, inter function communication, standard functions. Arrays – Concepts, using arrays in C, inter function communication, array applications, two – dimensional arrays, multidimensional arrays.

UNIT – III

Pointers – Introduction, Pointers for inter function communication, pointers to pointers, compatibility, Pointer Applications – Passing an array to a function, Memory allocation functions, array of pointers. Strings – Concepts, C Strings, String Input / Output functions, arrays of strings, string manipulation functions, string / data conversion.

UNIT – IV

Derived types – The Typedef, enumerated types, Structures – Declaration, definition and initialization of structures, accessing structures, operations on structures, complex structures. Unions – Referencing unions, initializers, unions and structures. Input and Output – Text vs Binary streams, standard library functions for files, converting file types, File programs – copy, merge files.

UNIT – V

Sorting- selection sort, bubble sort, insertion sort, Searching-linear and binary search methods. Data Structures – Introduction to Data Structures, abstract data types, Linear list – singly linked list implementation, insertion, deletion and searching operations on linear list, Stacks - Operations, array and linked representations of stacks, stack applications, Queues-operations, array and linked representations.

Text Books:

1. C Programming & Data Structures, B.A.Forouzan and R.F. Gilberg, Third Edition, Cengage Learning.
2. Problem Solving and Program Design in C, J.R. Hanly and E.B. Koffman, Fifth Edition, Pearson Education.
3. The C Programming Language, B.W. Kernighan and Dennis M.Ritchie, PHI/Pearson Education.

Reference Books:

1. C & Data structures – P. Padmanabham, 3rd Edition, B.S. Publications.
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press.
3. Programming in C – Stephen G. Kochan, III Edition, Pearson Education.
4. C for Engineers and Scientists, H. Cheng, McGraw-Hill International Edition.
5. Data Structures using C – A. M. Tanenbaum, Y. Langsam, and M.J. Augenstein, Pearson Education / PHI.
6. C Programming & Data Structures, E. Balagurusamy, TMH.
7. C Programming & Data Structures, P. Dey, M Ghosh R Thereja, Oxford University Press.
8. C & Data structures – E V Prasad and N B Venkateswarlu, S. Chand & Co.

Classical Engineering Mechanics ME104ES

L	T	P	C
3	0	0	3

Course Objectives:

- To understand the resolving forces and moments for a given force system.
- To analyze the types of friction for moving bodies and problems related to friction.
- To determine the centroid and second moment of area

Course Outcomes:

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

- Resolve forces and moments for a given system.
- Analyze the friction for moving bodies.
- Determine centroid and second moment for a given area of a body.

UNIT-I:

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT-II:

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions -Motion of Bodies-Wedge Screw, Screw-jack and differential screw –jack

UNIT-III:

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity of Bodies – Centroids of Volumes – Center of gravity of composite bodies.

UNIT-IV:

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures, Product of Inertia, Transfer Formula for Product of Inertia.

UNIT-V:

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies.

TEXT BOOKS:

1. Singer's Engineering Mechanics Statics and Dynamics by K. Vijaya Kumar Reddy and J. Suresh Kumar, BS Publications, 3rd Edition (SI Units) 5th impression 2013.
2. Engg. Mechanics by Irving Shames, G. Krishna Mohan Rao, Prentice Hall

REFERENCE BOOKS:

1. Engineering Mechanics by Timoshenko & Young
2. Engineering Mechanics by Umesh Regl, Tayal.
3. A text of Engineering Mechanics by YVD Rao, K. Govinda Rajulu, M. Manzoor Hussain, Academic Publishing Company
4. Text Book in Applied Mechanics by Malhotra, Subramanian, Gahlot and Rathore, New Age.
5. Engineering Mechanics by KL Kumar, Tata McGraw Hill.
6. Engineering. Mechanics by M.V. Seshagiri Rao & D Rama Durgaiah.
7. Engineering Mechanics by S.S. Bhavikati & K.G. Rajasekharappa

English for Skill Enhancement HSC

(Based on AICTE Model Curriculum for First Year UG Degree Courses in Engineering & Technology-2018 and the Guidelines of NEP-2020)

L	T	P	C
3	0	0	3

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

LEARNING OBJECTIVES

This course will enable the students to:

a. Improve their vocabulary.

b. Use appropriate sentence structures in their oral and written communication.

c. Develop their reading and study skills.

d. Equip students to write paragraphs, essays, précis and draft letters.

e. Acquire skills for Technical report writing.

COURSE OUTCOMES

Students will be able to:

CO1 Choose appropriate vocabulary in their oral and written communication. (SDG 4, 8)

CO2 Demonstrate their understanding of the rules of functional grammar and sentence

structures. (SDG 4)

CO3 Develop comprehension skills from known and unknown passages. (SDG 4, 8)

CO4 Write paragraphs, essays, précis and draft letters. (SDG 4)

CO5 Write abstracts and reports in various contexts. (SDG 4, 8)

SYLLABUS

The course content / study material is divided into Five Units.

Unit –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 BlackSwan 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.

Unit –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.

Unit –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.

Unit –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 BlackSwan 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.

Unit –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 BlackSwan 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

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

References:

1. Swan, Michael. (2016). Practical English Usage. Oxford University Press. New Edition.
2. Karal, Rajeevan. 2023. English Grammar Just for You. Oxford University Press. New Delhi
3. 2024. Empowering with Language: Communicative English for Undergraduates. Cengage
4. Learning India Pvt. Ltd. New Delhi
5. Sanjay Kumar & Pushp Lata. 2022. Communication Skills – A Workbook. Oxford
6. Univeristy Press. New Delhi
7. Wood,F.T. (2007). Remedial English Grammar. Macmillan.
8. Vishwamohan, Aysha. (2013). English for Technical Communication for Engineering
9. Students. Mc Graw-Hill Education India Pvt. Ltd.

Engineering Physics Laboratory BSC

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To explore the electromagnetic and dielectric behavior of materials through experiments such as B-H curve and dielectric constant determination.
2. To understand fundamental quantum phenomena by experimentally determining physical constants like Planck's constant and work function.
3. To investigate optical phenomena using diffraction, interference (Newton's Rings), and study of optical fiber properties.
4. To characterize the performance of semiconductor and optoelectronic devices like laser diodes, solar cells, and Hall effects sensors.
5. To develop analytical and data fitting skills through experimental modeling and application of the least squares method.

1. Study of B-H curve of a ferromagnetic material.
2. Determination of dielectric constant of a given material.
3. Determination of work function and Planck's constant using photoelectric effect.
4. Determination of wavelength of source using diffraction grating.
5. Study of V-I & L-I characteristics of a given laser diode.
6. Determination of acceptance angle and numerical aperture of a given optical fibre.
7. Newton Rings: to determine the radius of curvature of Plano-convex lens.
8. Determination of energy gap of a semiconductor.
9. Determination of Hall coefficient and carrier concertation of a given semiconductor.
10. Understanding the method of least squares – Torsional pendulum as an example.
11. To study and analyze the characteristics of a solar cell by plotting the V-I (voltage-current) and P-V (power-voltage) curves
12. To determine the frequency of the A.C. mains supply using a sonometer by finding the resonant length of the vibrating wire that matches the frequency of the alternating current.

Note: Any 8 experiments are to be performed.

COURSE OUTCOMES:

Upon successful completion of this course, students will be able to:

1. Analyse magnetic and dielectric properties of materials using B-H curve and dielectric constant experiments. **(SDG 9)**
2. Determine key quantum mechanical constants and validate the photoelectric effect. **(SDG 4, 9)**
3. Measure optical parameters using diffraction gratings and Newton's Rings, and study fiber optic properties. **(SDG 7, 9)**
4. Evaluate characteristics of semiconductor and optoelectronic devices, including energy gap, Hall Effect, laser diodes, LEDs, and solar cells. **(SDG 7, 13).**
5. Apply curve fitting techniques such as the least squares method to analyze experimental data and estimate physical quantities. **(SDG 4, 9)**

C Programming and Data Structures Laboratory CSC

L	T	P	C
0	0	2	1

Course Objectives: Introduce the importance of programming, C language constructs, program development, data structures, searching and sorting.

List of Experiments:

1. Write a C program to find the sum of individual digits of a positive integer.
2. 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.
3. Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
4. Write a C program to find the roots of a quadratic equation.
5. Write a C program to find the factorial of a given integer.
6. Write a C program to find the GCD (greatest common divisor) of two given integers.
7. Write a C program to solve Towers of Hanoi problem.
8. 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)
9. Write a C program to find both the largest and smallest number in a list of integers.
10. Write a C program that uses functions to perform the following: i) Addition of Two Matrices ii) Multiplication of Two Matrices
11. Write a C program that uses functions to perform the following operations: i) To insert a sub-string in to a given main string from a given position. ii) To delete n Characters from a given position in a given string.
12. Write a C program to determine if the given string is a palindrome or not
13. Write a C program that displays the position or index in the string S where the string T begins, or –1 if S doesn't contain T.
14. Write a C program to count the lines, words and characters in a given text.
15. Write a C program to generate Pascal's triangle.
16. Write a C program to construct a pyramid of numbers.
17. Write a C program that uses functions to perform the following operations: i) Reading a complex number ii) Writing a complex number iii) Addition of two complex numbers iv) Multiplication of two complex numbers (Note: represent complex number using a structure.)
18. i. Write a C program which copies one file to another. ii. Write a C program to reverse the first n characters in a file.

(Note: The file name and n are specified on the command line.)

19. i. Write a C program to display the contents of a file. ii. 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)

20. Write a C program that uses functions to perform the following operations on singly linked list.: i) Creation ii) Insertion iii) Deletion iv) Traversal

21. Write C programs that implement stack (its operations) using i) Arrays ii) Pointers

22. Write C programs that implement Queue (its operations) using i) Arrays ii) Pointers

23. Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii) Insertion sort

24. Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers: i) Linear search ii) Binary search

Text Books:

1. C Programming & Data Structures, B.A. Forouzan and R. F. Gilberg, Third Edition, Cengage Learning.
2. Let us C, Yeswanth Kanitkar
3. C Programming, Balaguruswamy.

Course Outcomes:

1. Develop modular and readable C Programs
2. Solve problems using strings, functions
3. Handle data in files
4. Implement stacks, queues using arrays, linked lists.
5. To understand and analyze various searching and sorting algorithms.

Engineering Workshop ME108ES

L	T	P	C
0	0	2	1

Pre-requisites: Practical skill

Course Objectives:

- To Study of different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipments and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- It explains the construction, function, use and application of different working tools, equipment and machines.
- To study commonly used carpentry joints.
- To have practical exposure to various welding and joining processes.
- Identify and use marking out tools, hand tools, measuring equipment and to work to prescribed tolerances.

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

- Study and practice on machine tools and their operations
- Practice on manufacturing of components using workshop trades including pluming, fitting, carpentry, foundry, house wiring and welding.
- Identify and apply suitable tools for different trades of Engineering processes including drilling, material removing, measuring, chiseling.
- Apply basic electrical engineering knowledge for house wiring practice.

1. TRADES FOR EXERCISES:

At least two exercises from each trade:

I. Carpentry – (T-Lap Joint, Dovetail Joint, Mortise & Tenon Joint)
II. Fitting – (V-Fit, Dovetail Fit & Semi-circular fit)
III. Tin-Smithy – (Square Tin, Rectangular Tray & Conical Funnel)
IV. Foundry – (Preparation of Green Sand Mould using Single Piece and Split Pattern)
V. Welding Practice – (Arc Weldimg & Gas Welding)
VI. House-wiring – (Parallel & Series, Two-way Switch and Tube Light)
VII. Black Smithy – (Round to Square, Fan Hook and S-Hook)

2. TRADES FOR DEMONSTRATION & EXPOSURE:

Plumbing, Machine Shop, Metal Cutting (Water Plasma), Power tools in construction and Wood Working

Text Books:

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

Reference Books:

1. Work shop Manual - P.Kannaiah/ K.L.Narayana/ Scitech
2. Workshop Manual / Venkat Reddy/ BSP

English Language and Communication Skills Laboratory HSC

(Common to all Branches of Engineering)

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.

Listening Skills:

Objectives

1. To enable students develop their active listening skills

2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

3. To improve their pronunciation and neutralize accent

4. To enable students express themselves fluently and appropriately

5. To practise speaking in social and professional contexts

Learning Outcomes

Students will be able to:

CO1 Listen actively and identify important information in spoken texts (SDG 4)

CO2 Interpret the speech and infer the intention of the speaker (SDG 4)

CO3 Improve their accent for intelligibility (SDG 4, 8, 10)

CO4 Speak fluently with clarity and confidence (SDG 4, 8, 10)

CO5 Use the language in real life situations (SDG 4, 8)

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

a. Computer Assisted Language Learning (CALL) Lab which focusses on listening skills

b. 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:

1. 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

2. 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:

1. Shobha, KN & Rayen, J. Lourdes. (2019). Communicative English – A workbook. Cambridge University Press
2. Board of Editors. (2016). ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities. Orient Black Swan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). English Language Skills: A Practical Approach. Cambridge University Press
4. (2022). English Language Communication Skills – Lab Manual cum Workbook. Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. Five Minute Activities – A Resource Book for Language Teachers. Cambridge University Press.

I Year **II Semester**

Ordinary Differential Equations and Vector Calculus **BSC**

(Common to All Branches)

L	T	P	C
3	0	0	3

Pre-requisites: Mathematical Knowledge at pre-university level

Objectives:

To learn

- Methods of solving the differential equations of first and higher order.
- Concept, properties of Laplace transforms.
- Solving ordinary differential equations 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

UNIT-I: First Order Ordinary Differential Equations **8 L**

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 **10 L**

Higher 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.

UNIT-III: Laplace Transforms **10 L**

Laplace Transforms: Laplace Transform of standard functions – First shifting theorem – Laplace transforms of functions multiplied by 't' and divided by 't' – Laplace transforms of derivatives and integrals of function – 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 **10 L**

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 **10 L**

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

Course outcomes:

After learning the contents of this paper, the student must be able to

- Identify whether the given differential equation of first order is exact or not
- Solve higher differential equation and apply the concept of differential equation to real world problems.
- Use the Laplace Transforms techniques for solving Ordinary Differential Equations.
- Evaluate the Line, Surface and Volume integrals and converting them from one to another

Text Books

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

References

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

Applied Chemistry BSC

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 students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes (CO's):

1. Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes. (SDG 4, 6)
2. Students will gain basic knowledge of electrochemical processes and their relevance to corrosion and its control methods. (SDG 4)
3. Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs. (SDG 4, 7, 9)
4. Students will learn the basic concepts and properties of polymers and other engineering materials. (SDG 4, 9)
5. Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications. (SDG 4, 9, 13)

UNIT-I: Water and its treatment: [8]

Introduction, types 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. Defluoridation- Nalgonda technique.

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: Electrochemistry and Corrosion: [8]

Introduction- Electrode potential, standard electrode potential, types of electrodes, Nernst equation (no derivation), Galvanic cell, cell representation, EMF of cell- Numerical problems. Reference electrodes - Primary reference electrode – Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Determination of pH of an unknown solution using SHE and Calomel electrode.

Corrosion: Introduction - Definition**,** causes and effects of corrosion - Theories of corrosion, chemical and electrochemical corrosion - Mechanism of electrochemical 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: [8]

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, Calorific value of fuel - HCV, LCV- Dulongs formula - Numerical problems.

Fossil fuels: Introduction, classification, Petroleum- Refining of Crude oil, Cracking - Moving bed catalytic cracking. LPG and CNG - composition and uses.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

Definition, classification of polymers: Based on origin and tacticity with examples - Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization.

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

Conducting polymers: Definition and classification with examples - Mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

Biodegradable polymers: Polylactic acid (PLA) and its applications.

UNIT-V - Applications of Materials: [8]

Cement: Portland cement, its composition, setting and hardening.

Phase rule: Definition – Phase, component, degrees of freedom. Phase rule equation. Phase diagrams - One component system - water. Two component system - Lead silver system.

Lubricants: Definition and characteristics of a good lubricant – thin film mechanism of lubrication, properties of lubricants - viscosity, cloud and pour point, flash and fire point.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection).

SUGGESTED TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE TEXT BOOKS:

3. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
4. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
5. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
6. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
7. Challenges and Opportunities in Green Hydrogen by Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
8. Raman Spectroscopy in Human Health and Biomedicine, https://www.worldscientific.com/doi/epdf/10.1142/13094
9. E-Content- https://doi.org/10.1142/13094 | October 2023

Innovations in Mechanical Engineering **ME203PC**

L	T	P	C
2	0	0	2

Prerequisites: Basic understanding of High School Physics and Mechanics

Course Objectives:

- Introduce mechanical innovation history and key milestones.
- Encourage creative thinking and design methodologies.
- Familiarize with modern tools like CAD, 3D printing, robotics.
- Explore sustainability and emerging tech in mechanics.
- Guide idea-to-product journey and entrepreneurship basics.

Course Outcomes:

- Recall major innovations and inventors.
- Use design thinking for problem-solving.
- Operate basic CAD/CAE tools and prototyping methods.
- Understand sustainable and smart technologies.
- Build prototypes and grasp basics of start-ups and IPR.

UNIT – I

Evolution & Inspiration in Mechanical Innovation: Ancient to modern mechanical systems: From pulleys to turbines, Timeline of iconic inventions: Steam engine, automobile, aircraft, CNC machines, etc., Inventors and changemakers: James Watt, Nikola Tesla, Karl Benz, etc., Case studies of mechanical breakthroughs that changed the world, Learning from nature: Biomimicry in mechanical design

UNIT - II

Design Thinking and Ideation in Engineering: The engineering design process: Problem definition to final solution, Stages of Design Thinking: Empathize, Define, Ideate, Prototype, Test, Creativity tools: SCAMPER, Mind Mapping, Brainstorming, TRIZ, Design for Manufacturing (DFM) and Assembly (DFA) basics, Reverse Engineering: Learning through disassembly and analysis, Research to Market (Technology readiness levels), Disruptive Innovation.

UNIT - III

Sustainable and Emerging Innovations: Sustainable product design: Lifecycle thinking, circular economy, Renewable energy systems: Solar, wind, hybrid mechanical designs, Smart materials and nano-materials in mechanical systems, Internet of Things (IoT) in mechanical applications, Case studies on AI, ML, and data analytics in mechanical innovation, Global Trends, Quantum Computing, AR in Mechanical Engineering,

UNIT - IV

Modern Tools & Technologies for Innovation: CAD/CAE tools: Basic Features of Fusion 360, SolidWorks, ANSYS, 3D printing & Rapid prototyping: Additive manufacturing overview, CNC & Automation basics: G-codes, machine control, real-world use cases, Introduction to Robotics & Mechatronics, Simulation and Digital Twins in innovation

UNIT - V

Prototyping, Implementation & Entrepreneurship: Market Research, Building and testing mechanical prototypes, Innovation challenges and real-world constraints (cost, feasibility), Introduction to patents, intellectual property rights (IPR), Basics of engineering entrepreneurship: Idea → Pitch → Start-up, Case studies: Indian mechanical start-ups & innovations (Agri-tech, Aero, Auto, etc.), Industry 4.0

TEXT BOOKS:

1. Design of Everyday Things – Don Norman
2. Engineering Design: A Project-Based Introduction – Dym & Little
3. S. Scotchmer. Innovation and Incentives. Cambridge MA: MIT Press, 2004

References:

1. Engineering Innovation – Roberts
2. Mechanical Design Process – Ullman

Elements of Electrical and Electronics Engineering ESC

L	T	P	C
3	0	0	3

Course Objectives:

1. To introduce the concepts of electrical circuits and its components
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors, and
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits
3. To study the working principles of Electrical Machines
4. To introduce components of Low Voltage Electrical Installations
5. To identify and characterize diodes and various types of transistors.

UNIT - I:

D.C. Circuits: Electrical circuit elements (R, L and C), voltage and current sources, KVL and KCL, analysis of simple circuits with dc excitation.

A.C. Circuits: Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor, Analysis of single phase ac circuits, Three phase balanced circuits, voltage and current relations in star and delta connections.

UNIT - II:

Electrical Installations: Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

UNIT - III:

Electrical Machines: Working principle of Single phase transformer, equivalent circuit, losses in transformers, efficiency, Three phase transformer connections. Construction and working principle of DC generators, EMF equation, working principle of DC motors, Torque equations and Speed control of DC motors, Construction and working principle of Three phase Induction motor, Torques equations and Speed control of Three phase induction motor. Construction and working principle of synchronous generators.

UNIT - IV:

P-N Junction and Zener Diode: Principle of Operation Diode equation, Volt, Ampere characteristics, Temperature dependence, Ideal versus practical, Static and dynamic resistances, Equivalent circuit, Zener diode characteristics and applications.

Rectifiers and Filters: P-N junction as a rectifier, Half Wave Rectifier, Ripple Factor, Full Wave Rectifier, Bridge Rectifier, Harmonic components in Rectifier Circuits, Filters – Inductor Filters, Capacitor Filters, L- section Filters, π- section Filters.

UNIT - V:

Bipolar Junction Transistor (BJT): Construction, Principle of Operation, Amplifying Action, Common Emitter, Common Base and Common Collector configurations, Comparison of CE, CB and CC configurations.

Field Effect Transistor (FET): Construction, Principle of Operation, Comparison of BJT and FET, Biasing FET.

TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M S Sukija and TK Nagasarkar, Oxford University, 1st Edition, 2012
2. Basic Electrical and electronics Engineering, D P Kothari and I J Nagarath, McGraw Hill Education, 2nd Edition, 2020

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.
3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. De Carlo and Pen,Min,Lin, Oxford University Press, 2nd edition, 2004.
5. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th edition, 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.

Material Science and Metallurgy ME205ES

L	T	P	C
3	0	0	3

Course Objectives: Students will be able to

1. Learn the concepts of metallurgy and materials science in manufacturing processes.
2. Interpret phase diagrams of different alloy systems.
3. Describe the concept of heat treatment and other strengthening mechanisms.

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

1. Memorize the types of Crystal structures and their defects.
2. Learn the necessity of alloying and identify types of alloy phases.
3. Demonstrate importance of critical understanding of heat treatment in achieving required properties.
4. Apply the knowledge of heat treatment to enhance surface properties.
5. Analyze the properties and micro structure of ferrous and non-ferrous alloys.
6. Develop new materials and enhance properties for the advanced applications.

UNIT – I: **Crystal Structure**

Unit cells, Metallic and Ceramic crystal structures. Imperfection in solids: Point, line, surface and volume defects; dislocations, strengthening mechanisms, slip systems, critical resolved shear stress.

UNIT – II: Hume – Rothery Rules

Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, Eutectiod, peritectoid and monotectic reactions. Iron, Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, pearlite, ferrite and cementite.

UNIT –III: Heat treatment

Isothermal transformation diagrams for Fe-C alloys and microstructures development. Martensite, Bainite. Annealing. Normalising, Hardening, Tempering and Spheroidising.

UNIT – IV: **Cooling Curves and Surface Hardening**

Continuous cooling curves and interpretation of final microstructures and properties-Thermo mechanical treatments like austempering, martempering, surface hardening methods like case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening.

UNIT – V: Alloys and Composites

Alloy steels, properties and applications of stainless steels and tool steels, maraging steels- Types of cast irons (grey, white, malleable and spheroidal graphite cast irons), copper and its alloys (Brass and bronze)- Aluminium and its alloys (Al-Cu Alloys). Ceramics and Composites: Types, properties and applications.

TEXT BOOKS:

1. Introduction to Physical Metallurgy, SIDNEY H AVNER, McGraw Hill, 2nd Edition, 2017
2. Material Science and Engineering, V. Raghavan, Prentice Hall of India Private Limited, 5th Edition, 2004.

REFERENCE BOOKS:

1. Engineering Materials, Kenneth G. Budinski and Michael K. Budinski, Prentice Hall of India Private Limited, 9th Edition, 2009.
2. Engineering Materials and Metallurgy, U. C. Jindal, Pearson, 1st Edition, 2011.
3. Mechanical Metallurgy, George E. Dieter, Tata McGraw-Hill, 3rd Edition, 2013.

4. Materials Science and Engineering: An Introduction, William. D. Callister and David G. Rethwisch, John Wiley & Sons, 10th Edition, 2018.

Engineering Graphics and Computer Aided Drafting ME206ES

L	T	P	C
2	0	2	3

Course Objectives:

1. To develop the ability of visualization of different objects through technical drawings
2. To acquire computer drafting skill for communication of concepts, ideas in the design of engineering products

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

1. Apply computer aided drafting tools to create 2D and 3D objects
2. sketch conics and different types of solids
3. Appreciate the need of Sectional views of solids and Development of surfaces of solids
4. Read and interpret engineering drawings
5. Conversion of orthographic projection into isometric view and vice versa manually and by using computer aided drafting

UNIT – I: Introduction to Engineering Graphics (Conventional)

Principles of Engineering Graphics and their Significance, Geometrical Constructions, Scales – Plain & Diagonal, Conic Sections including the Rectangular Hyperbola – General method only. Cycloid, Epicycloid and Hypocycloid.

UNIT- II: Orthographic Projections (Conventional and Computer Aided)

Principles of Orthographic Projections – Conventions – Projections of Points and Lines, Projections of Plane regular geometric figures. Auxiliary Planes. Computer aided orthographic projections – points, lines and planes. Introduction to Computer aided drafting – views, commands and conics.

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

Auxiliary Views - Sections or Sectional views of Right Regular Solids – Prism, Cylinder, Pyramid, Cone – Auxiliary views, Computer aided projections of solids – sectional views

UNIT – IV: Development of Surfaces (Conventional)

Prism, Cylinder, Pyramid and Cone.

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

Principles of Isometric Projection – Isometric Scale – Isometric Views –Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts. Conversion of Isometric Views to Orthographic Views and Vice-versa –Conventions. Conversion of orthographic projection into isometric view.

Note:

1. The Semester End 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, 54th Edition, 2023.
2. Engineering Drawing and graphics Using AutoCAD, T. Jeyapoovan and Vikas: S. Chand and 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, WILEY, John Wiley & Sons Inc, 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.

Chemistry Laboratory for Engineers BSC

L	T	P	C
0	0	2	1

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.

Course Outcomes (CO's):

1. Students will develop practical skills through hands-on chemistry experiments relevant to engineering. (SDG 4, 9)
2. Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions. (SDG 6, 12)
3. Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions. (SDG 4, 9)
4. Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6. (SDG 9, 12)
5. Students will understand the working principle of Colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law). (SDG 3, 13)

List of Experiments:

I. Volumetric Analysis: Estimation of Hardness of water by EDTA Complexometry method.

II. Conductometry:

1. Estimation of the concentration of strong acid by Conductometry.
2. Estimation of the concentration of strong and weak acid 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 strong acid with strong base by Potentiometry using quinhydrone

IV. pH Metry: Determination of an acid concentration using pH meter.

V. Preparations:

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

VI. Corrosion: Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.

VII. Lubricants:

1. Estimation of acid value of given lubricant oil.
2. Estimation of viscosity of lubricant oil using Ostwald's Viscometer.

VIII. Virtual lab experiments

1. Construction of Fuel cell and it's working.
2. Smart materials for Biomedical applications
3. Batteries for electrical vehicles.
4. Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022)
2. Vogel's text book of practical organic chemistry 5^{th} edition
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007)

Python Programming Laboratory CSC

L	T	P	C
0	1	2	2

Course Objectives:

1. To install and run the Python interpreter
2. To learn control structures.
3. To Understand Lists, Dictionaries in python
4. To Handle Strings and Files in Python Note: The lab experiments will be like the following experiment examples

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

1. Develop the application specific codes using python.
2. Understand Strings, Lists, Tuples and Dictionaries in Python.
3. Verify programs using modular approach, file I/O, Python standard library.
4. Implement Digital Systems using Python.

Week -1:

1. i) Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation. ii) Start the Python interpreter and type help() to start the online help utility.

2. Start a Python interpreter and use it as a Calculator. 3. i) Write a program to calculate compound interest when principal, rate and number of periods are given. ii) Given coordinates (x1, y1), (x2, y2) find the distance between two points 4. Read name, address, email and phone number of a person through keyboard and print the details.

Week - 2:

1. Print the below triangle using for loop. 5 4 4 3 3 3 2 2 2 2 1 1 1 1 1
2. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character (use 'if-else-if' ladder)
3. Python Program to Print the Fibonacci sequence using while loop
4. Python program to print all prime numbers in a given interval (use break)

Week - 3:

1. i) Write a program to convert a list and tuple into arrays.
   ii) Write a program to find common values between two arrays.
2. Write a function called gcd that takes parameters a and b and returns their greatest common divisor.
3. Write a function called palindrome that takes a string argument and returnsTrue if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.

Week - 4:

1. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.

2. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

i). Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.

ii). The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.

iii). Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.

3. i) Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e' ii) Remove the given word in all the places in a string?

iii) Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?

4. Writes a recursive function that generates all binary strings of n-bit length

Week - 5:

1. i) Write a python program that defines a matrix and prints ii) Write a python program to perform addition of two square matrices iii) Write a python program to perform multiplication of two square matrices

2. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.

3. Use the structure of exception handling all general purpose exceptions.

Week-6:

1. a. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.

b. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.

c. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.

d. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.

2. Write a Python program to demonstrate the usage of Method Resolution Order (MRO) in multiple levels of Inheritances.

3. Write a python code to read a phone number and email-id from the user and validate it for correctness

Week- 7

1. Write a Python code to merge two given file contents into a third file.

2. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.

3. Write a Python code to Read text from a text file, find the word with most number of occurrences 4. Write a function that reads a file file1 and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.

Week - 8:

1. Import numpy, Plotpy and Scipy and explore their functionalities.

2. a) Install NumPy package with pip and explore it.

3. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR

4. Write a program to implement Half Adder, Full Adder, and Parallel Adder

5. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

Text Books:

1. Supercharged Python: Take your code to the next level, Overland 2. Learning Python, Mark Lutz, O'reilly

Reference Books:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson.

2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson.

3. Programming with Python, A User’s Book, Michael Dawson, Cengage Learning, India Edition.

4. Think Python, Allen Downey, Green Tea Press.

5. Core Python Programming, W. Chun, Pearson.

6. Introduction to Python, Kenneth A. Lambert, Cengage.

Elements of Electrical and Electronics Engineering Laboratory **ESC**

L	T	P	C
0	0	2	1

Prerequisites: Basic Electrical and Electronics Engineering

Course Objectives:

1. To introduce the concepts of electrical circuits and its components.
2. To understand magnetic circuits, DC circuits and AC single phase and three phase circuits.
3. To study and understand the different types of DC, AC machines and Transformers.
4. To import the knowledge of various electrical installations.
5. To introduce the concept of power, power factor and its improvement.
6. To introduce the concepts of diodes and transistors.
7. To impart the knowledge of various configurations, characteristics and applications.

Course Outcomes:

1. To analyze and solve electrical circuits using network laws and theorems.
2. To understand and analyze basic Electric and Magnetic circuits.
3. To study the working principles of Electrical Machines.
4. To introduce components of Low Voltage Electrical Installations.
5. To identify and characterize diodes and various types of transistors.

List of Experiments:

PART A: ELECTRICAL

1. Verification of KVL and KCL
2. (i) Measurement of Voltage, Current and Real Power in primary and Secondary Circuits of a Single Phase Transformer
   (ii) Verification of Relationship between Voltages and Currents (Star Delta, Delta Delta, Delta Star, Star Star) in a Three Phase Transformer
3. Measurement of Active and Reactive Power in a balanced Three phase circuit
4. Performance Characteristics of a Separately Excited DC Shunt Motor
5. Performance Characteristics of a Three phase Induction Motor
6. No Load Characteristics of a Three phase Alternator

PART B: ELECTRONICS

1. Study and operation of
   (i) Multi meters (ii) Function Generator (iii) Regulated Power Supplies (iv) CRO.
2. P-N Junction diode characteristics
3. Zener diode characteristics and Zener as voltage Regulator
4. Input and Output characteristics of Transistor in CB, CE configuration
5. Full Wave Rectifier with and without filters
6. Input and Output characteristics of FET in CS configuration

TEXT BOOKS:

1. Basic Electrical and electronics Engineering, M.S. Sukija and T.K. Nagasarkar, Oxford University press, 1st Edition, 2012.
2. Basic Electrical and electronics Engineering, D.P. Kothari and I.J. Nagarath, McGraw Hill Education, 2nd Edition, 2020.

REFERENCE BOOKS:

1. Electronic Devices and Circuits, R. L. Boylestad and Louis Nashelsky, PEI and PHI, 9th Edition, 2006.
2. Millman's Electronic Devices and Circuits, J. Millman, C. C. Halkias and Satyabrata Jit, TMH, 2nd Edition, 1998.

3. Engineering Circuit Analysis, William Hayt and Jack E. Kemmerly, McGraw Hill, 6th Edition, 1971.
4. Linear circuit analysis, Raymond A. De Carlo and Pen,Min,Lin, Oxford University Press 2nd Edition, 2004.
5. Network Theory, N. C. Jagan and C. Lakshminarayana, McGraw Hill, 2nd Edition, 2005.
6. Network Theory, Sudhakar and Shyam Mohan Palli, Tata McGraw Hill, 2nd Edition, 2011.
7. Fundamentals of Electrical Engineering, L. S. Bobrow, Oxford University Press, 12th Edition 2003.
8. Electrical and Electronic Technology, E. Hughes, Pearson Education, 10th Edition, 2010.
9. Electrical Engineering Fundamentals, V. D. Toro, Prentice Hall India, 2nd Edition, 1989.