



First Year Curriculum

Admission Year 2026-27

**Diploma in Engineering
Chemical Engineering**

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Semester 1

- a. **Course Name:** Introduction to Chemical Engineering
- b. **Course Code:** 03062501PC01
- c. **Prerequisite:** Basic understanding of Chemistry and Physics.
- d. **Rationale:** This course provides an overview of chemical engineering's history and impact, introduces core concepts like unit operations and process design, and familiarizes students with equipment symbols and computer applications. It highlights the diverse career opportunities and interdisciplinary nature of the field.

e. Course Learning Objective:

CLOBJ 1	Describe the historical development and societal impact of chemical engineering and chemical process industries.
CLOBJ 2	Explain the fundamental principles of chemical engineering, including the role of core sciences and engineering concepts.
CLOBJ 3	Interpret and utilize standard equipment symbols to understand process flow diagrams.
CLOBJ 4	Differentiate between unit operations and unit processes, and apply these concepts to process design and representation.
CLOBJ 5	Recognize the role of computer applications and the diverse career opportunities available to chemical engineers in various industries.

f. Course Learning Outcomes:

CLO 1	Describe the historical development and societal impact of chemical engineering and chemical process industries.
CLO 2	Explain the fundamental principles of chemical engineering, including the role of core sciences and engineering concepts.
CLO 3	Interpret and utilize standard equipment symbols to understand process flow diagrams.
CLO 4	Differentiate between unit operations and unit processes, and apply these concepts to process design and representation.
CLO 5	Recognize the role of computer applications and the diverse career opportunities available to chemical engineers in various industries.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
4	0	0	4	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Introduction to the Subject Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering.	20	12

2	Components of Chemical Engineering Role of Mathematics, Physics, Chemistry and Biology; Thermodynamics, Transport Phenomena, Chemical Kinetics and Process dynamics, design and control. Opportunities for Chemical Engineers; Future of Chemical Engineering.	20	12
3	Fundamental Concepts: Unit Operations and Unit Processes Introduction to unit operations and unit processes, Unit Operations: Fluid flow: pumps, valves, pipes, Heat transfer: heat exchangers, condensers, jacketed vessels, Mass transfer: distillation columns, absorption columns, scrubbers, dryers, Mechanical operations: crushers, screens, filters (filter press, rotary filter), conveyors, cyclone, ESP. Unit Processes: Brief overview of common chemical reactions in petrochemical processes (e.g., cracking, reforming, polymerization)	26	16
4	Equipment Symbols and Industrial Application Introduction to process flow diagrams (PFDs) and piping and instrumentation diagrams (P&IDs). Standard symbols for: Heat exchangers (shell and tube, plate). Distillation and absorption columns. Pumps (centrifugal, positive displacement). Tanks and vessels (jacketed, agitated). Filters (filter press, rotary). Crushers and screens. Conveyors. Dryers. Cyclones and ESP's. Basic principles of equipment operation and maintenance. Industry examples of equipment applications.	24	14
5	Role of Computer in Chemical Engineering Role of Computer in Chemical Engineering; Chemical Engineering Software; Relation between Chemical Engineering and other engineering disciplines; Traditional vs. modern Chemical Engineering; Versatility of Chemical Engineering; Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc.	10	6
	Total	100%	60

i. Text Book and Reference Book:

1. "Introduction to Chemical Engineering Thermodynamics
By – Smith, J.M., Van Ness, H.C., & Abbot M. C. | McGraw Hill VII Edition 2004."
2. "Unit operations of Chemical Engineering
By Warren L. McCabe, Julian C. Smith, Peter Harriott | Mc-Graw-Hill"
3. "Computer Applications in Chemical Engineering
By R.G. Squires"

- a. **Course Name:** Pollution Prevention and Control Techniques
- b. **Course Code:** 03061501UE01
- c. **Prerequisite:** Student must be passed class 10th examination from a UGC-recognized board of education.
- d. **Rationale:** Study of environmental pollution, related to the industry is must to understand various types of pollutions and its preventive and control majors. The study of this course would help engineers in operating diverse pollution control equipment for controlling gaseous, water and land pollution. Hence the course has been designed to develop this competency and its associated cognitive and affective domain learning outcomes.

e. **Course Learning Objective:**

CLOBJ 1	Understand the basic concepts and types of environmental pollution.
CLOBJ 2	Analyze the causes, effects, and control measures of air pollution.
CLOBJ 3	Identify the sources and effects of water and noise pollution and recommend suitable control strategies.
CLOBJ 4	Understand the methods and practices involved in solid waste management.
CLOBJ 5	Interpret key environmental regulations and understand the concept of sustainability in civil and environmental engineering.

f. **Course Learning Outcomes:**

CLO 1	Understand the basic concepts and types of environmental pollution.
CLO 2	Analyze the causes, effects, and control measures of air pollution.
CLO 3	Identify the sources and effects of water and noise pollution and recommend suitable control strategies.
CLO 4	Understand the methods and practices involved in solid waste management.
CLO 5	Interpret key environmental regulations and understand the concept of sustainability in civil and environmental engineering.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Introduction to Pollution Definition of pollution and pollutants, Classification: Air, water, and solid pollution, Sources and effects of pollution.	10	6
2	Air Pollution and Control Major air pollutants and their impact, Sampling and monitoring of air pollutants, Air pollution control techniques (filtration, electrostatic precipitators, scrubbers).	25	10

3	Water and Noise Pollution: Sources, Impacts, and Control Measures Water pollutants and their effects, Wastewater treatment processes (primary, secondary, tertiary treatment), Effluent treatment plant (ETP), Sewage treatment Plant (STP) understanding process and parameters. Water standards. Noise pollution and its effects and its control measures.	25	10
4	Solid Waste Management Types of solid waste (municipal, industrial, hazardous), Collection, disposal, and recycling methods, Composting, incineration, and landfilling.	20	10
5	Environmental Regulations and Sustainability Environmental laws and policies (Air & Water Pollution Acts), ISO 14001 and environmental management systems, Role of industries in pollution control and sustainability initiatives.	20	9
	Total	100%	45

i. Text Book and Reference Book:

1. "Environmental Pollution Control Engineering,
2. By Rao C.S. | New Age International"
3. "Text Book of Environmental Pollution and Control
4. By Dr. Bhatia H. S. | Galgotia Publication, 1st edition, New Delhi"Pollution Control in Process Industries
5. By Mahajan S. P. | Tata Mc GrawHill, New Delhi, 21st reprint, 2008"
6. "Environmental Engineering
7. By Pandey G. N., Carney G. C. | Tata Mc GrawHill, New Delhi"

- a. **Course Name:** Applied Chemistry
 b. **Course Code:** 03069501BS01
 c. **Prerequisite:** Understanding of Basic knowledge of science for application.
 d. **Rationale:** Bridges the gap between theoretical chemistry and real-world industrial applications providing fundamental knowledge of chemical principles and their relevance in materials science, environmental sustainability, energy production, and various engineering processes.

e. **Course Learning Objective:**

CLOBJ 1	Understand the concept of matter and Existence of material in nature.
CLOBJ 2	Acquainted with the various Mechanism energy conversion and application of electrochemistry.
CLOBJ 3	Interpret corrosion concept types and mechanism with prevention methods.
CLOBJ 4	Develop skills and understand water treatment methods.
CLOBJ 5	Understand fundamentals of Lubricant in industrial applications.

f. **Course Learning Outcomes:**

CLO 1	Understand the concept of matter and Existence of material in nature.
CLO 2	Acquainted with the various Mechanism energy conversion and application of electrochemistry.
CLO 3	Interpret corrosion concept types and mechanism with prevention methods.
CLO 4	Develop skills and understand water treatment methods.
CLO 5	Understand fundamentals of Lubricant in industrial applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	0	2	4	20	20	50	60	-	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Chemical Bonding and Catalysis Atomic structure and Orbital concept. Shapes of s,p and d orbitals, Pauli's exclusion principle, Hund's rule of maximum multiplicity Aufbau rule, electronic configuration, Theory Of Valency, Electronic Configuration. Types of chemical bonds - Electrovalent bond, & its characteristics ,Covalent bond & its characteristics ,Co- ordinate bond , Hydrogen bond, its types and Significance , Metallic bond, Explanation of Metallic properties based on Electron Sea Model , Intermolecular force of attraction ,Vander Waals force of attraction, Structures of solids: Ionic solids, Molecular solids, Network solids, and Metallic solids Catalysis, Types of catalysis, Theory of Catalysis, Characteristics of Catalyst, Types of Catalyst, Positive Catalyst, Negative Catalyst, Auto-catalyst Catalytic Promoter and Catalytic inhibitor Industrial Application of Catalyst.	10	6

2	Concepts of Electrochemistry Introduction, Arrhenius theory of ionization., Degree of ionization, Factors affecting the degree of ionization, Definition of pH , pH of acid, base and neutral solution, pH calculations of acid, base and salt solution at different concentration, Importance of pH in various fields, Definition of buffer solution, Buffer Action & Types of buffer Solution, Application of buffer solutions, Electrolytes and Non-electrolytes, Types of electrolytes Definition the term ‘Electrode’ the Types of Electrodes Inert electrode, Working electrode & Reference electrode; with suitable Illustrations. Construction and working of electrochemical cell, Standard conditions, Standard hydrogen electrodes, Nernst theory of single electrode potential & Nernst equation (No derivation), Electrochemical series, galvanic series, Electrolysis, Faradays laws of electrolysis, Industrial application of Electrolysis, conductance of solution (a) Conductivity (b) Specific Conductivity (c) Equivalent conductivity (d) Molar conductivity.	20	9
3	Corrosion & its Control Definition of corrosion, Types of corrosion, Dry corrosion: Oxidation corrosion mechanism corrosion-mechanism, Nature of oxide film, Wet corrosion-mechanism, Concentration cell corrosion, Pitting corrosion, Waterline corrosion, Crevice corrosion, Stress Corrosion, Erosion Corrosion. Factors affecting the rate of corrosion, - Nature of film, Nature of Environment, pH of Solution, Area of cathode anode and, Temperature, Moisture, Purity of metal. Methods of prevention of corrosion, Modification of environment, Modification of the properties of metal, Use of protective coatings, Anodic and cathodic protection, Modification in design and choice of material.	10	5
4	Lubricants and Fuels Introduction and definition of lubricants and lubrication, function of lubricants Types of lubrication, Fluid film lubrication, Boundary lubrication, Classification of lubricants, Solid lubricants, Semi-solid lubricants, Liquid lubricants, Synthetic oils, Physical Properties of lubricants and their significance like. Viscosity and viscosity index, Flash point and fire point, Pour point and cloud point, oiliness Chemical Properties of lubricants: Saponification value, Neutralization number, Emulsification number, Selection Criteria of lubricants for Gears, Cutting tools and Steam turbine applications. Definition of fuel and combustion of fuel, classification of fuels, calorific values (HCV and LCV), Bomb Calorimeter, calculation of HCV and LCV, Ultimate and Proximate analysis of coal, Liquid fuels (Octane and Cetane number) Biofuels and Gaseous Fuels.	20	10
5	Polymer, Elastomers & Adhesives Introduction and Definition of Polymer and Monomer, Classification of Polymer on basis of Molecular structure as Linear, Branch and Cross-linked polymers, Classification on basis of monomers (homo polymer and copolymer) Classification of Polymers on basis of Thermal behavior (Thermoplastics& Thermosetting), Types polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis (only statement), properties and application of I. Polyethylene, Polypropylene iii. Polyvinyl chloride iv. Teflon v. Polystyrene vi. Phenol formaldehyde vii. Acrylonitrile viii. Epoxy Resin. Elastomer- Natural rubber and its properties. Vulcanization of rubber, Synthetic rubber, Synthesis (only statement), properties and uses, Buna-S Rubber ii. Buna-N Rubber, Neoprene Rubber, Definition of adhesives and Examples, Characteristics of adhesives Classification of adhesives and their uses.	20	7
Total		100%	45

i. Text Book and Reference Book:

1. ""Engineering Chemistry By Jain & Jain | Dhanpat Rai"
2. "A Text Book Of Polytechnic Chemistry By V.P. Mehta | Jain Brothers"
3. "Engineering Chemistry By S S Dhara"
4. "Applied Chemistry By N Krishnamurthy(New Edition)Edition | Tata Mcgraw-Hil"
5. "Textbook Environmental Chemistry And Pollution Control By By S. S. Dara"

j. List of Experiments:

Sr. no.	Experiment List
1.	Determine the strength of given acidic solution using standard solution of base.
2.	Standardize KMnO_4 solution by preparing standard oxalic acid and to estimate ferrous ions.
3.	Standardize $\text{Na}_2\text{S}_2\text{O}_3$ solution by preparing standard potassium dichromate and to estimate percentage of copper from brass.
4.	Determination of viscosity of given lubricating oil by using Red-wood Viscometer.
5.	Determination of pH-Values of given samples of Solution by using Universal Indicator and pH-meter.
6.	To determine Acid Value of given lubricating Oil.
7.	To determine % of moisture content in given coal sample by proximate analysis.
8.	To determine of saponification value of lubricating oil.
9.	Determine Flash & Fire point of given lubricating oil.
10.	Study of Corrosion of Metals in the Acidic and Alkali Mediums.

- a. **Course Name:** Mathematics - I
- b. **Course Code:** 03069101BS01
- c. **Prerequisite:** Student must be passed class 10th examination from recognized board of education. Also, students has knowledge of basic concept studied till 10th standard.
- d. **Rationale:** The goal of this Mathematics course is to give students a strong foundation in fundamental ideas and procedures that are essential for both everyday problem-solving and future education. This course aims to foster logical reasoning and critical thinking skills while covering subjects that are directly relevant to a variety of engineering, technology, business, and scientific domains.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of logarithms, partial fractions, trigonometry, complex numbers, functions, limits, and differentiation.
CLOBJ 2	Develop analytical and mathematical problem-solving skills required for engineering and scientific applications.
CLOBJ 3	Apply trigonometric identities, complex number operations, and logarithmic principles in solving mathematical problems.
CLOBJ 4	Analyze functions and limits to understand continuity and behavior of mathematical expressions.
CLOBJ 5	Apply differential calculus techniques for solving algebraic, trigonometric, exponential, and logarithmic problems.
CLOBJ 6	Build a strong mathematical foundation for advanced engineering and biomedical applications.

f. **Course Learning Outcomes:**

CLO 1	Solve problems involving logarithms, antilogarithms, and partial fraction decomposition.
CLO 2	Apply trigonometric functions, identities, and formulae to solve mathematical and engineering problems.
CLO 3	Perform operations on complex numbers and represent them in Cartesian and polar forms using De Moivre's theorem.
CLO 4	Evaluate functions and limits using standard limit theorems and mathematical techniques.
CLO 5	Differentiate algebraic, trigonometric, exponential, logarithmic, implicit, and composite functions accurately.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	0	4	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Logarithms and Partial Fractions Logarithms: Definition, Logarithm as a transformation, Antilogarithm, Rules of Logarithms and examples, Use logarithmic functions for simplifying arithmetic computations. Partial fractions: Definition of partial fractions, Types of partial fraction (denominator containing non-repeated linear factors, repeated linear factors and irreducible non-repeated quadratic factors).	17%	8

2	Trigonometry Units of Angles (degree and radian), Trigonometric Functions, Allied & Compound Angles, Multiple –Submultiples angles, Graph of Sine and Cosine, Periodic trigonometric functions, Sum and factor formulae.	23%	9
3	Complex Numbers Definition of a complex number, real and imaginary parts of a complex number, Polar and Cartesian representations of complex number, Conjugate of complex number, Geometric representation of complex numbers and their operations, Modules and Amplitude form, De Moivre's Theorem, Root of Complex Number, Use of De Moivre's Theorem to simplify mathematical expressions.	20%	9
4	Function and Limit Definition and concept of function, Concept of limits and standard forms of limits, Standard formulae of Limit and related simple examples.	17%	8
5	Differentiation Definition of derivative, differentiation of standard function by first principle, Rule of Differentiation, Differentiation of algebraic, trigonometric, Exponential, Logarithmic, Implicit functions and Composite functions, Higher order derivatives.	23%	11
	Total	100%	45

i. Text Book and Reference Book:

1. Advanced Mathematics for Polytechnic By Pandya N R | Macmillan Publishers India Ltd.,2012
2. Mathematics-I, By Deepak Singh | Khanna Book Publishing Co.
3. Mathematics II, By Garima Singh | Khanna Book Publishing Co.
4. A text book of Engineering Mathematics, By N.P. Bali and Manish Goyal | Laxmi Publications
5. Polytechnic Mathematics, By S P Deshpande | Pune Vidyarthi Gruh Prakashan

- a. **Course Name:** Basic Physics
b. **Course Code:** 03069202BS01
c. **Prerequisite:** High School Level Physics.
d. **Rationale:** Applied Physics aims to give an understanding of this world both by observation and by prediction of the way in which objects behave. Concrete use of physical principles and analysis in various fields of engineering and technology are given prominence in the course content. The course will help the diploma engineers to apply the basic concepts and principles to solve broad-based engineering problems and to understand different technology-based applications.

e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of physics related to measurements, electricity, magnetism, semiconductor physics, modern physics, lasers, fiber optics, and nanotechnology.
CLOBJ 2	Develop analytical and problem-solving skills for interpreting physical phenomena and engineering applications.
CLOBJ 3	Apply the concepts of electric and magnetic fields, circuits, and electromagnetic laws in scientific and technological systems.
CLOBJ 4	Explain the working principles and applications of semiconductor devices, lasers, optical fibers, and nanomaterials.
CLOBJ 5	Analyze modern technological developments based on principles of electronics, photonics, and nanotechnology.
CLOBJ 6	Build a strong foundation in applied physics for biomedical, electronics, and engineering applications.

f. **Course Learning Outcomes:**

CLO 1	Apply units, dimensions, and measurement techniques to solve engineering and physical problems.
CLO 2	Analyze electric circuits and apply concepts such as electric field, capacitance, resistance, Kirchhoff's laws, and electromagnetic induction.
CLO 3	Explain magnetic properties, magnetic field interactions, and the working principles of galvanometers and measuring instruments.
CLO 4	Describe semiconductor materials, pn junctions, diodes, solar cells, and their applications in electronic systems.
CLO 5	Interpret the principles and applications of lasers, optical fibers, and communication technologies.

g. **Teaching Examination scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	50	60	-	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Physical world, Units and Measurements Physical quantities; fundamental and derived, Units and systems of units (FPS, CGS and SI units), Dimensions and dimensional formulae of physical quantities, Principle of homogeneity of dimensions, Dimensional equations and their applications (conversion from one system of units to other, checking of dimensional equations and derivation of simple equations), Limitations of dimensional analysis. Measurements: Need, measuring instruments, least count, types of measurement (direct, indirect), Errors in measurements (systematic and random), absolute error, relative error, error propagation, error estimation and significant figures.	15%	8
2	Electrostatics Current Electricity Coulombs law, unit of charge, Electric field, Electric lines of force and their properties, Electric flux, Electric potential and potential difference, Gauss law. Capacitor and its working, Types of capacitors, Capacitance and its units. Capacitance of a parallel plate capacitor, Series and parallel combination of capacitors (related numerical), dielectric and its effect on capacitance, dielectric break down. Electric Current and its units, Direct and alternating current, Resistance and its units, Specific resistance, Conductance, Specific conductance, Series and parallel combination of resistances. Factors affecting resistance of a wire, carbon resistances and color coding. Ohm's law and its verification, Kirchhoff's laws, Wheatstone bridge and its applications (slide wire bridge only), Concept of terminal potential difference and Electro motive force (EMF) Heating effect of current, Electric power, Electric energy and its units (related numerical problems), Advantages of Electric Energy over other forms of energy.	25%	10
3	Electromagnetism and Magnetic materials Types of magnetic materials; dia, para and ferromagnetic with their properties, Magnetic field and its units, magnetic intensity, magnetic lines of force, magnetic flux and units, magnetization. Concept of electromagnetic induction, Faraday's Laws, Lorentz force (force on moving charge in magnetic field). Force on current carrying conductor, force on rectangular coil placed in magnetic field. Moving coil galvanometer; principle, construction and working, Conversion of a galvanometer into ammeter and voltmeter.	20%	8
4	Semiconductor Physics Energy bands in solids, Types of materials (insulator, semi-conductor, conductor), intrinsic and extrinsic semiconductors, p-n junction, junction diode and V-I characteristics, types of junction diodes. Diode as rectifier –half wave and full wave rectifier (center taped). Transistor; description and three terminals, Types- pnp and npn, some electronic applications (list only). Photocells, Solar cells; working principle and engineering applications.	20%	10
5	Modern Physics Lasers: Energy levels, ionization and excitation potentials; spontaneous and stimulated emission; population inversion, pumping methods, optical feedback, Types of lasers; Ruby, He-Ne and semiconductor, laser characteristics, engineering and medical applications of lasers. Fiber Optics: Introduction to optical fibers, light propagation, acceptance angle and numerical aperture, fiber types, applications in; telecommunication, medical and sensors. Nanoscience and Nanotechnology: Introduction, nanoparticles and nanomaterials, properties at nanoscale, nanotechnology, and nanotechnology-based devices and applications.	20%	9
Total		100	45

i. Text Book and Reference Book:

1. Comprehensive Practical Physics - Volume I and II, By in Jaiswal | Laxmi Publishers
2. Text Book of Physics for Class XI& XII (Part-I, Part-II), By N.C.E.R.T., Delhi

j. List of Experiments:

Sr. no.	Experiment List
1.	To measure length, radius of a given cylinder, a test tube and a beaker using a Vernier calliper and find volume of each object.
2.	To determine diameter of a wire, a solid ball and thickness of cardboard using a screw gauge.
3.	To verify Ohm's law by plotting graph between current and potential difference.
4.	To verify laws of resistances in series and parallel combination.
5.	To draw V-I characteristics of a semiconductor diode (Ge, Si) and determine its knee voltage.
6.	To verify Kirchhoff's law using electric circuits.
7.	To determine A.C. frequency with the help of sonometer.
8.	To calculate SA/V ratio of simple objects to understand nanotechnology.

- a. **Course Name:** Fundamentals of Communication Skills
b. **Course Code:** 03060001HM01
c. **Prerequisite:** Knowledge of English Language studied till 10th standard.
d. **Rationale:** Basic communication skills are essential for all Engineers.
e. **Course Learning Objective:**

CLOBJ 1	Develop fundamental communication skills required for academic, professional, and social interactions.
CLOBJ 2	Understand and apply basic English grammar concepts including parts of speech, tenses, and active-passive voice in oral and written communication.
CLOBJ 3	Enhance vocabulary through synonyms, antonyms, and one-word substitutions for effective expression.
CLOBJ 4	Improve speaking confidence through role-plays, self-introductions, group activities, and interpersonal communication exercises.

f. **Course Learning Outcomes:**

CLO 1	Communicate confidently in basic speaking situations including introductions, role-plays, and everyday conversations.
CLO 2	Apply grammar concepts such as parts of speech, tenses, prepositions, conjunctions, and active-passive voice correctly in communication.
CLO 3	Use appropriate vocabulary, synonyms, antonyms, and one-word substitutions in written and spoken English.
CLO 4	Draft simple formal and informal applications, narratives, and structured written content effectively.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
0	-	2	1	-	-	20	-	30	50

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Ice Breaker + Introducing your Friend Fun Fact Exchange (e.g., Two Truths and a Lie) Describing Personality and Hobbies Using Adjectives to Talk About People (Link to Parts of Speech) Structured Self and Peer Introduction (Name, Interests, Goals)	5%	2
2	Parts of Speech Identifying and Using Nouns, Pronouns, and Adjectives Verbs and Adverbs in Sentence Construction Prepositions and Conjunctions: Linking Ideas Interjections and Their Usage in Conversations	8%	2

3	Story Mason Elements of a Story (Character, Setting, Plot, Conflict, Resolution) Sequencing Events (Beginning, Middle, End) Using Tenses Appropriately in Narratives	15%	4
4.	Tenses Simple Tenses (Present, Past, Future) Continuous Tenses (Present, Past) Perfect Tenses (Present, Past) Perfect Continuous Tense (Present)	10%	4
5.	Active -Passive Voice Rules of Active & Passive Voice Identifying Active vs Passive Constructions Converting Sentences from Active to Passive and Vice Versa Tense Changes in Passive Voice	10%	2
6.	Vocabulary Building: One-word Substitution, Synonyms, and Antonyms List and Practice Common One-word Substitutions Synonym-Antonym Match-Up Games Use New Words in Sentences/Short Paragraphs	8%	2
7.	Types of Application Formal vs Informal Applications Structure and Format of an Application (Salutation, Body, Closing) Writing Leave Applications	10%	2
8.	Role Play Generic Situation(Buying, Asking for Directions, At a Doctor etc) Customer Service and Complaint Handling	15%	6
9.	Goal Setting SMART Goals (Specific, Measurable, Achievable, Relevant, Time-bound) Short-term vs Long-term Goals Overcoming Obstacles to Goals	7%	2
10.	Reading Skills- Basic level Types of reading Strategies of reading Reading comprehension	12%	4
11.	Revision of all topics	5%	2
	Total:	100%	32

i. Text Book and Reference Book:

1. Word Power Made Easy, By Norman Lewis | Goyal Publishers, Year 2014.
2. Soft Skills: Enhancing Employability and Career Development, By M. Ashraf Rizvi | McGraw Hill Education, Pub. Year 2010.
3. High School English Grammar and Composition, By Wren & Martin | S. Chand Publishing, Pub. Year 2017.
4. Developing Communication Skills, By Krishna Mohan & Meera Banerji | Macmillan Publishers India, Pub. Year 2009
5. English Grammar in Use, By Murphy, Raymond | Cambridge University Press, Pub. Year 2019

j. List of Experiments:

Sr. no.	Experiment List
1.	Ice Breaker and Introducing your Friend Fun Fact Exchange (e.g., Two Truths and a Lie), Describing Personality and Hobbies, Using Adjectives to Talk About People (Link to Parts of Speech), Structured Self and Peer Introduction (Name, Interests, Goals).
2.	Story Mason Elements of a Story (Character, Setting, Plot, Conflict, Resolution), Sequencing Events (Beginning, Middle, End), Using Tenses Appropriately in Narratives.

3.	Parts of Speech Identifying and Using Nouns, Pronouns, and Adjectives, Verbs and Adverbs in Sentence Construction, Prepositions and Conjunctions: Linking Ideas, Interjections and Their Usage in Conversations.
4.	Tenses Simple Tenses (Present, Past, Future), Continuous Tenses (Present, Past), Perfect Tenses (Present, Past), Perfect Continuous Tense (Present).
5.	Active -Passive Voice Rules of Active & Passive Voice, Identifying Active vs Passive Constructions, Converting Sentences from Active to Passive and Vice Versa, Tense Changes in Passive Voice.
6.	Vocabulary Building: One-word Substitution, Synonyms, and Antonyms List and Practice Common One-word Substitutions, Synonym-Antonym Match-Up Games, Use New Words in Sentences/Short Paragraphs.
7.	Types of Application Formal vs Informal Applications, Structure and Format of an Application (Salutation, Body, Closing), Writing Leave Applications.
8.	Role Play Generic Situation (Buying, Asking for Directions, At a Doctor etc), Customer Service and Complaint Handling.
9.	Goal Setting SMART Goals (Specific, Measurable, Achievable, Relevant, Time-bound), Short-term vs Long-term Goals, Overcoming Obstacles to Goals.
10.	Reading Skills- Basic level Types of reading, Strategies of reading, Reading comprehension.

- a. **Course Name:** Environmental Science
- b. **Course Code:** 03061501MC01
- c. **Prerequisite:** Basic knowledge of science (biology, chemistry, physics), environmental awareness, geography, data interpretation, and ethical responsibility towards sustainability.
- d. **Rationale:** Sustainable development is essential for a nation's progress, making environmental conservation and hazard management crucial for every Indian citizen. The country has endured numerous natural disasters, and significant energy wastage remains a challenge. Saving energy is as valuable as producing it. Industrial mismanagement and lac of discipline have led to rising environmental pollution. Embracing renewable energy is a key solution to both the energy crisis and pollution control. This course aims to raise awareness of these pressing issues, inspiring students to act responsibly and contribute to a cleaner, more sustainable future for the country and the world.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of ecosystem, environmental pollution, renewable energy, waste management, and disaster management.
CLOBJ 2	Develop awareness regarding environmental issues related to air, water, soil, noise pollution, and their impact on human health and ecosystems.
CLOBJ 3	Apply principles of environmental protection, pollution control, and sustainable resource management.
CLOBJ 4	Understand the importance of renewable energy resources and their role in sustainable development.

f. **Course Learning Outcomes:**

CLO 1	Explain the structure and functions of ecosystems and describe biotic, abiotic, and ecological cycles.
CLO 2	Identify sources, effects, and control measures of air, water, soil, and noise pollution.
CLO 3	Describe water treatment methods, solid waste management techniques, and environmental protection practices.
CLO 4	Analyze the principles, applications, and significance of renewable energy resources such as solar, wind, geothermal, and ocean energy.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	-	0	20	20	-	-	-	40

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Ecosystem Structure of ecosystem, Biotic & Abiotic components, Food chain and food web Carbon, Nitrogen, Sulphur, Phosphorus cycle.	10%	2

2	Air and Noise Pollution Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator). Gaseous Pollution Control: Absorber, Catalytic Converter, and Effects of air pollution due to Refrigerants, I.C., Boiler, Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.	25%	3
3	Water and Soil Pollution Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation. Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis), Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.	25%	3
4	Renewable Sources of Energy Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills. Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas. Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy. New Energy Sources: Need of new sources. Different types new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.	25%	3
5	Solid Waste Management Solid waste generation- Sources and characteristics of: Municipal solid waste, E- waste, biomedical waste. Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.	10%	2
6.	Seismic Engineering and Disaster Management Introduction of seismic engineering and its application civil engineering designs, Features of disasters such as Floods, Earthquakes, Fires, Epidemics, Gas/radioactive leaks etc. Management and mitigation of above disasters.	5%	2
Total:		100 %	45

i. Text Book and Reference Book:

1. Basics of Environmental Studies, By U K Khare | Tata McGraw Hill
2. Environmental Sciences, By Daniel B Botkin & Edward A Keller | John Wiley & Sons
3. Environmental Pollution Control Engineering, By Rao C.S. | New Age International
4. Environmental Studies, By Dr. Suresh K Dhameja | S.K Kataria & Sons New Delhi
5. Air Pollution, By M. N. Rao and H. V. N. Rao; | Tata McGraw-Hill Publishing Company.

Semester 2

- a. **Course Name:** Chemical Engineering Materials
b. **Course Code:** 03062502PC01
c. **Prerequisite:** Basic understanding of Chemistry and Physics
d. **Rationale:** This course aims to provide students the knowledge of various classes of material like metals and alloys, ceramics, polymers, composites, coatings, insulating materials, adhesives and lubricants for different applications. Study of Chemical Engineering Materials also has importance towards the understanding of properties of materials for construction of various equipment's and piping systems. Properties of materials affect the life and performance of equipment's to the large extent. Thus, information of properties of these materials is important for students to ensure the minimum cost of products and safety in the plants.

e. **Course Learning Objective:**

CLOBJ 1	Describe the fundamental mechanical, thermal, and chemical properties of engineering materials relevant to chemical processes.
CLOBJ 2	Explain the mechanisms of corrosion and material degradation in chemical environments and apply methods for corrosion prevention.
CLOBJ 3	Select appropriate materials for specific chemical engineering applications based on their properties and process conditions.
CLOBJ 4	Classify and compare the properties and applications of different classes of engineering materials, including metals, polymers, ceramics, and composites.
CLOBJ 5	To acquaint the student with common manufacturing processes and recent technological developments that is used in creating products from plastics and composites.

f. **Course Learning Outcomes:**

CLO 1	Describe the fundamental mechanical, thermal, and chemical properties of engineering materials relevant to chemical processes.
CLO 2	Explain the mechanisms of corrosion and material degradation in chemical environments and apply methods for corrosion prevention.
CLO 3	Select appropriate materials for specific chemical engineering applications based on their properties and process conditions.
CLO 4	Classify and compare the properties and applications of different classes of engineering materials, including metals, polymers, ceramics, and composites.
CLO 5	To acquaint the student with common manufacturing processes and recent technological developments that is used in creating products from plastics and composites.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
4	0	0	4	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Introduction to Engineering Materials Introduction to material science and engineering. Classification of engineering materials (metals, polymers, ceramics, composites). Atomic structure and bonding. Crystal structures and imperfections. Material properties: Definition of Melting point, Boiling point, Specific heat, Thermal conductivity, Thermal expansion, Thermal insulation, Stresses, Strain, Yield stress, Fatigue, Creep.	18	10
2	Structure and Imperfections in Crystals Crystal structure Crystal geometry, structure of solids, methods of determining structures. Imperfection in crystals - types of imperfection. Point imperfection	12	8
3	Metals and Alloys Properties and uses of Cast iron, Wrought iron, Mild steel, Stainless steel, Comparison of ferrous metals and alloys, Properties and uses of metals: Aluminium, Zinc, Chromium, Nickel, Tin, Copper, Titanium, Tungsten, Platinum and Silver.	25	15
4	Ceramic Materials Ceramic materials, Composition, properties and uses of china clay, fire clay, bentonite, Classification, properties and uses of refractories, Composition, properties and uses of Soda lime glass, borosilicate glass, high silica glass, fibre glass, glass wool, form glass, Composition, properties and uses of Porcelain, Composition Properties and types of Cement.	25	15
5	Protective Coatings and Insulations Paints: classification and uses, Ingredients of paints: their properties and importance, Special types of paints and their applications, Varnishes: classification and uses, Ingredients of Varnishes, Types of insulations, Properties and applications of different : (i) Electric insulation (ii) Thermal insulation	10	6
6	Composites, Lubricants and Adhesives List of composite materials, Properties and uses of Fiber reinforced plastics (FRP), Metal matrix composites (MMC), Ceramic matrix composites (CMC), Classification, properties and uses of Synthetic lubricants, Semisolid lubricants, Advanced materials (Biomaterials, nanomaterials) with special reference to the applications in chemical Industries	10	6
	Total	100%	60

i. Text Book and Reference Book:

1. Engineering Materials (TextBook) By S C Rangwala | Charotar Publishing House Pvt. Ltd.
2. Safe Handling of Hazardous Chemicals By A.K. Rohatgi | J.K. Enterprise
3. Engineering Metrology and Instrumentation By R.K. Rajput By R.G. Squires"

- a. **Course Name:** Disaster Management
- b. **Course Code:** 03061502UE01
- c. **Prerequisite:** High School Science.
- d. **Rationale:** Disaster management is an essential subject for equipping students with the knowledge and skills needed to prevent, prepare for, respond to, and recover from disasters efficiently. It contributes to building safer communities and sustainable development.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of disaster, hazard, vulnerability, risk, and disaster management.
CLOBJ 2	Develop knowledge of different types of natural, technological, biological, and manmade disasters along with their causes and impacts.
CLOBJ 3	Understand the disaster management cycle including prevention, preparedness, mitigation, response, recovery, and rehabilitation.
CLOBJ 4	Analyze disaster management frameworks, policies, institutional mechanisms, and disaster management practices in India.
CLOBJ 5	Develop awareness regarding the application of science and technology in disaster prediction, communication, mitigation, and management.
CLOBJ 6	Promote disaster preparedness, safety awareness, and sustainable strategies for minimizing disaster risks and impacts.

f. **Course Learning Outcomes:**

CLO 1	Explain the concepts of disaster, hazard, vulnerability, risk, and capacity in disaster management.
CLO 2	Identify and classify different types of disasters and analyze their causes, consequences, and control measures.
CLO 3	Describe the disaster management cycle and apply principles of preparedness, mitigation, rescue, relief, and rehabilitation.
CLO 4	Explain disaster management policies, institutional frameworks, and the role of governmental and non-governmental agencies in India.
CLO 5	Demonstrate understanding of early warning systems, disaster communication, and disaster-safe planning and construction practices.
CLO 6	Apply scientific and technological tools such as GIS, GPS, and remote sensing in disaster monitoring and management applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	0	0	3	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Introduction and Basic Principle of Disaster Management Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, and Capacity. Disaster and Development, and disaster management.	10%	3
2	Types, Trends, Causes, Consequences and Control of Disasters Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters) Global Disaster Trends − Emerging Risks of Disasters – Climate Change and Urban Disasters.	20%	10
3	Disaster Management Cycle and Framework Basics of Disaster Management Cycle, Paradigm Shift in Disaster Management, Understanding Risk, How to Prevent and Reduce Disaster Impact, Early Warning Systems, Being Prepared: Awareness and Capacity Building, What to Do During a Disaster, Search and Rescue Operations in Disaster Situations, Relief and Rehabilitation After a Disaster ,Assessing Damage and Restoring Infrastructure, Reconstruction and Redevelopment.	30%	12
4	Disaster Management in India Disaster Profile of India − Mega Disasters of India and Lessons Learnt. Disaster Management Act 2005 & minus; Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies.	20%	10
5	Applications of Science and Technology for Disaster Management Geo-informatics in Disaster Management (RS, GIS, GPS and RS). Disaster Communication System (Early Warning and Its Dissemination). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters. S&T Institutions for Disaster Management in India.	20%	10
	Total	100%	45

i. Text Book and Reference Book:

1. Disaster Management Guidelines, By GOI-UNDP Disaster Risk Reduction Programme (2009-2012)
2. Environment Engineering and Disaster Management, By Sharma, Sanjay K. | Luxmi Publications, New Delhi
3. Handbook of Disaster Management: Techniques & Guidelines, By Singh B.K
4. Disaster Management, By Ghosh G.K.

- a. **Course Name:** Organic Chemistry
 b. **Course Code:** 03069502BS01
 c. **Prerequisite:** Understanding and recognizing the organic compounds that will be studied in organic chemistry chapters.
 d. **Rationale:** Organic chemistry is a fundamental branch of chemistry focusing on the structure, properties, composition, reactions, and synthesis of carbon-containing compounds. It plays a crucial role in various scientific and technological advancement.

e. **Course Learning Objective:**

CLOBJ 1	Understand the Fundamental Concepts of Organic Chemistry.
CLOBJ 2	Master Techniques for the Purification of Organic Compounds.
CLOBJ 3	Demonstrate Proficiency in Detection and Estimation of Elements in Organic Compounds.
CLOBJ 4	Acquire Knowledge on Aliphatic Compounds and Aromatic Compounds.
CLOBJ 5	Understand the Chemistry of Carbohydrates, Soaps, Detergents and Dyes.

f. **Course Learning Outcomes:**

CLO 1	Understand the Fundamental Concepts of Organic Chemistry.
CLO 2	Master Techniques for the Purification of Organic Compounds.
CLO 3	Demonstrate Proficiency in Detection and Estimation of Elements in Organic Compounds.
CLO 4	Acquire Knowledge on Aliphatic Compounds and Aromatic Compounds.
CLO 5	Understand the Chemistry of Carbohydrates, Soaps, Detergents and Dyes.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	0	2	4	20	20	50	60	-	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Concept of Organic Chemistry Introduction -Classification of Hydrocarbons, Functional group classification of organic compound, IUPAC system of nomenclature. Structural Isomerism -Position Isomerism, Chain Isomerism, Mesomerism Isomerism, Functional Isomerism Stereo Isomerism- Optical isomerism, Geometrical Isomerism	10	6

2	Purification of Organic Compounds Crystallization, Sublimation, Distillation-Simple distillation, Fractional distillation, Distillation under reduced pressure, Steam distillation, Tests of purification- M.P. & B.P. of organic compounds.	10	5
3	Detection & Estimation of Elements Detection of C, H, N, halogens, S & P., Lassaigne's Test for detection of N, Cl, Br, I & S., Estimation of C & H., Estimation of Nitrogen by Duma's method. Estimation of Nitrogen by Kjeldahl's method, Estimation of halogens, sulphur and Phosphorous by Carius Method. Problems based on methods of estimation.	15	6
4	Study of Aliphatic Compounds Preparation, Properties (Physical and Chemical) & Uses of following Compounds. Alcohol, Aldehyde & Ketone (Methanol, Ethanol, Acetaldehyde & Acetone.) Carboxylic Acid (Acetic Acid & Oxalic), Esters and ether (Methyl & Ethyl Acetate & Diethyl ether), Amines (Methylamine, Ethyl Amine).	20	8
5	Study of Aromatic Compounds Preparation, Properties (Physical and Chemical) & Uses - Benzene & Toluene, Nitrobenzene & Aniline., Phenol & Benzaldehyde, Benzoic Acid & Salicylic Acid. Styrene. & Naphthalene, Anthracene and Urea, Benzamide.	20	8
6	Carbohydrates, Soaps & Detergent Introduction: Carbohydrates and its classification with Suitable Examples and functions of carbohydrates Explain soaps and Detergent, Classification of soaps and detergent with suitable example of each class Mechanism of cleansing action.	10	4
7	Chemistry of Dyes Definition and theories of color, Chromogens, Chromophore, and Auxochrome, Introduction to Natural to synthetic dyes, Classification of Dyes based on structure and method of application. Azo dyes, Mordant dyes. Anthraquinone (VAT) dyes, Indigoid dyes. Reactive dyes and Disperse dye: Introduction, Classification and applications.	15	8
Total		100%	45

i. Text Book and Reference Book:

1. A text book of organic chemistry – Arun Bahl, B.S. Bahl. S. Chand
2. A Text Book of Organic Chemistry
By Arun Bahl and B.S. Bahl | Sultan Chand & Sons, New Delhi
3. Text Book Of Organic Chemistry
By P. L. Soni | Sultan Chand & Sons, New Delhi
4. Organic chemistry by I.L. Finar, Volume-I & II. Longmans
5. Organic Chemistry by Morrison and Boyd. Pearson education

j. List of Experiments:

Sr. no.	Experiment List
1.	Identification of Organic Acid, Base, Phenol & Neutral Compounds.(Their physical state, Structural formula & Solubility).
2.	Purification of a given organic compound by crystallization.
3.	Purification of a given organic compound by Solvent Treatment method.
4.	Detection of Melting point of some Organic Solids by Thiele's Method.
5.	Detection of Boiling point of some Organic liquids by Thiele's Method.

6.	Organic Separations-I (Acid + Phenol + Base).
7.	Preparation of Nitrobenzene from Benzene.
8.	Purification of organic compounds by Sublimation method.
9.	Detection of Inorganic Elements by Lassaigne's test.
10.	Organic spotting - i) Acetic Acid & Benzoic Acid (ii) Aniline & Nitrobenzene iii) Benzene & Acetone (iv) Chloroform & Phenol.

- a. **Course Name:** Mathematics - II
- b. **Course Code:** 03069102BS01
- c. **Prerequisite:** Knowledge of Basic concept of mathematics studied till first semester.
- d. **Rationale:** This course is an extension of the course Mathematics-I of first semester namely Mathematics II. Using the methods of differentiation, integration, differential equations, matrix theory, geometry, and differential equations, the course aims to instill its applications in pertinent engineering and technological fields.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental concepts of matrices, determinants, vector algebra, coordinate geometry, integral calculus, and differential equations.
CLOBJ 2	Develop analytical and mathematical problem-solving abilities required for engineering and scientific applications.
CLOBJ 3	Apply matrix operations, vector algebra, and coordinate geometry techniques to solve algebraic and geometrical problems.
CLOBJ 4	Understand the principles and applications of integration and differential equations in engineering mathematics.
CLOBJ 5	Develop the ability to analyze mathematical models and apply computational approaches using basic MATLAB concepts.
CLOBJ 6	Build a strong mathematical foundation for advanced engineering, biomedical, and scientific studies.

f. **Course Learning Outcomes:**

CLO 1	Solve systems of linear equations using determinants, Cramer's rule, and matrix inversion methods.
CLO 2	Perform vector operations including scalar and vector products and apply them to engineering-related problems.
CLO 3	Analyze and formulate equations of straight lines and circles using coordinate geometry concepts.
CLO 4	Apply techniques of integration including substitution, integration by parts, and partial fractions to solve mathematical problems.
CLO 5	Evaluate areas and volumes using definite integrals and applications of integration.
CLO 6	Solve first-order differential equations using standard methods and demonstrate basic understanding of MATLAB applications.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	1	0	4	20	20	-	60	-	100

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Determinants and Matrices Elementary properties of determinants up to 3rd order, consistency of equations, Cramer's rule. Algebra of matrices, Inverse of a matrix, matrix inversion method to solve a system of linear equations in 3 variables.	23%	10
2	Vector Algebra Definition notation and rectangular resolution of a vector. Addition and subtraction of vectors. Scalar and vector products of 2 vectors. Simple problems related to work, moment and angular velocity.	20%	9
3	Co-Ordinate Geometry Straight line Inclination and slope of a line, different forms of equations to a straight line, Slope-intercept form, and Point slope form, Two-point form, Intercept form. General equation of a Straight line, Family of lines. Conditions for concurrency of lines. Circle Definition, Equation of a circle with given center and radius, General form of equation of circle, Equation of a circle when intercepts are given, circle passing through three points, Equation of chord, Equations of tangents and normal at a point on a circle.	17%	8
4	Integral Calculus Integration as inverse operation of differentiation, Integration of simple functions, Integration by substitution, by parts and by partial fractions (for linear factors only). Definite integral: Definition, Properties of Definite integral, Odd and Even functions, Use of formulas, and for solving problems Where m and n are positive integers. Applications of integration for i. Simple problem on evaluation of area bounded by a curve and axes. ii. Calculation of Volume of a solid formed by revolution of an area about axes. (Simple problems)	23%	10
5	Differential Equations Solution of first order and first degree differential equation by variable separation method (simple problems), Exact differential equations (simple problems), Linear differential equations (simple problems), MATLAB – Simple Introduction.	17%	8
Total		100%	45

i. Text Book and Reference Book:

1. Mathematics-I, By Deepak Singh | Khanna Book Publishing Co
2. Mathematics II, By Garima Singh | Khanna Book Publishing Co.
3. Elementary Engineering Mathematics, By Dr. B. S. Grewal | Khanna Publishers | 15th Edition
4. Calculus and Analytic Geometry, By G. B. Thomas, R. L. Finney | Addison Wesley | 9th Edition
5. Higher Engineering Mathematics, By B. S. Grewal | Khanna Publications.

- a. **Course Name:** Applied Mechanics
- b. **Course Code:** 03061502ES01
- c. **Prerequisite:** Basic knowledge of Laws and Principles of Mathematics and Physics.
- d. **Rationale:** The primary purpose of the study of Engineering Mechanics is to develop the capacity to predict the effects of force while carrying out the creative design functions of engineering. The course addresses the modeling and analysis of static equilibrium problems with an emphasis on real world engineering applications and problem solving. It bridges the gap between physical theory and its application to technology.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the fundamental principles of engineering mechanics including forces, equilibrium, motion, friction, and lifting machines.
CLOBJ 2	Develop analytical and problem-solving skills related to statics and dynamics in engineering applications.
CLOBJ 3	Apply concepts of centroid, centre of gravity, force systems, and moments for analyzing engineering structures and mechanical systems.
CLOBJ 4	Understand equilibrium conditions of coplanar concurrent and non-concurrent force systems and their engineering significance.
CLOBJ 5	Analyze frictional forces and the working principles of simple lifting machines used in mechanical systems.
CLOBJ 6	Build a strong foundation in applied mechanics for engineering design, analysis, and industrial applications.

f. **Course Learning Outcomes:**

CLO 1	Explain the basic concepts of mechanics, force systems, vector representation, and Newton's laws of motion.
CLO 2	Determine centroid and centre of gravity of simple and composite geometrical figures and solids.
CLO 3	Resolve forces and analyze equilibrium conditions of coplanar concurrent force systems using analytical methods.
CLO 4	Calculate moments, beam reactions, and equilibrium conditions for coplanar non-concurrent force systems.
CLO 5	Analyze frictional problems involving bodies on horizontal and inclined planes using laws of friction.
CLO 6	Explain the principles, efficiency, velocity ratio, and applications of simple lifting machines used in engineering practice.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
3	0	2	4	20	20	50	60	-	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Basics of Mechanics Significance and relevance of Mechanics, Applied mechanics, Statics, Dynamics. Space, time, mass, particle, flexible body and rigid body. Scalar and vector quantity, Units of measurement (SI units) - Fundamental units and derived units. Force – unit, representation as a vector and by Bow's notation, characteristics and effects of a Force. Newton's Laws of Motion. Principle of transmissibility of force, Principle of Superposition. Force system and its classification.	10%	4
2	Centroid & Centre of Gravity Concept of Centroid, Centre of Gravity. Axis of reference and Axis of Symmetry. Centroid of One Dimensional geometrical figures using principle of moment. Centroid of Two Dimensional geometrical Plane figures (Square, Rectangle, Triangle, Circle, Semi-circle, Quarter circle) & Composite figures (not more than three figures) using first moment of area. Centre of Gravity of Simple solids (Cube, Cuboid, Cone, Cylinder, Sphere, and Hemisphere) & Composite solids (not more than two solids) using first moment of mass.	15%	7
3	Coplanar Concurrent Forces Resolution of a force - Orthogonal components of a force. Equilibrium and Equilibrant, Free body and Free body diagram, conditions of equilibrium. Resultant of forces using analytical methods for the forces acting at a point: 1. Law of Parallelogram, 2. Law of triangle, and 3. Law of Polygon. Lami's Theorem – statement and explanation, Application for various engineering problems using analytical methods.	25%	12
4	Coplanar Non-Concurrent Forces Moment of a force, Varignon's Theorem, Couple, application, properties of couple, conditions of equilibrium. Resultant of force, Equilibrium forces and its position using analytical methods for the coplanar non – concurrent force system. Types of beam, supports (simple, hinged, roller and fixed) and loads acting on beam (vertical point load, uniformly distributed load, uniformly varying load). Beam reaction for cantilever, simply supported beam with or without overhang – subjected to combination of Point load and uniformly distributed load.	25%	12
5	Friction Friction, Types of Friction and laws of friction, limiting equilibrium, limiting friction. Coefficient of friction, angle of friction, angle of repose, relation between coefficient of friction and angle of friction. Equilibrium of bodies on level surface subjected to force parallel and inclined to plane. Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.	15%	6
6	Simple Lifting Machines Simple lifting machine, load, effort, mechanical advantage, applications and advantages. Velocity ratio, efficiency of machines. Application of law of machine. Ideal machine, friction in machine, maximum Mechanical advantage and efficiency. Reversible and non-reversible machines, conditions for reversibility. Velocity ratios of Simple wheel and axle, Differential axle and Wheel and, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack.	10%	4
	Total	100%	45

i. Text Book and Reference Book:

1. Applied Mechanics, By H. J. Shah and S. B. Junarkar | Charotar publication
2. A Text Book of Engineering Mechanics, By Bansal R K | Laxmi Publishers, New Delhi.

3. Engineering Mechanics, By S.S. Bhavikatti and K. G. Rajashekarappa | Wiley 'Eastern Ltd
4. Engineering Mechanics, By J.L. Meriam, and L.G.Kraige | John Wiley and sons, New York.

j. List of Experiments:

Sr. no.	Experiment List
1.	Verify and calculate resultant force through Law of Parallelogram using analytical and graphical methods.
2.	Verify Law of Triangle using analytical and graphical methods.
3.	Verify and calculate resultant force through Polygon Law of Forces using analytical and graphical methods.
4.	Verify and calculate the value of unknown force through Lami's Theorem.
5.	Verify and calculate support reactions of a simply supported beam using analytical and graphical methods.
6.	Calculate centroid of a lamina having regular and irregular shapes.
7.	Calculate angle of repose for different surfaces – Wood, Glass, Steel, plastic, wrought iron etc...
8.	Calculate coefficient of Static Friction for different surfaces – Wood, Glass, Steel, plastic, wrought iron etc...
9.	Verify and calculate theoretical and practical velocity ratios of any four simple lifting machines. (Simple wheel and axle, Differential axle and wheel and simple screw jack)

- a. **Course Name:** Logical Reasoning
b. **Course Code:** 03060002HM01
c. **Prerequisite:** Basic knowledge of Grammar and Communication.
d. **Rationale:** Practical language proficiency and essential soft skills for academic and professional success.
e. **Course Learning Objective:**

CLOBJ 1	Develop effective listening, speaking, reading, and writing skills required for academic and professional communication.
CLOBJ 2	Enhance vocabulary and language proficiency through the study of homophones, homonyms, homographs, phrasal verbs, and idioms.
CLOBJ 3	Understand and apply grammatical concepts such as subject-verb agreement and direct-indirect speech in communication.
CLOBJ 4	Improve interpersonal and presentation skills through activities such as product presentations, public speaking, and storytelling.
CLOBJ 5	Develop professional communication skills including formal letter writing and email writing.
CLOBJ 6	Build personality development, analytical thinking, and self-assessment skills through SWOT analysis and logical reasoning activities.

f. **Course Learning Outcomes:**

CLO 1	Demonstrate effective listening habits and identify barriers to effective communication.
CLO 2	Use advanced vocabulary, idioms, phrasal verbs, homophones, homonyms, and homographs appropriately in communication.
CLO 3	Apply grammatical rules related to subject-verb agreement and direct-indirect speech accurately in oral and written English.
CLO 4	Draft formal and informal letters and professional emails using appropriate format, tone, and language.
CLO 5	Deliver short presentations and speeches confidently with improved pronunciation, voice modulation, and organization of ideas.
CLO 6	Apply SWOT analysis, logical reasoning, and creative thinking skills in personal, academic, and professional situations.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	-	2	2	40	-	20	60	30	150

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Listening Skills- Basic level Introduction and importance of good Listening, Difference between listening and hearing, Types of listening, Barriers to effective Listening, Traits of a good listener.	10%	1
2	Crazy Scientist Invent a product, Presentation of a product	8%	1
3	Advanced Building Vocabulary: Homophones, Homonyms, Homographs, Phrasal verbs & Idioms Homophones and Their Confusing Pairs, Homographs and Contextual Meaning, Homonyms: Words with Multiple Meaning, Common Phrasal Verbs in Conversation, Popular Idioms and Their Real-Life Application.	10%	2
4.	Subject Verb Agreement Basic Rules and Exceptions, Spot the Error & Correction Exercises.	8%	2
5.	SWOT Analysis Introduction to SWOT, Creating a Personal SWOT Chart, Applying SWOT for Goal Setting.	10%	1
6.	Letter Writing & E-mail Writing Formal vs Informal Letter Format, Structure of a Professional Email (Subject, Greeting, Body, Sign-off), Tone and Language Appropriateness, Common Mistakes in Letters/Emails.	13%	2
7.	Direct-Indirect Speech Rules for Changing Tenses, Pronouns, and Time Expressions, Reporting Statements, Questions, Commands, and Requests, Reporting Modal Verbs (can & rarr; could, will & rarr; would), Conversion Exercises.	8%	2
8.	Blood Relation & Alphabetical series Introduction to Family Tree Terms, Types of Blood Relation Questions, Introduction to Alphabetical Series, Common Patterns in Alphabetical Series.	8%	1
9.	Story Writing by using hints Elements of a Story (Characters, Setting, Plot, Conflict, Resolution, Types of Stories (Narrative, descriptive, imaginative, moral-based, fables).	10%	1
10.	Speaking Skill Building Introduction Overcoming Stage Fear and Speaking Anxiety, Voice Modulation and Pronunciation Tips, Organizing Thoughts Before Speaking, Basic Public Speaking Formats (Self-Intro, Small Speeches).	15%	2
	Total:	100%	15

i. Text Book and Reference Book:

1. English Grammar in Use, By Raymond Murphy | Cambridge University Press, Pub. Year 2019
2. Word Power Made Easy, By Norman Lewis | Goyal Publishers, Pub. Year 2014
3. A Modern Approach to Logical Reasoning, By R.S. Aggarwal | S. Chand Publishing, Pub. Year 2018
4. Developing the Leader Within You, By John C. Maxwell | Thomas Nelson, Pub. Year 2013
5. Cambridge Listening and Speaking Skills Series, By Cambridge University Press
6. | Cambridge University Press, Pub. Year 2017
7. The 7 Habits of Highly Effective People, By Stephen R. Covey | Simon & Schuster, Pub. Year 2020

j. List of Experiments:

Sr. no.	Experiment List
1	Listening Skills – Basic level Audio Comprehension Practice (e.g., TED Talks, dialogues, interviews), Note-Taking While Listening (key points, summarizing), Fill in the Blanks from Audio Clips, Listening for Tone and Emotion.
2	Crazy Scientist - Practice Group Activity: Invent & Present a Scientific Invention, Create a Poster or Diagram of an invention.
3	Advanced Building Vocabulary: Homophones, Homonyms, Homographs, Phrasal verbs & Idioms - Practice Sorting Game: Match Homophones/Homographs to Meanings, Fill in the Blanks with Correct Homonyms, Vocabulary Crossword or Word Jumble Challenges, Finding the meaning of different Phrasal verbs & Idioms.
4	Subject Verb Agreement- Practice Spot the Error Exercises in Paragraphs, Group Quiz: “Choose the Correct Verb”, Rewrite Sentences with Correct Agreement.
5	SWOT Analysis - Practice Individual SWOT Chart Creation, Peer Review: Partner Reviews Your SWOT, Case Study Analysis (SWOT of a famous person or company), Group Discussion: Present Your SWOT Plan, Goal-Setting Activity Based on SWOT Insights.
6	Letter Writing & E-Mail Writing - Practice Writing practice of different types of Formal Letters, Drafting Emails with Subject, Salutation, Body, and Sign-off, Email Etiquette Activity (Identify Dos and Don'ts).
7	Direct-Indirect Speech - Practice Convert Dialogue into Reported Speech, Rewriting News Headlines from Direct to Indirect, Mixed Tense Exercises Involving Speech Conversion.
8	Blood Relation & Alphabetical Series – Practice Diagram Drawing Practice: Family Tree, Solving questions of Blood Relation, Solving questions of Alphabetical series.
9	Story writing by using hints - Practice Story Starters: Continue the Given Opening, Peer Feedback: Review and Improve Stories, Group Story Chain (Each Student Adds a Sentence), Edit and Rewrite: Improve a Poorly Written Story.
10	Speaking Skill Building Activity Self-Introduction and Peer Introduction, Extempore Speech Practice (1–2 min topics), Pronunciation Practice Using Tongue Twisters or Audio Aids.

- a. **Course Name:** Universal Human Values
- b. **Course Code:** 03060002MC01
- c. **Prerequisite:** Basic communication and interpersonal skills.
- d. **Rationale:** The Universal Human Values (UHV) course aims to develop a holistic understanding of life, fostering ethical behavior, responsible decision-making, and harmonious living. It helps students align their personal and professional actions with core human values, ensuring happiness, well-being, and sustainable development in society.

e. **Course Learning Objective:**

CLOBJ 1	Understand the concept and importance of value education for holistic human development and continuous happiness.
CLOBJ 2	Develop self-awareness and self-exploration to identify the relationship between human values, behavior, and ethical living.
CLOBJ 3	Understand harmony within the individual, family, society, and nature for peaceful and sustainable coexistence.
CLOBJ 4	Analyze the role of trust, respect, justice, and responsibility in maintaining healthy human relationships and social harmony.
CLOBJ 5	Develop awareness regarding environmental balance, coexistence, and mutual fulfillment among all forms of nature.
CLOBJ 6	Apply universal human values and professional ethics in personal life, education, workplace, and society.

f. **Course Learning Outcomes:**

CLO 1	Explain the significance of value education, self-exploration, and holistic development in human life.
CLO 2	Differentiate between the needs of the self and the body and understand the importance of self-regulation and health.
CLO 3	Demonstrate understanding of harmony in family and society through values such as trust, respect, justice, and cooperation.
CLO 4	Analyze the interconnectedness and coexistence among human beings, society, and nature.
CLO 5	Explain the role of ethical conduct, professional ethics, and humanistic values in personal and professional life.
CLO 6	Apply value-based thinking and ethical decision-making for sustainable development and social well-being.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				T	CE	P	Theory	P	
1	0	0	0	20	20	-	-	-	40

L- Lectures; T- Tutorial; P- Practical; C- Credit; MSE- Mid-Semester Evaluation, CE-Continuous Evaluation, ESE- End Semester Examination

h. **Course Content:**

Sr. No.	Content	Weightage (%)	Teaching Hours
---------	---------	---------------	----------------

1	Introduction to Value Education Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.	20%	3
2	Harmony in the Human Being Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	20%	3
3	Harmony in the Family and Society Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to- Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.	20%	3
4.	Harmony in the Nature/Existence Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	20%	3
5.	Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	20%	3
	Total:	100%	15

i. Text Book and Reference Book:

1. A. Nagraj, 1998, Jeevan Vidyaek Parichay, Divya Path Sansthan, Amarkantak.
2. A.N. Tripathy, 2003, Human Values, New Age International Publishers
3. The Story of My Experiments with Truth, By M K Gandhi
4. Small is Beautiful, By E. F Schumacher
5. Rediscovering India, By Dharampal