



First Year Curriculum

Admission Year 2026-27

**Bachelor of Technology
Biotechnology**

Faculty of Engineering & Technology

Parul University

Vadodara, Gujarat, India

Semester 1

- a. **Course Name:** Chemistry-I
- b. **Course Code:** 03019501BS01
- c. **Prerequisite:** This subject requires the basic Knowledge of chemistry in Engineering field.
- d. **Rationale:** Engineering Chemistry bridges the gap between fundamental chemical sciences and engineering applications. This subject provides a strong foundation in chemical principles, reaction mechanisms, and material properties, enabling engineering students to understand and apply chemistry in various technological advancements and industrial processes.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the principles of water chemistry including hardness, softening methods, and treatment processes, and apply these concepts to solve numerical problems related to water quality.
CLOBJ 2	Apply electrochemical principles to analyze electrode potentials using the Nernst equation, understand reference electrodes, and evaluate various energy storage and conversion systems including batteries and hydrogen fuel cells.
CLOBJ 3	Classify and characterize engineering materials including polymers, elastomers, paints, varnishes, refractories, and glasses in terms of their composition, properties, and industrial applications.
CLOBJ 4	Explain nuclear chemistry concepts including radioactivity, nuclear reactions, and the working of nuclear reactors, and identify the applications of radioisotopes in diverse scientific and industrial fields.
CLOBJ 5	Analyze metallic alloys and apply the phase rule to one- and two-component systems to predict phase equilibria and understand material behavior in engineering contexts.

- f. **Course Learning Outcomes:**

CLO 1	Understand fundamental water chemistry concepts, such as hardness and treatment techniques, and solve related numerical problems.
CLO 2	Gain knowledge on Principles of electrochemistry and its applications and understand working of Fuel Cell and Batteries.
CLO 3	Demonstrate knowledge of engineering materials, including polymers and refractories, focusing on their properties and industrial uses.
CLO 4	Explain nuclear chemistry concepts like radioactivity and the applications of radioisotopes in science and industry.
CLO 5	Evaluate metallurgy processes, alloy properties, and phase rule applications in material science relevant to engineering.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme		
L	T	P	C	Internal Evaluation		ESE
				MSE	CE	Total
3	-	2	4	20	20	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	Unit 1 Water Chemistry and Corrosion Water chemistry: Hardness of water-types, degree of hardness, Effects, causes and prevention methods; numerical problems on hardness of water. Softening of water – Ion exchange, Soda-Lime method, Zeolite/Permutit method, Treatment of water –Breakpoint of chlorination. Drinking water specification, COD, BOD Dissolve Oxygen content Corrosion and its prevention: Introduction, Electrochemical theory of corrosion, Factors affecting the rate of corrosion: ratio of anodic to cathodic areas, nature of corrosion product, nature of medium – pH, conductivity and temperature. Types of corrosion - Differential metal and differential aeration (pitting and water line). Corrosion control: Anodizing – Anodizing of aluminum, Cathodic protection - sacrificial anode and impressed current methods, Different Metal coatings methods.	20%	10
2	Unit – II Electrochemistry and energy storage systems Electrochemistry: Introduction, Potential, EMF of cell, Free Energy, Single electrode potential-Derivation of Nernst equation, Numerical problems based on Nernst Equation (E, Eo & Ecell). Reference Electrodes: construction, working and applications of SHE, calomel electrode, ion selective electrodes: Introduction, construction, working and applications of Glass electrode, Energy storage Systems: Introduction, Classification of batteries (primary, secondary and reserved batteries). Applications of Electrochemistry- Li-ion batteries. Brief introduction of Na-ion battery. Green fuel: Hydrogen-production and applications in hydrogen fuel cells (Construction, working and applications)	25%	10
3	Unit – III Engineering Materials Definition, Classification of	25%	10

	Polymers (Natural and Synthetic) Types of Polymerization, Polymerization Techniques Plastics –Thermosetting and Thermoplastic (Difference) and Properties and uses of Important commercial Plastics– PE,PS, Polypropylene, PVC,PTFE, Epoxy resin,). Single used Plastics, Biodegradable polymers: Introduction and their requirements, Properties and applications, Inorganic Polymers and its Industrial Importance. Elastomers –Natural and Synthetic, disadvantages of natural rubber, Compounding of rubber, Ingredients and their functions – Vulcanization, properties and uses of Butyl Rubber, Neoprene, SBR, Silicone, NBR. Paint – definition, Components and properties of paints. Varnish – definition, properties and examples. Refractories – Definition, Classification, properties and applications. Glass and Refractories- Definition and General Properties of Glass, Types of Glasses and their Applications, Refractories: Definition and Characteristics of Refractory, Classification of refractories: Acid, Basic and Neutral refractories.		
4	Unit – IV Nuclear Chemistry Introduction, radioactivity, type of radiations, type of radioactive decay, Radioactivity and Radioactive laws, Fission & Fusion reactions, Nuclear reactor, Chain Reaction, nuclear waste disposal. Detection and measurement of radioactivity by Cloud chamber, Geiger-Muller counter, scintillation counter, ionization chamber. Applications of Radioisotopes in Physicochemical investigation, Agriculture field, Biology, healthcare.	15%	7
5	Unit – V Metallurgy and Phase rule Metal and Alloys- Introduction, Physical and chemical properties of metals, purpose of making alloys, Ferrous and Non-Ferrous alloys and its industrial applications. Phase Rule- Introduction, Phase, Components, Degree of freedom, Derivation of Gibb's Phase, One component system like water, sulphur systems, two component system, Eutectic systems like silver-lead, zinc-cadmium system	15%	8
Total:		100%	45

i. Text Book and Reference Book:

1. Engineering Chemistry, By Jain and Jain, Dhanpat Rai Publication
2. Engineering Chemistry, By O.G. Palanna, McGraw Hill Education
3. Engineering Chemistry, By Shashi Chawla, Dhanpat Rai & Co.
4. A Textbook of Engineering Chemistry, By S.S. Dara, S. Chand Publication
5. Engineering Chemistry, By K.Sesha Maheswaramma & Mridula Chugh, Pearson Publication

Semester-I

- a. **Course Name:** Programming for Problem Solving
- b. **Course Code:** 03010501ES01
- c. **Prerequisite:** Requires Basic Knowledge of Computer
- d. **Rationale:** This course is designed to provide basic ideas of computer programming. This course also helps to understand programming language. It will help to develop logical abilities.
- e. **Course Learning Objective:**

CLOBJ 1	Understand the basic structure of a C program and develop skills to write, compile, and execute programs, including formatted input/output operations.
CLOBJ 2	Apply knowledge of constants, variables, data types, operators, and expressions to write syntactically and semantically correct C programs.
CLOBJ 3	Implement decision-making and looping constructs to develop programs that solve logical and repetitive computational problems.
CLOBJ 4	Utilize arrays and strings to store, manipulate, and process collections of data effectively in C programs.
CLOBJ 5	Design and implement user-defined functions, structures, and unions to build modular and well-organized C programs.
CLOBJ 6	Apply concepts of pointers, dynamic memory allocation, and file management to develop efficient and robust C programs.

- f. **Course Learning Outcomes:**

CLO 1	Write, compile, and execute simple C programs demonstrating the basic structure of C language and use of input/output functions.
CLO 2	Apply appropriate data types, operators, and expressions to construct valid C programs for given computational tasks.
CLO 3	Develop programs using if-else, switch, while, do-while, and for loop constructs to handle branching and iteration.
CLO 4	Implement programs using one-dimensional and two-dimensional arrays and built-in string functions to process data.
CLO 5	Create modular C programs using user-defined functions with parameter passing, recursion, structures, and unions.
CLO 6	Develop programs using pointers, dynamic memory allocation (malloc, calloc, free, realloc) and standard file handling functions.

g. Teaching & Examination Scheme:

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	-	2	4	20	20	20	60	30	150

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

Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Introduction to 'C' Programming What is C language, History of C language, Application areas of C, Features of C language, structure of C Program, execution flow of program, reading a character, writing a character, formatted input, formatted output functions.	10%	8
2	Constants, Variables, Data Types, Operators and Expressions Constants, Variables, Data Types: Character Set, C tokens, Keywords and Identifiers, Constants, Variables, Data types, Declaration of Variables, Assigning values to variables, typedef, and Defining symbolic constants. Operators and Expression: Introduction to Operators and its types, Evaluation of expressions, Precedence of arithmetic operators, Type conversions in expressions, Operator precedence and associativity.	15%	5
3	Control Structures in C Decision Making & branching: Decision making with If & If..Else statements, If..Else statements (Nested....Ladder), The Switch, The break statement & goto statements, The ternary (?:) Operator. Looping: The while statement, & The Do..While loop, The FOR loop, Jump within loops - Programs.	15%	4
4	Arrays and Strings Arrays: Introduction, One-dimensional array, Two-dimensional array, Concept of Multidimensional arrays. Strings: String declaration, storage, Built-in-string functions.	20%	7
5	User-Defined Functions, Structure and Unions User-Defined Functions: Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing. Structure and Unions:	20%	10

	Introduction, Structure definition, declaring and initializing Structure variables, Accessing Structure members, Copying & Comparison of structures, Arrays of structures, Arrays within structures, Structures within Structures, Structures and functions, Unions.		
6	Pointers, Dynamic Memory Allocation and File Management in C Pointers: Basics of pointers, pointer to pointer, pointer and array, Pointer to array, array of pointers, functions returning pointers. Dynamic memory allocation: Introduction to Dynamic memory allocation, malloc(), calloc(), free(), realloc(). File Management in C: Introduction and standard file handling functions.	20%	8
Total:		100%	42

h. Text Book and Reference Books:

1	Programming in ANSI C (TextBook)	E. Balaguruswamy	Tata McGraw-Hill
2	C Programming: Test Your Skills	Ashok Kamthane	
3	Computer Fundamentals	P.K. Sinha and Priti Sinha	BPB Publications, 4th Edition
4	Star C Programming	STAR Certification	C Certification Exam
5	Programming with C	Byron Gottfried	Tata McGraw Hill Education
6	C The Complete Reference	Herbert Schildt	
7	Let Us C	Yeshavant Kanetkar	BPB Publications

i. List of Practicals:

Practical Set 1 (Basics)

1. Write a program to print HELLO FRIENDS!
2. Write a program that reads two nos. from key board and gives their addition, subtraction, multiplication, division and modulo.
3. Write a program to calculate area of circle, use Ω as symbolic constants.
4. Write a program to convert days into months and days.
5. Write a program which calculates the summation of three digits from the given 3 digit number.
6. Write a program to demonstrate enumerates data type.
7. Write a program to compute Fahrenheit from centigrade.
8. Write a program to calculate simple interest.
9. Read the price of item in decimal form e.g. 12.50 and separate Rs and Paise from the given value e.g. 12 rupees and 50 paise.

Practical Set 2 (Control Structures)

1. Write a program to find the largest of the three nos. using Nested-If-Else statement.
2. Write a C program to enter a character and to check whether it is a small letter or it is a capital letter or it is a digit or it is a special symbol.
3. Write a program to read marks from keyboard and your program should display equivalent grade according to the given table (100-80: Dist, 60-79: First Class, 35-59: Second Class, 0-34: Fail).
4. Write a program to read marks of a student from keyboard whether the student is pass (if).
5. Write a program to find the sum of first N odd numbers.
6. Write a program using while loop construct which finds the factorial of a given integer number.
7. Write a C program using do...while and for loop constructs to reverse the digits of the number.
8. Write a program to demonstrate use of Switch-Break Statement.
9. Write a program to find out all the numbers divisible by 5 and 7 between 1 to 100.
10. Check for Armstrong number. A number is Armstrong if sum of cube of every digit is same as the original number. E.g. $153 = 1^3 + 5^3 + 3^3 = 153$.
11. Write a program to print the output of series: $1! + 2! + 3! + 4! + \dots + n!$
12. Write a program to print triangle patterns using for loop.

Practical Set 3 (Array & Strings)

1. Write a program which sorts 10 numbers into ascending order.
2. Write a program to find maximum element from 1-D array.
3. Write a program to find number of odd and even elements from the 1-D array.
4. Write a program add two 2x2 matrices.
5. Write a program to count number of positive, negative and zero elements from 3x3 matrix.
6. Write a function for the following operations on string: Copy one string to another, Comparing two strings, Adding a string to the end of another.
7. Write a program to count vowels from a entered String.
8. Write a program which finds whether a string is a palindrome or not.

Practical Set 4 (Functions)

1. Write a program to find factorial of a number using recursion.
2. Write a program that used user defined function Swap() and interchange the value of two variables.
3. Write a function to return 1 if the number is prime otherwise return 0.

Practical Set 5 (Structures)

1. Define a structure type, personal that would contain person name, date of joining and salary.
2. Define a structure called cricket that will describe the following information: Player name, Team name, Batting average.

Practical Set 6 (Pointers)

1. Write a program to add two numbers using pointers.
2. Write a program to swap two numbers using pointer.

Practical Set 7 (File Management)

1. Write a program to illustrate reading files contents.
2. Write a program to illustrate the use of `fgets()`.

Semester-I

- a. **Course Name:** Principles of Communication Skills
- b. **Course Code:** 03010001HM01
- c. **Prerequisite:** Knowledge of English Language studied till 12th standard.
- d. **Rationale:** Basic Communication Skills are essential for all Engineers.
- e. **Course Learning Objective:**

CLOBJ 1	Apply essential grammar rules for accurate and effective communication.
CLOBJ 2	Construct clear and coherent sentences and paragraphs using varied sentence structures.
CLOBJ 3	Enhance reading and listening comprehension through identification of main ideas, details, and contextual meanings.
CLOBJ 4	Build confidence in everyday communication using appropriate greetings, expressions, and speaking skills.
CLOBJ 5	Encourage creative and logical thinking through picture perception and extempore activities.

- f. **Course Learning Outcomes:**

CLO 1	Enable students to apply essential grammar rules for accurate and effective communication.
CLO 2	Develop ability to construct clear and coherent sentences and paragraphs using varied sentence structures.
CLO 3	Enhance reading and listening comprehension through identification of main ideas, details, and contextual meanings.
CLO 4	Build s confidence in everyday communication using appropriate greetings, expressions, and speaking skills.
CLO 5	Encourage creative and logical thinking through picture perception and extempore activities.
CLO 6	Help students set and track realistic personal and academic goals for continuous self-improvement.

g. Teaching & Examination Scheme:

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

L: Lectures; **T-** Tutorial; **P-**Practical; **C-** Credit; **MSE-** Mid-Semester Evaluation, **CE-** Continues Evaluation,

ESE- End Semester Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Parts of Speech: Punctuation Overview of 8 parts of speech Basic punctuation marks and their usage Importance of grammar in writing	10%	4
2	TensesTypes: Present, Past, Future Forms and correct usage Common tense errors	8%	2
3	Phrase and Clauses: Types of Sentences (Structure Wise)Difference between phrases and clauses Classification of Simple, Compound & Complex Interchange of Simple to Compound, Simple to Complex, Compound to Complex	10%	4
4	Picture Perception: Observing and interpreting images Building a short story or description Improving vocabulary and creativity	15%	4
5	Paragraph Development: Structure: topic sentence, development, conclusion	8%	2
6	Meeting and Greeting (Initiating a conversation): Basic conversation skills Formal and informal greetings Common phrases for starting interactions	7%	2
7	Reading Comprehension (Basic Level)Types: Skimming & Scanning Reading short passages Identifying main ideas and details Answering basic questions	12%	4

8	Listening Comprehension (Basic Level): Listening to short audios/Conversation Understanding and responding to key information	8%	2
9	Extempore Speech: Speaking on random topics Organizing thoughts quickly Improving fluency and confidence	15%	4
10	Goal Setting and Tracking: Setting SMART goals Planning and tracking progress Self-assessment and reflection	7%	2
Total:		100 %	30

i. Text Book and Reference Book:

1. English Grammar in Use (TextBook) By Murphy, Raymond | Cambridge University Press, Pub. Year 2019
2. A Practical English Grammar (TextBook) By Thomson & Martinet | Oxford University Press, Pub. Year 1986
3. The St. Martin's Guide to Writing By Rise B. Axelrod & Charles R. | Cooper, Bedford/St. Martin's, Pub. Year 2021
4. Tactics for Listening (Basic) By Jack C. Richards | Oxford University Press, Pub. Year 2011
5. Active Skills for Reading: Book 1 By Neil J. Anderson | Cengage Learning, Pub. Year 2013
6. Speak with Impact By Allison Shapira | HarperCollins Leadership, Pub. Year 2018

Semester-I

a. Course Name: Student Induction Program with Essence of Indian Knowledge System

b. Course Code: 03010001MC01

c. Prerequisite: None

d. Rationale: This course is designed as a Student Induction Program to familiarize first-year BTech students with foundational concepts in Mathematics, Communication Skills, Computer Science, and Physics, while integrating the Essence of Indian Knowledge System (IKS). It aims to bridge the gap between school and higher education, encourage curiosity, and foster appreciation for India's rich scientific and cultural heritage.

f. Course Learning Objective:

CLOBJ 1	Explore mathematical concepts including 3D shapes, conic sections, trigonometry, set theory, probability, statistics, and geometric progressions through hands-on activities and real-world applications.
CLOBJ 2	Develop effective communication skills in English covering grammar, sentence formation, active/passive voice, and integrate Indian Knowledge System perspectives on speaking, listening, and healthy living.
CLOBJ 3	Understand fundamental computer architecture, appreciate historical contributions of Indian scholars to computing, and gain awareness of emerging technologies such as AI, IoT, blockchain, and quantum computing.
CLOBJ 4	Investigate core physics concepts including measurement, electrostatics, electromagnetics, optics, laser, fiber optics, and explore the connection between Vedic Physics and modern cosmology.

g. Course Learning Outcomes:

CLO 1	Apply mathematical tools such as trigonometry, set theory, probability, matrices, calculus, and geometric progressions to solve practical and engineering problems.
CLO 2	Communicate effectively in English using correct grammar, tenses, and sentence structures, and demonstrate awareness of Indian communication traditions and innovations.
CLO 3	Describe the architecture of a computer system, relate Indian scholarly contributions to modern computing, and identify applications of emerging technologies in engineering.
CLO 4	Explain fundamental physics phenomena in electrostatics, electromagnetics, optics, and fiber optics, and connect Vedic Physics concepts with contemporary scientific understanding.

h. Teaching & Examination Scheme:

L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
12	-	-	0	-	50	-	-	-	50

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

i. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	<p>Activities in Mathematics</p> <ul style="list-style-type: none"> • Exploring 3D Shapes (Cylinder, Cone, Cube, Cuboid) • The Geometry of Conic Sections: Properties and Applications • Measuring the Height of a Tree or Building Using Trigonometry • Techniques for Measuring Top and Bottom Angle Reflections • Fundamental Elements of Set Theory • Set Theory Tools for Probability Analysis • Key Concepts in Combinatorial Mathematics • Probability Fundamentals: Key Ideas and Concepts • Foundations of Statistical Theory: Key Concepts Explained • Principles of Geometric Progressions and Series • Matrix Application in Cryptography • An experimental approach to measure velocity and acceleration • Analysing Rate of Change and Optimisation • Utilising Integration for Problem Solving • A B C of Tangrams 	25%	12
2	<p>Activities in Communication Skills</p> <p>Phase-1: Part of Speech, Articles, Tenses, Basic Sentence Formation</p> <p>Phase-2: Verb, Subject Verb Agreement, Active Passive Voice, Idioms and Phrases</p> <p>Phase-3: Introduction to IKS, Indian ways of Speaking and Listening, Healthy Daily Life: The Indian Way, Indian Achievers and Innovations</p>	25%	12
3	<p>Activities in Computer Science</p> <p>Computer Basic Architecture: Introduction to Computer Systems, Von Neumann Architecture, Components of a Computer: CPU, Memory, I/O devices, Data Representation and Number Systems, Registers, ALU, Control Unit, Memory Hierarchy: Cache, RAM, ROM, Secondary Storage.</p> <p>Indian Knowledge System in Context of Computing: Historical Contributions of Indian Scholars to Mathematics and Computing, Algorithms in Ancient Indian Texts, Concept of Zero and Decimal Number System, Indian Logic</p>	25%	12

	<p>and Computation Models, Sanskrit Computational Models and Grammar, Traditional Indian Computing Tools and Techniques, Integration of Traditional Knowledge with Modern Computing.</p> <p>Emerging Technologies in Computer Engineering: Introduction to Artificial Intelligence and Machine Learning, Internet of Things (IoT), Blockchain Technology, Quantum Computing Basics, Edge Computing and Cloud Computing Advances, Cybersecurity Trends and Challenges, 5G and Networking Innovations, Bioinformatics and Computational Biology, Robotics and Automation in Computing.</p>		
4	<p>Activities of Physics</p> <ul style="list-style-type: none"> • Measurement • Electrostatics • Electromagnetics • Optics • Laser and Fiber Optics • Vedic Physics and Cosmology 	25%	12
Total:		100%	48

Semester - 2

- a. **Course Name:** Cell Biology
 b. **Course Code:** 03014402PC01
 c. **Prerequisite:** Knowledge of basic Biology up to 12th class
 d. **Rationale:** The course is aimed to make the student understand the basic concept of cell structure, membrane, cellular functions of different types of cells, modes of cellular signalling and signal amplification.

e. **Course Learning Objective**

CLOBJ 1	Identify and describe the historical development of cell biology, distinguish between prokaryotic and eukaryotic cells, and explain the structure and function of cell organelles including the plasma membrane and cytoskeleton
CLOBJ 2	Explain the mechanisms of passive and active membrane transport, endocytosis, and exocytosis, and analyze the types of cell signalling and signal transduction pathways including GPCRs, RTKs, and second messenger systems
CLOBJ 3	Describe the phases and checkpoints of the cell cycle, elucidate the roles of cyclins and CDKs, compare the processes of mitosis and meiosis, and relate cell division errors to diseases such as cancer and aneuploidy.
CLOBJ 4	Discuss the theories of cellular aging and senescence, differentiate between apoptosis, necrosis, and autophagy, and evaluate the intrinsic and extrinsic pathways of programmed cell death and their implications for health and disease.

f. **Course Learning Outcome:**

CLO1	Describe the fundamental structures, diversity, and functions of cells and subcellular organelles.
CLO2	Explain the mechanisms involved in membrane transport and cellular signaling pathways.
CLO3	Illustrate the regulation and significance of the cell cycle, mitosis, and meiosis and their relevance to human diseases.
CLO4	Discuss cellular aging processes, mechanisms of cell death, and their implications for health and disease.

g. **Teaching & Examination scheme**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	0	0	2	20	20	0	60	0	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	Topics	Weightage (%)	Teaching hours
1.	Cell Structure and Organization History of Cell Biology- Modern Cell Theory and its relevance- Prokaryotic vs. Eukaryotic Cells- Viruses, Viroids, and Prions. Plasma Membrane Structure (Fluid Mosaic Model)- Cytoplasm and Cytoskeleton (Microfilaments, Microtubules, Intermediate filaments)- Structure and Function of Cell Organelles (Nucleus, Mitochondria, ER, Golgi Complex, Lysosomes, Peroxisomes).	30%	9
2.	Cell Membrane Dynamics Passive Transport (Diffusion, Osmosis, Facilitated Diffusion)- Active Transport (Primary, Secondary Active Transport)- Endocytosis and Exocytosis. Types of Cell Signalling (Autocrine, Paracrine, Endocrine, Synaptic)- Signal Transduction Pathways (GPCRs, RTKs)- Second Messengers (cAMP, IP3, DAG, Calcium Ions).	25%	7
3.	Cell Cycle and Division Phases of Cell Cycle (G1, S, G2, M)- Cell Cycle Checkpoints and their Regulation- Cyclins and Cyclin-Dependent Kinases (CDKs). Phases and Significance of Mitosis- Mechanisms and Regulation of Meiosis- Comparative Analysis of Mitosis and Meiosis- Cell Division Errors and Associated Disorders (e.g., Cancer, Aneuploidy).	25%	8
4.	Cellular Aging and Death Theories of Aging (Telomere Shortening, Free Radical Theory)- Mechanisms and Markers of Cellular Senescence Effects of Aging on Cells and Tissues. Programmed Cell Death (Apoptosis: Intrinsic and Extrinsic pathways)- Necrosis: Causes, Mechanisms, and Consequences- Autophagy and its Role in Cell Survival & Death.	20%	6
	Total	100%	30

i. Reference Books:

1. Cell and Molecular Biology- Concept and Expts. John Wiley and Scne Ine., USA (TextBook) | By Gerald Karp 1999
2. Cell and Molecular Biology | By De Robertis, E.D.P | Lippincott Williams and Williams (eighth Edition)
3. The Cell: A Molecular Approach | By Geoffrey M. Cooper, Kenneth Adams | Oxford University Press | 9th
4. Molecular Biology of the Cell (TextBook) | By Bruce Alberts et al. | Garland Science | 7th
5. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology (TextBook) | By P.S.Verma and V. K. Agarwal | Chand (S.) & Co Ltd, India | 1st

Semester -2

- a. **Course Name:** Biopharmaceutical Chemistry
 b. **Course Code:** 03019502BS01
 c. **Prerequisite:** Basic Chemistry (Semester 1)
 d. **Rationale:** The course provides a chemistry background related to biotechnology

e. **Course Learning Objective:**

CLOBJ 1	Identify and name common drafting tools and their uses.
CLOBJ 2	Interpret engineering drawings and symbols.
CLOBJ 3	Demonstrate the ability to create accurate engineering drawings using industry-standard software.
CLOBJ 4	Solve engineering design problems by applying geometric and spatial concepts.
CLOBJ 5	Generate accurate and professional engineering drawings independently.
CLOBJ 6	Design and create 3D models of engineering components using computer-aided design (CAD) tools.

f. **Course Learning Outcomes:**

CLO 1	To understand the fundamental concepts of chemistry relevant to biotechnology.
CLO 2	To apply chemical principles in biochemical and industrial processes.
CLO 3	To familiarize students with analytical techniques essential for biotechnology applications.
CLO 4	Differentiate between synthetic and bio polymer
CLO 5	Design different pharmaceutical formulations based on bio polymers and nano materials.

g. **Teaching & Examination Scheme:**

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MS E	CE	P	Theor y	P	
2	-	2	3	20	20	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	Topics	Weightage (%)	Teaching hours
1	Organic Chemistry for Biotechnology Structure and properties of biomolecules (carbohydrates, lipids, proteins, nucleic acids) Reaction mechanisms in biomolecules (hydrolysis and oxidation – reduction reactions) Heterocyclic compounds and their biological significance (Ribose sugar, Deoxyribose, amino acids) Chirality and its role in biological systems.	25%	5
2	Physical Chemistry in Biological Systems Thermodynamics in biological systems (laws of thermodynamics, entropy, enthalpy) Enzyme-catalysis Emulsions in biotechnology. Electrochemistry: pH, buffers, and redox reactions in biological systems	25%	8
3	Analytical Techniques in Chemistry Spectroscopic techniques: Principle and applications UV-Vis, IR, NMR, Mass spectrometry Chromatographic techniques - Principle & applications: Gas Chromatography (GC), High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC) Electrophoresis & Electro osmosis and its applications in biotechnology. Centrifugation techniques and applications.	15%	6
4	Industrial and Environmental Chemistry Introduction to Biochemical pathways: Definition and Importance of Biochemical pathways. Biocatalyst in industrial biotechnology pharmaceutical wastes and their disposal techniques. Definition and classification of pharmaceutical waste Sources: hospitals, pharmacies, research labs, manufacturing plants, households Environmental and health impacts of improper disposal Outline of Classification of Pharmaceutical Wastes: Expired or Unused medications (over-the-counter & prescription drugs) Contaminated packaging (bottles, blister packs, ampoules) Cytotoxic and hazardous drugs (chemotherapy drugs, controlled substances) Infectious and biological waste (vaccines, blood-contaminated drugs) Antibiotic and antimicrobial waste (contribution to antibiotic resistance) Radioactive pharmaceuticals (used in nuclear medicine) Pharmaceutical Waste Management and Disposal Techniques Sustainable biotechnology: Principles of green chemistry pharmaceutical wastes and their disposal techniques.	25%	6

5	Polymeric and Nanomaterials in biotechnology Biopolymers: Introduction, Classification and Functions. Basic understanding of use of biodegradable polymers in biotechnology. Nanotechnology applications in drug delivery and diagnostic	10%	5
	Total	100%	30

a. Text Book and Reference Book:

- a. Lehninger Principles of Biochemistry | By David L. Nelson and Michael M. Cox | W.H. Freeman and Company (7th Edition)
- b. Physical Chemistry | By P. W. Atkins | Oxford University Press (10th Edition)
- c. Instrumental Methods of Chemical Analysis | By Gurdeep R. Chatwal and Sham K. Anand | Himalaya Publishing House (5th Edition).

b. List of Practical

S.No	List of Practical's
1	To prepare and study the properties of acidic buffer solution and to determine their pH stability.
2	To prepare and study the properties of basic buffer solution and to determine their pH stability
3	Chromatographic separation of biomolecules (TLC, HPLC demo)
4	To separate and identify biomolecules using Thin Layer Chromatography (TLC) demo
5	To understand the working principle of High-Performance Liquid Chromatography (HPLC) through a demonstration. demo
6	Spectrophotometric analysis of biomolecules (UV-Vis demo)
7	Spectrophotometric analysis of biomolecules (UV-Vis demo)
8	Synthesis of biodegradable polymer and its characterization: Synthesis of Biodegradable Polymers: Starch-Based Bioplastic & Poly(lactic acid) (PLA)
9	Electrochemical analysis using potentiometry.
10	Electrochemical analysis using conductometry.

Semester – 2

- a. Course Name:** Mathematics for Biotechnology
b. Course Code: 03014402BS01
c. Prerequisite: Basic knowledge of Algebra, Calculus, and Probability; Basic biology concepts related to biotechnology.
d. Rationale: This course introduces fundamental mathematical concepts and their applications in biotechnology. Students will learn linear algebra, calculus, differential equations, probability & statistics, and numerical methods, with an emphasis on real-world biological applications.

e. Course Learning Objective:

CLOBJ 1	Understand the fundamental concepts of descriptive statistics including mean, median, mode, standard deviation and variance, and their applications in biological data analysis.
CLOBJ 2	Apply probability concepts and distributions (Poisson, Normal, Binomial) to analyze biological and clinical data using correlation and regression analysis.
CLOBJ 3	Use numerical methods including Trapezoidal and Simpson's Rule for solving linear/nonlinear equations and differential equations arising in biotechnology.
CLOBJ 4	Solve first and higher-order ordinary differential equations, Cauchy's and Euler's equations, and apply Laplace Transforms to model pharmacokinetic and epidemiological systems.
CLOBJ 5	Integrate concepts of linear algebra, calculus, differential equations, probability, and numerical methods to analyze real-world biotechnology problems in gene expression, enzyme kinetics, and medical imaging.

f. Course Learning Outcomes:

CLO 1	Apply statistical measures and data visualization techniques (histograms, boxplots) to interpret and analyze biological experimental data.
CLO 2	Use probability distributions and regression analysis to model and draw inferences from biological and clinical trial datasets.
CLO 3	Solve algebraic and differential equations numerically using Trapezoidal and Simpson's Rule and single-step methods for biotechnology applications.
CLO 4	Solve differential equations and apply Laplace Transforms to model pharmacokinetics, drug release, and epidemic dynamics.
CLO 5	Analyze gene expression data using linear algebra (PCA, eigenvalues), model enzyme kinetics using calculus, and approximate medical image data using numerical methods.

g. Teaching & Examination Scheme:

Teaching Scheme			Evaluation Scheme			
I	T	D	C	Internal Evaluation	ESE	Total

				MSE	CE	P	Theory	P	
3	0	0	3	20	20	20	60	30	150

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

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Descriptive Statistics & Data Analysis Mean, Median, Mode, Standard Deviation, Variance, Data Representation (Histograms, Boxplots), Applications in Biological Data Analysis.	15%	8
2	Probability Distributions & Regression Analysis Probability Basics, Random Variables, Poisson, Normal, and Binomial Distributions, Correlation & Regression Analysis.	15%	8
3	Numerical Methods & Equation Solving Solution of Linear & Nonlinear Algebraic Equations, Integration by Trapezoidal & Simpson's Rule, Single-Step Methods for Differential Equations.	20%	9
4	Differential Equations & Their Applications First & Higher-Order ODEs, Cauchy's & Euler's Equations, Laplace Transforms, Applications in Pharmacokinetics & Epidemiology.	25%	10
5	Applications in Biological Systems Linear Algebra, Calculus, Differential Equations, Probability & Numerical Methods Applied to Biotechnology (Gene Expression, Enzyme Kinetics, Medical Imaging). Gene Expression & Metabolic Pathways (Linear Algebra): Use eigenvalues and eigenvectors for PCA in gene expression analysis. Enzyme Kinetics & Drug Release (Calculus): Apply differentiation to find the maximum reaction rate in enzyme kinetics. Pharmacokinetics & Drug Absorption (Differential Equations): Model drug concentration in the bloodstream using first-order ODEs Clinical Trial Data Analysis (Probability & Statistics): Use binomial and normal distributions to analyze vaccine trial data. Medical Image Processing (Numerical Methods): Approximate tumor size in MRI scans using Simpson's or Trapezoidal Rule.	25%	10
Total:		100%	45

i. Text Book and Reference Book:

1. Mathematical Models in Biology: An Introduction, By Elizabeth S. Allman, John A. Rhodes | Cambridge University Press, Pub. Year 2003
2. Statistical Methods in Bioinformatics – An Introduction, By W. Ewans & G. Grant

3. Fundamentals of Applied Statistics, By S.C. Gupta & V.K. Kapoor | Sultan Chand and Sons, New Delhi, Pub. Year 2003
4. Fundamentals of Mathematical Statistics, By Gupta, S.C. and Kapoor, V.K. (2008) | Sultan Chand & Sons | 4th Edition

Semester – 2

a. Course Name: Engineering Graphics and Design

b. Course Code: 03010901ES02

c. Prerequisite: Zeal to learn the subject.

d. Rationale: Engineering Graphics is the language of communication for Engineers. Engineering Graphics course provides tools and techniques of communication for various fields of Engineering.

e. Course Learning Objective:

CLOBJ 1	Familiarize students with drawing instruments, accessories, BIS drawing standards (BIS-SP-46), engineering scales, types of lines, dimensioning terms and notations used in engineering graphics.
CLOBJ 2	Enable students to classify, construct and apply various engineering curves including Conics, Spirals, Involutives, and Cycloids along with their tangents and normals.
CLOBJ 3	Develop understanding of principles of projection, and enable students to draw projections of points, lines and planes located in various quadrants and with inclinations to reference planes.
CLOBJ 4	Equip students to draw projections of solids (Prism, Pyramid, Cone, Cylinder, Tetrahedron, Cube) and develop lateral surfaces using Parallel Line and Radial Line Development methods.
CLOBJ 5	Enable students to convert pictorial views into orthographic projections and orthographic views into isometric projections/views, including sectional views.
CLOBJ 6	Introduce students to Computer Aided Drafting (AutoCAD) for preparation of 2D sketches and 3D models using basic modelling commands.

f. Course Learning Outcomes:

CLO 1	Understand and apply the uses of drawing instruments, accessories, engineering scales, types of lines, and BIS drawing standards (BIS-SP-46) in engineering graphics practice.
CLO 2	Construct various engineering curves such as Conics, Spirals, Involutives, and Cycloids, and draw their tangents and normals using standard drafting techniques.
CLO 3	Illustrate projections of points, lines, and planes located in same and different quadrants, and determine true lengths and inclinations with reference planes using orthographic projection techniques.
CLO 4	Draw projections of right regular solids, sectional views, and develop lateral surfaces of solids using Parallel Line and Radial Line Development methods.
CLO 5	Draw orthographic and isometric projections of 3D objects by converting between pictorial and multi-view representations using basic principles of projection.

CLO 6	Create 2D sketches and 3D models of engineering components using Computer Aided Drafting tools (AutoCAD) with basic modelling, dimensioning, and editing commands.
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g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
2	-	4	4	20	20	20	60	30	150

L – Lectures; **T** – Tutorial; **P** – Practical; **C** – Credit; **CE** – Continuous Evaluation; **SEE** – Semester End Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Introduction Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Engineering Scales, Dimensioning Terms and Notations, Types of Lines used in Engineering. Practice recommended by BIS.	10%	5
2	Engineering Curves Classification of Engineering Curves, Application of Engineering Curves, Constructions of Engineering Curves – Conics, Spirals, Involutives and Cycloids with Tangents and Normals.	15%	10
3	Principles of Projections Types of Projection, Parallel Projection, One-point Perspective projection. Introduction to principal planes of projections. Projections of the points: Projections of the points located in same quadrant and different quadrants. Projections of line: Projections of line with its inclination to one reference plane and with two reference planes. True length and inclination with the reference planes. Projections of planes: Projections of planes (polygons, circle and ellipse) with its inclination to one reference plane and with two reference planes, Concept of auxiliary plane method for projections of the plane.	20%	15

4	Projections and Development of Solids Projections of Solids: Classifications of basic Solids, Projections of Solids – Right Regular Prism, Pyramid, Cone, Cylinder, Tetrahedron and Cube; Sectional Views. Development of Surfaces: Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	20%	10
5	Orthographic and Isometric Projections Orthographic Projections: Principle of orthographic projections, Conversion of pictorial views into orthographic projections including sectional orthographic projections. Isometric Projections: Conversion of orthographic views into isometric projections/views.	20%	5
6	Computer Aided Drafting Basic User Interface of Drafting Software, Demonstration of basic modelling commands, Preparation of 2D and 3D models using Drafting Software.	15%	15
	Total	100%	60

i. Text Book and Reference Book:

1. A Text Book of Engineering Graphics (TextBook), By P.J. Shah | S. Chand & Company Ltd., New Delhi | 2021st Edition
2. Engineering Drawing, By N. D. Bhatt | Charotar Publishing House | 55th Edition, Pub. Year 2010
3. A Text Book of Engineering Drawing, By P.S. Gill | S.K. Kataria & Sons | 2013th Edition
4. Engineering Graphics with Auto CAD, By James D. Bethune | Pearson Education | 2020th Edition

j. List of Practicals:

S.No.	Name of experiments
1.	Demonstration of different drawing instruments, dimensioning systems, symbols and Engineering Scale.
2.	Exercise on Projections of Points and Lines.
3.	Exercise on Projections of Planes.
4.	To draw a sheet involving Projections of Solids and Sections of Solids.
5.	To draw a sheet involving Development of Surfaces.
6.	Practice sheets on Orthographic Projections.
7.	Practice sheets on Isometric Projection.
8.	Demonstration of Industrial Drawings.
9.	To create basic objects (2D sketches) using Computer Aided Drafting tool.
10.	To create precise drawing (3D modeling), dimensions and editing using Computer Aided Drafting tool.

Semester - 2

a. Course Name: Electrical and Electronics Engineering

b. Course Code: 03010601ES02

c. Prerequisite: Knowledge of Physics and Mathematics up to 12th science level

d. Rationale: Electrical and Electronics Engineering knowledge is fundamental as it provides a strong foundation for various engineering disciplines, promotes problem-solving skills, supports innovation, and opens doors to diverse career opportunities.

e. Course Learning Objective:

CLOBJ 1	Gain familiarity with electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLOBJ 2	Solve problems related to Alternating current, alternating voltage, etc., Demonstrate a clear understanding of Pure R, L C circuit and combination of RLC, Series and Parallel combination of R, L and C, etc.
CLOBJ 3	Acquire knowledge of the resistor, capacitor, and inductor and their performance characteristics for series and parallel connections.
CLOBJ 4	Understand different single phase and three phase circuits.
CLOBJ 5	Demonstrate a clear understanding of the basic concepts, working principles and applications of transformer, DC machines and AC machines.
CLOBJ 6	Study the use of LT Switch Gear, Fuse, MCB, ELCB etc.

f. Course Learning Outcomes:

CLO 1	Understand electrical current, potential difference, power and energy, sources of electrical energy and elements of electrical circuit.
CLO 2	Solve basic electrical circuit problems using various laws and theorems
CLO 3	Understand the role of resistor, capacitor and inductor and their performance characteristics for series and parallel connections.
CLO 4	Discuss three phase-balanced circuits.
CLO 5	Understanding the basic concepts and working principles of transformers, DC machines and AC machines.
CLO 6	Acquire knowledge about electrical installations

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	20	60	30	150

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	<p>DC Circuits Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, Mesh and Node analysis, Simplifications of networks using series and parallel combinations and star-delta conversions. Superposition, Thevenin and Norton Theorems.</p>	20%	10
2	<p>AC Circuits Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of instantaneous, peak (maximum), average and R.M.S. values, frequency, cycle, period, peak factor and form factor, phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasors, examples based on theory. Study of A.C. circuits consisting of pure resistance, pure inductance, pure capacitance and corresponding voltage current phasor diagrams and waveforms. Development of the concept of reactance, the study of series R-L, R-C, R-L C circuit and resonance, study of parallel R-L, R-C and R-L C circuit, concept of impedance, admittance, conductance and susceptance in case of above combinations and relevant voltage-current phasor diagrams, the concept of active, reactive and apparent power and power factor, examples based on theory. Concept of three-phase supply and phase sequence. Voltages, currents and power relations three-phase have balanced star-connected loads and delta-connected loads along with phasor diagrams, Power and power factor measurement in balanced three-phase circuits (one, two and three wattmeter methods), examples.</p>	30%	13
3	<p>Diode and Transistors Introduction to Ideal Diode, Effect of temperature Ideal diodes, unbiased diode and Forward and reverse bias of Diode. PIV, surge current, Diode as Uncontrolled switch. Rectifiers: Half wave, Full wave, and bridge wave. Ripple factor, PIV rating. Choke and Capacitor input filter rectifiers, Clipper and Clamper</p>	30%	12

	circuits, Construction and working of BJT, Characteristics & specifications of BJT (PNP & NPN transistors), Biased and unbiased BJT, Configuration of the transistor, the concept of gain & BW, Operation of BJT in the cut-off, saturation & active regions (DC analysis), BJT as a switch, Transistor as an amplifier, Voltage divider bias and analysis, VDB load line and Q point.		
4	Voltage Regulators and Transducers Basic series and shunt regulator, Types of voltage regulator IC: Fixed and adjustable positive and negative linear voltage regulator, IC linear fixed voltage regulator (78XX, 79XX,) Linear Adjustable Regulator, DC Regulated Power supply. Introduction of Transducers. Types of Transducers and its applications	20%	10
	Total:	100 %	45

a. Text Book and Reference Book:

1. Electrical Engineering Fundamentals, By V. D. Toro, Prentice Hall India, Pub. Year 1989
2. Basic Electrical Engineering, By D. C. Kulshreshtha, McGraw Hill
3. Fundamentals of Electrical Engineering, By Leonard S. Bobrow, Oxford University Press, Pub. Year 1996
4. Electrical and Electronics Technology, By E. Hughes Pearson, Pub. Year 2010
5. Basic Electrical Engineering, By D. P. Kothari and I. J. Nagrath, Tata McGraw Hill, Pub. Year, 2010
5. A textbook of Electrical Technology Volume 1&2, By B. L. Theraja, S. Chand Publication

b. List of Experiments

S.No.	Name of experiments
1	To study about various electrical and electronics symbols and demonstrate various measuring instruments used in electrical & electronics laboratories.
2	Verification of superposition theorem with DC source.
3	Verification of Thevenin's theorem with DC source.
4	To experimentally investigate the behaviour of a series RLC circuit under AC excitation.
5	Verification of current and voltage relations in three-phase balanced star and delta-connected loads
6	To plot V-I characteristics of the P-N junction diode.
7	To perform half wave rectifier with and without filter.
8	To perform full wave rectifier with and without filter
9	To plot and study input-output characteristics of the Common Emitter (CE) configuration of the transistor

10

To perform and observe the response of voltage regulator IC 7805

Semester -2

a. Course Name: Advanced Communication and Interpersonal Skills

b. Course Code: 03010002HM01

c. Prerequisite: Basic Communication Skills are essential for all Engineers.

d. Rationale: Strengthen core language and soft skills through applied grammar, communication tasks, and vocabulary building.

e. Course Learning Objective:

CLOBJ 1	Enable students to understand and apply essential rules of English grammar including subject-verb agreement, reported speech, active and passive voice for accurate written and spoken communication.
CLOBJ 2	Build students' vocabulary through systematic learning of word meanings, synonyms, antonyms, homonyms, homophones, homographs, and idioms for effective language use.
CLOBJ 3	Develop students' reading and listening comprehension skills at an intermediate level to identify main ideas, tone, purpose, and supporting details from written and spoken texts.
CLOBJ 4	Strengthen students' writing skills by training them to structure and compose well-organized essays using appropriate language, logical sequencing, and formal tone.
CLOBJ 5	Foster personality development, professional grooming, and self-awareness through SWOT analysis, self-introduction, confident body language, and professional etiquette.
CLOBJ 6	Improve students' time management and interpersonal skills by developing prioritization habits, scheduling techniques, and awareness of effective communication in professional contexts.

f. Course Learning Outcomes:

CLO 1	Remember and apply essential rules of English grammar — subject-verb agreement, reported speech, and active/passive voice — in written and spoken communication tasks.
CLO 2	Use vocabulary knowledge including synonyms, antonyms, homonyms, homophones, and idioms accurately in everyday and professional communication contexts.
CLO 3	Understand spoken and written texts at an intermediate level by identifying main ideas, supporting details, tone, and purpose, and responding appropriately.
CLO 4	Apply structured writing skills to compose well-organized essays with a clear introduction, body, and conclusion using appropriate language and tone.
CLO 5	Analyze personal strengths, weaknesses, opportunities, and threats through SWOT analysis and deliver a confident self-introduction demonstrating professional grooming and body language.
CLO 6	Analyze personal communication habits and time use patterns to develop effective time management strategies and improve

	professional and interpersonal effectiveness.
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g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Marks			External Marks		Total
				T	CE	P	T	P	
1	–	2	2	40	–	20	60	30	150

L – Lectures; **T** – Tutorial; **P** – Practical; **C** – Credit; **CE** – Continuous Evaluation; **SEE** – Semester End Examination

h. Course Content:

Sr. No.	Content	Weightage (%)	Teaching Hours
1	Subject Verb Agreement Rules of subject-verb matching Singular vs plural forms Common agreement errors	10%	1
2	Reported Speech Direct and indirect speech Changing tenses, pronouns, and time expressions Reporting statements, questions, and commands	10%	1
3	Active and Passive Voice Difference between Active and Passive Rules for converting sentences Usage in real-life contexts	10%	1
4	Building Vocabulary Word meanings and usage Synonyms and antonyms Homonyms, Homophones, Homographs, Idioms	10%	2
5	Grooming and Personality Development Importance of dressing and professional etiquette Building confidence and positive body language	10%	2
6	SWOT Analysis with Self Introduction Identifying strengths, weaknesses, opportunities, threats Preparing and delivering a confident self-introduction Developing self-awareness and a growth mindset	10%	2
7	Reading Comprehension (Intermediate Level) Understanding written texts Finding main ideas and supporting details Answering questions accurately	10%	2
8	Listening Comprehension (Intermediate Level) Listening for specific information Identifying tone and purpose Responding appropriately	10%	1
9	Essay Writing Structure of an essay: introduction, body, conclusion Organizing ideas logically Using appropriate language and tone	10%	2

10	Time Management Importance of managing time Prioritization Creating schedules	10%	1
Total:		100%	15

i. Text Book and Reference Book:

1. Technical Communication: Principles And Practice, By Sangeetha Sharma, Meenakshi Raman | Oxford University Press | 2nd Edition
2. Personality Development and Soft Skills, By Barun K Mitra | Oxford, 2011
3. High School English Grammar and Composition, By Wren & Martin | S. Chand Publishing, Pub. Year 2017
4. English Grammar in Use, By Raymond Murphy | Cambridge University Press, Pub. Year 2019
5. Communication Skills and Soft Skills, By Suresh Kumar | Pearson Publication, 2010

j. List of Practicals:

S.No.	Name of experiments
1.	Subject Verb Agreement: a. Fill-in-the-blank exercises b. Sentence correction tasks c. Group quiz competition d. Role-play using correct subject-verb forms
2.	Reported Speech: a. Dialogue conversion practice b. Pair work: narrate a conversation c. Reporting classroom news d. Role-play followed by reporting
3.	Active and Passive Voice: a. Transform active sentences to passive and vice versa b. Rewrite instructions in passive voice c. Classroom narration using passive structures d. Group activity: change story voice
4.	Building Vocabulary: a. Daily word journal b. Vocabulary flashcards and games c. Synonym-antonym match-up d. Word building through storytelling
5.	Grooming and Personality Development: a. Personal grooming checklist task b. Group discussion on personality traits c. Mock social interaction d. Confidence-building exercises
6.	SWOT Analysis with Self Introduction: a. SWOT worksheet filling b. Self-introduction in pairs or groups c. Strength-sharing circle d. Feedback on introductions

7.	<p>Reading Comprehension (Intermediate Level):</p> <ul style="list-style-type: none"> a. Reading passage followed by Q&A b. Find-the-theme activity c. Vocabulary hunt from the passage d. Summarizing a short text
8.	<p>Listening Comprehension (Intermediate Level):</p> <ul style="list-style-type: none"> a. Listen and answer exercises b. Listening and completing notes c. Audio-based MCQs d. Paraphrasing what was heard
9.	<p>Essay Writing:</p> <ul style="list-style-type: none"> a. Brainstorming and outline creation b. Writing on guided topics c. Peer feedback session d. Editing and final draft submission
10.	<p>Time Management and Team Building:</p> <ul style="list-style-type: none"> a. Create a weekly schedule b. Prioritization task (urgent vs important) c. Reflection on time use habits

Semester -2

- a. Course Name:** Environmental Science
b. Course Code: 03010002MC01
c. Prerequisite: Knowledge of Physics, Chemistry and Mathematics up to 12th science level and Biology up to 10th science level
d. Rationale: Basic knowledge of the environment is essential for all human beings for a good life and sustainable existence
e. Course Learning Objective:

CLOBJ 1	Apply systems thinking to analyze the city as a system, demonstrating application
CLOBJ 2	Evaluate the role of smart citizens and approaches for citizen engagement
CLOBJ 3	Identify sources and stressors of water resources, demonstrating understanding
CLOBJ 4	Analyze the causes, effects, and control measures of population explosion

f. Course Learning Outcomes:

CLO 1	Understand the interrelation and interdependency of organisms and their interactions with the environment
CLO 2	Identify eco-friendly measures in engineering projects
CLO 3	Understand preventive steps for environmental protection.
CLO 4	Act as a responsible individual who is aware of efficient usage of resources and securing sustainable development

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
1	0	0	Audit Course	-	50	-	-	-	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	Weighage(%)	Teaching Hours
1	Environmental Health Ecology and Quality of Life Environmental education: Objective and	25%	7

	scope, Impact of technology on the environment, Environmental disasters: Case studies, Global environmental awareness to mitigate stress on the environment, Structure and function of an ecosystem, Ecological pyramids, Pyramid of number, Pyramid of energy and pyramid of biomass.		
2	<p>Pollution Prevention</p> <p>Air & Noise pollution -Sources & their Effects, Case studies of Major Catastrophes, Structure and composition of the atmosphere, Water, Soil, Marine, Thermal & Marine Pollution: The story of fluoride contamination, Eutrophication of lakes, control measures, Measuring water quality: Water quality index, Waste water treatment (general) primary, secondary and tertiary stages, Municipal Solid waste management: Sources and effects of municipal waste, Biomedical waste, Hazardous waste</p>	20%	6
3	<p>Pollution Growth Global Environmental Challenges & Latest Developments</p> <p>Population Explosion - Causes, Effects and Control, an International initiative in population-related issues, Urbanization, Growth of the world's large cities, Water resources: Sources of water, Stress on water resources, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Variation in concentrations of GHG gases in ambient air during last millennium, Role of Environmental Information System (ENVIS) in India and similar programs run by EPA(USA), Role of soft tools like Quantum GIS, Autodesk Building Information Modelling (BIM) and City Finance Approach to Climate-Stabilizing Targets (C- FACT), Life Cycle Assessment, Bioinformatics and Optimization tools for sustainable development.</p>	25%	7
4	<p>Smart Cities</p> <p>Introduction to smart cities - about smart cities, what is a smart city, world urbanization, case studies of Songdo, Rio De Janeiro, what makes cities smart.</p> <p>City as a system of systems – Introduction, systems thinking, Milton Keynes Future Challenges, Rich picture as city challenges,</p>	30%	10

	<p>Wicked problems, Development of smart city approach – core elements, open data, sustainability, privacy and ethics, development processes. Smart Citizens – their role, engaging citizens, IES Cities, Energy systems, Approaches for Citizen Engagement, co-creating smart cities, cities unlocked, living labs, city problems, crowdsourcing ideas, redesigning cities for citizens, all age-friendly cities, mobility on demand, motion maps. Infrastructure, Technology and Data – urban infrastructure and its technology, future of lighting, IoT, connected objects, sensing the city, NOx eating paints and air quality sensors, safest, smart citizen kit, sensing your city, Sensored City, Cyber security for data power, open, shared and closed data, satellite data, open data revolution, Smart City Project Data. Innovation – smart innovations, smart city ecosystem, data-driven innovations for smart cities Standards and Capacity Building – the role of Standard, BSI smart city Standards, Hyper Cat, ITU Smart Sustainable cities, Smart City Readiness, Lessons Learnt from Amsterdam Smart Measurements - metrics and indicators, city indicators, WCCD data portal, value proposition, integrated reporting, smart city learning and education, urban data school.</p>		
Total:			100%

i. Text Book and Reference Book:

1. Environmental Studies for Undergraduate Courses” (Textbook) | By Dr Erach Bharucha | Orient Black Swan | Second Edition, Pub. Year 2013.
2. Basics of Environmental Studies | By U K Khare, Tata McGraw Hill
3. Environmental Studies” By Anindita Basak, Drling Kindersley (India) Pvt. Ltd Pearson
4. Environmental Sciences”, By Daniel B Botkin & Edward A Keller, John Wiley & Sons
5. “Air Pollution”, By M N Rao, H. V N Rao, McGraw Hill Publishing Company Limited, New Delhi

Semester -2

- a. **Course Name:** Principles of Management
- b. **Course Code:** 06M10202UE01
- c. **Prerequisite:** Basic understanding of organizational structure and general awareness of business operations.
- d. **Rationale:** This course lays the foundational framework for understanding managerial roles and functions in contemporary business settings.

e. Course Learning Objective:

CLOBJ 1	Understand and describe the core principles and functions of management, tracing the historical evolution of management thought from classical to contemporary approaches.
CLOBJ 2	Apply planning techniques, analyze the internal and external environment of business, and use forecasting and premising tools for effective managerial decision-making.
CLOBJ 3	Evaluate various management styles, apply Management by Objectives (MBO), and design effective organizational structures through organizing, directing, and coordination.

f. Course Learning Outcomes:

CLO 1	To describe the core principles of management, analyze historical developments, and apply planning techniques considering environmental factors.
CLO 2	To evaluate various management styles, design effective organizational structures, and apply decision-making and staffing techniques in managerial contexts
CLO 3	To demonstrate effective leadership and communication strategies, manage organizational change, and critically assess modern-day managerial challenges.

g. Teaching & Examination Scheme:

Teaching Scheme				Evaluation Scheme					
L	T	P	C	Internal Evaluation			ESE		Total
				MSE	CE	P	Theory	P	
3	0	0	0	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	Module 1: Introduction to Management; Evolution of Management Thought; Planning; Understanding environment of business; Forecasting and Premising.	40%	18
2	Module 2: Decision-making; Management by Objectives and Styles of Management; Organizing and Directing; Staffing and Coordination.	20%	9
3	Module 3: Career Development Strategy; Leadership styles of Managers; Organizational Communication; Change management; Challenges of Contemporary Business.	40%	18
Total		100%	45

i. Text Book and Reference Book:

1. Principles of Management, By P. C. Tripathi and P. N. Reddy, Tata McGraw Hill
2. Management: Concepts and Practices, By T. N. Chhabra, Sun India Publications
3. Principles and Practices of Management, By L. M. Prasad, Sultan Chand & Sons
4. Management, By Stephen P. Robbins and Mary Coulter, Pearson Education
Essentials of Management, By Harold Koontz and Heinz Wehrich