

**Payyanur College, Payyanur
(Affiliated to Kannur University)**

Programme Outcomes (POs)

BSc DEGREE PROGRAMME (FOR SCIENCE)

PROGRAMME OUTCOMES (PO)

PO1. Critical Thinking:

- 1.1. Acquire the ability to apply the basic tenets of logic and science to thoughts, actions and interventions.
- 1.2. Develop the ability to chart out a progressive direction for actions and interventions by learning to recognize the presence of hegemonic ideology within certain dominant notions.
- 1.3. Develop self-critical abilities and also the ability to view positions, problems and social issues from plural perspectives.

PO2. Effective Citizenship:

- 2.1. Learn to participate in nation building by adhering to the principles of sovereignty of the nation, socialism, secularism, democracy and the values that guide a republic.
- 2.2. Develop and practice gender sensitive attitudes, environmental awareness, empathetic social awareness about various kinds of marginalization and the ability to understand and resist various kinds of discriminations.
- 2.3. Internalize certain highlights of the nation and region history. Especially of the freedom movement, the renaissance within native societies and the project of modernization of the post-colonial society.

PO3. Effective Communication:

- 3.1. Acquire the ability to speak, write, read and listen clearly in person and through electronic media in both English and in one Modern Indian Language
- 3.2. Learn to articulate, analyze, synthesize, and evaluate ideas and situations in a well-informed manner.
- 3.3. Generate hypotheses and articulate assent or dissent by employing both reason and creative thinking.

PO4. Interdisciplinarity:

- 4.1. Perceive knowledge as an organic, comprehensive, interrelated and integrated faculty of the human mind.
- 4.2. Understand the issues of environmental contexts and sustainable development as a basic interdisciplinary concern of all disciplines.
- 4.3. Develop aesthetic, social, humanistic and artistic sensibilities for problem solving and evolving a comprehensive perspective.

Programme Specific Outcomes (PSOs)

Name of the Programme: **BSc CHEMISTRY**

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1.

Understand the fundamental concepts, principles and processes underlying the academic field of chemistry, its different subfields (analytical, inorganic, organic and physical), and its linkages with related disciplinary areas/subjects.

PSO2.

Demonstrate procedural knowledge that creates different types of professionals in the field of chemistry and related fields such as pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry, etc.

PSO3.

Employ critical thinking and the scientific method to design, carry out, record and analyze the results of chemical experiments and get an awareness of the impact of chemistry on the environment and the society.

PSO4.

Use chemical techniques relevant to academia and industry, generic skills and global competencies, including knowledge and skills that enable students to undertake further studies in the field of chemistry or a related field, and work in the chemical and non-chemical industry sectors.

PSO5.

Undertake hands on lab work and practical activities which develop problem solving abilities required for successful career in pharmaceuticals, chemical industry, teaching, research, environmental monitoring, product quality, consumer goods industry, food products, cosmetics industry, etc.

PSO6.

Understand safety of chemicals, transfer and measurement of chemical, preparation of solutions, and find out the green route for chemical reaction for sustainable development.

PSO7.

Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

Course Outcomes (COs)

Name of the Programme: **BSc CHEMISTRY**

COURSE OUTCOMES (COs)

Sl. No	Name of the Course	Outcomes
1.	1B01CHE: THEORETICAL & INORGANIC CHEMISTRY	CO1: Correlate the structure and behavior of atom. CO2: Differentiate the various chemical interactions in molecules through bonding concepts. CO3: Analyze and interpret the gradation in the properties of elements in the periodic table. CO4: Predict the nuclear transmutations. CO5: Identify the role of radioactive materials in different applications.
2.	2B03CHE: ANALYTICAL & INORGANIC CHEMISTRY – I	CO1: Determine the error, standard deviation and relative standard deviation of analytical data. CO2: Understand statistical treatment of analytical data and the principles underlying volumetric titrations. CO3: Understand basic principles behind selective precipitation of cation. CO4: Summarize the characteristics of s- and p- block elements. CO5: Compare the various concepts of acids and bases.
3.	3B04CHE/PCH: ORGANIC CHEMISTRY – I	CO1: Explain the types of electron displacement in organic molecules and predict the properties of molecules based on electron displacement effect. CO2: Distinguish aromatic, anti-aromatic and nonaromatic compounds and ions and analyze the mechanistic details of aromatic electrophilic substitution. CO3: Classify stereo isomers, understand the property of chirality, apply CIP rules to recognize the configuration and explain the stability of conformations drawing energy profile diagram. CO4: Explain the mechanism of polymerization, synthesis and application of industrially important Polymers. CO5: Explain the classification and the methods of preparation of important dyes. CO6: Illustrate the preparative methods and synthetic applications of important synthetic Reagents.

4.	4B06CHE/PCH: ORGANIC CHEMISTRY – II	<p>CO1: Describe mechanisms for substitution and elimination reactions, and predict the effect of nucleophile, leaving group, and solvent on the relative rates of SN1 versus SN2 reactions, and E1 versus E2 reactions, as well as on the relative rates of substitution versus elimination.</p> <p>CO2: Explain Chagaev and Cope eliminations and E1CB mechanism.</p> <p>CO3: Illustrate the preparative methods and important properties of Hydrocarbons, halogen compounds, Hydroxy compounds and Carbonyl Compounds.</p> <p>CO4: Explain the mechanism of important name reactions including rearrangements involving hydroxyl and Carbonyl functional groups.</p>
5.	5B07CHE/PCH: ANALYTICAL AND INORGANIC CHEMISTRY-II	<p>CO1: Understand the qualitative and quantitative aspects of analysis and separation techniques</p> <p>CO2: Explain instrumentation and working principle of different analytical techniques – TGA, DTA and radio chemical method of analysis.</p> <p>CO3: Familiarize with the preparation, properties and uses of some inorganic compounds like hydrides of boron, sulphur and silicon based inorganic polymers and understand their importance.</p> <p>CO4: Explain the classification of refractories.</p> <p>CO5: Know the position, electronic configuration and physical properties of noble gases and explain hybridization and geometry of different xenon compounds.</p> <p>CO6: Explain various steps involved in metallurgical operations and power metallurgy and understand Corrosion, theories of Corrosion and factors affecting Corrosion.</p>
6.	5B08 CHE/PCH: INORGANIC CHEMISTRY	<p>CO1: Understand the behavior of transition and inner transition elements and explain the separation of lanthanides by ion exchange method and lanthanide contraction.</p> <p>CO2: Understand key features of co-ordination compounds and illustrate the theories of coordination complexes, stability of complexes and explain factors affecting crystal field splitting.</p> <p>CO3: Explain biological functions of metal ions.</p>

		<p>CO4: Familiarize new elements in periodic table and understand recent developments in inorganic chemistry.</p>
7.	<p>5B09 CHE/PCH: PHYSICAL CHEMISTRY I</p>	<p>CO1: Recognize and relate the properties of ideal and real gases.</p> <p>CO2: Describe the properties of liquids.</p> <p>CO3: Identify and distinguish the types of solutions.</p> <p>CO4: Explain colligative properties of dilute solution and determine the molecular weight of a solute.</p> <p>CO5: Identify different crystallographic systems and various types of crystal defects.</p> <p>CO6: Describe X ray diffraction to explain internal structure of solids.</p>
8.	<p>5B10 CHE/PCH: PHYSICAL CHEMISTRY II</p>	<p>CO1: Identify the fundamental concepts of thermodynamics.</p> <p>CO2: Relate and interpret the various laws of thermodynamics.</p> <p>CO3: Understand the concept of entropy and how the whole universe is related to it.</p> <p>CO4: Construct phase diagrams and study the equilibrium exists between various states of matter, and apply principles phase diagram to separation processes and for property modification of different type of system.</p> <p>CO5: Understand basic principles of surface chemistry and its application in various fields.</p> <p>CO6: Correlate the types of colloids with its properties and to explore the applications in day today life.</p>
9.	<p>6B14CHE/PCH: ORGANIC CHEMISTRY – III</p>	<p>CO1: Acquaint with the classification, structures and properties of carbohydrates, explain the configuration of glucose and fructose, their inter conversion, illustrate Killiani-Fischer synthesis and Ruff degradation.</p> <p>CO2: Illustrate the preparative methods and the properties of different classes of organic acids, nitrogen containing compounds and heterocyclic compounds.</p>

		<p>CO3: Classify amino acids and peptides and explain the synthesis of simple peptides by N protection (t-butyloxy carbonyl and phthaloyl) & C-activating groups and Merrifield solid phase synthesis. Explain the methods of determination of primary structure of peptides.</p> <p>CO4: Distinguish the components of nucleic acids and lipids and their roles in biological system and the biological importance of various natural products. Familiarize with important drugs and their therapeutic applications.</p> <p>CO5: Recognize the types and characteristics of pericyclic reaction and analyze the pericyclic reactions by FMO methods. Understand the photochemistry of carbonyl compounds.</p> <p>CO6: Understand the principles of Green Chemistry and the importance of green synthesis and recognize the impact of green chemistry on human health and the environment.</p>
10.	6B15CHE/PCH: PHYSICAL CHEMISTRY – III	<p>CO1: Understand the mechanism of electrical conductance, theories of electrical conductance, and conductometric titrations.</p> <p>CO2: Understand the basic principle of ionic equilibrium and its application in laboratories.</p> <p>CO3: Design different types of electro chemical cell and able to calculate its potential.</p> <p>CO4: Familiarize with electro analytical methods.</p> <p>CO5: Acquaint with kinetics of simple, complex, enzymatic and surface reactions.</p> <p>CO6: Understand basic principles of photochemistry and its application in spectrophotometry.</p>
11.	6B16CHE/PCH: PHYSICAL METHODS IN CHEMISTRY	<p>CO1: i) Explain the important principles of spectroscopy. ii) Apply spectroscopic techniques in analyzing the structure of simple organic molecules.</p> <p>CO2: Acquainting the working principles of various instruments and their functions.</p> <p>CO3: Understand the basic principles of symmetry and group theory and its applications in Chemistry.</p> <p>CO4: Study the basic principles of nanochemistry and understand the various nanofabrication methods.</p> <p>CO5: Explain the important principles for quantum chemical and molecular mechanic methods of computing the geometry and energy of molecules.</p>

DISCIPLINE SPECIFIC ELECTIVE COURSE		
12.	6B17CHE/PCH- A: ENVIRONMENTAL CHEMISTRY	<p>CO1: Know the importance of environmental studies and methods of conservation of natural resources.</p> <p>CO2: Describe the structure and function of an ecosystem and explain the values and Conservation of bio-diversity.</p> <p>CO3: Explain the sources, environmental effects and control measures of various types of pollutions.</p> <p>CO4: Identify the toxic chemicals in environment and understand the sources, effects and treatment of heavy metal poisoning.</p> <p>CO5: Understand the methods of domestic water treatment, Sewage analysis and Sewage Treatment.</p>
13.	6B17CHE/PCH- B: APPLIED CHEMISTRY	<p>CO1: Explain the origin of coal, coal products, petroleum products and their applications.</p> <p>CO2: Explain the manufacture of fertilizers, pesticides and their applications.</p> <p>CO3: Understand the manufacture of glasses, cement, ceramics and the formulations of paints and varnishes.</p> <p>CO4: Familiarize with the chemistry of fats and oils and explain the production of soaps and detergents.</p> <p>CO5: Understand the chemistry of food additives and explain the manufacture and refining of pulp.</p> <p>CO6: Understand importance of industrial safety and industrial pollution control.</p>
14.	6B17CHE/PCH- C: POLYMER CHEMISTRY	<p>CO1: Classify polymers and explain the configuration of polymers and properties like glass transition temperature and melting point of polymers.</p> <p>CO2: Illustrate the preparation, properties and applications of polymers.</p> <p>CO3: Interpret the mechanism of polymerization.</p> <p>CO4: Acquaint various polymer processing technologies and explain thermal methods of analysis of polymers.</p> <p>CO5: Know the recent advances in polymer chemistry.</p>
15.	6B17CHE/PCH – D: NANOCHEMISTRY	<p>CO1: Understand the basic concepts and classification of nanomaterials.</p> <p>CO2: Analyze different nano systems and their properties.</p> <p>CO3: Understand the various techniques adopted for the synthesis and characterization of nanomaterials.</p> <p>CO4: Characterize the nanomaterials using various microscopic techniques.</p>

		CO5: Understand the application of nanomaterials in various fields including catalysis, photonics, and medicine.
16.	1B02CHE/PCH & 2B02CHE/PCH: CORE COURSE PRACTICAL I	<p>CO1: Apply the theoretical concepts while performing experiments.</p> <p>CO2: Acquire practical skill to estimate acid, base, oxidizing agents etc by volumetric titration method.</p> <p>CO3: Estimate the metallic ions by complexometric titration method.</p> <p>CO4: Acknowledge experimental errors and their possible sources.</p> <p>CO5: Able to prepare inorganic complexes.</p> <p>CO6: Design, carry out, record and analyze the results of chemical experiments.</p>
17.	3B05CHE/PCH & 4B05CHE/PCH: INORGANIC QUALITATIVE ANALYSIS	<p>CO1: Apply the theoretical concepts while performing experiments.</p> <p>CO2: Acquire practical skill to analyze the anions and cations qualitatively present in a mixture of inorganic salts.</p> <p>CO3: Able to design, carry out, record and analyze the results of chemical experiments.</p> <p>CO4: Learns the effective usage of chemicals.</p>
18.	5B11 CHE /PCH & 6B11 CHE/PCH: GRAVIMETRIC ANALYSIS	<p>CO1: Make use of standardized procedures for the Gravimetric analysis.</p> <p>CO2: learn the skills of Precipitation process, digestion, filtration, incineration etc.</p> <p>CO3: Acquire practical Knowledge of co-precipitation.</p> <p>CO4: Handle sintered glass vessels.</p> <p>CO5: Acknowledge experimental errors and their possible sources.</p> <p>CO6: Able to design, carry out, record and analyze the results of chemical experiments.</p>
19.	5B12 CHE/PCH& 6B12 CHE/PCH: ORGANIC CHEMISTRY	<p>CO1: Apply the theoretical concepts while performing experiments.</p> <p>CO2: Acquire practical skill in qualitative analysis of organic compounds.</p> <p>CO3: Acquire practical skill in preparing organic compounds and in their purification by crystallization.</p> <p>CO4: Separate organic compounds in a mixture –by steam distillation, TLC and Column Chromatography.</p>

		CO5: Acquire the habit of working safely with the chemicals and handling of equipment.
20.	6B18CHE/PCH: PHYSICAL CHEMISTRY	CO1: Acquire practical skill in physical chemistry experiments such as Cryoscopy, Transition Experiments, Phase Rule Experiments, Conductometric titrations, Potentiometric titrations, colorimetry and Chemical Kinetics. CO2: Learn statistical approach for evaluating data. CO3: Able to carry out and record these experiments in a skillful manner. CO4: Acquire the habit of working safely with the chemicals and handling of equipment.
21.	PROJECT	CO1: Able to enhance the skills of managing the resources, time and team work. CO2: Students will be able to function as a member of an interdisciplinary problem-solving team.
22.	5D01CHE/PCH: CHEMISTRY IN SERVICE TO MAN	CO1: i) Understand the classification, structure, function and applications of polymers. ii) Understand the importance of biodegradable polymers. CO2: Acquaint with different types of fertilizers and pesticides and understand the effect of fertilizers and pesticides on the environment. CO3: Explain the classification of fuels and composition of petroleum and familiarize the fuel cells and batteries and understand their applications in modern life. CO4: Explain different types of glasses, their applications and the composition of Portland Cement. CO5: Identify the harmful chemicals present in cosmetics and understand their effects in human Body.
23.	5D02CHE/PCH: DRUGS - USE & ABUSE	CO1: Familiarize the classes of drugs and their examples. CO2: Distinguish prescription drugs and over the counter drugs. CO3: Understand the routes of administration of drugs and their importance. CO4: Familiarize various synthetic drugs and their uses. CO5: Understand the consequences of misuse of antibiotic. CO6: Recognize the drugs of abuse and understand the consequences of drug abuse.

24.	5D03CHE/PCH: ENVIRONMENTAL STUDIES	<p>CO1: Differentiate the environmental segments and understand the importance of environmental segments.</p> <p>CO2: Identify the types of environmental pollution and the various sources of the pollution.</p> <p>CO3: Understand the consequences of environmental pollutions.</p> <p>CO4: Explain the measures of control of environmental pollution.</p> <p>CO5: Recognize various sustainable energy sources.</p>
25.	5D04CHE/PCH: NANOMATERIALS	<p>CO1: Understand the basic concepts of nanoscale science and technology.</p> <p>CO2: Inculcate the enquiry-based learning and increase the level of interest in nanoscience.</p> <p>CO3: Understand the societal implications and the scope of nanotechnology.</p>
26.	5D05CHE/PCH: CHEMISTRY IN EVERYDAY LIFE	<p>CO1: Identify the harmful ingredients and their effects of cleansing agent and cosmetics.</p> <p>CO2: Familiarize adulterants in food, food additives and food preservatives.</p> <p>CO3: Explain the harmful effects of modern food habits.</p> <p>CO4: Classify the drugs and familiarize the applications of various drugs.</p> <p>CO5: Understand the consequences of misuse of antibiotics.</p> <p>CO6: Prepare toilet soap using vegetable oil.</p>
COMPLEMENTARY ELECTIVE COURSE		
27.	1C01CHE/PCH: CHEMISTRY FOR PHYSICAL & BIOLOGICAL SCIENCES	<p>CO1: Understand the atomic structure, basics of quantum chemistry and its applications.</p> <p>CO2: Explain theories of chemical bonding and molecular structure.</p> <p>CO3: Classify environmental pollution and recognize the causes of pollution.</p> <p>CO4: Understand the basic concept of Chemical equilibrium and theories of acids and bases.</p> <p>CO5: Calculate pH values.</p> <p>CO6: Explain common ion effect and solubility product.</p>
28.	2C02CHE/PCH: CHEMISTRY FOR PHYSICAL &	<p>CO1: Understand the basic concept of classification, IUPAC nomenclature, bonding and structure of Organic compounds.</p>

	BIOLOGICAL SCIENCES	<p>CO2: Explain the concept of aromaticity and non-benzenoid aromatics.</p> <p>CO3: Understand the basic concepts of chemical equilibrium. Explain colloids, their properties and applications.</p> <p>CO4: Illustrate the laws of photochemistry and explain the photochemical phenomena such as Photosensitization, quenching, Fluorescence, Phosphorescence, Chemiluminescence and bioluminescence.</p> <p>CO5: Familiarize different types of analytical methods in chemistry and explain the principle of colorimetry.</p> <p>CO6: Explain the principles underlying the qualitative and quantitative analysis.</p>
29.	3C03CHE/PCH(PS): CHEMISTRY FOR PHYSICAL SCIENCE	<p>CO1: Understand the basic principle underlying various spectroscopy.</p> <p>CO2: Understand the basic concepts of thermodynamics and laws of thermodynamics.</p> <p>CO3: Explain the formation, nomenclature and applications of coordination complexes, Illustrate the valance bond theory of coordination complexes and explain the factors affecting the stability of complexes.</p> <p>CO4: Understand the basic concepts of chemical kinetics and calculate the value of E_a from the values of k at two temperatures. Illustrate the types of Catalysis and understand the Characteristics of catalytic reactions.</p> <p>CO5: Understand the basic concept of nuclear chemistry, and explain the detection of isotopes using Aston's mass spectrograph and separation of isotopes by diffusion methods.</p> <p>CO6: Explain the principle and applications of different types of Chromatography.</p>
30.	4C04CHE/PCH(PS): CHEMISTRY FOR PHYSICAL SCIENCE	<p>CO1: Understand the basic concept in gaseous state Explain the deviation of real gases from ideal behavior and Maxwell distribution of velocities and its use in calculating molecular velocities. Distinguish average velocity, RMS velocity and most probable velocity.</p> <p>CO2: Understand the basic concepts of internal structure of Crystals (crystallography) and explain X-ray analysis of crystals.</p> <p>CO3: Understand the basic concepts in liquid state and solutions. Illustrate Henry's law and explain its</p>

		<p>applications. Identify colligative properties and apply colligative properties to determine molecular mass.</p> <p>CO4: Distinguish Specific conductance – molar conductance and equivalent conductance and explain laws of electrolysis, conductometric titrations and its applications.</p> <p>CO5: Explain electrochemical cell, electrode potential, types of electrodes, EMF Nernst equation and potentiometric titration.</p> <p>CO6: Acquaint with various instrumental methods in chemistry and understand basic concepts of Nanochemistry.</p>
31.	3C03CHE/PCH: CHEMISTRY FOR BIOLOGICAL SCIENCES	<p>CO1: i) Understand the basic concept of Coordination Chemistry, nomenclature, Werner's coordination theory and Valence bond theory of coordination complexes. ii) Write the name of Coordination compounds. iii) Explain Werner's coordination theory and Valence bond theory of coordination complexes. iv) Explain the application of coordination complexes.</p> <p>CO2: i) Understand the electron displacement effects in organic molecules. ii) Explain the mechanism of nucleophilic substitutions and eliminations in alkyl halides. iii) Explain the mechanism of aromatic electrophilic substitution reactions.</p> <p>CO3: i) Classify the isomerism in organic molecules. ii) Distinguish the geometrical isomers and explain their stability. iii) Explain the characteristics of chiral compound. iv) Explain the conformational isomers in alkanes and cycloalkanes</p> <p>CO4: i) Explain the important types of polymerizations, thermoplastics and thermosetting plastics. ii) Understand the characteristics of biodegradable plastics.</p> <p>CO5: Understand the basic concept of thermodynamics and laws of thermodynamics</p> <p>CO6: i) Understand the basic concept of chemical kinetics. ii) Calculate E_a from the values of k at two temperatures. iii) Explain homogeneous catalysis, heterogeneous catalysis and Characteristics of catalysis reactions.</p>
32.	4C04CHE /PCH: CHEMISTRY FOR	<p>CO1: Illustrate the preparatory methods of glucose and fructose and explain their configurations. Familiarize</p>

	<p>BIOLOGICAL SCIENCES</p>	<p>the structure and properties of sucrose and polysachrides.</p> <p>CO2: Know the structure of important five membered and six membered heterocyclic compounds and explain their reactivity and important reactions. Explain the preparation and properties of Quinoline and iso quinoline.</p> <p>CO3: Understand the structure and functions of neuclic acids, classify amino acids and explain the structure of protein and its importance.</p> <p>CO4: Understand the mechanism of enzyme action, enzyme catalysis.</p> <p>CO5: Know the structure of Vitamin A, B and C. and hormones progesterone, Testosterone, cortisone, adrenaline and Thyroxin.</p> <p>CO6: Understand the importance of metal ions in biological systems and Mechanism of O₂ and CO₂ transportation – Nitrogen Fixation Na-K pump.</p>
33.	<p>4C05 CHE/PCH-COMPLEMENTARY ELECTIVE - CHEMISTRY PRACTICAL</p>	<p>CO1: Apply the theoretical concepts while performing experiments.</p> <p>CO2: Acquire practical skill to estimate acid, base, oxidizing agents etc by volumetric titration method.</p> <p>CO3: Acknowledge experimental errors and their possible sources.</p> <p>CO4: Design, carry out, record and analyze the results of chemical experiments.</p> <p>CO5: Acquire practical skill to analyze the anions and cations qualitatively present in a mixture of inorganic salts.</p> <p>CO6: Learns the effective usage of chemicals.</p>