Program Outcomes (PO) B.Sc.●

Science graduates are expected

PO-01	To do masters in the basic areas of the discipline.
PO-02	To apply their broad knowledge of science across a range of fields, with in-depth knowledge in at least one area of study.
PO-03	To articulate the methods of science and explain why current scientific knowledge is both contestable and testable by further inquiry.
PO-04	To apply appropriate methods of research, investigation and design, to solve problems in science, including the planning and/or conduct of a significant project, problem or investigation.
PO-05	To recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation.
PO-06	Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies.
PO-07	To evaluate the role of science, in addressing current issues facing local and global communities, for example climate change, health and disease, food security, sustainable energy use etc.
PO-08	To work effectively in groups to meet a shared goal with people who's disciplinary and cultural backgrounds differ from their own.
PO-09	To communicate clearly and convincingly about science ideas, practice and future contributions to expert and non-expert audiences, matching the mode of communication to their audience.

Department of Chemistry

Programme Specific Outcome (Chemistry):

On the completion of B.Sc. Chemistry the students:

PSO1	Understand the scope, methodology and application of modem chemistry
PSO2	Study theoretical and practical concepts of instruments that are commonly used in most chemistry field.
PSO3	Plan and conduct scientific experiments and record the results of such experiments.
PSO4	Get acquaint with safety of chemicals, transfer, and measurement of chemicals, preparation of solutions, and using physical properties to identity compounds and chemical reactions.
PSO5	Describe how chemistry is useful to solve social, economic and environmental problem and issues facing our society in energy, medicine and health.

Course Outcome (Chemistry):

F.Y.B.Sc. (Chemistry)	
1. Chemical Energetics	1. Students will be able to apply thermodynamic principles to physical and chemical process 2. Calculations of enthalpy, Bond energy, Bond dissociation energy, resonance energy 3. Variation of enthalpy with temperature –Kirchoff's equation 4. Third law of thermodynamic and its applications
2. Chemical Equilibrium	Knowledge of Chemical equilibrium will make students to understand 1. Relation between Free energy and equilibrium and factors affecting on equilibrium constant. 2. Exergonic and endergonic reaction 3. Gas equilibrium , equilibrium constant and molecular interpretation of equilibrium constant 4. Van't Haff equation and its application
3. Ionic equilibria	Ionic equilibria chapter will led students to understand 1) Concept to ionization process occurred in acids, bases and pH scale 2) Related concepts such as Common ion effect hydrolysis constant, ionic product, solubility product 3) Degree of hydrolysis and pH for different salts , buffer solutions
1. Atomic Structure	1) Various theories and principles applied to revel atomic structure 2) Origin of quantum mechanics and its need to understand structure of hydrogen atom 3) Schrodinger equation for hydrogen atom 4) Radial and angular part of hydrogenic wave functions 5) Significance of quantum numbers 6) Shapes of orbitals
2. Periodicity of Elements	1) Rules for filling electrons in various orbitals. 2) Electronic configuration of an atom and anomalous electronic configurations. 3) Stability of half-filled and completely filled orbitals. 4) Concept of exchange energy and relative energies of atomic orbitals 5) Skeleton of long form of periodic table. 6) Block, group, modern periodic law and periodicity. 7) Classification of elements as main group, transition and inner transition elements

	8) Name, symbol, electronic configuration, trends and properties. 9) Periodicity in the following properties in details: 10) Effective nuclear charge, shielding or screening effect; some numerical problems. 11) Atomic and ionic size. 12) Crystal and covalent radii 13) Ionization energies 14) Electronegativity- definition, trend, Pauling electronegativity scale. 15) Oxidation state of elements
3. Chemical Bonding	1) Attainment of stable electronic configurations 2) Types of chemical bonds- Ionic, covalent, coordinate and metallic bond 3) Ionic Bond- characteristics of ionic bond, types of ions, energy consideration in ionic bonding, lattice and solvation energy and their importance in the context of stability and solubility of ionic compounds, Born-Lande equation, Born-Haber cycle, Fajan's rule, bond moment, dipole moment and % ionic character. 4) Covalent bond- VB approach, Hybridization with example of linear, trigonal, square planer, tetrahedral, TBP, and octahedral. 5) VSEPR theory – assumption, need of theory, applications of 6) Concept of different types valence shell electron pairs and their contribution in bonding 7) Application of non-bonded lone pairs in shape of molecule 8) Basic understanding of geometry and effect of lone pairs with examples such as ClF_3, Cl_2O, BrF_5, XeO_3 and $XeOF_4$.
4. Calculations used in Analytical Chemistry	1. Calculations of mole, molar concentrations and various units of concentrations which will be helpful for preparation of solution 2. Relation between molecular formula and empirical formula 3. Stoichiometric calculation
Course Outcomes Practicals CH- 101: Physical Chemistry	After completing the course work learner will be acquired with knowledge of chemical energetics, Chemical equilibrium and ionic equilibria.
CH- 102: Organic Chemistry	Will learn Fundamentals of organic chemistry, stereochemistry (Conformations, configurations and nomenclatures) and

Course	Outcomes
	functional group approach for aliphatic hydrocarbons
CH- 201: Organic Chemistry	Will learn Fundamentals of organic chemistry, stereochemistry (Conformations, configurations and nomenclatures) and functional group approach for aliphatic hydrocarbons
CH- 201: Inorganic Chemistry	Students will learn quantum mechanical approach to atomic structure, Periodicity of elements, various theories for chemical bonding and calculations used in analytical chemistry
CH-202: Organic Chemistry	Students will learn Functional group approach for the various reactions (preparations & reactions) incontext to their structure
Lab Course CH 103 and CH-203	1. The practical course is in relevance to the theory courses to improve the Understanding of the concepts. 2. It would help in development of practical skills of the students. 3. Use of microscale techniques wherever required

S.Y.B.Sc. (Chemistry)

Course	Outcomes
CH-301 : Physical and Analytical Chemistry (Physical Chemistry)	• Concept of kinetics , terms used , rate laws , types of order Discuss examples of first order and second order reaction. Pseudo molecular reactions • Factors affecting on rate of reaction Techniques of measurement of rate of reaction • Know about photochemistry • Understand difference between thermal and photochemical reactions • Understand laws of photochemistry • Learn what is quantum yield and it's measurement • Know Types of photochemical reactions and photophysical process Know about quenching and chemiluminescent • Concept of distribution of solute amongst pair of immiscible solvents ii. Distribution law and it's thermodynamic proof • Distribution law and nature of solute in solution state iv. Application – Solvent extraction • Students should learn • What is Analytical Chemistry • Chemical analysis and its applications

	• Sampling • Common techniques • Instrumental methods and other techniques • Choice of method • Meaning of error and terms related to expression & estimation of errors • Methods of expressing accuracy and precision • Classification of errors • Significant figures and computations • Distribution of errors • Mean and standard deviations • Reliability of results Basic principles in qualitative analysis • Meaning of common ion effect • Role of common ion effect and solubility product • Different groups for basic radicals • Group reagent and precipitating agents
CH-302 : Inorganic and Organic Chemistry (Organic Chemistry)	• Students should be able to – • Identify chiral center in the given organic compounds. • Define Erythro, threo, meso, diasteroisomers with suitable examples. • Able to find R/S configuration in compounds containing two chiral centers. • Explain Bayer's strain theory, Heat of combustion and relates stability of cycloalkanes. • Explain the stability of cyclohexanes. • Draw the structure of boat and chair configuration of cyclohexane. • Draw axial and equatorial bonds in cyclohexane. • Draw structure of conformations of mono- & disubstituted cyclohexanes • Explain the stability of axial and equatorial conformation of monosubstituted • Cyclohexanes. Define and classify heterocyclic compounds. • Use Huckel rule to predict aromaticity. • Suggest synthetic route for preparation of various heterocyclic compounds. • Write and complete various reactions of heterocyclic compounds. • Predict products.
CH-203: Practical Chemistry	• Inorganic volumetric analysis and synthesis of Inorganic compounds. • Chemical analysis of commercial products. • Preparations and purification of organic compounds.

CH-301 : Physical and Analytical Chemistry	
(Analytical Chemistry)	- Meaning of equivalent weight, molecular weight, normality, molality, primary and secondary standards. - Different way to express concentrations of the solution. Preparation of standard solution. - To solve numerical problems. - Calibrate various apparatus such as burette, pipette, volumetric flask, barrel pipette etc. - Types instrumental and non instrumental analysis. Explain role of indicators. - Know mixed and universal indicators. - Know neutralization curves for various acid base titration - Know principle of complexometric precipitation and redox titrations. - Know the definitions and difference between iodometry and iodimetry. - To know standardization of sodium thiosulphate and EDTA. - Reactions between $CuSO_4$ and Iodine and liberated I_2 and $Na_2S_2O_3$ - Choice of suitable indicator. - Estimate copper from $CuSO_4$ and available chlorine in bleaching powder. - Prepare standard silver nitrate solution. - Mohr's and Fajan's method. - Determine the amount of halides separately and in presence of each other.
CH-302 : Inorganic and Organic Chemistry (Inorganic Chemistry)	- A student should be able – - To differentiate between ore and minerals. - To differentiate between calcination and roasting and smelting. - To know the different methods for separation of gangue or matrix from metallic compounds. - To know the terms smelting, flux. - A student should be able - - To know physico-chemical principles involved in electrometallurgy. - To understand electrolysis of alumina and its refining. - To explain the uses of Aluminum and its alloys. - To know purification of bauxite ore. To explain the term pyrometallurgy and to explain the physico chemical principles - involved in the reduction process by carbon monoxide. - To know different reactions in the blast furnace. - To differentiate between properties of pig iron and wrought iron. - To explain the basic principles of different methods for preparation of steel.

	To explain the merits and demerits of different methods.
CH-303: Practical Chemistry Paper-III	• Verification of theoretical principles by experiment observations and interpret practical output with the help of theoretical principles. • Methods of identification of substance by chemical methods. • To write and verify balanced equation for the chemical reactions performed in the laboratory. • Different reactions of organic and inorganic synthesis and follow the progress of the chemical reaction by suitable method (colour change, ppt. formation, TLC). • To arrange and set the apparatus for the desired experiments. • Quantitative chemical analysis of substances & explain principles behind it. • Systematic working skill in the laboratory.

T.Y.B.Sc. Chemistry (First Term)

Course	Outcomes
CH-501:Physical Chemistry	After studying this course, the student will be able to • Understand the term additive and constitutive properties. The term specific volume, molar volume and molar refraction. The meaning of electrical polarization of molecule, induced and orientation polarization. • Dipole moment and its experimental determination by temperature variation method. Electromagnetic spectrum, Nature of wave and its characteristics such as wavelength, wave number, frequency and velocity, Energy level diagram, • Classification of molecules on the basis of moment of Inertia, • Rotational spectra of rigid diatomic molecules, selection rules, nature of spectral lines. Simple Harmonic oscillator model, Born-Oppenheimer approximation. Vibrational spectra of diatomic molecules selection rules, nature of spectral lines. The difference between Rayleigh, Stokes and anti-Stokes lines in a Raman

	spectrum.
	• Justify the difference in intensity between Stokes and anti-Stokes lines.
	• Draw the Stokes and anti-Stokes lines in a Raman spectrum
	• \ Raman spectra: Concept of polarizability, Pure rotational Raman spectra of diatomic molecules, Energy Expression, Selection rule,
	• Rotational energy level diagram, Rotational Raman spectrum and Problems
CH-502: Analytical Chemistry	After completion of the course student should be able to
	• Define basic terms in gravimetry, spectrophotometry, qualitative analysis and parameters in instrumental analysis. Such as: Gravimetry, precipitation, solubility product, ionic product, common ion effect, precipitating agent, washing of ppt., drying and ignition of ppt., linearity range, detection limit, precision, accuracy, Sensitivity, Selectivity, Robustness and Ruggedness, electromagnetic radiations, spectrophotometry, Beers law, absorbance, transmittance, molar absorptivity, monochromator, wavelength of maximum absorbance.
	• Identify important parameters in analytical processes or estimations. Example: minimum analyte concentration in particular method, reagent concentration in particular analysis (gravimetry, spectrophotometry, thermogravimetry), reagent for particular analysis, reaction condition to convert analyte into measurable form, drying and ignition temperature for ppt in gravimetry, heating rate thermogravimetry, wavelength in spectrophotometry, group reagent, removal borate and phosphate in qualitative analysis.
	• Perform quantitative calculations depending upon equations student has studied I n the theory. Furthermore, student should able to solve problems on the basis of theory. . Discuss / Describe procedure for different types analyses included in the syllabus. Select particular method of analysis if analyte sample is given to him. Differentiate / distinguish / Compare among the different analytical terms, process and analytical methods.8. Demonstrate theoretical principles with help of practical. Design analytical procedure for given sample.
CH-504:Inorganic Chemistry	A student should know:
	• The assumptions and limitations of VBT .Understand the need of concept of MOT. Know LCAO principal and its approximation Understand and show the formation of bonding and antibonding

	MO's .Draw the shapes of s, p, d orbital. Draw combinations of s-s, s-p, p-p and d-d orbital to form σ and π molecular orbitals.
	• The meaning of term f-block elements, Inner transition elements, lanthanides, actinides. Electronic configuration of lanthanides and actinides. Oxidation states of lanthanides and actinides and common oxidation states. Separation lanthanides by modern methods.. Lanthanide contraction and effects of lanthanide contraction on post-lanthanides. Use of lanthanide elements in different industries. Transuranic elements. Preparation methods of transuranic elements. Nuclear fuels and their application.
	• The difference between metal, semiconductor and insulator. Metallic bond on the basis of band theory. The energy band and energy curve. n and p type of semiconductors. Discovery and applications of superconductors.
CH-505: Industrial Chemistry	The students are expected to learn
	• Importance of chemical industry. Meaning of the terms involved, Comparison between batch and continuous process, Knowledge of various industrial aspects. Concept of basic chemicals, their uses and manufacturing process. They should also know the physico-chemical principals involved in manufacturing process.
	• Importance of sugar industry, Manufacture of direct iii. Consumption (plantation white) sugar with flow diagram. Cane juice extraction by various methods, Clarification by processes like carbonation, Sulphitation, Phosphatation, etc. Concentration of juice by using multiple effect evaporator system, Crystallization of sucrose by using vacuum pan.
	• Importance, Basic requirement of fermentation process, Manufacturing of ethyl alcohol by using molasses and fruit juice.
	• Different types of soap products, Chemistry of soap. Raw materials required for soap manufacture
	• Meaning of the term's Surfactants, Types of surfactants. Raw materials for detergents. Detergent builders, additives ,Washing action of soap and detergents

CH-507:Organic Chemistry	• After studying the polynuclear and heteronuclear aromatic compounds, students will able to Define and classify polynuclear and hetreonuclear aromatic hydrocarbons. Write the structure, synthesis of polynuclear and hetreonuclear aromatic hydrocarbons. Understand the reactions and mechanisms. Explain the reactivity of polynuclear and hetreonuclear aromatic hydrocarbons. • Meaning of active methylene group. Reactivity of methylene group, Synthetic applications ethyl acetoacetate and malonic ester .To predict product with panning or supply the reagent/s for these reactions • Students will also learn about Elimination, different rearrangement reaction. • To predict product/s or supply the reagent/s for these reactions • Different types of carbon-carbon unsaturated compounds • Orientation / rules in addition reactions • The structure of carbonyl group • Reactivity concept • Correct mechanism of addition reactions using different reagents • Types of some known addition reactions • To predict product/s or supply the reagent/s for such reactions
CH-508: Chemistry of Biomolecules	The student will understand • Cell types, Biological composition and • Organization of cell membrane, structure and function of various cell organelles of plant and animal cell. Concepts of biomolecules • Types of carbohydrates, Lipids, Proteins, Amino acids and Enzymes • Basic concepts of Endocrinology. Types of Endocrine glands and their hormones. Biochemical nature of hormones. Mechanism of action of lipophilic and hydrophilic hormone.
CH:510 (A): Introduction of Medicinal Chemistry	Upon completion of the course the student shall be able to understand, • The basics of medicinal chemistry, biophysical properties, overview of basic concepts of traditional systems of medicine. • Over view of the overall process of drug discovery, and the role played by medicinal chemistry in this process. • Biological activity parameters and importance of stereochemistry

Course	Outcomes
	of drugs and receptors. Knowledge of mechanism of action of drugs belonging to the classes of infectious and non-infectious diseases.
CH-511 (A) : Environmental Chemistry	The students are expected to learn • Concept and scope of chemistry • Acquire Knowledge about water Pollution, Pollutants and various techniques of Analysis • Various Treatment Methods

(Second Term)

Course	Outcomes
CH-601 : Physical Chemistry	After studying this topic students are expected to know and understand: • Distinguish between crystalline and amorphous solids / anisotropic and isotropic solids. • Explain the term crystallography and laws of crystallography. • Weiss and Millers Indices, determination of Miller Indices • Bravais lattices, space groups, seven crystal systems and fourteen Bravais lattices; • Cubic lattice and types of cubic lattice • Distance between the planes for 100, 110 and 111 for cubic lattice • Methods of Crystal structure analysis: The Laue method and Braggs method: Derivation • Bragg's equation, • Determination of crystal structure of NaCl by Bragg's method, • X ray analysis of NaCl crystal system and Calculation of d and λ for a crystal system, • Problems
CH-602 : Physical Chemistry	After studying this course students are expected to know • Meaning of the terms-Solution, electrolytes, nonelectrolytes and colligative properties, Lowering of vapour pressure of solvent in solution, Elevation of B.P. of solvent in solution, Landsberger's method, freezing point depression, Beckmann's method Osmosis and Osmotic pressure, Berkeley and Hartley method, Application of colligative properties to determine molecular weight of

	nonelectrolyte, abnormal molecular weight, Relation between Vant Hoff's factor and degree of dissociation of electrolyte bycolligative property, • Factors affecting on solid state reactions, Rate laws for reactions in solid state .Applying rate laws for solid state reactions. Results of kinetics studies • History of polymers. Classification of polymers .Chemical bonding & Molecular forces in Polymer. Molecular weight of polymers. Practical significance of polymer molecular weights. Molecular weight determination
CH-604 : **Inorganic** **Chemistry**	Students should be able • To understand M-C bond and to define organometallic compounds , to define organometallic chemistry • To understand the multiple bonding due to CO ligand.To know methods of synthesis of binary metal carbonyls. • To understand the structure and bonding using valence electron count (18 ele. rule) To understand the catalytic properties of binary metal carbonyls. To understand the uses of organometallic compounds in the homogenous catalysis. Chemistry of ferrocene • Understand the phenomenon of catalysis, its basic principles and terminologies, differentiate homogeneous and heterogeneous catalysis, brief account of homogeneous catalysts. Understand the essential properties of homogeneous catalysts, examples of heterogeneous catalysts. Understand the classification and essential properties of heterogeneous catalysts. • Identify the biological role of inorganic ions & compounds. Know the abundance of elements in living system and earth crust. Classification of metals as enzymatic and non-enzymatic. Understand the role of metals in non-enzymatic processes. Know the metalloproteins of iron. Explain the functions of hemoglobin and myoglobin in O2 transport and storage. Understand the toxicity of CN- and CO binding to Hb. the structure of Vit.B12 and give its metabolism.
CH-605: **Inorganic** **Chemistry**	Student will learn • The concept of acid base and their theories. They will also come to know different properties of acids and bases. Strength of various types acids. Know the nature of solids. Know the crystal structures of solids.

	- Be able to define Pauling's univalent radius and crystal radius. Able to solve simple problems based on Pauling's univalent radii and crystal radii. Know how to draw Born-Haber cycle. Able to solve simple problems based on Born- Haber cycle. Know the defects in Ionic solids. - Different Zeolite Framework Types and their classification. Zeolite synthesis and their structure. Application of zeolites - Various methods of nanoparticle synthesis. Stabilization of Nanoparticles in solution. Properties and Application of Nanoparticles. Know about carbon nanotube and its application. - Toxic chemical in the environment. Know the impact of toxic chemicals on enzyme. Know the biochemical effect of Arsenic, Cd, Pb, Hg. Explain biological methylation.
CH-607: Organic Chemistry	- Students will learn the interaction of radiations with matter. They will understand different regions of electromagnetic radiations. They will know different wave parameters. - Students will learn the principle of mass spectroscopy, its instrumentation and nature of mass spectrum. Students will understand the principle of UV spectroscopy and the nature of UV spectrum. They will learn types of electronic excitations. Students will be able to calculate maximum wavelength for any conjugated system. And from the value of λ-max they will be able to find out the extent of conjugation in the compound. - Students will understand the principle of IR spectroscopy, types of vibrations and the nature of IR spectrum. Students will understand the principle of NMR spectroscopy and will understand various terms used in NMR spectroscopy. They will learn measurement of chemical shift and coupling constants. Students will be able to interpret the NMR data and they will be able to use it for determination of structure of organic compounds. Students will be able to determine the structure of simple organic compounds on the basis of spectral data such as λ max values, IR frequencies, chemical shift (δ values).
CH-608: Organic Chemistry	Students should be able to learn about . Retrosynthetic Analysis and Applications, Organic Reaction Mechanism and Synthetic Applications

	- Reagents in Organic Synthesis, Natural Products - Terpenoids: Introduction, Isolation, Classification. Citral-structure determination usingchemical and spectral methods, Synthesis of Citral by Barbier and Bouveault Synthesis. - Alkaloids: Introduction, extraction, Purification, Some examples of alkaloids and their natural resources. Ephedrine- structure determination using chemical methods
CH-610 (A) : Chemistry of Soil and Agrochemicals	Students will Know about - The different components and properties of soil.Classification of soil on the basis of pH. Can Identify the problematic soil and recommend method for their reclamation.Tthe different plant nutrients required for plants and their functions. Know the role of various fertilizers and manures required for plant growth. The various methods and their techniques in analysis of soil. Importance of manures as compared to chemical fertilizers - Know various techniques to protect the plants. Have the knowledge of various pesticides, insecticides, fungicides and herbicides.
CH-611(A): Analytical Chemistry-	After completion of the course student should able to Basic terms in solvent extraction, basics of chromatography, HPLC, GC, and AAS and AES. Some important terms are: solvent extraction, aqueous and organic phase, distribution ratio and coefficient, solute remain unextracted, percent extraction, ion association complex, theoretical plate, HETP, retention time, selectivity, resolution, stationary phase, normal and reverse phase, ion exchange, column efficiency, carrier gas, split and spitless injection, packed column, tubular column, atomic absorption and emission spectroscopy, electronic excitation in atoms, nebulization, atomization, reduction of metal ions in flame, absorbance by atoms in flame, flame atomizers, furnace atomizers, interference in AES and FES, HCL, hydride generator, etc

Course Outcomes Practical

- **Physical chemistry-I (Sem-V)**
  - The molecular weight of polymer by using Ostwald viscometer.
  - Different instrument like pH meter, Spectrophotometry, colorimeter, photoflurometer etc. and are able to determine different parameters.
  - Students can develop the technique to analysis of the given vibration-rotation spectrum of HCl(g)

- **Inorganic Chemistry-I (Sem-V)**
  - Gravimetric analysis of ores and alloy. Preparation of various inorganic complex
    and their % purity.
  - Removal of borate and phosphate from inorganic binary mixtures. Chromatographic techniques

- **Organic Chemistry-I (Sem-V)**
  - Separation of organic binary mixture and its qualitative analysis
  - Preparation of dibenzalpropanone, nitration of phenol and bromination of acetamide by green synthesis route.
  - Preparation of 1,4-dihydropyrimidone, p-Iodonitrobenzene and p-Chloro benzoic acid.
  - Preparation of organic derivative of carboxylic acid, glucose and p-Aminophenol

- **Physical chemistry-I (Sem-VI)**
  - Determination of plateau voltage, resolving time of GM counter and Emax of beta particle.
  - Handling of different instrument like pH meter, conductivity meter, turbidometer etc. and determine different parameters.
  - Determination of various colligative properties and analysis of crystal structure from X-ray diffraction spectra.

- **Inorganic Chemistry-I (Sem-VI)**
  - Gravimetric and volumetric analysis of ores and alloy..
  - Importance of flame photometry, column chromatography techniques for estimation and purification respectively. Synthesis of Nanomaterial.

> ➢ Verification of periodic trends using solubility of alkaline earth metal hydroxides.

Organic Chemistry-I (Sem-VI)

> ➢ Functional group from given IR spectra and structure from NMR spectra of organic compound.

> ➢ Estimation of glucose, glycine, Alkali content in antacid and saponification value of oil volumetrically.

> ➢ Extraction of caffeine from tea leaves, Eugenol form cloves, lycopene from tomato peels, cinnamic acid from cinnamon and Trimyristin from nutmeg.

> ➢ Separation of mixture of aldehyde and carboxylic acid, o-nitrophenol and p-nitrophenol by column chromatography.

Program Outcomes (PO) M.Sc.•

Post graduates are expected

PO-01	To do Ph.D. in allied subject.
PO-02	To apply their advance knowledge of science in society and among the community
PO-03	To become a researcher and upgrade the skills in industries
PO-04	To apply appropriate methods of research, investigation and design, to solve problems in science, including the planning and/or conduct of a significant project, problem or investigation.
PO-05	To recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation.
PO-06	Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies.
PO-07	To evaluate the role of science, in addressing current issues facing local and global communities, for example climate change, health and disease, food security, sustainable energy use etc.
PO-08	To work effectively in groups to meet a shared goal with people who's disciplinary and cultural backgrounds differ from their own.
PO-09	To communicate clearly and convincingly about science ideas, practice and future contributions to expert and non-expert audiences, matching the mode of communication to their audience.

M.Sc. Organic Chemistry

Programme specific outcomes:- A Student

PSO1	Gains complete knowledge about all fundamental aspects of all the elements of chemistry
PSO2	Understands the background of organic reaction mechanisms, complex chemical

	structures, Instrumental method of chemical analysis, molecular rearrangements and separation techniques.
PSO3	Appreciates the importance of various elements present in the periodic table, coordination chemistry and structure of molecules, properties of compounds, structural determination of complexes using theories and instruments.
PSO4	Gathers attention about the physical aspects of atomic structure, dual behaviour, reaction pathways with respect to time, various energy transformations, molecular assembly in nanolevel, significance of electrochemistry, molecular segregation using their symmetry.
PSO5	Learns about the potential uses of analytical industrial chemistry, medicinal chemistry and green chemistry.
PSO6	Carry out experiments in the area of organic analysis, estimation, separation, derivative process, inorganic semi micro analysis, preparation, conduct metric and potentiometer

Course Outcomes (COs):M.Sc.: Organic Chemistry

Semester-I

1. CCTP-1:CHP-110 :Physical Chemistry-I
(Fundamentals of Physical Chemistry)
  - ➢ Learns the classical status of thermodynamics
  - ➢ Appreciates the fundamentals of molecular thermodynamics
  - ➢ Understand colligative properties for liquids
  - ➢ Understands the basis of quantum chemistry and its application
  - ➢ Learns the importance of chemical reaction against time
  - ➢ Understand the fundamentals of molecular dynamics
  - ➢ Appreciates the effect of enzyme catalysis
  - ➢ Idea about Molecular thermodynamics

2. CCTP-2:CHI-130 : Inorganic Chemistry-I
(Molecular Symmetry and Chemistry of Main Group
Elements)

  - ➢ Student should visualize/ imagine molecules in 3 dimensions.
  - ➢ To understand the concept of symmetry and able to pass various symmetry elements through the molecule.
  - ➢ Understand the concept and point group and apply it to molecules.
  - ➢ To understand product of symmetry operations.
  - ➢ To apply the concept of point group for determining optical activity and dipole moment.
  - ➢ Student should understand the importance of Orthogonality Theorem.
  - ➢ They should able to learn the rules for constructing character table.
  - ➢ Using reduction formulae should be able to find out the possible type of hybridization.
  - ➢ Student should know the concept of SALC.

- Student able to find out character for reducible representation.
- To know about projection operator.
- Apply projection operator to find out the normalized wave function for atomic orbital.
- Student should correlate the application of symmetry to spectroscopy.
- Students able to find out the possible modes of vibration.
- From the previous knowledge of symmetry student must able to find out which mode are IR active.
- Understands Classification of Hydrides, electron deficient, electron precise and electron rich hydrides
- Learns properties of Alkali and Alkaline Earth Metals
- Enhance knowledge in Structural and bonding in different group of periodic tables
- Understands organometallic compounds and its application.

3. CCTP-3:CHO-150 : Organic Chemistry-I :(Basic Organic Chemistry)
- Understands the basic concepts of stereochemistry with different representation in three dimensions
- Students are able to define molecules and its representation

- Students learns about molecular reaarangement in deficient as well as rich center transfer of groups
- Students are about basic chemistry of carbanion, carbocations, carbenes
- Students become familiar to ylides and types of ylides and its applications
- Learns about basic reactions using oxidising and reducing agents

4. CBOP-1 : CHG-190 :Section-I: General Chemistry-I, Theory Course

- The goal of this course is to introduce students to fundamental concepts in Chemical Biology and methods of chemistry used to solve problems in molecular and cell biology. After completion of this course, successful students will:
- Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.
- Students will be able to function as a member of an interdisciplinary problem solving team.
- To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.
- Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.

Section-II: General Chemistry Practical (Any one)

5. CCPP-1 : CHP-107: Basic Practical Chemistry-I

- This course is designed to make students aware of how to perform Inorganic Compounds in laboratory.
- Study the gravimetric and volumetric analysis of ores and alloy.
- The course includes synthesis of various inorganic complexes and determine its % purity.
- To find out the percent of metal compositions and purity will help them in industry or while doing research in inorganic chemistry.
- This practical course is also designed to make student aware of nanotechnology and Preparation of nonmaterial.
- Role of nanocatalysts in environmental remediation
- The students learn how to synthesize the nanoparticles from different methods and different precursors.
- Also the characterization of nanoparticles and analysis of data.
- Learns principle of distillation, crystallization, sublimation
- Understands the method of organic preparation
- Use of instruments like conductivity meter, pH-meter, colorimeter

Semester- II
6. CCTP-4 : CHP-210 : Physical Chemistry - II
(Molecular Spectroscopy and Nuclear Chemistry)

- Validates the theoretical background of rotational spectra
- Analyses the physical approach of IR and Raman spectra
- Students able to find out the possible modes of vibration.
- From the previous knowledge of symmetry student must able to find out which mode are IR active.
- Gains knowledge about NQR and ESR spectra
- Understands different molecular spectroscopy such as microwave, IR, Raman, Electronic and Mossbauer.
- Defines the theory and advancement in nuclear chemistry
- Different elements of radiations are understood
- Learns types of nuclear fission
- Understands application of radioactivity

7. CCTP-5: CHI-230: Inorganic Chemistry -II
(Coordination and Bioinorganic Chemistry)

- Understands Concept and Scope of Ligand Fields
- Idea about ligand field theory of complexes
- Learns about electronic spectra of complex
- Understands Overview of Bioinorganic Chemistry
- Idea about Concepts of Inorganic Chemistry in Bioinorganic chemistry
- Learns about Functions and Transport of Alkali and Alkaline Earth Metal Ions
- Biochemistry of different elements

8. CCTP-6 : CHO-250 : Organic Chemistry-II
(Photochemistry, Pericyclic and Organic spectroscopy)

- ➤ Students are able to understand the concept of photochemical excitation and photochemical reactions
- ➤ Learns about pericyclic reactions and its different types of pericyclic reactions
- ➤ MOT and will be able to extend this in predicting reaction mechanism and stereochemistry of electrocyclic reactions
- ➤ The concepts in free radical reactions, mechanism and the stereochemical outcomes.
- ➤ The basic principle of spectroscopic methods and their applications in structure elucidation of organic compounds using given spectroscopic data or spectra.
- ➤ Students are aware of U.V. spectroscopy and its applictions
- ➤ Students learns about IR spectroscopy and its applications
- ➤ Students learns about 1H-NMR and 13C-NMR spectroscopy and its applications
- ➤ Students are familiar with mass spectrometry and its application

9. CBOP-2 : CHG-290 : Section-I: General Chemistry-II, Theory
Elective Option-B : Organometallic and Inorganic Reaction Mechanism

- ➤ At the end of course students will able to explain
- ➤ Valence electron count, back bonding in organometallics, spectral characterization of organometallic compounds.
- ➤ Catalytic reaction involving organometallic compounds and mechanism of these reactions
- ➤ Types of reaction involving organometallic compounds
- ➤ Types of reactions in coordination compounds, inert and labile complexes, substitution reactions in coordination complexes and their mechanism, stereochemistry of reaction, kinetics of reactions.

Section-II: General Chemistry, Practical (Any one option)
Elective Option-A: Electroanalytical Techniques of Analysis
10. CCPP-2 : CHP-227 Basic Practical Chemistry-II

- ➤ After completion of this course, students aware of
- ➤ Synthesis of coordination complexes
- ➤ Determination of metal complexes by conductometric measurement.
- ➤ Determination of solubility product.
- ➤ To understands the basis of Inorganic characterisation techniques.
- ➤ To know Inorganic Kinetics Experiments.
- ➤ To study Ion-Exchange Chromatography.
- ➤ To study Solvent Extraction and Colorimetry

- ➢ Use of instruments like conductivity meter, pH-meter, colorimeter
- ➢ Understands the method of organic preparation

1. **Semester- III**

1. CCTP-7: CHO-350: Organic Reaction Mechanism and Biogenesis

The goal of this course is to introduce students to
- ➢ Study the design of organic synthesis.
- ➢ Understand the reaction pathway via various intermediate.
- ➢ Get an idea about the synthesis of natural products.

2. CCTP-8: CHO-351: Structure Determination of Organic Compounds by Spectroscopic Methods
- ➢ Students are are about advances in spectroscopic techniques
- ➢ Students are familiar with application of different spectroscopic tecnhiques such as 1H-NMR, 13C-NMR. Mass spectrometry
- ➢ Students are able to solve numericals based on spectroscopic techniques.

3. CCTP-9: CHO-352 :Stereochemistry and Asymmetric Synthesis of Organic Compounds.
- ➢ Study the stereochemistry concept of different molecules
- ➢ Students are able to draw stereo structures of different structure .
- ➢ Understand asymmetric synthesis and its terms.
- ➢ Students gain knowledge for application of asymmetric synthesis in designing chiral molecules.

4. CBOP-3: CHO-353: Theory: CHO-353-A) Protection - De-protection, Chiron approach and Carbohydrate Chemistry
- ➢ The goal of this course is to introduce students to
- ➢ Study the design of organic synthesis, protection deprotection of hydroxyl, amino carboxyl, ketones and aldehyde, amines, solid state peptide synthesis
- ➢ Study of carbohydrates: Introduction of sugar, structure of triose tetrose, pentose , hexose, stereochemistry of glucose.
- ➢ Understand the chiral approach, concept of chiral templates, and utilization of the basic concept for retrosynthetic strategy.

5. CCPP-3: CHO-354 Practical I: Solvent Free Organic Synthesis
- ➢ To know and study the
- ➢ Study of green chemistry approach.
- ➢ No involvement of organic solvents, less time, improved yields, mild conditions & ready   operations.

➤ Reduce pollution and bring down handling costs due to simplification of experimental procedure, work up technique and saving in labour.

2. **Semester- IV**

6. CCTP-10: CHO-450 Chemistry of Natural Products
➤ Understands the planning of total synthesis without altering the stereochemistry
➤ Able for total synthesis of natural products.

7. CCTP-11: CHO-451 Organometallic Reagents in Organic Synthesis
To know and study the
➤ Study of transition metal complexes in organic synthesis.
➤ Learn C=C formation reaction, multi compound reaction, ring formation reaction.
➤ Study of sharpless azides Cycloaddition, use of boron and silicon in organic synthesis.

8. CBOP-4: CHO-452: Theory: A) Medicinal Chemistry
At the end of course students will able to explain
➤ Helps in correlating between pharmacology of a disease and its mitigation or cure.
➤ To understand the drug metabolic pathways adverse effect and therapeutic value of drugs.
➤ Well acquainted with the synthesis of some important class of drugs.
➤ To know the structural activity relationship of different class of drugs.

9. CBOP-5: CHO-453 Practical: Practical III: Select any two Sections
Section-I: Ternary Mixture Separation
Section-I: Project / Industrial Training/ Internships/Summer Project
➤ This course is designed to make students aware of how to perform organic Compounds in laboratory.
➤ Different components of a mixture are separated in order to either separate the unrequired components from a mixture.
➤ To obtain pure substances.
➤ To separate more than one useful components from a mixture.
➤ Students undergo industrial training or summer project to different industry or institution to upgrade practical skill knowledge and get hands on training.

10. CCPP-4: CHO-454 Practical II: Convergent and Divergent Organic Syntheses.

After completion of this course, students aware of
 ➢ Synthesis of Organic compounds.
 ➢ It gives shorter and more efficient than a linear synthesis leading to a higher overall yield.
 ➢ It is flexible and easier to execute due to the independent synthesis of the fragments of the target molecule.
 ➢ Several compounds can make from a common intermediate.

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