

B.Sc (P) PHYSICAL SCIENCES

Course Outcomes

| Paper No | Paper Name |
|----------|--|
| CORE - 1 | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (Theory) |
| CO-1 | <ul style="list-style-type: none">Solving the conceptual questions by applying the learnt concepts about the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, s, p, and d orbital shapes, and periodicity in atomic radii, ionic radii, ionisation energy, and electron affinity of elements |
| CO-2 | <ul style="list-style-type: none">Constructing viable molecular shapes and geometries (homo- & hetero-nuclear diatomic molecules) |
| CO-3 | <ul style="list-style-type: none">To understand how to Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements. |
| CO-4 | <ul style="list-style-type: none">Understand the Shapes of s, p and d atomic orbitals, nodal planes, discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). |
| CO-5 | <ul style="list-style-type: none">Rules for filling electrons in various orbitals, electronic configurations of the atoms, stability of half-filled and completely filled orbitals, concept of exchange energy, relative energies of atomic orbitals, anomalous electronic configurations. |
| CO-6 | <ul style="list-style-type: none">Know about the Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules). |
| CO-7 | <ul style="list-style-type: none">Understand about the hybridization in inorganic complex with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. |
| CO-8 | <ul style="list-style-type: none">Understand the concept of resonance and resonating structures in various inorganic and organic compounds. |
| CO-9 | <ul style="list-style-type: none">Learn and understand the fundamental concepts of organic chemistry |
| CO-10 | <ul style="list-style-type: none">To write mechanism of different organic reactions |
| CO-11 | <ul style="list-style-type: none">To understand the stereochemistry of organic compounds |
| CO-12 | <ul style="list-style-type: none">Understand and explain the preparation, Physical properties and chemical reactions associated with Aliphatic hydrocarbons |
| CORE - 1 | Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (Practical) |
| CO-1 | <ul style="list-style-type: none">Understanding the basic concept of titrimetric analysis |
| CO-2 | <ul style="list-style-type: none">Carrying out redox, acid base titrations for understanding the principles of the above titrations. |

| | |
|-----------------|--|
| CO-3 | <ul style="list-style-type: none"> Carry out purification via crystallization and distillation of organic compound and confirm same using melting point and boiling point |
| CO-4 | <ul style="list-style-type: none"> Carry out chromatography for separation of mixtures and sugars |
| CO-5 | <ul style="list-style-type: none"> Separate the components in a mixture of two amino acids |
| CORE - 2 | Chemical Energetics, Equilibrium and Functional Group Organic Chemistry (Theory) |
| CO-1 | <ul style="list-style-type: none"> Understanding of the laws of thermodynamics, thermochemistry and chemical equilibria. |
| CO-2 | <ul style="list-style-type: none"> Understand concept of pH and its effect on the various physical and chemical properties of the compounds. |
| CO-3 | <ul style="list-style-type: none"> Use the concepts learnt to predict feasibility of chemical reactions and to study the behaviour of reactions in equilibrium. |
| CO-4 | <ul style="list-style-type: none"> Understand the fundamentals of functional group chemistry |
| CO-5 | <ul style="list-style-type: none"> Understand the concepts of stereochemistry |
| CO-6 | <ul style="list-style-type: none"> Able to design new synthetic routes for organic compounds |
| CORE - 2 | Chemical Energetics, Equilibrium and Functional Group Organic Chemistry (Practical) |
| CO-1 | <ul style="list-style-type: none"> Use calorimeter to find heat capacity, Enthalpy of neutralization, Enthalpy of solution, enthalpy of hydration |
| CO-2 | <ul style="list-style-type: none"> Use pH meter to find pH of unknown solutions, prepare buffer solutions (acidic and basic buffer solutions) |
| CO-3 | <ul style="list-style-type: none"> Prepare of various compounds like bromination of phenol/aniline, benzoylation of amines/phenols, oxime, 2,4 dinitrophenyl hydrazone and semicarbazone of -CHO/-CO. |
| CORE - 3 | Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry (Theory) |
| CO-1 | <ul style="list-style-type: none"> Understanding thermodynamic aspects of equilibria between phases. |
| CO-2 | <ul style="list-style-type: none"> Learning the concept of conductance and its variation with dilution, migration of ions in solutions and applications of conductance measurement. |
| CO-3 | <ul style="list-style-type: none"> Understanding the applications of thermodynamic principles to solutions. |
| CO-4 | <ul style="list-style-type: none"> Illustration of Nernst distribution law and its applications. |
| CO-5 | <ul style="list-style-type: none"> Understanding the concept of EMF and calculating thermodynamic properties and other parameters from the EMF measurements. |
| CO-6 | <ul style="list-style-type: none"> Understanding the relevance of structure of biomolecules and to determine chemical properties, reactivity and biological uses. |
| CO-7 | <ul style="list-style-type: none"> Designing synthetic routes for various organic compounds |
| CORE - 3 | Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry II (Practical) |
| CO-1 | <ul style="list-style-type: none"> To construct phase diagram of simple eutectic systems |
| CO-2 | <ul style="list-style-type: none"> To determine CST of Phenol-water impurities and study the effect of impurities on CST |
| CO-3 | <ul style="list-style-type: none"> To perform conductometric titrations |
| CO-4 | <ul style="list-style-type: none"> To perform potentiometric titrations |

| | |
|-----------------|--|
| CO-5 | <ul style="list-style-type: none"> To find the functional group present in a organic compound using systematic analysis |
| CORE - 4 | Chemistry of s- and p-block elements, states of matter and Chemical Kinetics (Theory) |
| CO-1 | <ul style="list-style-type: none"> Understanding the most common modes of metal occurrence based on typical electrode potentials |
| CO-2 | <ul style="list-style-type: none"> Developing a thorough understanding Ellingham diagrams for metal oxide reduction with carbon as the reducing agent. |
| CO-3 | <ul style="list-style-type: none"> Understanding of the metallurgical processes like cyanide method for silver and gold. Electrolytic, oxidative refining, van Arkel-de Boer procedure, and Mond's process and all methods for purifying metals (Al, Pb, Ti, Fe, Cu, Ni, Zn) |
| CO-4 | <ul style="list-style-type: none"> Critical thinking skills for understanding the concepts of Electronic configuration, atomic and ionic size, ionisation enthalpy, electronegativity (Pauling, Winker, and Allred-Rochow scales) all such aspects of periodicity in s- and p-block elements. |
| CO-5 | <ul style="list-style-type: none"> Understanding of concepts of Inert pair effect, diagonal relationship, and anomalous behaviour of the first member of each group), oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship, and anomalous behaviour of the first member of each group s- and p-Block Elements Compounds Diborane and the multicentre bonding idea |
| CO-6 | <ul style="list-style-type: none"> Understanding following compounds' structure, bonding, and essential features such as oxidation/reduction, acidic/basic nature, and uses in industrial and environmental chemistry : Nitrogen hydrides, Phosphorous and Sulphur halides and oxohalides |
| CO-7 | <ul style="list-style-type: none"> Understanding and deriving the mathematical expressions for ideal gas law, real gas law and comment on deviation from ideal behaviour |
| CO-8 | <ul style="list-style-type: none"> Derive and explain the Maxwell Boltzman distribution, critical constants and viscosity of gases |
| CO-9 | <ul style="list-style-type: none"> Explain and derive mathematical equations to explain properties of liquids |
| CO-10 | <ul style="list-style-type: none"> Understand symmetry elements in Solid state |
| CO-11 | <ul style="list-style-type: none"> Understand rate of reaction and derive different rate of equation, theories of reaction rates and explain experimental observations |
| CORE - 4 | Chemistry of s- and p-block elements, states of matter and Chemical Kinetics (Practicals) |
| CO-1 | <ul style="list-style-type: none"> To perform semi-micro qualitative analysis to determine the anion and cation in a mixture |
| CO-2 | <ul style="list-style-type: none"> To use stalagmometer to determine the surface tension of unknown liquids |
| CO-3 | <ul style="list-style-type: none"> To use viscometers to determine the viscometer of unknown liquids |
| CO-4 | <ul style="list-style-type: none"> To study the kinetics of reaction using different methods |

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)

| Paper No | Paper Name |
|----------|---|
| DSE - 1 | Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (Theory) |
| CO-1 | <ul style="list-style-type: none"> Understand the chemistry of d & f block elements, Latimer diagrams, VBT and CFT |
| CO-2 | <ul style="list-style-type: none"> Understanding the basic principles of quantum mechanics: operators |
| CO-3 | <ul style="list-style-type: none"> Provides understanding of basic concepts of microwave |
| CO-4 | <ul style="list-style-type: none"> Illustration of Lambert-Beer's law |
| DSE - 1 | Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (Practical) |
| CO-1 | <ul style="list-style-type: none"> Learn about the Estimation of the amount of nickel present in a given solution as bis - (dimethylglyoximate) nickel(II) or aluminium as oxinate in a given solution gravimetrically. |
| CO-2 | <ul style="list-style-type: none"> Understand about the Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA. |
| CO-3 | <ul style="list-style-type: none"> Learn about the Estimation of total hardness of a given sample of water by complexometric titration. |
| CO-4 | <ul style="list-style-type: none"> Determination of the composition of the Fe^{3+} - salicylic acid complex / Fe^{2+} - phenanthroline complex in solution by Job's method. |
| CO-5 | <ul style="list-style-type: none"> Verify Lambert-Beer's law and determine the concentration of $CuSO_4/KMnO_4/K_2Cr_2O_7/CoSO_4$ in a solution of unknown concentration |
| CO-6 | <ul style="list-style-type: none"> Know about the chemical Kinetics; Study the kinetics of the following reactions. 1. Initial rate method: Iodide-persulphate reaction 2. Integrated rate method: Saponification of ethyl acetate. |
| DSE - 2 | Organometallic, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (Theory) |
| CO-1 | <ul style="list-style-type: none"> Inorganic chemistry topics, organometallics and bioinorganic chemistry were discussed in detail, and students accomplished better insights about basic terminology involved. |
| CO-2 | <ul style="list-style-type: none"> Students were excited and curiously learned about basic concepts on structure elucidation of various polynuclear aromatic compounds and their important reactions. |
| CO-3 | <ul style="list-style-type: none"> They were explained about active methylene compounds, particularly ethylacetoacetate. |
| CO-4 | <ul style="list-style-type: none"> An extensive discussions were made on the basic spectroscopic techniques and their usage in structure elucidation of known compounds. |
| CO-5 | <ul style="list-style-type: none"> Based on the discussion and assignments attempted by the students, the course played an important role to obtain better insight about polynuclear, heteronuclear aromatic compounds, and spectral analysis. |
| DSE - 2 | Organometallic, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (Practical) |
| CO-1 | <ul style="list-style-type: none"> Students were exposed to the basic/preliminary separation technique, paper chromatography, which plays an important role while isolation or divorce |

| | |
|------|---|
| | of metal ions or organic compounds. |
| CO-2 | <ul style="list-style-type: none"> A few inorganic preparations were dictated and discussed in detail, in turn students revealed their insightful questions, which were further elaborated with appropriate responses by the class teachers. |
| CO-3 | <ul style="list-style-type: none"> An extensive discussions were made on the basic spectroscopic techniques and their usage in structure elucidation of known compounds. |
| CO-4 | <ul style="list-style-type: none"> Separately, systematic qualitative analysis of organic compounds was explained, performed and demonstrated to the students. |
| CO-5 | <ul style="list-style-type: none"> Students were exposed to the basic/preliminary separation technique, paper chromatography, which plays an important role while isolation or divorce of metal ions or organic compounds. |

SKILL ENHANCEMENT ELECTIVE COURSES (SEC)

| Paper No | Paper Name |
|----------|---|
| SEC 1 | IT Skills for Chemists (Theory) |
| CO-1 | <ul style="list-style-type: none"> Understanding of mathematical techniques and basic computer skills in order to solve chemistry problems. |
| CO-2 | <ul style="list-style-type: none"> Learning the concept of uncertainty and error in experimental data. |
| CO-3 | <ul style="list-style-type: none"> Provides understanding of different software for data tabulation, calculation, graph plotting, data analysis and document preparation. |
| CO-4 | <ul style="list-style-type: none"> Understanding of mathematical techniques and basic computer skills in order to solve chemistry problems. |
| SEC 1 | IT Skills for Chemists (Practical) |
| CO-1 | <ul style="list-style-type: none"> Hands on exercises on computers that helps in preparing a word processing document having tables, chemical structures and chemical equations. |
| CO-2 | <ul style="list-style-type: none"> Solving chemistry problems and simulating graphs using basic computer skills. |
| CO-3 | <ul style="list-style-type: none"> Usage of software for tabulating data, plotting graphs and charts, carry out statistical analysis of the data. |
| CO-4 | <ul style="list-style-type: none"> Hands on exercises on computers that helps in preparing a word processing document having tables, chemical structures and chemical equations. |
| SEC 2 | Pharmaceutical Chemistry (Theory) |
| CO-1 | <ul style="list-style-type: none"> Gain insight into retro-synthesis approach in relation to drug design and drug discovery. |
| CO-2 | <ul style="list-style-type: none"> Learn synthetic pathways of major drug classes |
| CO-3 | <ul style="list-style-type: none"> Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins |
| CO-4 | <ul style="list-style-type: none"> Information about the sources of drugs like marine, biological, minerals and plant tissue culture |
| CO-5 | <ul style="list-style-type: none"> Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colours |
| SEC 2 | Pharmaceutical Chemistry (Practical) |
| CO-1 | <ul style="list-style-type: none"> Understand the method of synthesis of drugs(Aspirin, Paracetamol, |

| | |
|-------------|---|
| | sulphacetamide, Ibuprofen) |
| CO-2 | <ul style="list-style-type: none">• Gain insight into the methods of qualitative analysis of drugs and their properties |
| CO-3 | <ul style="list-style-type: none">• Demonstrate the method for the determination of alcohol content in liquid drug |
| CO-4 | <ul style="list-style-type: none">• Understand difference between the iodometric and iodimetric titrations |
| CO-5 | <ul style="list-style-type: none">• Learn the steps for the analysis of Vitamin C tablet available commercially |