Program: M. Sc. Chemistry

Program Specific Outcomes

PSO1 Gain complete knowledge about all fundamental aspects of all the elements of chemistry

PSO2 Understand the background of organic reactions, techniques used for analysis of mechanism, complex chemical structures, various intermediates with their detailed discussion and Stereochemistry involved in organic reactions.

PSO3 Appreciate the importance of various elements present in the periodic table, coordination chemistry, structure of molecules, properties of compounds, theoretical understanding of various topics like Formation of Covalent bond, Hybridization, Organometallic, Bioinorganic Chemistry, Group Theory and Character tables to identify the all features of the particular compounds.

PSO4 Gather attention about the physical aspects of atomic structure, dual behavior; quantum Chemistry, Chemical Kinetics; reaction pathways with respect to time, various energy transformations; significance of electrochemistry & thermodynamics.

PSO5 Students from Biology background learn about vectors and Matrix Algebra, Coordinate Geometry, Trigonometry, Calculus, Elementary Differential Equations and Permutation and Probability.

PSO6 Students from Mathematics background get awareness for Bio molecules i.e Proteins, Carbohydrates, Amino acids and their Properties to familiarize with the both living and non-livingOrganisms.

PSO7 Knowledge of theoretical and experimental concepts of C language, Decision & Control Structure.

Course Outcomes:

Semester-I

Course: Physical Chemistry

CO1 Students will know the Basic concepts of Ist, IInd laws of thermodynamic and entropy

CO2 Students will develop understanding of activity and fugacity

CO3 Students will learn Concept of absolute entropy

CO4 Students will relate Thermodynamics with living system

CO5 Students will be provided with basic knowledge of statistical thermodynamics at microscopic level

CO6 Students will be cleared with basics of electrochemistry, ion -solvent interactions

CO7 Students will develop interest for fundamentals of electrochemistry, activity and activity coefficient,Debye Onsager theory

CO8 Students will take keen interest for basic concept of electrical

double layer

CO9 Students will understand various applications of electrochemistry

Course: Inorganic Chemistry

CO1 Students would know quantum mechanical approach to different types of molecule and ions and itsapplication to find the energy of the system

CO2 Students will gather information about various types of complexes containing different types of ligands having different nature through the theories of bonding in transition metal complexes

CO3: Students would learn magnetic behavior of various transition complexes with orbital

splitting

CO4: Students would collect detailed information of the spectral properties of the

complexes and application in determining the nature and shapes of metal complexes

CO5: Students will be able to get the information about the various types of biological enzymes and their chemistry with appropriate structures and Uses of various metals in body functioning

Course: Organic Chemistry

CO1: Students will be getting brief idea about various intermediates like carbocation, carbanion, carbene ,nitrene, benzyne and free radicals involve during chemical reaction

CO2: students able to explain various reactions like polymerisation, halogenation, addition reaction andautooxidation in which free radical involved as intermediate

CO3: students will be acquainted with nature of bonding in organic molecules and they will get familiarwith various techniques used for determination of reaction mechanism

CO4: Students will be able to explain various elimination reactions, their mechanism, stereochemistry andtheir orientation

CO5: Students will learn various types of pericyclic reactions like Cycloaddition, Electrocyclic reactionand Sigmatropic rearrangement with their mechanism and stereochemistry

Course: Mathematics for Chemists

CO1. Use the concepts of permutations, combinations and probability to understand the statistical nature of entropy

CO2. Use algebra and calculus to support the study of statistical thermodynamics

CO3. Use trigonometric functions to understand the concept of diffraction

CO4. Use matrix and vector methods, as well as complex numbers to help in understandingdiffraction patterns from crystal structures

Course: Biology for Chemists

CO1: Students would be provided with the structural and functional description of cells and its organellesalong with the concept of fertilization and metabolism.

CO2: Students would study the formation of biomolecules like carbohydrates and proteins and how theyplay major roles in the body.

CO3: Students would understand the formation, types and functioning of lipids in the body and would beable to describe how they are derived from their precursors.

CO4: Students would deal with various biocatalysts of body ie enzymes which enhance the biochemicalreactions.

CO5: Students would be able to draw & understand the structure of the nucleic acids like DNA and RNAie genetic material which help in the Inheritance

Semester-II

Course: Inorganic Chemistry

CO1: Students will be able to develop the understanding of various complexes containing different typesof metals and ligands with their properties and also will be able to find out nature of these types ofcompounds by spectroscopic study.

CO2: Students would be able to explain symmetry of a plane figure and some bounded three-dimensional figures and would also determine whether a given set and binary operation form a group by checking group axioms

CO3: Students will be able to understand the various concepts of group theory and will develop the imaginative power. Moreover, they will be able to apply this concept in field of spectroscopy.

Course: Physical Chemistry

CO1: Students would know basics of Quantum mechanics which is critically important for understandinghow individual atoms combine covalently to form molecules

CO2: Students would be able to correlate quantum numbers with Spherical Coordinates and further theywould understand concept of orbital and shapes of orbital

CO3: Students would get idea about both perturbation theory and variation method which provide good results in approximating the energy and wave functions of multi-electron atoms.

CO4: Students would know about eigen values and eigen functions

CO5: Students would predict the reactivity of aromatic systems with nucleophiles and electrophiles byapplying Hückel approach

CO6: Students would understand the reaction mechanisms and transition states by studying Chemicalkinetics

Course: Organic Chemistry

CO1: Students will be getting idea regarding Configurations, their representations & conversions

CO2: Students will be made familiar with Confirmations, Neighboring group participation, pyrolysis ofacetate, xanthates and amine oxide

CO3: Students will be able to explain geometrical isomerism (E&Z Nomenclature), Determination of curtin-Hammet principle, study of physical properties of isomers, addition to C-C multiple bonds

CO4: Students will get information regarding various types of reduction like wolf kishner reduction, clemmenson reduction, Meerwein Pondroff Varley reduction, Wittig's Reaction, Mechanism of condensation reaction involving enolates (Aldol, Knoevengel, Mannich, perkin and stobbe reactions

Program: M.Sc. Physical Chemistry

Program Specific Outcomes

The master's specialization, Physical Chemistry, will give student in-depth knowledge about macroscopic, atomic, subatomic and particulate phenomena in chemical systems in terms of the principles, practices and concepts of physics such as motion, energy, force, time, thermodynamics, quantum chemistry, statistical mechanics, analytical dynamics and chemical equilibrium.

PSO1: Explain statistical physics and thermodynamics as logical consequences of the postulates of statistical mechanics

PSO2: Gain knowledge of various spectroscopic techniques which are the key instruments of research lifeto find and study the structure of various molecules in all science streams

PSO3: Improve the Skill in physical research area

PSO4: Relate the concepts of how solar light act as incredible source for life survival and various conceptswhich build up future in research to save environment by using new techniques to utilize natural energy.

PSO5: Develop understanding of the range and theories of instrumental methods available in analytical chemistry, an understanding of the role of the chemist in measurement and problem solving in chemical analysis

PSO6: Identify the crucial building materials viz Polymers and catalysts which are very important in everyone’s daily life and industry life

PSO7: Familiarize the skill of identifying crystalline phases of various materials even at atomic level qualitatively and quantitatively

PSO8: Explain the concepts of physics and physical chemistry for various phenomena occurring in- biological systems and the supra-molecular structure of these systems

PSO9: Understand the professional and safety responsibilities residing in working on environmental problems

Program: M.Sc. Organic Chemistry

Program Specific Outcome

The master's specialization, Organic Chemistry, will give student in-depth knowledge about Organic reactions which are used in a vast way in nature and with a focus on principles for effective synthesis strategies, stereoselectivity, catalysis, as well as metal organic chemistry. This course gives the student thetheoretical basis of organic reaction and also helps them to find a way to carry out these types of reaction. It gives the quantitative ideas about the synthesis, properties and uses of organic compounds.

PSO1: Understand chemical and molecular processes that take place in organic reactions, Study of photochemistry & Learn Pericyclic reaction

PSO2: Improve the Skill in organic research area

PSO3: Use modern .methods when planning strategies for synthesis of new substances and characterizationof products.

PSO4: Master and use modern methods of synthesis and conduct sometimes extremely advanced experiments, the synthesis of complex molecular structures and handling sensitive chemicals.

PSO5: Modern theoretical and experimental methods used to study problems of molecular structure and bonding; emphasis on spectroscopic techniques.

PSO6: Synthesis of Natural products and drugs by using proper mechanisms.

PSO7: Develop understanding of the range and theories of instrumental methods available in analytical chemistry, an understanding of the role of the chemist in measurement and problem solving in chemical analysis

PSO8: Familiarize with heterocyclic chemistry and realizing the importance of heterocyclic compounds.

PSO9: Understanding of the professional and safety responsibilities residing in working on environmentalproblems.

M.Sc. Chemistry II Physical Specialization

Course Outcomes

Semester III

Course: Fundamentals of Spectroscopy

CO1: The main outcome of this course is to provide knowledge of interaction of radiation with matter, solution of schrodinger wave equation

CO2: Through this outcome, students are able to get knowledge of rigid rotator & non rigid rotator and application of this spectra to find moment of inertia of molecules

CO3: Students grab the knowledge of vibrational spectra which is used for thr detection of various functional groups

CO4: Students also learn the coupling of rotational vibrational spectra and intensities of spectral lines.

CO5: Students go through raman spectra which is used for structure elucidation of those compounds for which other spectroscopies don't work.

CO6: Students tend to know the various electronic transitions occurred in electronic spectra of molecules and application of this part for structure elucidation of molecules.

CO7: The outcome of this course is the study of NMR spectra which gives detailed information of electronsin particular atom in a molecule.

CO8: Students learn about ESR spectra which is also responsible for structure elucidation by showing linesthat occurs due to splitting by neighbouring electrons.

Course: Statistical Thermodynamics

CO1: The primary objective of this course is to develop familiarity with the physical concepts and facility with the mathematical methods of quantum mechanics. The aim of statistical mechanics is the evaluation of the laws of classical thermodynamics for macroscopic systems using the properties of its atomic particles. In addition to the classical thermodynamic the statistical approach provides information on the nature of statistical errors and variations of thermodynamic parameters.

CO2: In this students will compare Quantum mechanics and Classical Mechanics that quantum mechanics is about the physics of very small things, molecules and smaller. Classical mechanics is about macroscopic things. Also they go through the concept of Stability and Force of Interaction, Like the bonding potential energy, the stability of an arrangement of atoms is a function of the Lennard-Jonesseparation distance.

CO3: Debye postulated that there is a continuous range of frequencies that cuts off at a maximum frequency, which is characteristic of a particular solid. They will find out the relation of entropy with temperature and other parameters. Students will be able to discuss and explain evidence for the movement of molecules.

CO4: The objective of thermoelectric phenomenon is that it is used to create a heat flux between the junction of two different types of materials and by studying the relative current density and thermoelectric

potential, students will understand that minimum entropy production can be obtained when thethermoelectric potential is a specific, optimal value.

Course: Fundamental & Atmospheric Photochemistry

CO1: Students will learn about the different laws of photochemistry and there importance in calculation ofquantum yield

CO2: Students will learn the ways to find term symbols for gound and excited state, and various photophysical and photochemical processes

CO3: To understand photophysical processes of sulphur, oxygen and halogens

CO4: Students will learn various electronic transitions and the selection rules related to

them

CO5: Students will learn various photooxygenation reactions

CO6: Students will get knowledge about the application part of photochemistry

CO7: Students will understand the structure of atmosphere, various pollutants present in it and the variousways to control and monitor those pollutants

M. Sc. Chemistry II Organic Specialization

Course Outcomes

Semester III

Course: Analytical Chemistry

CO1: Students will learn different scale of operation of chemical analysis and various steps involved in quantitative analysis

CO2: Students will get to know what is the importance of selecting a representative sample and different criterion of a good sampling plan, Stratified sampling Vs. random sampling. How variance is minimized in stratified sampling, what are the sampling plan for solids, liquids and gases

CO3: Students will understand What are different Errors in chemical analysis, how Minimization of errorsoccur, Difference b/w accuracy and precision.

CO4: Students will be familiarized with Statistical terms viz Q test, t test, F test, mean, std deviation, variance correlation and Regression, linear regression. Analysis of variance

CO5: Students will know what is Polarography, Different types of currents residual, Migration, diffusion. polarographic maximum, Dropping Mercury Electrode, polar graphic wave and Ilkovic equation & deviations, Amperometric titrations & Biampometric titrations

CO6: Students will be able to explain Alternating current, Square Wave, pulse (normal and Differential), Tensometry, radio frequency and computer controlled polarograph.

CO7: Students will be familiarize with Chronoptentiometry

CO8: Students will acquire knowledge of Thermogravimetric analysis

CO9: Students will be able to differentiate b/w Differential Thermal analysis and differential scanning calorimetry on line analysis

CO10: Students will learn Thermometric titrations

CO11: Students will understand basics of Spectrophotometry and Colorimetry, Beer's law, Photometric accuracy.

CO12: Students will know basic principles of Solvent extraction, synergistic extraction, Ion pair formationMethods of extraction and their applications in analytical chemistry.

CO13: Students will learn to apply uses of Ion Exchange Resins and Ion exchange chromatography in analytical chemistry (a) Total cartion Conc in tap water (b) Cu (II)

from a brine solution U (VI) byliquid ion exchanger (d) use of mixed solvents.

Course: Photochemistry and Pericyclic Reactions

CO1: This course aims at providing acquire knowledge on Pericyclic reactions, organic photochemistry and their further applications in organic synthesis.

CO2: On the completion of the course students will have the understanding of basics of organic photochemistry and pericyclic reactions.

CO3: Various theories governing these pericyclic reactions will help them to predict the products with stereochemistry involved in these reactions.

Course: Chemistry of Natural Products

CO1: Students will learn about the use of dehydrogenation technique for structure determination of naturalproducts.

CO2: Students will acquire knowledge about the use of various degradation technique for structure determination of natural products.

CO3: Students will acquire knowledge about the use of oxidation technique for structure determination ofnatural products.

CO4: Students will learn about the chemical synthesis of natural products using various reagents.

CO5: They will learn how we synthesize natural products biosynthetically using acetate pathway and mevalonic acid path way.

CO6: Students will learn about the chemical synthesis of natural products using various reagents.

Course: Heterocyclic Chemistry

CO1: This course gives the quantitative ideas about the synthesis, properties and uses of such heterocycliccompounds like Oxirane, Aziridine and thirane

CO2: Students will be able to explain the Methods of formation, physical and chemical properties andapplications of four membered heterocyclics with one hetero atom

CO3: Students will be familiar with the Methods of formation, physical and chemical properties andapplications of five membered heterocyclics with two hetero atom

CO4: Students will be able to explain the Methods of formation, physical and chemical properties andapplications of six membered heterocyclics with two hetero atom

CO5: Students will be able to explain molecular rearrangement in some heterocyclic compounds like ringcontraction1, 2 rearrangements in heterocyclic system and aromatic rearrangements

Course Outcomes

Semester-IV

Course: Applications of Organic Molecular Spectroscopy

CO1: Provide the basic knowledge of orbitals & electronic transitions involved in UV spectra.

CO2: Students grab the knowledge of solvent effect & conjugation effect and structure elucidation oforganic compound through UV.

CO3: Students also get to know about modes of vibration & factors affecting vibrational frequency in IRspectra

CO4: Through IR spectroscopy, students learn to identify functional groups in organic compounds

CO5: Students are able to find molecular mass & molecular formula of organic compounds

CO6: Students learn various fragmentations associated with functional groups.

CO7: The study of NMR spectra which is used for structure elucidation of compounds.

CO8: Students learn 13C NMR spectra which deals with DEPT, proton decoupled resonance which are alsoused for structure elucidation of compounds.

CO9: Study of 2-D spectra which includes NOSY, COSY, HETCOR is also a part of course outcomes.

Course: Organic Synthesis

CO1: Students will learn about disconnection approach. How to proceed for disconnection of certain molecules involving carbon hetero atom bond. They will also learn about the terms like umpolung and protection of various functional groups.

CO2: Students will be able to understand the C-C disconection in alcohols ,1,3 -difunctional compounds , 1,5 -dicarbonyl compounds,natural products

CO3: Students will get knowledge about the types of pericycllic reactions specially diels- alder reaction

CO4: This topic will aware students about the formation of C-Cbond. They will learn about the alkylationof enmines

CO5: They will learn about the various methods of formation of alkenes.

CO6: They will learn about what type of reactions are shown by carbonyl compounds.

Course: Modern Synthetic Reactions and Rearrangements

CO1: Students will get brief idea regarding various reactions , mechanism and applications used for fictionalization of non activated carbon.

CO2: Students will be familiar with the new applications of organosilicon compounds in synthesis.

Course: X-Ray Diffraction and Other Techniques

CO1: students will know about the structural parameters like unit dimensions.

CO2: student will be able to know about the distance between the different compounds.

CO3: Students will be able to identify the structure of different compounds used in daily life.

CO4: Students will acquire the knowledge of charge on compounds when their ions move.

CO5: student will be able to know the colour of the compounds.

CO6: student will be able to explain the use of X-rays in daily life.

CO7: Students will learn different method used to identify the structure which is useful in research work.

CO8: Students will be able to determine the bulk composition.

CO9: students will be made able for accurate measurements .

CO10: Students will learn to use phase identification of a crystalline material.

CO11: Students will study the variation in optical rotation of a substance means with their rotation.

CO12: Students will be able to find the absolute configuration of metal complexes means like in proteinsstorage complexes.

CO13: Students will be able to explain use of X-Rays in solids for observing the signals.

CO14: Students will be able to use extraction process and check the water detergents ration in pump.

CO15: Students will apply the concepts in geology for identifying the composition of Fe containingspecimens.

CO16: Students will be able to use this concept for improving catalytic activity.

CO17: Students will be able to observe the Doppler Effect by using theory of relativity.

Course: Biophysical Chemistry and Advanced Spectroscopy

CO1: In this students will analyze about folding transition and the functional transitions between useful states are encoded in the linear sequence of amino acids, and a long- term goal of structural biology is to be able to predict both the structure and function of molecules from the information in the sequence.

CO2: Students will learn about the basic principle of laser operation that is to create conditions so that thepopulation at a higher level is more than that in the ground state, they will also learn about main difference between a maser and a laser.

CO3: Mass spectrometry is an analytical tool useful for measuring the mass-to-charge ratio (m/z)

of one or more molecules present in a sample. These measurements can often be used to calculate the exact molecular weight of the sample components as well. While studying Mass spectrometry students will learn about this powerful technique with a myriad of different applications in biology, chemistry, and physics, but also in clinical medicine and even space exploration.

CO4: Photoelectron spectroscopy is a useful analytical tool used by chemists to determine the electronic structure of atoms and molecules, student will also learn that it is used to measures the elemental composition at the parts per thousand range, chemical state and electronic state of the elements that exist within a material.

Course: Polymers and Surface Chemistry

CO1: Students will be able to explain classification, kinetic study and mechanism involved in step polymerisation

CO2: Students will be familiar with kinetics and mechanism of radical chain polymerisation , Copolymersation and theories of emulsion polymerisation

CO3: Students will be get idea how to calculate number average and weight average molecular weight andvarious methods used to calculate that

CO4: Students will be able to explain adsorption and various theories like Langmuir adsorption isotherm, BET adsorption isotherm for unimolecular and multimolecular layers

CO5: Students will be familiar with kinetics of heterogenous reaction at solid surface, catalyst, its types, salt effects and spectroscopic methods like PES, AES, LEED to determine surface structure