

Program: M. Sc Inorganic Chemistry

Program objectives:

Apply theoretical knowledge and experimental skills of chemistry program to address challenges faced in chemical Industries.

Assess societal needs and develop new materials to improve quality of life.

Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of Chemistry experiments.

To gain broad knowledge in descriptive Chemistry, laboratory skills in both synthesis and analytical skills to work effectively in the various fields of chemistry.

Program Outcomes:

After successful completion of M.Sc. Chemistry program with Inorganic Chemistry specialization a student should be able to

- Learn the Inorganic chemistry along with necessary concepts of organic and Physical chemistry.
- Learn the synthesis and properties of Inorganic compounds.
- Propose and design the new reagents/catalysts for synthesis of molecules.
- Learn the analytical skills useful for industry and also for society.
- Determine molecular structure by using Spectral studies.
- Improve the necessary skills to carry the research.
- Learn the role of elements in biological systems.

Program specific outcomes:

- Know the structure and bonding in molecules and complexes.
- Understand the various types of reactions of metal complexes and their mechanisms.
- Understand and apply principles of spectroscopy in structure analysis.
- Appreciate the biological importance of transition metal complexes and their interaction with DNA.
- Describe the structure, properties and applications of nanomaterials
- Describe the structure and role of Biologically important compounds.
- Understand good laboratory practices and safety.

Program: M. Sc Organic Chemistry

Program objectives:

To impart an advance level theoretical and practical knowledge in the organic chemistry along with some required concepts of inorganic and physical chemistry.

To gain broad knowledge in descriptive Chemistry, laboratory skills in both synthesis and analytical skills to work effectively in the various fields of chemistry.

To motivate critical thinking and analysis skills to solve the analysis of data, synthetic logic and spectroscopy.

Program Outcomes

After successful completion of M.Sc. Chemistry program with Organic Chemistry specialization a student should be able to

- Learn the organic chemistry along with necessary concepts of Inorganic and Physical chemistry.
- Learn the synthesis and properties of organic compounds.
- Propose the synthetic routes for organic molecules with appropriate reagents.
- Solve the reaction mechanisms and assign the final product.
- Determine molecular structure by using Spectral studies.
- Synthesis of Natural products and drugs by using proper reagents.
- Study of Asymmetric synthesis.
- Understand the concepts of Medicinal chemistry.

Program specific outcomes

- Know the structure and bonding in molecules and predict the Structure of molecule.
- Understand the various types of reactions and their mechanisms.
- Understand and apply principles of Organic Chemistry to understand the Reaction mechanisms.
- Learn the Familiar name reactions and their reaction mechanisms.
- Understand good laboratory practices and safety.
- Study of reagents and their applications.
- Design of reactions with regioselectivity and stereoselectivity
- Synthesis of Natural products and drugs by using proper reagents.
- Study of Asymmetric synthesis.

Program: M. Sc Physical Chemistry

Program objectives:

To Learn the Physical chemistry along with necessary concepts of Inorganic and organic chemistry.

To learn the theories, principles and concepts to understand the chemical and physical process.

To understand the macroscopic and microscopic phenomena in chemical systems.

To gain the broad knowledge in major areas such as thermodynamics, quantum chemistry, kinetics and electrochemistry.

To understand the physical characteristics of Materials and principles of Spectroscopy.

To motivate critical thinking and analysis skills to solve the analysis of data.

Program Outcomes

After successful completion of M.Sc. Chemistry program with Physical Chemistry specialization the learners should be able to

- Understand and acquire knowledge in principles and applications of Quantum mechanics and Thermodynamics.
- Learn the concepts of Chemical kinetics, Electrochemistry.
- Acquire the knowledge on surface analytical techniques to measure surface properties of materials and selection rules for adsorption Catalysis
- To evaluate the analytical data in terms of statistics and estimates kinds of errors in chemical analysis.
- Determine the symmetry operations of any small and medium-sized molecule and apply point group theory to the study of optical and spectral properties.

Program specific outcomes:

- Know the statistical thermodynamics and various partition functions.
- Study the steady state approximation Lindemann-Hinshelwood mechanism, Michaelis-Menten mechanism, chain reaction, Rate determining steps and consecutive elementary reactions.
- Learn the symmetry elements and to apply the great orthogonality theorem to derive simple point groups.
- Apply time independent perturbation theory to complex problems of molecular energy levels and to distinguish different types of hybridization based on geometries of the complex and to calculate for a one-electron and two electron system, all the necessary integrals due to coulombic forces.

- Understand the bonding in metals, diffraction studies, and to learn principles of spectroscopy.
- Learn the principles involved in catalysis, characteristic properties and applications of catalysts.
- Use and interpret experimental data from sophisticated equipment used in physical chemistry research.
- Study basic concept and applications of chemistry of nanomaterials.

Course Outcomes:

Course code	Course Title	Course Outcomes At the end of the course learners able to:
1CHT1	Inorganic Chemistry	<ul style="list-style-type: none"> • Understand the theories of bonding in coordination complexes. • Learn the structure and reactivity of coordination complexes and their magnetic properties. • Predict the stability and the magnetic character of complexes.
1CHT2	Organic Chemistry	<ul style="list-style-type: none"> • Identify chirality and determine the absolute configuration. • Write mechanism of organic reactions involving reactive intermediates and concerted processes • Apply these reactions in organic synthesis • Understand the structure elucidation and synthesis of Natural products.
1CHT3	Physical Chemistry	<ul style="list-style-type: none"> • Calculate the change in thermodynamic properties for chemical reactions • Represent the electrochemical cells and calculate the EMF of cells • Calculate the rate constants for different types of reactions • Acquire the basic knowledge in quantum concepts.
1CHT4	Applied chemistry	<ul style="list-style-type: none"> • Use various reagents and organic reactions in a logical manner in organic synthesis. • Understand structure and functions of carbohydrates, polypeptides and proteins • Solve problems based on various analytical concepts. • Learn the applications of various methods to detect and purify the samples.
1CHP1	Inorganic Chemistry Practicals	<ul style="list-style-type: none"> • Analyze hardness of water • Estimation of metal ions • Preparation of the complexes and estimation of metal using conductance measurement. • Have hands-on experience/practical knowledge in performing experiments.
1CHP2	Organic Chemistry Practicals	<ul style="list-style-type: none"> • Learn the basic techniques and safety measures required to perform the experiments in laboratory. • Prepare some important organic molecules by applying methodologies of some well-known name reactions.

		<ul style="list-style-type: none"> • Determine the physical constants.
1CHP3	Physical Chemistry Practicals	<ul style="list-style-type: none"> • Study the theories of common physical chemistry experiments. • Prepare the solutions for the experiment. • Perform the experiments using the Instruments and record and analyse the data in a scientific manner.
2CHT5	Inorganic Chemistry	<ul style="list-style-type: none"> • Analyse the electronic spectra and magnetic properties of coordination compounds. • Predict the chemical behaviour and reactivity of main group and transition metal organometallic compounds. • To utilize the principles of transition metal complexes in understanding functions of biological systems.
2CHT6	Organic Chemistry	<ul style="list-style-type: none"> • Study the various reactions and reagents to design and apply in organic synthesis in a logical manner. • Evaluate the stability of various conformers of acyclic and cyclic systems using various effects. • Understand the concepts of aromaticity and properties of aromatic compounds.
2CHT7	Physical Chemistry	<ul style="list-style-type: none"> • Calculate change in thermodynamic properties, equilibrium constants, partial molar quantities, chemical potential. • Learn the various types of catalytical reactions and chain reactions. • Use Schrodinger equation to apply on rigid rotator • Applications of Variation method to hydrogen atom– perturbation method to particle in a one-dimensional box and Born-Oppenheimer approximation to construction of molecular orbitals. • Understand the bonding in metals, structure of solids and superconductors.
2CHT8	Spectroscopy	<ul style="list-style-type: none"> • Perform the symmetry operations, determine the symmetry elements and point groups of molecules • Understand the concepts of molecular spectroscopy. • Apply principles of microwave, infrared, electronic, NMR and ESR spectroscopy to identify the molecules. • Apply the spectroscopic methods for structure elucidation of molecules.
2CHP4	Inorganic Chemistry Practicals	<ul style="list-style-type: none"> • Estimate the ions/compounds • Plan and Conduct experiments for analysis of metal ions present in mixture.
2CHP5	Organic Chemistry Practicals	<ul style="list-style-type: none"> • Identify extra elements present in organic compounds. • Identify the functional groups present in organic compounds. • Determine the physical constants.
2CHP6	Physical Chemistry Practicals	<ul style="list-style-type: none"> • Show hands on experience to utilize instruments for quantitative analysis. • Outline in detail the importance and accuracy of the instruments.

		<ul style="list-style-type: none"> • Apply the knowledge of photochemical laws in estimation of chromophores using Colorimetry. • Verify Freundlich adsorption isotherms experimentally.
3CHT9	Spectroscopy	<ul style="list-style-type: none"> • Understand the principles and applications of ^{13}C-NMR, 2D-NMR spectroscopy in structure elucidation of organic molecules. • Learn the principles of Mass spectrometry methods and fragmentation pattern of organic molecules. • Understand the principles and applications of photoelectron and Mössbauer spectroscopy. • Use of the spectroscopic techniques in structure elucidation of molecules.
3CHT10	Synthetic Organic Chemistry-I	<ul style="list-style-type: none"> • Appreciate the photochemical phenomena by light and apply photochemistry concepts in organic synthesis. • Comprehend the orbital interactions and orbital symmetry correlations of various pericyclic reactions. • Use various reagents in formation of C-C bond formation in organic synthesis. • Use of important oxidants and reductants in organic reactions in a logical manner.
3CHT11	Bioinorganic and Supramolecular Chemistry	<ul style="list-style-type: none"> • Utilize the principles of transition metal coordination complexes in understanding functions of biological systems. • Know the functions of Metalloproteins and Metalloenzymes. • Understand the Metal complexes and their interaction with nucleic acids. • Learn the concepts and applications of supramolecular chemistry.
3CHT12	Inorganic Photochemistry and Chemistry of Materials	<ul style="list-style-type: none"> • Understand the Photochemistry of metal complexes. • Study the structures, classification and applications of ceramics. • Learn the methods of preparation of nanoparticles. • Characterization of nanomaterials using various spectral techniques.
3CHT13	General Organic Chemistry-I	<ul style="list-style-type: none"> • Learn the synthesis and properties of Heterocyclic compounds. • Study of special mechanistic aspects in organic chemistry. • Apply the advanced methods and green approach in organic synthesis.
3CHT14	Natural Products	<ul style="list-style-type: none"> • Learn the Classification, Isolation, Separation and Identification of Natural products. • Structure elucidation, stereochemistry and synthesis of Natural Products.
3CHT15	Quantum Chemistry, Kinetics and Electrochemistry	<ul style="list-style-type: none"> • Realize theories of chemical bonding and their applications. • Know the concept of hybridization and quantum mechanical treatment of hybrid orbitals. • Understand the mechanism of Electron transfer, oscillatory,

		<p>Branched Chain, Unimolecular reactions.</p> <ul style="list-style-type: none"> Express the mechanism of Battery devices and plan and design new devices based on the acquired knowledge.
3CHT16	Group Theory & Spectroscopy	<ul style="list-style-type: none"> Present Matrix representation of symmetry operations and point groups. Understand Group theoretical approach for UV transissions IR and Raman active modes of water molecule. Learn Structure analysis using X-Ray, Electron and Neutron diffraction. Understand Basic and principles applications of Photoelectron, Electron-Spin resonance, ¹³C-NMR, ATR ORD and CD Spectroscopy.
(3CHO1)	Environmental Chemistry	<ul style="list-style-type: none"> Understand the Enviroment and Natural cycles. Learn adverse effects of Air pollution, Radioactive pollution and its control measures. Aware about the water pollution, water quality parameters and Sewage treatment. Study the Soil pollution and Solid waste disposal methods Learnt Disposal methods of radioactive wastes.
3CHP7	Preparation of Complexes and their characterization by Physiochemical techniques	<ul style="list-style-type: none"> Experience in preparation of Complexes. Characterize the complexes by Physiochemical techniques.
3CHP8	Analysis of Ternary mixtures and Complex materials	<ul style="list-style-type: none"> Conduct experiments for identify inorganic compounds. Characterize inorganic compounds
3CHP9	Preparation of organic compounds and Spectral analysis.	<ul style="list-style-type: none"> Get Hands on experience in organic synthesis. Determine the structure of organic compounds using Spectral analysis.
3CHP10	Organic mixture analysis (with two component mixture)	<ul style="list-style-type: none"> Separate the organic components present in mixture. Identify the functional groups present in organic compound.
3CHP11	Kinetics	<ul style="list-style-type: none"> Explain the principle behind the experiments performed in the laboratory. Plan and Perform experiments and interpret experimental results.
3CHP12	Instrumentation	<ul style="list-style-type: none"> Handle Potentiometers to carry out quantitative estimations and P^H meters for qualitative analysis.
4CHT17	Analytical and Physical Chemistry	<ul style="list-style-type: none"> Learn the principles and applications of chromatography Learn the principles and applications of TGA, DTG, DTA, and DSC. Understand the Photo physical and chemical processes, and to calculate the Quantum yield. Understand the Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow
4CHT18	Synthetic Organic Chemistry-II	<ul style="list-style-type: none"> Get an idea about the disconnection approach of organic molecules to frame a chemical synthesis.

		<ul style="list-style-type: none"> • Use retrosynthetic method for the logical dissection of complex organic molecules and devise synthetic methods. • Learn different techniques of asymmetric synthesis. • Apply asymmetric transformations in a logical manner for the synthesis of chiral molecule.
4CHT19	Instrumental methods of analysis	<ul style="list-style-type: none"> • Learn principles and Applications of Electroanalytical methods, Spectrophotometry and Atomic absorption spectroscopy. • Learn principles, applications of Inductively coupled plasma-atomic emission spectroscopy (ICP-AES) and ICP-Mass spectrometry (ICP-MS) in analysis of trace and toxic metals in water. • Learn principles and Applications of Molecular fluorescence spectroscopy • Understand the structural characterization of Inorganic compounds.
4CHT20	Organometallic Chemistry	<ul style="list-style-type: none"> • Study the preparation, structures and properties of Organometallic compounds of transition metals and lanthanides. • Know the role of Organometallic compounds in organic synthesis. • Understand the principles and applications of Homogenous Catalysis.
4CHT21	General Organic Chemistry	<ul style="list-style-type: none"> • Learn the methods of synthesis and reactivity Heterocyclics • Describe the mechanisms and synthetic applications of rearrangement reactions. • Demonstrate the Chemistry and synthesis of vitamins and hormones. • Learn the synthesis and pharmacological applications and adverse effects of some important drugs.
4CHT22B	Medicinal chemistry	<ul style="list-style-type: none"> • Understand the basic concepts in Medicinal Chemistry, and Drug Discovery. • Gain the knowledge of the connection between the structural features of the drugs and their physico-chemical characteristics, mechanism of action and use. • Acquired the knowledge about the therapeutic classes of drugs.
4CHT23	Catalysis	<ul style="list-style-type: none"> • Learn the principles and applications of Heterogeneous Catalysis. • Understand mechanism of heterogeneous catalysis. • Understand Kinetics and mechanism of Enzyme Catalysis.
4CHT24A	Nanomaterials, Macromolecules and Data analysis	<ul style="list-style-type: none"> • Understand the synthesis of nanomaterials and their application. • Apply their learned knowledge to develop Nanomaterial's. • To evaluate the analytical data in terms of statistics and estimates kinds of errors in chemical analysis.

4CHT24B	Supramolecular, Material Sciences, Lasers and Computational Chemistry	<ul style="list-style-type: none"> • Learn the principles, types of interactions between host and guest molecules. • Study the structures, mechanical properties of ceramics and characterization of nanomaterials using various spectral techniques. • Learn the techniques of single crystal growths • Study characteristics of laser light and application of lasers in chemistry. • Acquire the knowledge in Molecular Modelling.
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