**Programme- M.Sc.**

**Course- M.Sc I$^{st}$ Semester I/ Paper I (Transition Metal Chemistry)**

**Objectives-**

To equip students with mechanism of reactions, anyl and alkyl derivatives; clusters formed by transition metals.Basic Information regarding different types of Boron hydrides isopoly & hetropoly acids.

**Course outcome:**

At the end of the course students must be well acquainted with-

i. Various aspects of mechanism of substitution reaction among octahedral and square planer complexes along with basic kinetics of substitution reactions.
ii. Introductory remarks about carbonyl clusters, their rules & their derivatives.
iii. Preparation, properties and structures of various Boron hydrides & their derivatives.
iv. Basic information's regarding iso & hetero polyacids & their salts.
v. Synthetic routes, decomposition pathways and stability among alkyls & aryls of transition metals.

**Assessment-** Students are assessed for their theoretical, analytical and numerical abilities at the completion of the course.

**Programme- M.Sc.**

**Course- M.Sc I$^{st}$ Semester I/ Paper II (Reaction mechanism)**

**Objectives-**

To discuss benzenoid and non-benzenoid compound and anesium ion mechanism. To discuss about the neighbouring group mech.

**Course outcome:**

Students come to know following

1) Benzenoid and non-benzenoid compound.
2) Optical activity of biphenyls, Allenes and spiranes.
3) Neighbouring group participation by $\pi$ and $\sigma$ bonds.
4) Orientation and reactivity.
5) Vilsmeier and Gattermann Koch reaction.
6) Aromatic nucleophilic substitution.

**Assessment-**

1) By the external examination at the end of semester.
2) Internal assessment by student seminar.

**Programme- M.Sc.**

**Course- M.Sc I$^{st}$ Semester I/ Paper III**

**(Physical Chemistry)**

**Objectives-**

To make the students conversant with-

- Solution of Schrodinger wave eqn for simple systems like particle in 3-D box, harmonic Oscillator, rigit rotor, H-atom etc.
- Application of variation and perturbation method to He-atom.
- Concept of partial molar properties of solution, chemical potential and significance of Gibbs' Duhem-Margules equation.
- Concept of irreversible thermodynamics, Huxes, forces and related pharmacological equations.

**Course outcome:**

The students will knowledge with-

- Understanding the energy calculations of real microscopic particles viz. $e^-$s, harmonic oscillator, rigid rotor etc.
- Calculations and applications of approximate methods in quantum mechanics.
- Partial molar properties like chemical potentials and their significance in thermodynamics of solutions.
- Concept of thermodynamically calculations in irreversible process.

**Programme- M.Sc.**

**Course- M.Sc I$^{st}$ Semester I/ Paper III**

**Physical Chemistry- (Quantum, Thermodynamics)**

## Objectives-

1. Understand and explain the differences between classical and quantum mechanics and understanding and relating the events which led towards the development of quantum mechanics.
2. Be able to apply the thermodynamics

## Course outcome:

- An ability to evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
- An understanding of the use of the Gibbs and Helmholtz free energies as equilibrium criteria, and the statement of the equilibrium condition for closed and open systems.
- Solve Schrodinger equation for one electron systems and identify and relate the Eigen value problems for energy, momentum, angular momentum and central potentials explain the idea of spin.
- Understand about exact and inexact differentials
- An understanding of approximate methods (variation and perturbation) and its applications in many electron system,

**Assessment**

External assessment is done after the completion of the semester

**Programme- M.Sc.**

**Course- M.Sc I$^{st}$ Semester / Paper IV (Analytical Chemistry)**

## Objectives-

To provide the definition of terms in mean, median, types of errors, source of errors and the uses of statistics, different types of thermal analysis, such as thermo gravimetry, differential thermal analysis, differential scanning calorimetry and thermo metric titrations.To discuss modern voltammetric methods sampled polarography, pulse polarography, cyclic valtammetry, AC polarography and different types of chromatography and acid base equilibria and buffer solution.

## Course outcome:

The students are able to explain about-

1) Definition and terms in mean, median, types of error and source of errors.
2) The different types of thermal analysis such as TGA, DTA, DSC and thermometric titrations.
3) Modern voltammetric methods.
4) Different types of chromatography and acid base equilibria and buffer solution.

## Assessment-

1) By the external examination at the end of the semester.
2) Internal assessment by student seminar.

**Programme- M.Sc.**

**Course- M.Sc II$^{nd}$ Semester / Paper I (Molecular symmetry and group Theory)**

**Objectives-**

To provide the knowledge about DNA polymerization glucose storage etc., structure and function of haemoglobin, myoglobin, hemocyanin, hemerythrin.To explain about Nitrogenase, several zinc, copper, molybdenum and cobalt containing metaloenzymes, electron transfer in biology and role of metals in medicive.

**Course outcome:**

The students are able to explain about-

1) DNA polymerization and glucose storage.
2) Structure and function of haemoglobin, myoglobin, haemocyanin and haemerythnin.
3) Nitrogenase, several metalloenzymes.
4) Electron transfer in biology and role of metals in medicine.

**Assessment-**

1) By the external examination at the end of semester.

**Programme- M.Sc.**

**Course- M.Sc Semester- II$^{nd}$ / Paper II**

**(Reaction mechanism-II and Organometallics)**

## Objectives-

To describe the mechanism and stereochemical aspects of the elimination reaction and to discuss the influence of the alkyl group, the nature of the leaving group, the reagent and solvent on elimination reaction.To discuss the mechanism of some pericyclic reaction embracing a variety of processes including cycloaddition, chelotropic reaction, electro cyclic reaction and sigmatropic rearrangement.

## Course outcome:

Students must be able:

1) To explain concerted reaction involving a cyclic flow of electron through a single transition state.
2) To explain the mechanism of the organic reaction explained during the course.

## Assessment-

1) By the external examination at the end of the semester.
2) Internal assessment by student seminar.

**Programme- M.Sc. I Semester- II$^{nd}$**

**Paper III: Physical Chemistry**

**(Dynamics, Surface and Electro)**

## Objectives-

To describe the general form of a (differential) rate law and describe how the rate of a chemical reaction depends on the concentrations of aspects that appear in the rate law and further describe the relationship between the order of a reactant and the stoichiometric coefficient for the reactant in the overall balanced chemical equation. Understanding of Debye Huckel Onsager Theory for strong electrolytes.

## Course outcome:

- An ability to evaluate reaction rates by using steady stake kinetics
- An understanding of the use of the Gibbs and Helmholtz fre energies in transition state theory
- Solve problems related to surface area by BET equation
- Understand about Ilkovic equation and half wave potential in polarography.
- An understanding of primary and secondary salt effect in study the rate of simple and complex reactions.

## Assessment-

External examination at the end of the semester.

# M.Sc. I$^{st}$ (Sem-II)

## Spectroscopy-(P-IV)

**Course Objectives:**

The students are well understanding the Interaction of tradition with matter and the consequence provide basic principles of spectroscopy,Microwave spectra,Demonstration of IR and Raman spectra for diatomic and polyatomic molecules,Analysing IR and Raman frequencies,Various types of electronics transition in uv-spectra and characteristics of absorption maxima,X-ray-spectroscopic techniques for studying the internal structure of crystals.

**Outcomes-**

The student's will-

- Knowledged with theoretical basis of molecular spectroscopy and spectral line parameters.
- Be able to understand & practice the spectroscopic methods for determination of structure of both organic and inorganic molecules.

# M.Sc. (Sem-III)

## Spectroscopy-(II)

## Paper-I

**Course Objectives:**

To make students To know how the nuclear management moment constitutes the basic of NMR and ESR spectroscopic methods,Analysis of complicated NMR-spectrum by the use of magnetic double resonance, contact-shift reagents etc,Understanding NOE, FTIR, Karpus-dihedral equation,Learning $C^{13}$-NMR spectral data,To study the structure of free radicals, & paramagnetic and several odd e-species using ESR spectra,Knowledged with photo electron spectroscopy & its application.

**Outcomes-**

Students will be able to learn and skilled with-

- NMR-methods & analysis the spectrum; obtained.
- Advance spectroscopic techniques for determining the structure & properties of compounds.

# M.Sc. (Sem-III)

## Organic synthesis –I and Photochemistry

## Paper-II

**Course Objectives:**

To identify organic reactions as being oxidation/ reduction and to discuss different oxidative and reductive process and the mechanism and stereochemistry of some organic reactions. The discuss the chemical reaction, isomerization that occur under the influence of uv/ visible light.

**Outcomes-**

Students must be able

1. To understand fundamental principles that are foundational to understand photochemical transformations.
2. To apply the organic reaction covered in the synthesis of complex organic molecules.
3. To define reaction condition for different types of organic transformations.

# M.Sc. (Sem-III)

## Coordination Chemistry

## Paper-III-A

**Course Objectives:**

To acquaint students with various aspects of bonding in coordination compounds. Spectral & magnetic nature of complexes of different geometrics.

**Outcomes-**

Students must be able to understand the problems regarding concepts and applications regarding.

i) Electronic configuration is multi-electron system.
ii) MOT of different complexes of various geometries.
iii) Spectral properties of geometries and their distortions.
iv) Calculation of terms & their uses in different ligand fields.
v) Magnetic nature of some specific complexes of oh, Td and $D_4h$ complexes.

**Assessment-**

Students are assessed for their conceptual, theoretical as well as analytical at the end of the course.

# M.Sc. (Sem-III)

## Medicinal Chemistry

## Paper-III-B

**Course Objectives:**

To discuss the overall process of drug discovery and the role played by medicinal chemistry and also the structure and physical properties of drugs to their pharmacological. To give brief knowledge of cancer chemotherapy and role of hormone and natural products in cancer chemotherapy.

**Outcomes-**

Students must be able

i) To understand the basic concept of drug design.
ii) To understand the structure and mode of action of antifungal, ant malarial and antiviral drugs.

**Assessment-**

By the external examination at the end of semester.

# M.Sc. (Sem-III)

## (Solid State) (Elective)

## Paper-III-C

**Course Objectives:**

Students will be familiar to Imperfections in crystals,Bond theory for the crystalline structures of metals,Types of semi-conductor and junctions,Solid state reactions,Magnetic, dielectrically and optical properties of solid.

**Outcomes-**

Students will be familiar to-

i) Solid-State chemistry concerned to structures & properties.
ii) Fantastic superconductivity behaviour of solids.

# M.Sc. (Sem-III)

## Structural Inorganic Chemistry

## Paper-IV-A

**Course Objectives:**

The students are to be provided details of various spectroscopic techniques used in illustration of structure of Inorganic Compounds.

**Outcomes-**

Students must be equipped with-

i) NMR spectroscopy for inorganic compound.
ii) ESR spectroscopy techniques for inorganic compounds & ious.
iii) Basic of Moss bauer pectroscopy & its application in inorganic chemistry.
iv) Vibrational spectroscopy to illucidate symmetry & shape of inorganic molecules.
v) Basic of Molecular spectroscopy & its use in transaction metal Complex.

**Assessment:**

The external assessment of students at the end of the course.

# M.Sc. (Sem-III)

## Chemistry of natural product

## Paper-IV-B

**Course Objectives:**

To discuss basic concept of Terpenoids, Carotenoids, Alkaloids and Steroids and plant Pigments.

**Outcomes-**

Students comment to know following

i) About citral, Menthol and Carotene.
ii) Complete synthesis of cholesterol.
iii) Role of Mg in chlorophyll and Fe in Haemoglobin.
iv) Classification and physiological effects of prostaglandins.
v) Synthesis of $PGE_2$ and $PGF_2O$.
vi) Uses of natural products.

**Assessment:**

The external assessment of students at the end of the course.

# M.Sc. (Sem-III)

## Chemical kinetics

## Paper-IV-C

**Course Objectives:**

To make the students learning of Statistical approach to TST and various modified form of theories of reaction rates viz. Lindeman, Hinshelwood, RRK etc,Chemical kinetics and factors affecting reaction rates in fast reactions,Kinetics in polymerisation reactions.

**Outcomes-**

After completion of courses student came to know-

- Absolute reaction rate theories for reactions.
- How the rates of reactions determined in reactions occurring in solutions.
- Hammett equation and Linear free energy relationship in few organic reactions.
- Fast reaction kinetics and kinetics in polymerisation.

# M.Sc. (Sem-III)

## ELECTRO CHEMISTRY

## Paper-IV-D

**Course Objectives:**

To make the students conversant with Basics of ionic-interactions in solutions,Concerned theories with ionic behaviour in solutions viz DHLL, DHO, Bjerrum equation etc,Electro Kinetics in electrochemistry,Concept of electro catalysis.

**Outcomes-**

The students will become to

- Understand the ions behaviour in solutions.
- Advanced theories concerned to electrochemistry.
- Electro kinetics & electrolysis of cells.

# M.Sc. (Sem-IV)

## Environmental Chemistry

## Paper-I

**Course Objectives:**

To analyse the water for measuring their BOD, COD, DO, F, oils and metals analytical methods for measuring air pollutants. To discuss the Bhopal gas tragedy, Chernobyl Three mile island and Minamata disasters.

**Outcomes-**

1. They are able to help social groups and individuals to aware the sensitivity to the total environment and several problems.
2. The students are able to analyse the water for their DO, BOD, COD, F oils and metals.
3. They know several types of industrial pollution, Bhopal gas tragedy Minamata disasters, three mile islands etc.

**Assessment-**

1. By external examination at the end of semester.
2. Internal assessment by student project.

# M.Sc. (Sem-IV)

## Organotransition Metal Chemistry

## Paper-II

**Course Objectives:**

The students must be acquainted with the various aspects of Organometallic compounds of d-block.

**Outcomes-**

At the end of the course, students must acqura detailed knowledge about-

i) Fluxionality of Organomettalic Compounds.
ii) Metal Carbonyl and nitrosyl compounds.
iii) Different catalytic process using organometallic compounds as catalyst.
iv) Complex cartaining different π-bonding ligands.

**Assessment-**

The students are judged for their knowledge by external assessment at the end of the semester.

# M.Sc. (Sem-IV)

## Photoinorganic Chemistry

## Paper-III-A

**Course Objectives:**

To finish knowledge regarding photo chemistry for their basics, advances and applications in metal complex.

**Outcomes-**

Students are equipped with information regarding

i) Basic of Photochemistry
ii) Properties of excited states and deactivation
iii) Exeited states of Metal Complex and change transfer spectra.
iv) Photochemistry of ligand fields.
v) Redox reactions in some exeited metal complexes.
vi) Metal Complex sensitizers in different chemical system.

**Assessment-**

Students are assessed for their theoretical and analytical abilities at the end of the semester.

# M.Sc. (Sem-IV)

## (Organic Synthesis –II)

## Paper-III-B

**Course Objectives:**

To explain the retro synthetic analysis technique of simple and complex organic molecule synthesis such as camphor, reserpine. To discuss importance of protecting group in organic synthesis.

**Outcomes-**

1. Students must be aware of the idea of the retro synthetic analysis and be able to propose synthetic routes.
2. Students are able to identify the type of transformation required to obtain a Target Molecule.

**Assessment-**

1. By the external examination at the end of semester.
2. By the internal assessment by student project.

# M.Sc. (Sem-IV)

## (Advance quantum mechanics)

## Paper-III-C

**Course Objectives:**

To make the students Learn the inadequacy of classical mechanics and the origin of quantum mechanics,Apply the principles of quantum mechanics to simple atoms & molecules,Ab-initio calculation for closed shell systems,Huckel theory of conjugated system,Perturbation theory to He-atom.

**Outcomes-**

1. Basic ideal of quantum theory.
2. Ab-initio calculations.
3. Evaluating energies of various MOs in conjugated systems.

**Assessment-**

3. By the external examination at the end of semester.
4. By the internal assessment by student project.

# M.Sc. (Sem-IV)

## (Analytical Chemistry)

## Paper-IV-A

**Course Objectives:**

To analyse the moisture ash, different adulterants, pesticides in food products by HPLC, gas chromatography and their layer chromatography. To analyse the water pollutants such as chloride, sulphate, fluoride Silica, phosphate and different forms of Nitrogen.To analyse the soil, fuel, body fluids and drugs by different analytical methods.

**Outcomes-**

The students must able to explain-

1. About the analysis of food.
2. Analysis of the water pollutants such as chloride, sulphate, Fluoride, silica and phosphate.
3. Analysis of the soil, fuel, body fluids and drugs by different-analytical methods.

**Assessment-**

1. Internal assessment by student project.
2. By external examination at the end of semester.

# M.Sc. (Sem-IV)

## (Heterocyclic Chemistry)

## Paper-IV-B

**Course Objectives:**

To discuss nomenclature synthesis and chemical reaction of Heterocyclic compounds.

**Outcomes-**

Students come to know following-

1. Nomenclature of heterocyclic compound.
2. Cyclization and cycloaddition reaction.
3. Basicity of Pyrrole and Pyridine.
4. Meso ionic compound Type A and Type B.
5. Synthesis and reaction of coumarins and chromones.
6. Medicinal application of heterocyclic compounds.

**Assessment-**

1. By the external examination at the end of semester.
2. Internal assessment by student project.

# M.Sc. (Sem-IV)

## (Enzyme Chemistry)

## Paper-IV-C

**Course Objectives:**

To discuss mechanism of enzyme action. To discuss structure and biological functions of coenzymes A. $NDA^{+}$, $NADP^{+}$, FAD.

**Outcomes-**

Students come to know following-

1. Mechanism of enzyme action.
2. About enolic intermediates in isomerization reaction.
3. Enzyme catalyzed carboxylation and decarboxylation.
4. Structure and biological function of Coenzyme.
5. About crown ethers, cryptates.
6. Transition state theory.

**Assessment-**

1. By the external examination at the end of semester.
2. Internal assessment by student project.

# M.Sc. (Sem-IV) (Elective)

## (Statistical thermodynamics)

## Paper-IV-D

**Course Objectives:**

To make the students conversant with Statistical mechanics and terminologies.Various types of distribution law viz. Maxwell-Boltzmann, Fermi Dirac, Base-Einstein. Partition function and its significance.Heat capacity of solids & concerned theories.

**Outcomes-**

Students are familiar with-

1. Basic concept of statistical thermodynamics.
2. Various types of statistical distribution laws.
3. Estimation of heat capacity of solids.

# M.Sc. (Sem-IV)

## (Chemistry of Materials)

## Paper-IV-E

**Course Objectives:**

To offer concepts, properties, types of industrially important materials.

**Outcomes-**

Students must be competent about Study of different type of alloys,Study of Ceramics, Composites and nano materials,Study of Thin & Langmuir-Blodgett films,Study of polymeric materials,Study of Ionic conductors,Study of high Te Materials.

**Assessment-**

External assessment at the end of the semester.