

M.Sc. Chemistry

Program Outcomes (PO):

PO1: Creative Thinking: Students will be able to think creatively (divergently and convergent) to propose novel ideas in explaining facts and figures or providing new solution to the problems in chemistry. The skills of observations and drawing logical inferences from the scientific experiments will also be developed.

PO2: Interdisciplinary Approach: Students will realize how developments in any science subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments. Also the knowledge of subjects in other faculties such as humanities, performing arts, social sciences etc. can have greatly and effectively influence which inspires in evolving new scientific theories and inventions.

PO3: Personality Development: Students will imbibe ethical, moral and social values in personal and social life leading to highly cultured and civilized personality. They will also realize that pursuit of knowledge is a lifelong activity and in combination with untiring efforts and positive attitude and other necessary qualities leads towards a successful life.

PO4 Skills in research and industrial field: Students will build a scientific temper and will be able to learn the necessary skills to succeed in research or industrial field. In addition they will acquire the skills in handling scientific instruments, planning and performing in laboratory experiments.

PO5 Communication Skills: Students will develop various communication skills such as reading, listening, speaking, etc., which we will help in expressing ideas and views clearly and effectively.

PO6 Environmental monitoring: Students will be able to understand the environmental issues Global warming, Climate change, Acid rain, Ozone depletion and will create awareness in society .

Program Specific Outcomes (PSO):

PSO-1 Students will understand the basic concepts, fundamental principles, and the scientific theories related to various scientific phenomena and their relevancies in the day-to-day life. They will also be able to acquire knowledge about the fundamentals and applications of chemical and scientific theories.

PSO-2 Students will find that every branch of science and technology is related to Chemistry. They will develop scientific outlook not only with respect to science subjects but also in all aspects related to life.

PSO-3 Students will become familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer and biochemistry. They will also learn to apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PSO-4 The student will acquire knowledge of Chemical Thermodynamics, Kinetics, Electrochemistry, Atomic Structure, Organic Chemistry, Spectroscopy and Skill in Industrial Chemistry.

PSO-5 Viewing chemistry as a tool the developing mind and critical attitude and the faculty of logical reasoning that is prepared to serve in diverse fields.

PSO-6 Students will gain a thorough Knowledge in the subject to be able to work in projects at different research as well as academic institutions.

COURSE OUTCOMES

COURSE NAME: LIGAND FIELD THEORY

CLASS - M.Sc. Chemistry

SEMESTER – I

Objectives: This course aims at acquainting students to concept of Crystal field and Ligand field theory. The symmetry, magnetic properties and spatial arrangements of molecules are studied in good detail.

Programme Learning Outcomes:

A. Knowledge and Understanding:

Students will be able to analyse the point group of chemical molecules. They will learn the relation of structure to magnetic properties.

B. Intellectual (Cognitive and Analytical) Skills:

Students will be able to understand the structure and arrangement of ligands around different oxidation state of metals.

C. Practical Skills

Students will learn the theoretical basis of stability of different electronic states.

D. Transferable Skills

Students will be able to make a correlation between structure and stability of different metal compounds.

COURSE NAME: ORGANIC REACTION MECHANISM-I

CLASS - M.Sc CHEMISTRY

SEMESTER – I

Objectives of the Course :

This course aims at acquainting students with the knowledge of organic reaction mechanisms of aromatic electrophilic substitution and aromatic nucleophilic substitution reactions. It provides an introduction to the synthesis of complex organic molecules. Transformations for C-X and C-C bond-formation, functional group reactivity, chemoselectivity, regioselectivity, and the strategy of multistep synthesis will be the core topics that are covered.

Program Learning Outcomes:

The aim is to help the students to study in detail the basics of very important substitution reactions in organic chemistry. Along with the revision of basic concepts of electrophilic and nucleophilic reactions, further applications in advanced fields of organic chemistry are aimed to be discussed.

Concepts include strategy/retrosynthesis, advanced aromatic chemistry, protecting groups, stereochemistry, enolates and other carbonyl chemistry, alkene synthesis, reduction/oxidation (introductory), heterocycles, cross-coupling reactions and other modern methods of synthesis.

COURSE NAME: PHYSICAL CHEMISTRY – THERMODYNAMICS

CLASS - M.Sc CHEMISTRY

SEMESTER – I

Objectives of the Course :

- This course aims at to accustom the students the basic concepts of thermodynamics along with the Non-ideal systems including the basic Debye Huckel theory.

- Students will be guided to apply phase rule to various systems (2 and 3 component systems) and introduction to the basic concepts of non equilibrium thermodynamics along with the applications is another purpose.

Program Learning Outcomes:

Knowledge and Understanding:

Students will explain statistical chemistry and thermodynamics as logical consequences of the postulates of statistical mechanics;

Intellectual (Cognitive and Analytical) Skills:

Apply the principles of statistical mechanics to selected problems;

Practical Skills

Apply techniques from statistical mechanics to a range of situations;

Transferable Skills

Use the tools, methodologies, language and conventions of chemistry to test and communicate ideas and explanations.

COURSE NAME: SPECTROSCOPY A: TECHNIQUES FOR STRUCTURE ELUCIDATION OF ORGANIC COMPOUNDS

CLASS - M.SC CHEMISTRY

SEMESTER – I

Objectives of the Course:

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

Program Learning Outcomes:

The student will learn :

- To perform rigorous characterization of their compound using 1- and 2-dimensional NMR techniques (¹H and ¹³C),
- Mass spectrometry, infrared spectroscopy and UV-Vis spectroscopy.

COURSE NAME: COMPUTER FOR CHEMISTS – THEORY

CLASS - M.SC CHEMISTRY

SEMESTER – I

Objective of the Course:

This course aims at acquainting students with learn various concepts and basic techniques essential for conduct of practical in computers

Course Outcomes:

A. Knowledge and understanding:

Basic understanding about Computer

Understanding the basic concept associated with C- Language and program designing

Students will develop different programs, Run and Retrieve results.

B. Intellectual (Cognitive/Analytical) skills:

Design program in C-language on the basis of given query.

Use of data structures in C

C. Practical skills:

Use of standard input (scanf) and standard output (printf) functions

Use of variables, keywords, arithmetic operators, relational operators, logical operators, unary operators, assignment operator, arithmetic assignment operators and conditional operator.

Use of library functions and user defined functions.

Use of Looping Statement (like while, do-while, for loops) and branching statements (like if, if-then, if-then-else).

Create functions and to show different calls: Call by reference, Call by value.

In future student may be able to develop a big program(s)(Software) which may simulate the behavior of the chemical reaction/processes/events

COURSE NAME: ORGANOMETALLICS CHEMISTRY

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Objectives of the Course:

This course aims at acquainting students to complete knowledge of catalytic and industrial uses of organometallic compounds.

Course Outcomes:

A. Knowledge and Understanding:

Students will be able to understand the role of coordination number, coordination geometry and oxidation state of metal in catalytic cycles.

B. Intellectual (Cognitive and Analytical) Skills:

Students will be able to study the wide variety of organometallic compounds and the choice of hapticity in different conditions.

C. Practical Skills

Students will learn to go through some important emerging compounds especially multi-decker sandwich compounds.

D. Transferable Skills

Students will be able to study the reactions at coordinated ligands.

COURSE NAME: ORGANIC REACTION MECHANISM -II

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Objectives of the Course:

- The aim of the course is to provide the vast knowledge to the Students regarding various topics related to Organic Chemistry such as Free Radical reactions, Elimination Reactions and their Mechanisms, Addition to C-C and C- Hetero Multiple bonds etc.

Course Outcomes:

- The aim is to provide vast knowledge of Organic Reactions and their mechanisms along with their Stereo-chemical aspects.

COURSE NAME: PHYSICAL CHEMISTRY – QUANTUM CHEMISTRY

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Objectives of the Course ;

This course aims at to accustom the students the principles and applications of quantum mechanics in detail with further introduction of different types of operators later on used in the solution of conjugated systems.

Course Outcomes:

The aim is to help the students to revise the basic principles of quantum mechanics. Introduction to new operators such as Hermitian and Hamiltonian and their use in the solution of Hydrogen and Hydrogen like atoms.

Students will also be able to apply quantum postulates in solution of particles in one, two and three dimensional boxes.

COURSE NAME: REACTION MECHANISMS AND METAL CLUSTERS

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Objectives of the Course:

This course aims at acquainting students to reaction mechanisms of Inorganic complex ions. Inorganic reaction mechanisms are point of study due to variable coordination number and oxidation states of metal ions.

Programme Learning Outcomes:

A. Knowledge and Understanding:

Students will be able to interpret the different mechanisms of reactions based on rate constant data available.

B. Intellectual (Cognitive and Analytical) Skills:

Students will be able to predict whether reaction follows outer sphere path or inner sphere path in the reaction mechanisms under study.

C. Practical Skills

Students will learn to understand the preference of a metal ion to undergoing a particular pathway of reaction mechanism.

D. Transferable Skills

Students will be able to judge the relative stability of products in variety of reactions.

COURSE NAME: SPECTROSCOPY B: TECHNIQUES FOR STRUCTURE ELUCIDATION OF INORGANIC COMPOUNDS

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Objectives of the Course:

This course aims at acquainting students with techniques that measure the elemental composition at microscopic level, electronic state, chemical state of matter, binding energy, empirical formula and more of surface region of solids

Course Outcomes:

(Knowledge and Understanding of the fundamental concepts, Learning Outcomes:

Students will know how to define the various electronic energy levels in atoms and molecules ,excitations & ejection of electrons, understand and explain the basic concepts associated with Symmetry & molecular orbitals, Dissociation, Predissociation, change of shape on excitation.

COURSE NAME: MATHEMATICS FOR CHEMISTS

CLASS - M.Sc. CHEMISTRY

SEMESTER – II

Course Objectives:

This course introduces the math content to chemistry students. It has been designed to compliment lecture material with particular focus on the application of math's in chemistry.

Course Outcomes:

A. Knowledge and Understanding:

Students will be able to know

- Matrix and its types, Determinant and its properties.
- Define the derivative and integral of the trigonometric, logarithmic and inverse trigonometric and rational functions
- Recognize the different techniques of integration (by parts, trigonometric integrals, partial fractions).
- definite integrals

B. Intellectual(cognitive/Analytical) skills:

- Calculate the rank of matrix
- Determine derivatives of function using different techniques.
- Evaluate integrals by different methods of integration.
- Calculate the areas of plane regions.

C. Practical skills:

- Have the ability to carry out complex calculations orally and mentally.
- Present mathematics to others in oral and written form clearly and in a well organized manner.

COURSE NAME: BIOLOGY FOR CHEMISTS

CLASS - M.Sc CHEMISTRY

SEMESTER – II

Course Name: **Course–XIII BIOLOGY FOR CHEMISTS**

Class: **M Sc. (Chemistry)**

Semester - **II**

Objectives of the course:

1. To study the structure and organization of cell membrane and cell wall, process of membrane transport and membrane models.
2. To understand the DNA structural organization and biochemical composition of genetic material.
3. To understand the vascular tissues, structure of woods and anomalous secondary growth, anatomical variations and tissue systems in plant shoot system.
4. To know various tissue systems and understand the normal and anomalous secondary growth in plants

Course Outcomes:

- (a) Knowledge and Understanding:** Student will know about whittaker system of classification, plant and animal tissue systems, genetic principles, structure and functional aspects of biomolecules.
- (b) Intellectual Cognitive /Analytical skills:** Students will be able to understand the basic principles of biology and biomolecules.

(c) **Transferable skills:** communicate and interact about the biological principles applied to chemistry.

COURSE NAME: INORGANIC CHEMISTRY-II

CLASS - M.Sc CHEMISTRY

SEMESTER – III

Objectives of the Course:

This course aims at acquainting students to concept of bio-inorganic chemistry. Due to ever increasing role of metals in medicine, these topics are of good concern in chemistry.

Course Outcomes:

A. Knowledge and Understanding:

Students will be able to analyse the relation between oxidation state of metals and their biological behaviour.

B. Intellectual (Cognitive and Analytical) Skills:

Students will be able to understand the role of metals and chemicals in biological systems.

C. Practical Skills

Students will learn the use of porphyrins of different metal ions in biological systems.

D. Transferable Skills

Students will be able to make a correlation between enzymatic functions and metals.

COURSE NAME: ORGANIC SYNTHESIS

CLASS - M.Sc CHEMISTRY

SEMESTER – III

Objectives of the Course:

This course aims at acquainting students to concept of synthesis in organic chemistry. This will cover a wide area of synthesis including polynuclear compounds, heterocyclic compounds, reagents in organic synthesis, and basic concepts of supramolecular chemistry.

Course Outcomes:

A. Knowledge and Understanding:

Students will be able to analyse the difference in the basic types of synthetic approaches.

Intellectual (Cognitive and Analytical) Skills:

Students will be able to understand the role of reagents and catalysts in organic synthesis.

Transferable Skills

Students will be able to make a correlation between supramolecular and normal organic synthesis.

COURSE NAME: SURFACE AND POLYMER CHEMISTRY

CLASS - M.Sc CHEMISTRY

SEMESTER – III

Objectives of the Course :

This course aims at acquainting the students the knowledge of the basic concepts of polymers. A complete packet of knowledge of the kinetics, thermodynamics of polymerization, various techniques of determination of molecular mass and applications of polymers in various fields of life will be provided to the students.

Various factors affecting the structure and properties of polymers will be discussed in detail which makes students aware of the things to be considered while preparing polymers commercially.

Program Learning Outcomes:

This course will equip the students with the necessary detailed chemical knowledge concerning the chemistry of macromolecules.

This will also help to develop skills to interpret and explain various factors affecting structure and property of macromolecules. The students will be able to pursue their career objectives in higher education, scientific research and teaching.

COURSE NAME: ELECTROCHEMISTRY AND CHEMICAL DYNAMICS

CLASS - M.Sc CHEMISTRY

SEMESTER – III

Objectives of the Course :

- This course aims at acquainting students with the knowledge of various concepts and theories related to physical chemistry. The present syllabus has been framed as per the latest UGC guidelines and recent research trends in the subject.

- To equip students with necessary chemical knowledge concerning the concept of reaction rates and electro analytical techniques and to bring forth the importance of academic and laboratory skill for the students.

Program Learning Outcomes:

Learning Outcomes(Knowledge and Understanding):

Students will understand the fundamentals of Chemical dynamics and Voltammetry and their applications.

B. Intellectual(Cognitive/ Analytical) Skills:

Students will be able to develop the academic and laboratory skills.

C. Practical Skills

Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

D. Transferable Skills :

Students will be skilled in problem solving, critical thinking and analytical reasoning as applied to scientific problems.

COURSE NAME: PHOTOCHEMISTRY AND PERICYCLIC REACTIONS

CLASS - M.Sc CHEMISTRY

SEMESTER – III

Objectives of the Course ;

This course aims at acquainting students with the detailed knowledge of pericyclic as well as photochemical reactions. Starting from the very basic ideas, and moving towards the classification using different approaches, electrocyclic and sigmatropic rearrangements will be discussed.

Program learning outcomes:

Students will learn the basic difference between photochemical and thermal reactions. Based on the different principles of photochemistry, they will be able to solve different practical problems. Further some well known named reactions in this field will add on to the knowledge of the students.

COURSE NAME: ADVANCED INORGANIC CHEMISTRY

CLASS - M.Sc CHEMISTRY

SEMESTER – IV

Objectives of the Course:

This course aims at acquainting students to the knowledge of transition metal compounds with bonds to hydrogen. Such compounds have wide synthetic applications from study point of view.

Course Outcomes:

A. Knowledge and Understanding:

Students will be able to characterise theoretically the type of bond of hydrogen with the transition metal.

B. Intellectual (Cognitive and Analytical) Skills:

Students will be able to understand the reducing properties of compounds and the chemical reactions.

C. Practical Skills

Students will learn to make difference of terminal and bridging hydrogen bonds.

D. Transferable Skills

Students will be able to think and devise new synthetic applications of such compounds.

COURSE NAME: NATURAL PRODUCTS

CLASS - M.Sc CHEMISTRY

SEMESTER – IV

Objectives of the Course:

- Recognize and draw particular carbohydrate structures
- Know general structural elements of cyclic monosaccharides and disaccharides, and their implications for structure/function
- Predict the products of condensation reactions and hydrolysis.
- Knowledge of Sequence determination of amino acids
- Familiarity with Enzymes, Kinetics, inhibition mechanism.
- Know general structure of Nucleosides, nucleotides, DNA, RNA structure etc.

Course Outcomes:

- Students will able to Recognize and draw particular carbohydrate structures, general of cyclic monosaccharides and disaccharides, and their implications for structure/function.
- Students will able to predict the products of condensation reactions and hydrolysis.
- Students will capable of determining the Sequence of amino acids

- Students will be Familiar with Enzymes, Kinetics, inhibition mechanism and structure of Nucleosides, nucleotides, DNA, RNA structure etc.

COURSE NAME: CHEMISTRY OF MATERIALS

CLASS - M.Sc CHEMISTRY

SEMESTER – IV

Objectives of the Course :

- This course aims at acquainting the students the knowledge of the factors affecting glass formation various thermodynamic, kinetic factors controlling the designing of glass materials, important compositions and different properties.
- A complete packet of knowledge of the preparation of smart materials and their applications as nano drug delivery agents and energy storage materials.

Program Learning Outcomes:

- The aim is to help the students to understand the basics of glass formation from different materials along with different kinetic and thermodynamic aspects discussing the applications also. Smart materials will be introduced while discussing different electrical and magnetic properties.