

M.Sc. Degree Applied Chemistry Programme

Aim and Objective of the Syllabi

Aim

Chemistry is a central subject of science. It is also closely related to daily life. The Master's program not only offers the option of focusing on a specialist area but students will also acquire the necessary skills for this and they will learn to think independently and act responsibly. Graduates will become familiar with the terminologies and special aspects of chemistry, its strengths and limitations and will be able to apply their knowledge to new issues and situations, even in an interdisciplinary context. They will gain knowledge and practical skills relating to the current state of research in selected fields. They will be able to analyze chemical issues and assess them critically, to develop independent solution strategies and to estimate their impacts in a wider context. The broad spectrum of the academic program will ensure that students acquire the skills necessary for demanding fields of activity in industry, economy and administration

Objective

The Master's course in chemistry is designed with an objective to teach post graduates with the skills to critically assess and deal with issues requiring the utilization of chemical principles from each sub-disciplines such as organic, inorganic, physical, analytical and biochemistry. It is the objective of the chemistry program to teach students the necessary knowledge in a way that enables them to familiarize themselves quickly with new developments, to be introduced to new areas and to make independent contributions to further developments of research and technology in their specialized area once they have finished their program.

PG1APL C01 Inorganic Chemistry - I

Aim and Objectives

This is a chemistry module designed for chemistry majors and features the principles of coordination chemistry, boron compounds and that of nuclear chemistry. In depth discussion about coordination compounds focusing primarily on their structure and various aspects of bonding will be done. The course covers synthesis, structure and bonding of organometallic compounds. Kinetics of reactions of metal complexes and their mechanism will also be illustrated. The learners should be able to apply these topics in various fields.

PG1APL C02 Organic Chemistry - I

Aim and Objectives

The module deals primarily with the basic principles to understand the structure and reactivity of organic molecules. Emphasis is on substitution and elimination reactions of aliphatic and aromatic compounds. Learners will get the essential ideas on how simple molecules can be constructed. Bonding in conjugated systems, reactions mechanism, organic transformations and stereochemistry will likewise be discussed.

PG1APL C03 Theoretical Chemistry - I

Aim and Objectives

This module looks at quantum chemistry and group theory. A more profound comprehension of quantum chemistry beginning from its postulates and basic systems such as particle-in-a-box to hydrogen like atoms is explored. The second part of the module looks at molecular symmetry and applications in molecular orbitals analysis and vibrational spectroscopy, electronic transitions of carbonyl chromophore and origin of selection rule of electronic transition. Learners will be able to apply these ideas to individual atoms and molecular systems.

PG1APL C04 Physical Chemistry - I

Aim and Objectives

Physical chemistry is the study of phenomena in chemical systems in terms of physical concepts and laws. In this module, different branches of thermodynamics will be explored. In *Classical Thermodynamics*

kinetic theory of gases, and the energetics of chemical reactions will be explored. Thermodynamics of natural processes and energy transformations in living organisms will be discussed in *Irreversible thermodynamics*. *Statistical Thermodynamics* looks at the relationship between molecular and bulk properties of matter, including examples such as the use of partition functions in equilibrium, transition states and heat capacity of chemical systems. Learners will be familiarized with the behavior of matter in bulk.

PG2APL C05 Inorganic Chemistry - II

Aims and Objectives

This module covers three parts: non-aqueous solvents, bioinorganic chemistry and organometallic chemistry. Part 1 deals with acid-base concept and reactions in non-aqueous solvents. Part 2 describes basic principles and concepts of bioinorganic chemistry including the mechanisms of reactions catalyzed by metalloproteins, and kinetics of electron transfer in proteins. Part 3 focusses on the spectral and magnetic properties of transition metal complexes. A comprehensive discussion on inorganic cages and metal clusters follows. The learners will understand the different modes of reactions of organometallic compounds and their applications can be explored.

PG2APL C06 Organic Chemistry - II

Aim and Objectives

This module covers the study of a selected series of organic reactions involving reactive intermediates and/or molecular rearrangements. Emphasis is placed on an understanding of their reaction mechanisms. These will include reactions involving carbocations, carbanions, carbenes, carbenoids, nitrenes and arynes as intermediates. Reactions initiated by radicals will be covered. Comprehensive discussions on organic photochemistry including the rules and stereochemical consequences in pericyclic reactions will be given. The learners should be able to apply these ideas in the field of organic synthesis.

PG2APL C07 Theoretical Chemistry - II

Aim and Objectives

The objective of this model is to familiarize the learner with the approximation methods of quantum mechanics and its applications to the various theories of chemical bonding. Molecular structure evaluation using group theory will enable the learners to apply it in the field of spectroscopy. To apply the concept of molecular modelling to isolated molecular systems.

PG2APL C08 Physical Chemistry - II

Aim and Objectives

In this module, the basic idea of how light interacts with matter, in particular atoms and molecules will be conferred. Microwave, infrared, Raman, electronic and nuclear magnetic resonance spectroscopic techniques will be discussed. Students will be able to apply these principles in the area of molecular spectroscopy.

PG1APL P01 Inorganic Chemistry Practical- I

Aim and Objectives

This is a module intended for chemistry majors. It deals with qualitative and quantitative inorganic analysis along with preparation and characterization of inorganic complexes. The learners will have the option to apply these ideas in various fields pertaining to inorganic chemistry.

PG2APL P02 Organic Chemistry Practical- I

Aim and Objectives

In this module, students will learn to apply various techniques to separate a mixture into its individual components and identify each component. Guided under the general principles of analytical and physical chemistry, these techniques include solvent extraction, TLC and column chromatography. Students will also acquire the skill to use the computational tools to draw the reaction schemes and mechanisms of various organic reactions.

PG2APL P03 Physical Chemistry Practical- I

Aim and Objectives

In this module, students will learn about the practical applications of various principles of physical chemistry like phase rule, adsorption, and surface tension. Learners will be able to use computational software to predict the geometry of a molecule, calculate its energy levels, assess the HOMO and LUMO energy, and predict its spectral behavior.

PG3APLC09 Organic Chemistry-III (Organic Synthesis)

Aim:

Course Outcomes:

- To identify the basic principles, terminology and important strategies of retro synthesis
- To make awareness about the reagents and basic organic reactions
- To study the influence of light and thermal energy for the formation of cyclic systems
- To aware of basic ideas and applications of supramolecular chemistry
- To understand the structure determination and synthesis of natural products

Course Objectives:

- To identify the basic principles, terminology and important strategies of retro synthesis
- To make awareness about the reagents and basic organic reactions
- To understand the chirality, chiral catalyst and asymmetric synthesis
- To study the influence of light and thermal energy for the formation of cyclic systems
- To aware of basic ideas and applications of supramolecular chemistry
- To understand the structure determination and synthesis of natural products

PG3 APL C10 Physical chemistry- III (Selected topics in Physical Chemistry)

Objectives:

- To give an in-depth account of different theories of reaction rates, kinetics of fast reactions and reaction in solution.
- To study the different types of quantum statistics and its comparison, Laws related to heat capacity of solids, phase transition and thermionic emission.
- To study the chemistry of surfaces and various techniques employed for the characterization of different types of surface phenomena and the importance of adsorption process and catalytic activity at the solid surfaces
- To impart knowledge about acid-base, enzyme and surface catalysis.
- To impart knowledge about enzyme inhibition, protein folding and molecular motors.
- To recognize the general properties of colloids and macromolecules
- To acquire knowledge of photochemistry and photophysical principles, their applications

Outcome:

- The student will acquire knowledge about different theories on reaction rate, can analyse the mechanistic path and the experimental conditions of different types of reactions.
- Will able to understand the different techniques for analysing fast reactions.
- Will able to classify the particles according to different statistics and to do problems based on the arrangement of particles in different energy states.
- To compare the different laws related to heat capacities.
- To generate idea about phase transitions and thermionic emissions.
- Will acquire knowledge about the acid base catalysis, enzyme catalysis and their principles.
- Will appreciate the applications of chemical principles of surface catalysis and colloidal chemistry in industrial synthesis.
- Able to classify colloids present in nature and apply its properties in daily life.
- Apply the principles of adsorption in daily life situations.
- The student will able to apply photochemistry and photophysical principles on environmental and biological processes and will explain photophysical energy conversion to generate electricity
- Gains numerical ability and analysing power to solve problems.

PG3APL C11 (Fatty Acids, Nano and Green Chemistry)**Course Objectives:**

- To understand the classification, nomenclature of lipids
- To study the functions and applications of fatty acids
- Identify various fatty acids
- Analyse various methods of separations of fatty acids
- Describe the applications of TLC and FID and spectroscopic analysis of triglycerides
- To understand the properties and biochemistry of fatty acids
- To study the importance of Nanomaterials and Green Chemistry

PG3APL C12 Spectroscopic Methods in Chemistry**Course Objectives:**

- To understand the basic ideas of different spectroscopic Techniques
- To identify the compounds by analyzing the UV, IR NMR and Mass spectrum
- To interpret the spectrum of organic compounds
- To develop the structure elucidation skill of organic compounds using different types of spectral data

PG4APL E01- Analysis of Fats, Oils and Waxes**Course Objectives**

- To make an awareness of the different methods of extraction of oils and fats
- To understand the source and utilization of different types of oils and fats
- To understand the structure and synthesis of glycerides
- To study the physical and chemical properties fats and oils
- To develop the chemistry and functions of nonglyceride constituents of fats and oils
- To study the occurrence, classification, properties and composition of waxes and drying oils

PG4APL E02 Industrial Oil and Fat Products**Course objectives:**

- To make an awareness of the processing of oils and fats

- To understand the hydrogenation oils
- To understand the esterification reactions of fats
- To study the applications of grease and lubricating oils
- To study the manufacture methods and analysis of soaps, shampoos and synthetic detergents
- To study the basic ideas of paint, varnish and lacquers
- To study the instrumental methods of analysis of oils and fats

PG4APL E03 Essential Oils and Aromatics

Course objectives:

- To make an awareness of the production and isolations of essential oils and terpenoids
- To understand the constituents of essential oils
- To understand the source, production and chemical constituents of spices and spice oils
- To study the classification, preparation and applications of flavors
- To study the classification, preparation and applications of perfumes

PG4APL E04 - Polymer Chemistry

Course Objectives:

- To acquire the knowledge about different types of polymers
- To understand the different types of polymerization
- To study the physical and chemical properties of polymers
- To understand the morphology and order in crystalline polymers
- To study the advances in polymers
- To understand the basic ideas of dendrimers and dendritic polymers

PG4APL P04- Industrial Oil and Fat Products Practical

Course Objectives:

- To develop skills in analysis of vanaspathi, soap and glycerin
- To understand the methods of preparation of different types of soap

PG4APL P05 - Essential Oils and Aromatics Practical

Course Objectives:

- To understand different techniques of extraction of essential oils
- To test the assay of essential Oils and perfumery material
- To make awareness about detection and estimation of common adulterants in essential oils
- To study the synthesis of essential oils and distinguish by spectral analysis

PG4APL P06- Fixed Oils and Fats Practical

Course Objectives:

- To understand the experimental methods of the determination of physical chemical constants of oils and fats
- To make the skills of special tests of oils
- To find out the adulterants in oils and fats
- To prepare the common fatty acids involving chemical reactions