



## DEPARTMENT OF CHEMISTRY

### Program Outcome

#### Programme Specific Outcomes

##### M.Sc. Chemistry (M.Sc.):

After completion of the M.Sc., students should be able to:

- ✚ Learns about the potential uses of analytical, industrial, inorganic, organic & medicinal chemistry and green chemistry.
- ✚ To know the importance of stereochemistry, spectroscopy, retro synthesis and biochemistry in drug designing & discovery.
- ✚ Carry out their research work in various fields of sciences contributing their potentials in the arena of chemical sciences.

### Course Outcome

##### M.Sc. Chemistry (M.Sc.):

##### M.Sc. Chemistry (M.Sc.I):

##### CHP-110: Fundamentals of Physical Chemistry-I

- ✚ To understand the basic concepts of heat, work and conservation of energy and the first law of thermodynamics
- ✚ Work of adiabatic expansion-Irreversible adiabatic expansion, reversible adiabatic expansion.
- ✚ Second law of thermodynamics and the concept of entropy.
- ✚ The third law of thermodynamics
- ✚ Open system and the chemical potential of a perfect gas.
- ✚ Partial molar quantities and the thermodynamics of mixing.
- ✚ Colligative properties-The elevation of boiling point, the depression of freezing point, solubility, osmosis.
- ✚ The failures of classical mechanics- Black body radiation, Photo electric effect, Specific heats of solids and atomic spectra
- ✚ Schrodinger equation, free particle, particle in one dimensional box, hydrogen like atoms.

- ✚ The determination of the rate law, first order, second order reactions, half lives, fractional order reactions.
- ✚ The temperature dependence of reaction rates.
- ✚ Kinetics of complex reactions and steady state approximations
- ✚ Collision theory activated complex theory.
- ✚ Michaelis-Menten mechanism and Line weaver Burk and Eadie plots

### **CHI-130: Molecular Symmetry & Chemistry of p- 04 04 block elements**

- ✚ Students are made to understand the symmetry and group theory and use this knowledge to interpret the properties like dipole moment, optical activity, and signals in IR and Raman spectroscopy for structure identification.
- ✚ Students are also made to understand the periodic trends in properties of S and P block elements and their applications in fields like catalysis, industry, human metabolism and medicines etc.

### **CHO-150: Basic organic chemistry**

- ✚ This is a primary course for both organic & Drug Chemistry students.
- ✚ This course is designed to make students aware of basic organic chemistry, including reaction mechanism, how to write structures of organic molecules more realistically, Stereochemistry of carbon compounds etc.
- ✚ The main intention of this course is to make the students perfect for mechanisms of some basic organic reactions.

### **CHA-190: Safety in Chemical Laboratory and Good Laboratory Practices**

- ✚ The course acquaints the student with the knowledge & importance of safety in chemical laboratory.
- ✚ It will help students realized their responsibility as laboratory individual and contribution in maintaining effective security management.
- ✚ Students will be able to revolutionize their working habits in the laboratory by use of Personnel protective such as gloves, goggles, lab coat.
- ✚ Students will be able to know the role & use of various safety equipments like respirators, heat detectors, eye wash unit, safety shower etc.
- ✚ Student will be able to assess various hazards arising from use of toxic chemicals through different routes of exposure as ingestion, inhalation & direct contact with skin.
- ✚ Students will be able to attain good housekeeping practices, clear planning for scientific working, ability to assess laboratory hazards, ability to manage chemicals & chemical wastes.
- ✚ The course will inculcate the attitude in the students for emergency preparedness in all aspects of laboratory hazards.

### **CHP-107: Practical Course (Physical Chemistry)**

After the completion of this course, the students are expected to know:

- ✚ To impart students a broad outline of the methodology of science in general and chemistry in particular.
- ✚ To develop skills in doing experiments in kinetics, potentiometry and conductometry, colorimetry and pH metry. Enable the students to prepare data analysis using spreadsheet program.
- ✚ The students will learn the important analytical and instrumental tools used for practicing chemistry.
- ✚ They will learn computer based presentation and statistical analysis of data using spreadsheet software.
- ✚ To impart essential theoretical knowledge on atomic structure, chemical bonding, and nuclear chemistry.
- ✚ To develop skills for quantitative estimation using the different branches of volumetric analysis.

### **CHI-147: Practical Course (Inorganic Chemistry)**

- ✚ Students are trained for the preparation of various solutions, synthesis of various inorganic complexes and their characterization.
- ✚ The students are trained for handling of natural materials and their quantitative analysis which involves disintegration, separation and individual estimations.
- ✚ They are trained to handle various equipments like spectrophotometer, flame photometer, conductometer etc.

### **CHP-210: Fundamentals of Physical Chemistry-II**

After the completion of this course, the students are expected to know:

- ✚ To understand the theoretical concept of molecular spectroscopy
- ✚ To differentiate between different types of molecular spectroscopy
- ✚ To find the equation of rigid rotor, moment of inertia, energy levels, selection rule, nature of spectrum
- ✚ To calculate the energies of simple harmonic oscillator and anharmonic oscillator, selection rule, nature of spectrum.
- ✚ To understand the nature of Raman spectrum, Stoke's lines, anti-Stoke's lines and the quantum theory and classical theory of Raman spectroscopy
- ✚ Born – Oppenheimer approximation, Electronic spectra of diatomic molecules, Vibrational coarse structure and Rotational fine structure
- ✚ The applications of ESR, Mossbauer and NMRspectroscopy.
- ✚ Workings of G.M. Counter and Scintillation counter
- ✚ Radiation Chemistry, Unitsfor measuring radiation absorption and radiation dosimetry
- ✚ The four factor formula- the reproduction factor  $k$  and critical size of thermal reactor

- ✚ The Breeder reactor and India's nuclear energy programme
- ✚ Nuclear waste management and isotope separation for nuclear reactors
- ✚ Applications of radioactivity in the determination of Diffusion coefficients, surface area, solubility.
- ✚ Neutron activation analysis and Isotopic dilution analysis
- ✚ Radiometric titration and radiation gauging, friction and wear out, gamma radiography.

### **CHI-230: Coordination and Bioinorganic Chemistry**

- ✚ Students are made aware of spectral and magnetic properties of d and f block elements and spectrophotometric analysis of metals like Cr, Mn, Ni and magnetic behavior of various complexes of f block elements in MRI and as TV phosphors.
- ✚ Students are also made aware of a role of metal ion in biologically active compounds like Hb, Mb cytochromes and use of anticancer drugs i.e. platinum complexes.

### **CHO-250: Synthetic organic chemistry and spectroscopy**

- ✚ The first section of this course is aimed to make students familiar with various basic organic reactions with different examples along with their mechanism.
- ✚ The second sections deals with basic introduction to various Spectroscopic methods like UV, IR,  $^1\text{H}$ ,  $^{13}\text{C}$ -NMR and Mass Spectrometry and their application in structure determination of various organic molecules.

### **CHA-290: General Chemistry**

- ✚ The course deals with wide range of Spectroscopic techniques. After the completion of the syllabus students will acquire a thorough knowledge about physical and chemical basis of mass spectroscopy, use of modern separation techniques like Tandem mass & inductively coupled mass spectroscopy & their application in quantitative analysis.
- ✚ Students will be able to understand gas chromatography as an important tool for the analysis of mixture of volatile components & will be able to learn use of hyphenated techniques like GC-MS.
- ✚ Students will gain knowledge about HPLC as advanced separation technique & its hyphenation with mass spectroscopy.
- ✚ Students developed comprehension about various aspects of accuracy & precession in Analytical Chemistry.
- ✚ Students will understand the role & importance of Sampling and data handling in Analytical Chemistry.
- ✚ Students will be able to differentiate various methods of Separation like precipitation, distillation, ion exchange chromatography.

## CHO-247: Practical Course (Organic Chemistry)

Students will be able to know about

- ✚ The software used to draw the structures of organic molecules and their analysis.
- ✚ The purification techniques for solids and liquids like crystallization and distillation, vacuum distillation, steam distillation etc respectively
- ✚ Organic Qualitative analysis of ternary mixture by ether separation
- ✚ The various chemical reactions, their methods of synthesis and the practical aspects of obtaining the desired products with high percent yield & purity via single stage preparation.

## M.Sc. Chemistry (M.Sc. II):

### CHO-350: Organic Reaction Mechanism

- ✚ This course enables the students to learn the mechanistic aspects of organic reactions in details. This involves use of recent reagents, catalysts and their experimental set up to carry out reactions on industrial scale.
- ✚ In order to find the detailed mechanism, study of this course gives idea about the use of different techniques like radio labeling, isolation of intermediates and trapping of intermediates and pulse radiolysis.
- ✚ This helps to understand the paths of organic reactions in better way.

### CHO-351: Spectroscopic Methods in Structure Determination

- ✚ This course gives an idea about the basic understanding of Spectroscopic methods like  $^1\text{H}$ ,  $^{13}\text{C}$ - NMR, 2D NMR Techniques and Mass Spectrometry.
- ✚ The students understand the basic theory of NMR, Mass Spectrometry and also advanced NMR techniques like 2D NMR.
- ✚ They also learn how to apply these analytical methods in structure determination of either known organic molecules or new chemical molecules.

### CHO-352: Organic Stereochemistry

- ✚ This course is framed mainly for stereochemistry of cyclic compounds, their stability & reactions.
- ✚ This course will be really helpful to students to understand stereochemistry of organic chemistry and to think about new stereo selective reactions as far as the asymmetric synthetic part is concerned.
- ✚ This course also includes resolution of racemic mixtures and stereochemistry using spectroscopic method viz. PMR.
- ✚ Which will be helpful for in their future to predict the stereochemistry using PMR like method.

### **CHO-353: Pericyclic Reactions, Photochemistry and Heterocyclic Chemistry**

- ✚ The course aims to giving a fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.
- ✚ This course also includes pericyclic and photochemical reactions along with reactive intermediates. Students are made aware of different types of pericyclic reactions like electrocycloisatation, cycloaddition, sigmatropic, chelotropic and group transfer.
- ✚ Molecular orbital theory, PMO and FMO theory are thoroughly discussed.
- ✚ Principles of photochemical reaction, photochemistry of carbonyl compounds are thoroughly discussed.

### **CHO-450: Chemistry of Natural Products**

- ✚ Post graduate students are taught to understand chemistry of natural products.
- ✚ In this course they learn how nature uses various pathways to synthesize large number of primary and secondary metabolites through the process of biogenesis.
- ✚ Following the same idea, that helps the chemists to plan synthetic strategies to prepare those pharmaceutically important compounds in laboratory.
- ✚ Part of this course involves multistep laboratory synthesis of some of the important secondary metabolites.

### **CHO-451: Advanced Synthetic Organic Chemistry**

- ✚ This course is specially designed for some advanced organic reactions viz. coupling reactions, multicomponent reactions, domino reactions, olefination reactions etc.
- ✚ This also includes designing organic synthesis using retrosynthetic method which will help students to plan the synthesis of new organic molecules.

### **CHO-452: Carbohydrate and Chiron Approach/ Chiral Drugs and Medicinal Chemistry**

- ✚ This course is designed to make students aware of sugar chemistry, structures of triose, tetrose, pentose, hexose, stereochemistry and reactions of Glucose, conformation and anomeric effects in hexoses.
- ✚ Chiron approach course is designed to understand retrosynthetic strategy and synthesis of simple and complex molecules such as – (S) Propanediol, (R) and (S) – Epichlorohydrin, L (+)-Alanine, (-) Multistratin, (-) Pentenomycin, (-) Shikimic acid.
- ✚ In addition, Introduction of chiral drugs, Eutomer, Distomer and eudesmic ratio concepts and Synthesis of medicinally and pharmacological active drugs such as S-Ibuprofen, S-Metaprolol, Inivir sulfate, Dextropropoxyphen, (+) Ephedrine, Griseofulvin, Dexormaplatin, R-Indacrinone, Nateglinide, Oxybutynin hydrochloride, S-S-captopril and S-S-S-Enalaprilate.

### **CHO-453: Designing Organic Synthesis and Asymmetric Synthesis**

- ✚ This course is designed to make students aware about how to design organic synthesis.
- ✚ This course deals with various concept which are backbone of organic synthesis such as Protection and de-protection of hydroxyl, amino, carboxyl, ketone and aldehyde functions as illustrated in the synthesis of polypeptide and polynucleotide, use of enamines and Umpolung in organic synthesis, Reterosynthesis.

### **CHO-347: Single Stage Preparations**

- ✚ This is a practical course of organic chemistry including one stage preparations of organic compounds also synthesis of some heterocycles. As per the objective this course is helpful to students to develop their skills in organic chemistry laboratory.

### **CHO-447: Double Stage Preparation**

- ✚ This gives hands on experience to students about the various organic transformations in laboratory. This involves preparations of organic compounds through single, double and multistep synthesis. They get training to set up new reactions, follow-up of progress of reaction by techniques like TLC, MP/BP and workup of reactions to purify desired products.
- ✚ Microscale preparations also help the students to improve upon their practical skills and reduce environmental pollution.

### **CHO-448: Project/Industrial Training/ Green Chemistry and Chemical Biology Experiments**

- ✚ This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.
- ✚ Here student learns how to avoid solvents and do solvent free reaction. Also the work-up procedure in many experiments is made more eco-friendly to environment.