MSc. Organic Chemistry

PROGRAMME OUTCOMES:

After completing M.Sc. Chemistry programme, students will be able to:

Knowledge Outcomes:

PO1:Demonstrate and apply the fundamental knowledge of the basic principles in various fields of Chemistry

PO2:Create awareness and sense of responsibilities towards environment and apply Knowledge to solve the issues related to Environmental pollution.

PO3: Apply knowledge to build up small scale industry for developing endogenous product.

PO4: Apply various aspects of chemistry in natural products isolations, Pharmaceuticals, dyes, textiles, polymers, petroleum products, forensic etc. and also to Develop interdisciplinary approach of the subject.

Skill Outcomes: It would help students to

PO4:collaborate effectively on team-oriented projects in the field of Chemistry or other Related fields.

PO5:communicate scientific information in a clear and concise manner both orally and in writing.

PO6:inculcate logical thinking to address a problem and become result oriented with a positive attitude.

PO7: Explain environmental pollution issues and the remedies thereof.

PO8:apply the knowledge to develop the sustainable and eco-friendly technology in Industrial Chemistry.

Generic Outcomes:

PO9: Have developed their critical reasoning, judgment and communication skills.

PO10: Augment the recent developments in the field of green and eco-friendly reactions, pharmaceutical, Bioinorganic Chemistry and relevant fields of research and development.

PO11: Enhance the scientific temper among the students so as to develop a research culture And implementation of the policies to tackle the burning issues at global and local level.

M.SC. PART I (ORGANIC CHEMISTRY) (Autonomous)

22-CCTP-1 : Physical Chemistry-I
Thermodynamics, Quantum Chemistry and Chemical Kinetics

CO1: To study the concepts in thermodynamic to understand the thermodynamics of the mixtures.
CO2: To understand the concept of partition function and its applications in finding the thermodynamic parameters with reference to translational, rotational, vibrational and electronic energies
CO3: To understand the need of quantum chemistry and its application in understanding the particle in a box concept.
CO4: To understand the advantages of valence bond theory over Molecular orbital theory.
CO5: To understand the kinetics of elementary and complex reactions
CO6: To know the different techniques to study the fast reactions.
CO7: To understand the kinetics of catalytic reactions based on enzyme catalysis, autocatalysis.
CO8: To understand the surface chemistry concepts.

22-CCTP-2 Inorganic Chemistry-I
Molecular Symmetry and Chemistry of Main Group Elements

CO1: To visualize molecule in 3-D, understand the concept of molecular point groups with their symmetry elements, symmetry operations, GMTs, character tables andgroup representations.
CO2: To understand how to derive the SALCs for molecules using the Projection Operators and also how to construct molecular orbitals using various symmetry operations and their representations.
CO3: To correlate application of symmetry to spectroscopy and find possible IR active modes of vibration.
CO4: To understand the detail chemistry of s- and p- block elements w.r.t. their compounds, reactions, applications and organometalllic chemistry of some important elements.

CO5: To learn the advance chemistry of boranes, fullerenes, silicates including zeolites, carbon nanotubes, Polymers, etc.

22-CCTP-3 Organic Chemistry-I
Basic Organic Chemistry

CO1: Understand fundamental aspects of organic chemistry, learn the concept of aromaticity and its types.

CO2: To study substitution and elimination reactions.

CO3: understand concepts of stereochemistry and will be able to stereochemical aspects in Organic chemistry

CO4: To study structure, formation, stability and related name reaction of intermediates like carbocation, carbanion, free radical, carbenes and nitrenes; recognise neighbouring group participation

CO5: To study rearrangement reaction with specific mechanism and migratory aptitude of different groups

CO6: To study Ylides and their reactions.

CO7: To understand the basis of redox reactions; reagents and mechanism for selective oxidation/reduction reactions of organic compounds.

22-CBOP-1 General Chemistry-I

SECTION - I Theory course

Option-B: Chemical Biology-I

CO1: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

CO2: Students will be able to function as a member of an interdisciplinary problem solving team.

CO3: To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.

CO4: Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.

CO5: Develop skills to critically read the literature and effectively communicate research in a peer setting.

22-CBOP-2 General Chemistry-I
SECTION - II Inorganic Chemistry Practical-1

CO1: Prepare the exact solutions for quantitative analysis.

CO2: Apply the knowledge of quantitative analysis for the determination of metals from ores/alloys.

CO3: Know different methods for the synthesis and characterization of nanoparticles

CO4: Learn various applications of nanoparticles

CO5: Understand principle and working ofIon-exchange chromatography for separation of metal ions using ion-exchange resin.

22-CCPP-1: Basic Practical Chemistry
Section I – Physical Chemistry Practical

CO1: The students should be able to apply and correlate the concepts in theory.
CO2: The students should develop the skill for the laboratory safety and handling of chemicals
CO3: The students should be able to work independently in the laboratory.

Section II- Organic Chemistry Practical

CO1: Students are trained to different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.
CO2: Students are made aware of safety techniques and handling of chemicals.
CO3: Students are made aware of carrying out different types of reactions and their workup methods.
CO4: This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.
CO5: Students are made aware of carrying out different types of reactions and their workup methods.

22-CCTP-4 Physical Chemistry-II
Molecular Spectroscopy, Nuclear and Radiation Chemistry

CO1: Students will be able to understand the principle of Microwave, IR, Raman, NMR and ESR spectroscopy

CO2: Students will be able to analyze Microwave, IR, Raman and ESR spectra.

CO3: The student should be able to understand the concepts in Nuclear and Radiation Chemistry

CO4: The student should be able to know the hazards of radioactivity and management of nuclear waste.

CO5: The student will understand the applications of radioactivity

22-CCTP-5 Inorganic Chemistry – II

Coordination and Bioinorganic Chemistry

After successfully completing this course, students will be able to

CO1: find out the number of microstates, construct a microstate table and know meaningful term symbols for various configurations.

CO2: find out splitting of the free ion terms in weak and strong ligand fields and draw Orgel, correlation and Tanabe-Sugano diagrams for various configurations in Td an Oh ligand field.

CO3: Study electronic spectra, its interpretation and solve numerical based on crystal field parameters.

CO4: Understand various terms involved in magneto chemistry, know various phenomena of magnetism and their temperature dependence.

CO5: Understand Importance of bioinorganic chemistry and Role of metals in living systems.

CO6: Know the similarities in coordination theory for metal complexes and metal ions complexed with biological ligands.

CO7: Importance and transport of metal ions by ionophores and Mechanism for active transport of Na^+ and K^+ ions.

22-CCTP-6 Organic Chemistry – II

Photochemistry, Pericyclic and Organic Spectroscopy

CO1: Students should understand free radicals formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.

CO2: They should understand carbon-carbon bond formation and will be able to write the mechanism for addition reactions.

CO3: Students should learn different types of name reactions.

CO4: Students should be able to calculate λmax of organic compounds and correlate IR bands with functional groups using numerical data as well as spectral data.

CO5: Students should to solve 1H-NMR problems and should also able to draw the 1H-NMR spectrum for simple organic compounds and should able to predict and analyze the multiplicity patterns with more than one coupling constants.

CO6: Students should be able to use 13C-NMR data to interpret the structure.

CO7: Students should able to know various key factors responsible for the spectroscopic data acquisition and should able to solve Problems based on UV, IR, MS, 1H-NMR,13C-NMR.

22-CBOP-2 General Chemistry-II

SECTION - I Theory course

Option-B: Chemical Biology-II

CO1: To impart the students thorough idea in the chemistry of carbohydrates, amino acids, proteins and nucleic acids etc.

CO2: Students will be able to explore new areas of research in both chemistry and allied fields of science and technology.

CO3: Students will be able to function as a member of an interdisciplinary approach.

CO4: Be able to describe the chemical basis for replication, transcription, translation and how each of these central processes can be expanded to include new chemical matter.

22-CBOP-2 General Chemistry-II
SECTION - II Physical Chemistry Practical - II

CO1: The student should get the hands on experience of conductivity meter, potentiometer and pH meter
CO2: The student should be able to analyse the experimental data.

22-CCPP-1: Basic Practical Chemistry
Section I – Inorganic Chemistry Practical - II

CO1: To prepare the exact solutions for quantitative analysis.

CO2: Understand the principle and working of different instruments like Colourimeter, conductometer, spectrophotometer, etc. and handle these instruments.

CO3: Synthesize Inorganic complexes and find their purity.

CO4: Study the electronic spectra of Ni(II) complexes.

Section II- Organic Chemistry Practical - II

CO1: Students should be able to use different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.

CO2: Students should be aware of safety techniques and handling of chemicals.

CO3: Students should be able to carry different types of reactions and their workup methods.

CO4: Student should know green chemistry and role of green chemistry in pollution reduction.

M.Sc. Part II (Organic Chemistry) (2019 Pattern)

Course: CCTP-7 CHO-350 Semester III (4 Credits) Course Name: Organic Reaction Mechanism and Biogenesis

After successfully completing this course, students will be able to:

CO1: understand biosynthesis of different Secondary metabolites and their importance.

CO2: understand the mechanisms of free radicals in different processes.

CO3: study the Linear free energy relationship and extend its applications in many reactions

CO4: correlate the Kinetic and non-kinetic methods for determination of mechanism of any organic reaction.

CO5: to understand various laboratory methods to determine structure and activity of unknown organic sample.

Course: CCTP-8 CHO-351 Semester III (4 Credits)

Course Name: Structure Determination of Organic Compounds by Spectroscopic Methods

After successfully completing this course, students will be able to:

CO1: Identify the structure of a molecule from.given spectroscopic data.
CO2: Interpret CMR spectrum

CO3: Interpret mass spectrum and thus identify structure of a molecule and it's molecular weight.
CO4: Predict the structure of an unknown compound when provided with UV, IR, PMR, CMR and 2D spectrum.
CO5: Interpretation of COSY and HETCOR spectrum.
CO7: Learn about nuclei other than C13 and H1 which are NMR active like N15, P,F. Which provide important information for structure determination
CO8: Determine molecular formula from molecular weight.

Course: CCTP-9 CHO-352 Semester III (4 Credits)

Course Name: Stereochemistry and Asymmetric Synthesis of Organic Compounds

After successfully completing this course, students will be able to:

CO1: Identify and justify different conformations in substituted cyclohexane rings.
CO2: Understand differential principles that are involved in the reactions of six membered rings and other than six membered rings, heterocyclic rings with nitrogen and oxygen.
CO3: Understand the different concepts involving 6-membered rings like I-strain, anomeric effects
CO4: Understand the nomenclature, synthesis and stereochemical aspects involved in multi-ring systems, Steroids, Bridged and fused ring system (bi, tri and polycyclo system) and also including heteroatoms.
CO5: Give justification for different conformations present. Students will also understand different Methods of resolution and analysis of stereomers. They will also come to know about the Stereochemistry of a polymer chains and their types.
CO6: Understand what is asymmetric synthesis, Chiral pool and auxillaries, Asymmetric Organocatalysis
CO7: Understand the different types of reactions involving transition metal catalysts.

Course: CBOP-3 CHO-353B Semester III (4 Credits)

Course Name: Designing Organic Syntheses and Heterocyclic Chemistry

After successfully completing this course, students will be able to:

CO1: Do retrosynthesis of any organic compound whether it is small or complex molecule.
CO2: Design new synthetic route for particular compound.
CO3: Understand interconversion of functional group.
CO4: Understand logical and Illogical synthesis and retrosynthesis.
CO5: Understand the synthesis and applications of Heterocyclic compounds.
CO6: Learn medicinal applications of Heterocyclic compounds.

CO7: Learn synthesis, reactions and structural effects of heterocyclic rings etc.

Course: CCPP-3 CHO-354 Semester III (4 Credits)

Course Name: Practical I: Solvent Free Organic Synthesis

After successfully completing this course, students will be able to:

CO1: Understand how to do various reactions with the help of green chemistry approach.

CO2: Learn to reduce the pollution and how to do reactions without using solvents.

CO3: Learn and understand green chemistry approach for C-C bond formation reactions.

CO4: Learn and understand green chemistry approach for C-N bond formation reactions.

CO5: Learn and understand green chemistry approach for C-X bond formation reactions.

CO6: Learn and understand green chemistry approach for C-S bond formation reactions.

CO7: Learn and understand green chemistry approach for N-N bond formation reactions

Course: CCTP-10 CHO-450 Semester IV (4 Credits)

Course Name: Chemistry of Natural Products

After successfully completing this course, students will be able to:

CO1: understand mechanism of various oxidising and reducing agents used in the total synthesis.

CO2: study the process of total synthesis starting from isolation of natural products.

CO3: understand the various physical and chemical methods to determine the correct structure of a natural product.

CO4: to reach simple starting materials from the target molecule using the concept of retrosynthesis.

CO5: to design their own total synthesis route of new natural product target molecule

Course: CCTP-11 CHO-451 Semester IV (4 Credits)

Course Name: Organometallic Reagents in Organic Synthesis

After successfully completing this course, students will be able to:

CO1**:** Understand homogeneous and heterogeneous catalysis.

CO2: Uses of palladium catalyst in synthesis. Cross coupling reactions.

CO3: Uses of transition metals in organic synthesis.

CO4: Double bond formation name reactions.

CO5: Green chemistry multicomponent reactions

CO6: Uses of boron and silicon in synthesis

Course: CBOP-4 CHO-452A Semester - IV (4 Credits)Course Name: Medicinal Chemistry

After successfully completing this course, students will be able to:

CO1: Understand the chemistry involved in peptides and proteins, their sequencing and applications in therapeutics. Students will study about chemistry of different vitamins.

CO2: Understand principles of drug discovery and drug design. Students will be able to understand the process of drug discovery.

CO3: Understand different concepts of pharmacokinetics and pharmacodynamics, absorption, distribution, metabolism and excretion of drugs

CO4: Understand about drug targets, drug-receptor interactions, structure activity relationship (SAR) & QSAR.

CO5: Introduction, Developments, SAR, Mode of action, limitations and adverse effect of different drug families (antimalerials, antibiotics, antivirals, antifungal, anti-infective agents)

Course: CBOP-5 CHO-453 Practical Course – III : Semester – IV (Credit 4)

Course Name: Section-I: Ternary Mixture Separation

After successfully completing this course, students will be able to:
CO1: Separate the components from given ternary mixture

CO2: Find out elements present in each compound

CO3: Identify the functional groups present in each compound

CO4: Find out their physical constants

CO5: Purify the separated components

Section-I: Carbohydrates Synthesis and Isolation of Natural Products

After successfully completing this course, students will be able to:

CO1: Isolate pigments and medicinally important components from natural products
CO2: synthesize carbohydrate derivatives

Section-I: Project / Industrial Training/ Internships/ Summer Project

After successfully completing this course, students will be able to:

CO1: Handle the different types of reactions on their own.
CO2: Monitor the reactions using TLC

CO3: Identify the structure of compounds from spectral data

CO4: Students will get acquainted with different reagents used in reactions

Course: CCPP-04 CHO-454 Semester IV (4 Credits)

Course Name: Practical II: Convergent and Divergent synthesis

After successfully completing this course, students will be able to:

CO1: understand the meaning of convergent synthesis and its applications.
CO2: understand the meaning of divergent synthesis reactions.

CO3: extend the knowledge of the reagents used to other divergent synthesis.

CO4: to learn post experiment skills such as work-up, purification of products and characterisation using NMR, IR methods.

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