M.Sc.-Organic Chemistry

Course Description and Learning Outcome

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01CCHE21-Electron spectroscopy and Magnetochemistry

Faculty: Ms. Hina Arya

Course Description

The course provides an introduction of complex and introduces practical application in industry. A basic feature is application of electron spectroscopy in complex, also about the magnetic behaviour of complex. Extensive use is made of complex in industrial level.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the basic concepts complex, chelate and ligand.
- Finding the system and term symbol of metal ion.
- Understand the magnetic behaviour and magnetic susceptibility of metal ion.
- Understand the concept of interpretation of spectra.
- Capable making complex in the laboratory.
- Understand the chemistry of lanthanide and actinide.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - I

Subject: PS01CCHE22: Organic Chemistry-I

Faculty: Dr. Kinnari Bhatt

Course Description

The course provides basic information about the aspects of stereochemistry includes chirality, prochirality, psedochiral centers etc. Also explain about homolytic and heterolytic fission, nucleophilic and electrophilic substitution reactions with electron releasing and electron withdrawing groups, occurrence of different products using addition and elimination reactions, isolation of different intermediates such as carbenes, nitrenes etc. The principle, reaction mechanism and application of various name reactions.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the electrophilic and nucleophilic reactions.
- Understand the behavioural effect of different groups on reaction.
- Understand the addition, substitution, elimination and rearrangement reactions.
- Gain the knowledge of important reagents used in synthesis and understand the reaction mechanism of various name reactions.
- After completion of this course one can gain knowledge and understanding which is useful for the development of new compounds of organic chemistry.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01CCHE 23 – Topics in Physical Chemistry - I

Faculty: Dr. Rohit L.Vekariya

Course Description

The course introduces chemical thermodynamics and all about the rate of reactions in the industry. The entire course provides important information regarding reaction progress, rate of reaction, and chemical kinetics of reactions along with that it is also provides the surface phenomena of materials including the surface tension of liquids. One of part is providing electro chemistry which is important to know electrical properties of synthesized energetic materials.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the basic concepts and laws of thermodynamics.
- Rate and progress of chemical reaction.
- Understand and know about the surface phenomena including surface tension and critical micelles concentration of surfactant based materials.
- Understand how to select a particular surfactant for a particular application according to nature of surfactants.
- Analyse the role of surfactant in various applications like detergency, adhesives, surface coatings, petroleum, pharmaceuticals etc.
- Understand chemical kinetics of reaction.
- Capable to synthesized energy materials and apply to energy device to get electrochemical parameters by analysing and testing of devices.
- With the help of physical chemistry knowledge one can evaluate the physical parameters including pH (whether it is basic, acidic or neutral), conductance and potential of compounds.

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Course Description and Learning Outcome

SEMESTER - 1

Subject: PS01ECHE22- Polymer Chemistry-I

Faculty: Ms. Hina Arya

Course Description

The course provides an introduction of all types of polymer, polymerization and functionality, repeating unit, degree of polymerization, bonding in polymers, Notation and Nomenclature of Polymers, Classification of Polymers. It also provides an understanding of colligative properties, glass transition temperature, and overall concept of molecular weight determination. It explains about step growth polymerization, chain growth polymerization, copolymerization, polymerization techniques and polymer solubility and solution.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the basic concepts of polymer and polymerization techniques.
- Determine Molecular weight of any type of polymer along with all colligative properties.
- Prepare the different types of polymers by solution method in the laboratory level. Also understand the broad concept of step growth and chain growth polymerization.
- Analyse the role of surfactant in various value-added applications like detergency, adhesives, surface coatings, petroleum, pharmaceuticals etc.

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Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02CCHE21: Quantum Chemistry

Faculty: Ms. Hina Arya

Course Description

The course provides basic information about Commutative property; momentum operator; Hamiltonian operator; angular momentum operator; angular momentum operators and their commutation relations; shift operators and their commutation relations; the effect of shift operators on an eigan value of the angular momentum; some theorems. It also provides a broad introduction as well as detailed concept of translational motion of particle, rotational motion of particle, Vibrational motion of particle and H-like atom.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Do commutative operation of any mathematical function.
- Explain the motion of particle in one dimensional as well as three dimensional.
- Understand the Hamiltonian and schrodinger equation.
- Understand the difference between H atom and H like atom.
- Find the energy, frequency and wavelength of electron in any plane and space respectively.

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Course Description and Learning Outcome

SEMESTER – 2

Subject: PS02CCHE22: Organic Chemistry-II

Faculty: Dr. Kinnari Bhatt

Course Description

The course provides information about the different name reactions as well as important reagents used as oxidizing and reducing reagents. It also gives information about how reaction occurs and proceeds with different path ways. Different chemo selective, regioselective and specific reaction and reagents explain the beauty of organic chemistry.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the way how reaction occurs
- Understand the behavioural effect of different reagents.
- Understand selectivity of important reagents.
- Knowledge of important reagents used in synthesis.
- Understand the reaction mechanisms of various name reactions.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - 2

Subject: PS02CCHE 23 **–** Topics in Physical Chemistry - II

Faculty: Dr. Rohit L.Vekariya

Course Description

The course provides an introduction to chemical kinetics and dynamics of chemical reactions on pilot scale to know types of reactions whether it is consecutive chemical reaction, opposing chemical reaction, parallel chemical reaction and its rate of progress and it introduces to practical application in

industry. Basic tools to design quantity of reaction, estimate the time required to complete the reactions. In addition with that one can also know about the orientation of molecules by point group and its chemical applications in group theory. The group theory and its application is very important for competitive exams.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Apply principles of physical chemistry to reaction progress and physical properties.
- Analyse various chemical reactions.
- Have a basic knowledge about point group of molecules.
- Understand the reactions happen in reactor in flow systems.

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Course Description and Learning Outcome

SEMESTER – 2

Subject: PS02ECHE21: Analytical Chemistry

Faculty: Ms. Hina Arya

Course Description

The course provides an overview of fundamentals of analytical chemistry, detailed introduction of verification and validation. It also provides knowledge of assessment of analytical problems and numerical chemistry. It is also about basic area of spectroscopy and components of optical instruments, separation methods and detailed knowledge of chromatography.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the application of analytical concept and apply it in an industry.
- Analyse the analytical problems.
- Understand the terminology and fundamentals of spectroscopy.
- Explain number of separation methods and use it in laboratory.
- Understand the detailed aspects of chromatography, and chromatograph.
- Apply chromatography and their principles in industry.

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Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CORC21 - Organic Spectroscopy
Faculty: Dr. Niraj H. Patel/Dr. Kinnari Bhatt

Course Description

The course mainly deals with molecular spectroscopy and it covers UV, IR, ^{1}H-NMR, ^{13}C-NMR, 2D NMR and mass spectroscopy. It covers almost all aspects like basic principle, theory and application of all mentioned spectroscopy.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to:

- Understand the basic concepts of spectroscopy.
- Understand theory, principle and application of various analytical techniques like IR, NMR, mass Spectroscopy etc.
- One can use the any analytical technique as per the need.
- Useful for identification of purity of sample, structural isomers as well as to confirm the molecular structure of any complex organic compound.

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Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CORC22 – Disconnection Approach
Faculty: Dr. Niraj H. Patel

Course Description

The course deals with design and synthesis of any type of Organic Compound.

It covers reterosynthesis of molecules containing one functional group like alcohol, ketone, ester, amide etc. The course also include disconnection and synthesis of molecules having two functional groups like of α-hydroxy carbonyl

compounds, 1,2-diols, 1,4- and 1,6- dicarbonyl compounds etc. In addition to that it comprises disconnection and preparation of small ring compounds and acyclic and cyclic hetero compounds. The course also covers Protection of organic functional groups using various protecting reagents and removal of protecting groups, Fragmentation reactions and synthesis of complex molecules like Mesoporhyrin – IX and Cephalosporin C, Nootkatone.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to:

- Using this theoretical approach one can design the synthesis of any organic molecule, natural products, drugs etc., and also imagine the various synthetic routes for same organic compound.
- Enhance the theoretical knowledge of various protecting and deprotecting reagents used in organic synthesis.

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Course Description and Learning Outcome

SEMESTER - 3

Subject: PS03CORC23 – Heterocyclic Chemistry
Faculty: Dr. Niraj H. Patel

Course Description

The course deals chemistry of oxygen and nitrogen containing five membered, six membered heterocycles and bicyclic heterocycles. It firstly covers Hantzsch-Widman nomenclature. The course includes synthesis, electrophilic substitution reactions, nucleophilic substitution/displacement reactions, side chain reactivity, oxidation and reduction reactions of all above mentioned heterocycles.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to:

- Understands the behaviour of heterocyclic compounds in various reaction conditions.
- Understand the electrophilic, nucleophilic reactions and synthesis of various heterocycles.
- As many heterocycles possesses various pharmacological activity, via gaining knowledge of this subject, one can plan the synthesis of new heterocyclic compound according to required pharmacological activity.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER – 3

Subject: PS03EORC21: Selected Topic in Organic Chemistry

Faculty: Dr. Kinnari Bhatt

Course Description

The course provides information about dyes and pigments, reasons for the appearance of colour, lighting and deepening of colour, way of modifications in colour and its shades, application of dyes in textile as well as non-textile fields such as colour photography, LCD, photolithiography etc. It also explains us the basics of pericyclic reactions which includes Huckel rule, Molecular orbital theory, cycloddition reactions, electrocyclic reaction, FMO approach sigmatropic rearrangements and ring closing and ring closing reactions.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the way how pericyclic reactions occurs.

- Understand the effect of different reaction pathways and about the symmetry of the product which in turn helpful in the development of new organic compounds with proper/required symmetry products.
- Understand selection of appropriate reaction condition as per the requirements.
- Knowledge of synthesis of different types of dyes at laboratory level.
- Students can learn the methods of dyeing on different fabrics with appropriate dye materials.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04CORC21 – Natural Products
Faculty: Dr. Niraj H. Patel

Course Description

The first unit covers classification, source and methods of isolation of natural products, General methods for the structure determination of natural products. It also includes structure elucidation and synthesis of various vitamins like Vitamin A_1, Vitamin B_1, Pyridoxine, Vitamin H and Vitamin B_2
The second unit covers structure elucidation and synthesis of Morphine, Cinchonine & Tropine. It also includes biogenesis of alkaloids and synthesis of Reserpine and Tylophorine
The third unit deals with structure elucidation and synthesis of terpenoids and carotenoids. It also includes biogenesis of terpenoids and carotenoids.
The fourth unit covers introduction, classification of steroidal hormons and its synthesis. It also covers structure elucidation and synthesis of cholesterol and biogenesis of steroids.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to:

- Have basic knowledge of the source and isolation of natural products.
- Have theoretical knowledge of synthesis above mentioned natural products.
- Via gaining the knowledge of this subject, one can predict the path for structure elucidation of unknown naturally occurring organic compound.

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Course Description and Learning Outcome

SEMESTER – 4

Subject: PS04CORC22: Medicinal Chemistry

Faculty: Dr. Kinnari Bhatt

Course Description

The course is design to inkalcate the knowledge of medicinal chemistry in terms of pharmacokinetics and pharmacodynamics of drugs. It explains administration, absorption, distribution, metabolism and excretion of the drug as well as shows the effect of drugs with receptors, chemical messengers, DNA etc. Different types of drugs for different systems of human body and their relation and mode of action is discussed in this subject in detail.

Learning Outcomes/Capability Development

At the completion of this course, students should be able to

- Understand the way how drug can be administrated, absorbed, distributed and metabolized.
- Understand the relation of drug with different types of receptors, chemical messengers, binding site and DNA.
- Understand the way how drug react with different systems of human body and their mode of action and with the help of that knowledge one can improve the understanding of drug behaviour.
- Co-relate the knowledge of drug behaviour and drug design in the field of synthesis of drug and also in the pharma company.
- Do research and development of drug in much better way.

M.Sc.-Organic Chemistry

Course Description and Learning Outcome

SEMESTER - 4

Subject: PS04CORC23 – Stereochemistry in Organic Compounds
Faculty: Dr. Niraj H. Patel

Course Description

The first unit covers Introduction, various approaches used in Asymmetric synthesis methodology of Asymmetric Synthesis and classification of Asymmetric reactions.
The second and third unit cover various resolution techniques and Resolution of (±)-2-octanol, (±)-phenylethylamine, (±)-alanine. In addition to that it includes the Conformational study of acyclic, cyclic, fused, and bridged cyclic ring compounds.
The fourth unit deals with Molecular Recognition, Chemical and Stereochemical Aspects

Learning Outcomes/Capability Development

At the completion of this course, students should be able to:

- Understand the use of resolution for separation of racemic mixtures.
- Have theoretical knowledge of various chiral reagents, chiral catalysts and chiral solvents used in asymmetric syntheses.
- Understand the various sterochemical aspects of many organic molecules that will help to study relative reactivity and relative product formation.

SEMESTER - 4

Subject: PS04EORC21 – Topics in Organic Chemistry
Faculty: Dr. Niraj H. Patel/Dr. Kinnari Bhatt

Course Description

The course mainly deals with Organometallic chemistry. The first unit covers reaction mechanism of various palladium catalysed cross coupling reactions.
The second unit covers action of various reagents in organic syntheses and study of Sharpless asymmetric hydroxylation, Staudinger reaction, Corey-Fuchs reaction, Ritter reaction, Nef reaction, Mcmurry reaction, Luche reduction, Wacker oxidation, Noyori asymmetric hydrogenation reaction mechanisms.
The third unit covers chemistry of Sulfur, Silicon and Phosphorous in Organic Chemistry. In addition to that it also includes detailed study of Julia Olefination, Peterson reaction and Witting reactions.
The fourth unit is completely based on problem solving in context to Competitive Examinations

Learning Outcomes/Capability Development
At the completion of this course, students should be able to:

- Have theoretical knowledge of various cross coupling reactions.
- Understand the reactivity of sulphur, silicon and phosphorous elements.
- Understand the reaction mechanism of various named reactions.
- Know the question pattern in competitive exam like NET & GATE and learn an approach to solve the questions.