

**ST JOSEPH'S COLLEGE FOR WOMEN (AUTONOMOUS)
VISAKHAPATNAM**

M.SC ORGANIC CHEMISTRY

Programme Specific Outcomes

PSO 1: To be able to acquire firm knowledge over fundamental theories, concepts of all branches of Chemistry and able to apply them to advanced studies. To be able to develop analytical thinking and apply the same for the understanding of underlying principles, proposing mechanism, problem solving, identification of chemical species and arriving to logical conclusion

Level of attainment: 64.61%

PSO 2: To be able to gain knowledge in classical laboratory techniques and be able to use modern instrumentation, so that they can perform new experiments, obtain experimental data and its interpretation through theoretical principles

Level of attainment: 94.23%

PSO 3: To be able to integrate knowledge learned in Chemistry to various Industry and Pharmaceutical needs. To be able to access, search and use the chemical literature and also able to work on spreading the science through CASE programme

Level of attainment: 100%

M.Sc Organic Chemistry --Course Out Comes

Students after the completion of the course are able / expected to

Semester –I

CH 101: GENERAL CHEMISTRY -1

CO 1: Explain accurate description of microscopic system.

CO 2: Analyze and focus on Quantum chemistry and its applications of quantum mechanics.

CO 3: Compare 1- dimension and 3- dimension wave equations and calculate the zero point energies.

CO 4: Interpret the selection rules for various wave equations.

CO 5: Calculate the energy levels and degeneracy in various wave equations.

CO 6: Understand the concepts of orthogonality and normalization.

CO 7: Understand the concept of tunneling

CO 8: Derive the energy expression for harmonic and anharmonic oscillators

CO 9: Predict the feasibility of electron transitions based on selection rules.

CO 10: Analyze microwave, IR, Raman, and electronic spectra

CO 11: Calculate the bond strength and bond length from microwave and IR spectra

Level of Attainment : 71.70%

CH 102: Inorganic Chemistry- 1

CO1: Construct M.O. energy level diagrams from Symmetry Adopted Linear Combination (SALC) of atomic orbitals

CO 2: Interpret the electronic spectra of complex compounds

CO 3: Understand the structure and bonding of inorganic compounds

CO4: Learn the preparations and properties of inorganic compounds

CO5: Apply the VSEPR theory to find out the structures of molecules and ions

CO 6: Compare and explain the magnetic properties of transition and inner transition elements

CO 7: Explain Orgel and Tanabe-Sugano diagrams

CO 8: Construct the pigeon-hole diagram to determine the term symbols

CO 9: Explain the Walsh diagram for H_2X .

CO 10: Predict the feasibility of electron transitions based on selection rules.

Level of Attainment : 51.75%	
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CH 103 - Organic Chemistry –I

CO 1: Understand the concepts of Aromaticity w.r.t. benzenoid, nonbenzenoid molecules and ions

CO 2: Apply Hückel's and Craig's rule to differentiate between aromatic and nonaromatic compounds

CO 3: Gain insights into generation, stability and reactions of organic intermediates

CO 4 : Predict the stability of reaction intermediates on the basis of electronic effects

CO 5: Project the 3Dimensional molecules in two dimensional way using Various Projection Formulae

CO 6: Determine the absolute and relative configurations of optical and geometrical isomers

CO 7: Derive the structure of some typical alkaloids and terpenoids

CO 8: Gain firm knowledge on Aromatic nature, preparation, properties and applications of heterocyclic compounds

CO 9: Predict the stabilities of cyclohexane and its derivatives

CO 10: Describe the optical isomerism exhibited by the molecules, which are not having asymmetric carbons

Level of Attainment : 46.35%	
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CH 104: PHYSICAL CHEMISTRY-1

CO 1: Develop and understand the breadth and concept of physical chemistry. And understand methods employed for problem solving.

CO 2: Describe, define the knowledge of polymer chemistry, photo chemistry, and electrochemistry and apply the basic principle.

CO 3: Gain knowledge in various principles and laws of physical chemistry along with feasibility and energy changes in chemical reaction.

CO 4: Determine various methods of molecular weight determinations by mathematical and instrumentation methods.

CO 5: Compare and classify about various types of macro molecules.

CO 6: Analyze as a member of an interdisciplinary problem solving team.

CO 7: Determine how chemical reaction rates, rate constants and equilibrium constants are measured.

CO8: Acquire firm foundation in fundamentals and applications of current reactions.

CO 9: Explore new area of research in both chemistry and allied fields of science and technology.

CO 10: Relate chemical equilibrium concept in various fields of chemistry.

Level of Attainment : 51.66%	
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CH 105: Inorganic Chemistry Practical -1

CO 1: Analyze radicals present in a compound

CO 2: Handle of chemicals and apparatus

CO 3: Analyze the principles involved in the preparations of complex compounds

CO 4: Weigh and prepare the solutions

CO 5: Eliminate the interfering anions

Level of Attainment : 93.56%	
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CH 106: Preparation of some organic compounds

CO 1: Acquire hands on experience on for the handling of Equipment, Glassware , Chemicals and safety measurements

CO 2: Develop the skills like preparation of solutions , crystallization techniques, checking the purity of compounds and collection of pure samples

CO 3: Correlate theoretical knowledge in the various steps of compound preparation

CO 4: Adopt the Techniques like Acetylation, Benzoylation, Nitration, Methylation, Condensation, Bromination , Deamination in the Preparation of Organic compounds

CO 5: Adopt the principles like Beckman's Rearrangement and Hoffmann's Rearrangement for preparation of Organic Compounds

Level of Attainment : 96.42%	
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CH 107: PHYSICAL CHEMISTRY Practicals-1

CO 1: Develop skill in procedure, principle and instrumental methods applied in analyzing practical tasks by using conduct meter.

CO 2: Apply the Nernst distribution law and utilize these laws in determining partition coefficient value and estimate the unknown samples.

CO 3: Interpret the data from an experiment, including construction of appropriate graph and evaluating error.

CO 4: Present the result of a practical investigating in a concise manner.

CO 5: Observe the changes in physical and chemical properties of a reaction.

Level of Attainment : 92.39%	
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Semester -II

CH 201: GENERAL CHEMISTRY -2

1. Perturb the time dependant and time independent wave functions.
2. Derive mathematical expression for molecular orbital.
3. Apply LCAO approximation for one electron system.

4. Derive expression for valence bond theory.
5. Apply the orthogonality theorem to construct the character table for a point group.
6. Understand the basics of computers
7. Analyze the character tables
8. Demonstrate the ball and stick models for various structures of molecules.
9. Evaluate the irreducible representations from reducible representations.
10. Draw the flow charts and programs in FORTRAN to solve the problems in chemistry

Level of Attainment : 81.96%

CH 202: Inorganic Chemistry -2

CO 1: Understand the structure and bonding of inorganic compounds

CO 2: Explain the mechanisms of inorganic reactions and derivations of rate equations

CO 3: Learn the preparations and properties of inorganic compounds

CO 4: Compare the stability of complexes using HSAB principle

CO5: Determine the stability constants of compounds using techniques like pH metric method, Job's method, etc

CO 6: Apply the 18 electron rule to determine the stability of organometallic compounds.

CO 7: Understand the concepts of inner sphere and outer sphere mechanisms

CO 8: Analyze the types and number of metal-metal bonds in metal clusters.

CO 9: Learn the factors favorable for the formation of metal clusters.

CO 10: Apply the rate laws in determining the mechanism of the reactions

Level of Attainment : 64.17%

CH 203 - Organic Chemistry –II

CO 1: Understand the concepts of Aromatic substitution reactions ie Electrophilic, nucleophilic, radical

CO 2: Gain insights into aliphatic nucleophilic substitution reactions

CO3: Apply the knowledge of mechanistic approach for various types of addition reactions

CO 4: Identify and predict the mechanism of Name reactions

CO 5: Identify the suitable conditions for the generation of reactive species and reaction intermediates

CO 6: Select the appropriate reagents to bring required reactions in substrate molecules

CO 7: Derive knowledge about spectroscopic techniques UV, IR, NMR & Mass

CO 8: Employ spectral data to verify functional nature of molecules and derive the structure of molecules

CO 9: Derive the structures of Nicotine, Atropine, quinine, caffeine,

CO 10: Describe the configurational studies of glucose & fructose

Level of Attainment : 57.50%

CH 204: PHYSICAL CHEMISTRY -2

1. Relate and measure the thermo dynamical state functions and predicting equilibrium concentrations of dissolving and reacting by the usage of electro chemistry principle.
2. Determine the structure of an unknown compound using chemical shift, T. M.S and coupling constant in N.M.R.
3. Determine the structure of unknown sample by the utility of hyperfine splitting in E.S.R .
4. Predict number of free radicals present in a sample.
5. Utilize the magnetic susceptibility of closely related quantities to the solution of problems by the usage of magneto chemistry.
6. Analyze and compare between electric double layer and liquid junction potential.
7. Calculate E.M.F of the cells.
8. Apply and analyze E.S.R principle in determining the nature and number of free radicals present in biological aspects.
9. Construct a cell and interpreting data.
10. Compare between a chemical cell and concentration cells.

Level of Attainment : 65.07%

CH 205: Inorganic Chemistry Practical- II

CO 1: Estimate the amount of a substance present in an unknown solution by gravimetric and volumetric analysis

CO 2: Handle the chemicals and apparatus

CO 3: Prepare and standardize the solutions

CO 4: Prepare the indicators and buffer solutions

CO 5: Analyze the concepts of solubility rules

Level of Attainment : 96.42%

CH 206: Analysis of Organic Compounds

CO 1: Acquire the skills of testing the solubilities and the regeneration of organic compounds

CO 2: Identify the presence of extra-elements (nitrogen, halogens and sulphur) and unsaturation

CO 3: Characterize the functional nature of given compounds

CO 4: Prepare solid derivatives for the given compound as per the functional group present in it

CO 5: Predict the structure of given compound basing on experimental observations with the correlation of theory knowledge

Level of Attainment : 96.21%

CH 207: PHYSICAL CHEMISTRY PRACTICALS -II

CO 1: Develop the skill in procedure, principle and instrumental methods applied in analyzing practical tasks by using potentiometer.

CO 2: Apply the laws and utilizing these laws in determining equilibrium constants and estimating unknown samples by using partition coefficient value.

CO 3: Interpret the data from an experiment, including construction of appropriate graph and evaluating error.

CO 4: Present the result of a practical investigating in a concise manner.

CO 5: Observe the changes in physical and chemical properties of a reaction.

Level of Attainment : 92.5%

Semester -III

CH 301 Reaction Mechanism-1 & Pericyclic Compounds

CO1: Analyse the various features of aliphatic nucleophilic substitution.

CO2: Gain knowledge on ambident nucleophiles, neighbouring group participation.

CO3: Interpret anomeric effect shown by sigma, pi bonds participation in acyclic, bicyclic systems,

CO4: Gain mechanistic insights into SE^1 , SE^2 Processes

CO5: Describe Meyer's synthesis of aldehydes, ketones and carboxylic acids

CO6: Acquire Knowledge on Pericyclic reactions, Symmetry properties and Frontier molecular orbitals.

CO7: Describe Electrocyclic reactions mechanism, and the stereo aspects

CO8: Gain knowledge on cycloaddition reactions mechanism and the stereo aspects different types of reactions.

CO9: Describe sigmatropic reactions, mechanism and the stereo aspects.

CO10: Describe the ene reaction, fluxional molecules

Level of Attainment : 71.98%

CH 302: Organic Spectroscopy -I

1. Interpret the structure of the organic molecules by using spectroscopy techniques.
2. Apply UV-Visible spectroscopy technique to identify the conjugation present in molecule.
3. Identify the various functional groups present in the organic molecule by using IR (Infrared) spectra.
4. Compare and differentiate organic molecules with Infrared spectroscopy.
5. Identify the nature of spin active nuclei by using NMR (Nuclear Magnetic Resonance Spectroscopy) spectroscopy.

6. Analyze the mass of organic molecule and fragments present in the molecule from mass spectral studies.
7. Separate organic molecules from the sample containing mixture of compounds by employing chromatography techniques.
8. Apply Thin layer chromatography and paper Chromatography to check the process of a chemical reaction.
9. Demonstrate the Column Chromatography for the purification of the organic sample.
10. Separate organic compounds from the mixture by using Solvent extraction, Electrophoretic methods.

Level of Attainment : 70.10%

CH 303: Organic Synthesis - I

1. Design a plan to synthesize organic compounds with different functional groups.
2. Develop methods to construct C-C and C=C bonds.
3. Analyze the formation of regioselective, enantioselective, diastereoselective products by using various reagents.
4. Explain the formation of various organic compounds by using organoboranes and silanes.
5. Explain HLF, Barton and reactions of organic hypohalites for reactions at unactivated C-H bonds.
6. Classify preparation methods of polymers and applications of polymers.
7. Summarize the involvement of enolates, enamines for the formation of C-C bonds.
8. Demonstrate on aldol, mannich, Umpolung, robbinsons annulation named reactions to construct the C-C bond.
9. Identify usage of organometallic reagents in the development of C-C bond helps to know the importance of organo metallic compounds in synthesis.
10. Explain pyrolyticsyn elimination, Sulfoxidesulfenate rearrangement, Shapiro reaction, Bamford-stevens reaction, wittigractraction for the formation of C=C bonds.

Level of Attainment : 63.30%

CH 304: NATURAL PRODUCTS & BIO POLYMERS-I

CO1: Understand alkaloids: Occurance, Isolation , structural illustration ,synthesis & bio synthesis.

CO2: able to classify different amino acids.

CO3: design and understand amino acid synthesis in various different methods.

CO4: Understand best methods for the synthesis of peptides.

CO5: Acquired knowledge on Iso electric point of aminoacids.

CO6: Categorize advantages and disadvantages of antibiotics.

CO7: Gain insights in to the the occurance & isolation of antibiotics.

CO8: Describe the structure and synthesis of various antibiotics.

CO9: understand about the occurance & Isolation of Terpenes.

CO10: Gain knowledge on structure & synthesis of various terpenes.

Level of Attainment : 58.33%

CH 305 Multistage synthesis of Organic compounds

CO 1: Acquire hands on experience on for the handling of Equipment, Glassware, Chemicals and safety measurements

CO 2: Able to acquire the skills like preparation of laboratory reagents, crystallization techniques, calculation of expected yields and checking the purity of compounds by the use of Chromatography

CO 3: Adopt the procedures like sulphonation, diazotization, condensation, acetylation, oxidation and reduction in various steps of multistage synthesis

CO 4: Correlate theoretical knowledge in the various steps of compound preparation

CO 5: Characterize the functional nature of the compound, its polarity a purity by the use of chromatography techniques

Level of Attainment : 93.75%

CH 306: Chromatography

CO 1: Acquire the hands on experience on handling the Equipment, Glassware, Chemicals, coating of TLC plates, setting of Column, Paper Chromatograms

CO 2: Understand the principles of separation using TLC, Column and Paper Chromatography

CO 3: Test the purity of compounds prepared in the laboratory by correlating with standard samples

CO 4: Predict the solvent systems to run TLC, Paper and Column Chromatographs

CO 5: Analyse the observations and draw the conclusions

Level of Attainment : 93.75%

Semester -IV

CH 401 Reaction Mechanism-II & Photochemistry

CO 1: Gain insights into mechanistic and stereochemical features of addition reactions

CO 2: Correlate addition to carbon - carbon and carbon hetero atom multiple bondings

CO 3: Understand the concepts of Elimination reactions like mechanism, orientation, stereochemistry

CO 4: Develop concepts of hydrogenation, homogeneous and heterogeneous

CO 5: Derive principles of name reactions like Mannich, Wittig, Tollen's, Prins

CO 6 : Acquire firm knowledge on rearrangement reactions like Classification

General mechanistic treatment and typical rearrangements like Wagner-Meerwein, Tiffman, Neber, Hoffman, and Steven's,

CO 7: Acquired knowledge on photochemical excitation with reference to Norrish

type I, Norrish type II reactions and Paterno Buchii reactions,

CO 8: Gained knowledge on elaborated photochemical reactions of carbonyl

reactions

CO 9: Gain insights into mechanistic aspects of important photochemical

Reactions with alkenes and the photo equilibrium state.

CO 10: Gain insights into mechanistic aspects of Aromatic compounds with 1-2,

1-3,1-4 additions

Level of Attainment : 96.32%

CH 402 Organic Spectroscopy II

1. Apply ORD & CD curves for the identification of absolute stereochemistry of the compounds.
2. Separate Chemical shift and coupling constants to get simple spectra by using 2D-NMR techniques.
3. Apply mass spectrometry to differentiate two organic compounds.
4. Demonstrate different XRD instrumental analysis.
5. Study High performance liquid chromatography and gas chromatography for purification of organic compounds.
6. Apply UV-Visible, FTIR and ^1H NMR spectroscopy and Mass spectrometry to interpret the structure of the organic molecule.
7. Demonstrate circular birefringence and circular dichroism to get the knowledge on interaction of optically active compound with the linearly polarized light.
8. Study many pulse experiment to convert the complex spectra into simple spectra.
9. Explain HOMO-COR spectra to study the coupling between homo nuclei helps the student to identify the type of ^1H nucleus in the organic molecule.
10. Discuss HETCOR spectra to study the interaction between ^1H nucleus and ^{13}C nucleus helps the student to identify the attachment of proton to carbons.
11. Study the theory of ESR (Electron spin resonance) spectroscopy and calculation of number of signals appeared in the ESR spectra of organic radicals (paramagnetic substances) helps the students to identify the structure of the paramagnetic substances.

Level of Attainment : 54.54%

CH 403: Organic Synthesis II

1. Design a reverse method to reconstruct the organic molecules, this helps the student to get the knowledge on the better approach for the synthesis of organic molecule by using retrosynthetic analysis.
2. Summarize the oxidizing and reducing agents used to convert one functional group into other.
3. Discuss different oxidizing and reducing methods for formation of desired functional groups.
4. Study organosilanes for the formation of various organic compounds.
5. Discuss on linear and convergent synthesis in retrosynthesis to identify the reverse path for the synthesis of target molecule.
6. Illustrates different oxidizing agents for oxidation of alkanes, alkenes, alcohols and carbonyl compounds.
7. Study various oxidizing agents such as KMnO_4 , OsO_4 , NBS, HIO_4 , Lead tetraacetate, CrO_3 and SeO_3 to identify proper method to oxidize a particular functional group.
8. Discuss different reducing methods for formation of desired functional groups.
9. Demonstrate on various approaches i.e. Catalytic reductions and reductions by chemical reactions to identify the reducing methods of organic functional groups.
10. Summarize the application of LiAlH_4 , NaBH_4 , DIBAL, AlH_3 , BH_3 , Li/Na in liq NH_3 , Zn-Hg/HCl , $\text{NH}_2\text{-NH}_2$ reducing agents helps to choose a proper reagent for the reduction of particular functional group.
11. Discuss formation of stereoisomers after reduction with the use of Felkin-Anh model and Cram's rule to predict the stereochemistry of the product after reduction.

Level of Attainment : 72.81%

CH 404 : NATURAL PRODUCTS & BIO-POLYMERS-II

CO1: Gain knowledge about the concepts & composition of RNA & DNA

CO2: Classify different Nucleic acids

CO3: Gain firm knowledge on structure of Nucleic acids

Co4: Acquire knowledge on importance of Rotenone insecticide

CO5: Understand different types of Acetogenesis & Shikimates

CO6: Describe the structure & synthesis of Cholesterol

CO7: Acquire knowledge on Bio synthesis of various Terpenes

CO8: Understand about the biological properties of Steroids

CO9: Gain insights in to Isolation, Occurrence & Structural properties of Alkaloids

CO10: Understand about the biological activity & synthesis of Alkaloids

Level of of Attainment : 56.52%

CH 405: Organic Mixture Analysis

CO 1: Identify the appropriate solvent for the separation of two
Components of the mixture

CO 2: Identify the appropriate regenerating agent/s to precipitate to precipitate the given
compounds from the solution phase

CO 3: Carry thorough analysis of the two compounds, identify the functional group and
prepare solid derivatives

CO 4: Predict the structure of the given compounds correlating experimental
observations and theoretical knowledge

CO 5: Demonstrate practical techniques for peers and juniors

Level of of Attainment : 93.47%

CH 406: Organic Isolations and Estimations

CO 1: Acquire the skills of preparing the solutions of required strengths for estimations and
standardising them

CO 2: Estimate the concentration of Glucose, Aniline and Sucrose by titrametric method

CO 3: Familiarize techniques involved in the solvent extraction and isolation of natural products
from plants

CO 4: able to extract Caffeine from Tea leaves and Coffee beans,

Lycopene from Tomatoes

CO 5: Demonstrate practical techniques to peers and juniors

Level of of Attainment : 93.47%