

PROGRAMME OUTCOME, PROGRAMME SPECIFIC OUTCOME AND COURSE OUTCOME

M. Sc. Chemistry (Organic Chemistry) :	
PROGRAMME OUTCOME	<p>On successful completion of M.Sc. Chemistry (Organic) Programme, students will have the ability to:</p> <ul style="list-style-type: none">➤ Gains complete knowledge about all fundamental aspects of all the branches of chemistry.➤ Understands the background of organic reaction mechanisms, complex chemical structures, quantum chemistry, molecular spectroscopy, structure elucidation of organic molecules, chemical analysis, molecular rearrangements and separation techniques.➤ Learn about the possible uses of analytical industrial chemistry, medicinal chemistry and green chemistry.➤ Think critically and analyze chemical problems.➤ Present scientific and industrial information resulting from laboratory experimentation in both written and oral formats.➤ Work efficiently and safely in a laboratory atmosphere.➤ Work in teams as well as independently.
PROGRAMME SPECIFIC OUTCOME	<p>After successful completion of M. Sc. Chemistry (Organic) programme the candidate will be:</p> <ul style="list-style-type: none">➤ Worldwide level research opportunities to pursue Ph. D. programme targeted approach of CSIR –NET, GATE examination.➤ Vast job opportunities at all level of chemical, pharmaceutical, food products, polymer, Health and life sciences oriented industries.➤ Specific placements in R & D and synthetic division of polymer & Material industries.➤ Discipline specific competitive exams conducted by service commission.➤ Opportunities to get jobs in central and state government organizations like IISc, IIT, NCL, ONGC, ISRO FSL etc.

COURSE OUTCOMES

I Semester

Inorganic Chemistry I (Ch-101)

- To develop interest among students in various branches of inorganic chemistry.
- To make them understand about chemical bonds and theories involved, stable molecule formation, crystal structure, important inorganic materials with wide applicability, various solvent systems, instrumental methods to explain the properties of compounds, metal carbonyls and metal clusters and nuclear chemistry.

Organic Chemistry I (Ch-102)

- After completion of these courses students should be able to;
- Understand the nature of bonding, particularly delocalization, conjugation, cross-conjugation, resonance, hyperconjugation, tautomerism, etc.
 - Realize the terms aromaticity, anti-aromaticity, homoaromaticity in different organic molecules.
 - Know about the class of meso-ionic compounds and alternant and non-alternant hydrocarbons.
 - Know about the definition and significance of synthetic molecular receptors with their structure and synthesis.
 - Know about the various reactive intermediates in organic synthesis.
 - Know about the types of reactions and mechanisms by realizing the various factors which are affecting on the reactions.
 - Understand the methods of determining mechanisms based on different factors.
 - Realize the concept of hard and soft acids and bases.
 - Understand the concept of stereochemistry by writing the different projection formulae.
 - Realize the concept of isomerism with the help of various rules and interconversions.
 - Write the conformations of different molecules and understand the conformational analysis.
 - Write the nomenclature and conformations of fused and bridged ring systems.
 - Understand the concept of prochirality.
 - Know about the carbohydrates and realize their reactions.

	<ul style="list-style-type: none"> • Know about the heterocyclic compounds and write their names. • Understand the structure and reactivity of various heterocyclic compounds. • Know about the biological importance and synthesis of different vitamins.
<p>Physical Chemistry I (Ch-103)</p>	<p>After studying the course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> • Able to understand the origin of quantum mechanics and identify the phenomena responsible for failure of classical mechanics • Able to understand the physical significance and commutation properties of angular momentum orbital and spin angular momentum operator in quantum mechanics • Able to appreciate the application of perturbation theory and variation method for studying complex chemical systems • Capable of writing and solving the Schrödinger equation for complex systems using quantum mechanical concepts. • Able to define rate law and rate constant, Arrhenius Equation, physical significance of Activation Energy and capable of solving the numerical problems • Capable of deriving the rate constant on the basis of collision theory, assumptions and principles of Transition State Theory • Understands and learns the skills used in various types of Flow Systems, different techniques for the study of kinetics of fast reactions, relaxation time for temperature jump method, Pressure Jump Method
<p>Analytical Chemistry (Ch-104)</p>	<p>The student will be able to;</p> <ul style="list-style-type: none"> ➤ Analysis the variations of practical errors. ➤ Differentiate the qualitative and quantitative analysis. ➤ Do the chromatographic experiments. ➤ Gains the potential about different precipitation processes. ➤ Determines the procedure for electro analytical techniques. ➤ Determines the procedure for thermo analytical techniques. ➤ Validates the strength of spectro analytical techniques.
<p>Mathematics for Chemistry (Ch-105)</p>	<p>The student will be able to;</p> <ul style="list-style-type: none"> ➤ Basic concepts of mathematics. ➤ Differentiation problems related to chemistry. ➤ Do vectors problems related to symmetry operation in molecular spectroscopy.

<p>Inorganic chemistry Practical-I (Ch-106)</p>	<ul style="list-style-type: none"> • To impart the students thorough knowledge of systematic qualitative analysis of mixtures containing two anions and three cations with interfering ion by Semi micro qualitative method.
<p>Inorganic chemistry Practical-II (Ch-107)</p>	<ul style="list-style-type: none"> • Preparation of Complexes to make the students to understand the various requirements for coordination complex preparation and analysis.
<p>Physical chemistry Practical-I (Ch-108)</p>	<ul style="list-style-type: none"> • The students will be able to determine the rate constant theoretically and graphically for the hydrolysis and saponification of esters • Able to verify Beer's Law and estimate the concentration of Cu^{2+} and Fe^{2+} ions by colorimetric method and also evaluate the molar extinction coefficient. • Able to estimate of Fe^{2+} ions in a given solution by titrating FAS versus KMnO_4 solution using colorimetric method. • Able to determine an extensive property i.e partial molar volume of solute (NaCl or KCl) – water system by apparent molar volume method
<p>Physical Chemistry Practical-II (Ch-109)</p>	<ul style="list-style-type: none"> • The student will be able to perform conductometric and potentiometric titrations • Able to study and perform precipitation reactions between Li_2SO_4 and BaCl_2 and can determine the concentration of Li_2SO_4 conductometrically. • Also able to perform the conductometric titrations between acids and salt mixtures against bases and determine its concentration. • Able to determine the dissociation constant of weak acid (CH_3COOH) and Equivalent conductance of a strong electrolyte. • Able to determine the pKa and Ka values of the weak acid by titrating against a strong base using quinhydrone electrode. • Able to prepare different buffer solutions and can determine the pH values of buffer solutions by using quinhydrone electrode and glass electrode.
<p>II Semester</p>	
<p>Inorganic Chemistry II (Ch-201)</p>	<ul style="list-style-type: none"> ➤ To develop ability in the students to understand the formation of stable complexes, their instability and their applicability in day to day life. ➤ To make them understand about various theories such as CFT, LFT, MOT, Orgel and T-S diagrams to know the formation of complexes. ➤ To inculcate the ability of understanding theoretically

	different instrumental and spectroscopic methods available for the analysis of complexes.
Organic Chemistry II (Ch-202)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Attain the skills for correct stereochemical assignment and interpretation in rather simple organic molecules. ➤ Formulate mechanistic study of organic reactions and synthesis. ➤ Basic concepts, classification and biological significance of vitamins and amino acids. ➤ Rearrangement reaction in organic chemistry.
Physical Chemistry II (Ch-203)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> • Know about free energy functions i.e. Gibb's free energy and work function, dependence of Gibbs free energy on temperature and pressure, Gibb's Helmholtz equation • Learn different Maxwell relations, Derive Gibb's Duhem equation, determine partial molar volume through intercept method • Know the concept of fugacity, Determine the coefficient of fugacity • Learn about the third law of thermodynamics, the concept of residual entropy, the significance of irreversible thermodynamics • Differentiate between equilibrium and non-equilibrium thermodynamics, postulates of non-equilibrium thermodynamics. • Know briefly about the concept of entropy, Study the entropy produced due to heat flow, Derive entropy produced in chemical reaction, Analyze the dependence of rate of the reaction on the rate of entropy production • Understand Statistical Mechanics and the role of Statistical Mechanics in Chemistry • Understands the relationship between statistical mechanics and quantum mechanics, different types of statistics applied to types particles present in a system • Understands the Debye Hückel Theory, its postulates and its mathematical treatment, Overview of the ionic cloud theory, the ionic cloud around the central ion, • Distribution of charge of ionic atmosphere in space around the central ion, Calculation of the Contribution of the Ionic Cloud to the electrostatic potential $r \psi$
Spectroscopy I (Ch-204)	<ul style="list-style-type: none"> • After studying this module, student shall be able to learn about the nature and properties of electromagnetic waves. • Able to learn about classical picture of light and electromagnetic waves, its spectrum and briefly the kinds of

	<p>spectroscopy observed in each region of the electromagnetic spectrum.</p> <ul style="list-style-type: none"> • Able to understand the different kinds of molecular spectroscopy and how it is different from atomic spectra. • Understand about rotational spectroscopy and the rigid rotator model to describe a rotating diatomic molecule, as well as the quantization of rotational energy levels. • The student will be able to: (a) Understand the interacting forces in species (b) Understand the essentials of Simple Harmonic Motion (c) Get a brief introduction to normal coordinates. • The student will be able to: (a) Understand electronic transitions of diatomic molecules (b) Use the Franck-Condon principle to predict the shape of the absorption curve • The student will be able to understand: (a) Use Group Theory to predict the normal modes of vibration of polyatomic molecules (b) Determine their IR and Raman activity. • The student will be able to understand: (a) The electronic structure of diatomic molecules (b) Molecular term symbols (c) Selection rules for electronic transitions. • The student will be able to understand: (a) Understand the vibrational Raman spectra (b) Understand the variation of the polarizability ellipsoid of a molecule during a vibration of triatomic molecules. (c) Understand and apply the Rule of Mutual Exclusion. (d) Understand the polarization of Raman lines.
<p style="text-align: center;">Green Synthesis (Ch-205)</p>	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Understand the concept of green synthesis. • Know about the use of ultrasound in different organic reactions with instrumentation and phenomenon. • Know about the use of microwaves in different organic reactions with instrumentation and phenomenon. • Know about the ionic liquids with their structure and synthesis. • Realize the use of ionic liquids as green synthetic method in organic synthesis. • Understand the concept of polymer supports in organic synthesis. • Know about the choice of polymer supports by knowing their properties and advantages. • Realize the use of polymer supports by their applications in various reactions. • Understand the concept of phase transfer catalysts. • Realize the concept of phase transfer catalysis by knowing the definition and mechanism.

	<ul style="list-style-type: none"> • Know about the applications of phase transfer catalysts in organic synthesis. • Know about the use of crown ethers as a green synthetic method in organic synthesis by knowing their features. • Realize the applications of crown ethers in organic synthesis. • Understand the concept of multicomponent reactions in organic synthesis. • Know about the mechanistic aspects and use of some multicomponent name reactions.
Inorganic chemistry Practical-III (Ch-206)	➤ Volumetric Analysis to develop skills for quantitative estimation using the different types of volumetric Analysis methods.
Inorganic chemistry Practical-IV (Ch-207)	➤ Gravimetric Analysis to give training in the quantitative analysis of metal ions using gravimetric method.
Physical chemistry Practical-III (Ch-208)	<ul style="list-style-type: none"> • The student must be able study the hydrolysis at two different temperature and concentration and report the relative strength and energy of activation. • Able to evaluate the Arrhenius parameter for the reaction between $K_2S_2O_8$ versus KI (first order). • Able to determine the dissociation constant of a given indicator by colorimetric method.
Physical Chemistry Practical-IV (Ch-209)	<ul style="list-style-type: none"> • The student will be able to perform conductometric and potentiometric titrations. • Also able to perform the conductometric titrations between of mixture of strong acid and weak acid versus strong base against bases and determine its concentration. • Also able to perform the titrations between of mixture of strong acid and weak acid versus strong base against bases and determine its concentration pH metry. • Able to determine acidic and basic dissociation constant and isoelectric point of an amino acid by pH metry • Able to determine the pKa value or dissociation constant of phosphoric acid. • Able to determine pH of acetic acid with sodium acetate buffer by potentiometric method. • Also able to determine the concentration and amount of $K_2Cr_2O_7$ and $KMnO_4$ by titrating against FAS and calculation of redox
III Semester	
Organic Reaction Mechanisms (Ch-301)	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Understand the concept of aliphatic nucleophilic and electrophilic reactions. • Realize about the different types of nucleophilic substitution

	<p>reactions in aliphatic compounds.</p> <ul style="list-style-type: none"> • Know about the different positions of nucleophilic substitution reactions in different class of compounds. • Realize about the different types of electrophilic substitution reactions and their mechanisms in aliphatic compounds. • Understand about the free radical chemistry. • Know about the generation of free radicals. • Know about the different types of free radical mechanisms in different class of compounds. • Know about the various name reactions which are involved with free radicals. • Understand the concept of organic photochemistry with different processes and terminologies. • Know about the photochemical reactions of various classes of compounds like olefins, carbonyl compounds, aromatic compounds. • Know about the various photochemical oxidation and reduction reactions. • Understand the concept of pericyclic reactions like electrocyclic, cycloaddition and sigmatropic reactions on the basis of MO pictures and different approaches. • Understand the concept of biochemical reactions and mechanisms involved in living systems. • Know about the various reactions involved with different biomolecules in the living systems.
<p style="text-align: center;">Chemistry of Natural Products (Ch-302)</p>	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Classification, isolation and source of the different natural products. ➤ Basic properties and significance of natural products like alkaloids, terpenoids, prostaglandins etc. ➤ Biosynthesis of natural products. ➤ Chemical synthesis of natural products. ➤ Structure elucidation of natural products. ➤ Various chemical conversions of natural products. ➤ Classification, synthesis and significance of insect pheromones.
<p style="text-align: center;">Organic Spectroscopy (Ch-303)</p>	<p>The student will be able to:</p> <ul style="list-style-type: none"> ➤ Understand basic concepts of organic spectroscopy. ➤ Learn the fundamentals of instrumentation of UV, IR, NMR and mass. ➤ Calculate the λ_{\max} value of organic molecules by Woodward rules. ➤ Analysis of organic molecules by different spectroscopic techniques.

	<ul style="list-style-type: none"> ➤ Do fragmentation pattern (analysis) of organic molecules by using mass spectrometry.
Open Elective (Ch-304)	<p>The student will be able to:</p> <ul style="list-style-type: none"> ➤ Understand the basic concept of banking and finance. ➤ To account for a range of advanced financial accounting issues.
Organic Chemistry Practicals-I (Ch-305)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Handling of the hazardous chemicals by safely. ➤ Predict and analysis of the major and minor products of a variety of organic reactions. ➤ Monitoring of the chemical reactions. ➤ Calculation of yield, percentage yield of the chemical reactions.
Organic Chemistry Practicals-II (Ch-306)	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Understand the concept of Qualitative analysis. • Understand the types of reactions involved in organic synthesis. • Realize the various functional groups which are there in different organic molecules. • Develop skills to understand the reactions of different functional groups by the hands on experience. • Know about the predictions of various reactions involved in a particular organic molecule by the changes which are occurred in apparatus. • Understand the waste management.
Organic Chemistry Practicals-III (Ch-307)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Organic reaction mechanism of the chemical reaction. ➤ Purification of the organic compounds by crystallisation, precipitation and distillation etc. ➤ Product analysis by physical and chemical methods.
Organic Chemistry Practicals-IV (Ch-308)	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Understand the concept of titrimetric quantitative estimations. • Understand the concept of standard solutions. • Prepare standard solutions. • Know about the Use of burettes, pipettes and other glass apparatus. • Know about the estimation of amount of unknown sample and the number of functional groups in an unknown organic compound.
IV Semester	
Organometallic and Heterocyclic Chemistry (Ch-401)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Use of organometallic reagents in organic synthesis. ➤ Properties of various organometallic reagents. ➤ Mechanism of organometallic reagents in organic synthesis.

	<ul style="list-style-type: none"> ➤ Synthesis of heterocycles including seven and eight membered ring. ➤ Classification, chemistry of some important meso-ionic heterocycles and their applications.
<p style="text-align: center;">Stereochemistry & Retrosynthetic Analysis (Ch-402)</p>	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Understand the concept of stereochemistry in various class of compounds. • Know about the optical activity in different class of compounds which are not having any chiral atom. • Know the assignment of R and S configurations in various classes of compounds in the absence of chiral atoms. • Understand the concept of optical activity due to the presence of hetero atoms. • Know about the transannular reactions with their conformational analysis. • Know about the determination of absolute and relative configuration with the help of different methods. • Understand the concept of retrosynthetic analysis. • Know the various termed involved in the retrosynthesis. • Know about the different disconnection approaches with chemo selectivity and reversal of polarity. • Know about the protecting groups for different functional groups. • Know about the C-C one group and two group disconnections by their applications in different organic reactions. • Know about the concept of ring synthesis with the help of retrosynthesis. • Know about the synthesis of some complex molecules using disconnection approach.
<p style="text-align: center;">Organic Synthesis (Ch-403)</p>	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Reaction mechanism of various reactions of C-C and C-N bond forming reactions. ➤ Oxidation reactions and their mechanism. ➤ Reduction reactions and their mechanism. ➤ Basic concepts of asymmetric synthesis. ➤ Idea of Chemoselectivity and stereoselectivity.
<p style="text-align: center;">Medicinal Organic Chemistry (Ch-404)</p>	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Drug-receptor interactions. ➤ Metabolism of the drugs in the body. ➤ Classification of the according to therapeutic use or action. ➤ Synthesis of various classes of the drugs. ➤ Mechanism action of different classes of drugs.

	<ul style="list-style-type: none"> ➤ Significance of antibiotics and steroids. ➤ Chemical and biosynthesis of various antibiotics and steroids.
Organic Chemistry Practical-V (Ch-405)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Organic reaction mechanism of the chemical reaction. ➤ Purification of the organic compounds by crystallisation, precipitation and distillation etc. ➤ Product analysis by physical and chemical methods.
Organic Chemistry Practical-VI (Ch-406)	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Develops the extraction techniques for organic molecules from plant materials. • Develops the isolation techniques for organic molecules from their sources. • Understand the process of natural product isolation. • Understand the concept of chromatography. • Develops the separation techniques for a mixture of organic molecules and drug materials through chromatographic technique.
Organic Chemistry Practical-VII (Ch-407)	<p>After studying Course the student shall be able to understand the following concepts:</p> <ul style="list-style-type: none"> ➤ Organic reaction mechanism of the chemical reaction. ➤ Purification of the organic compounds by crystallisation, precipitation and distillation etc. ➤ Product analysis by physical and chemical methods.
Organic Chemistry Practical-VIII (Ch-408)	<p>After completion of these courses students should be able to;</p> <ul style="list-style-type: none"> • Develops the separation techniques for binary organic mixtures. • Predicts the nature of organic molecules by their reactions. • Analyse and identifies the functional groups of a given unknown organic compound. • Determines the physical constants accurately and precisely. • Identify the different elements present in an organic compound. • Prepare the different derivatives for different functional groups. • Estimates the number of nitro groups, nitrogen atoms in a given unknown molecule. • Estimate the amount of acid in the presence of an amide and the amount of ester in the presence of and acid groups.

LEARNING OUTCOMES

I Semester

Inorganic Chemistry I (Ch-101)	<ul style="list-style-type: none"> ➤ Able to explain the stability of compounds with suitable theories and justification. ➤ Able to select the suitable solvent system for the synthesis of compounds. ➤ Able to understand the basics of nuclear chemistry specific to formation of nucleus, radioactivity process and theories involved in radioactivity
Organic Chemistry I (Ch-102)	<ul style="list-style-type: none"> ➤ Able to recognize the delocalization of electrons in different compounds. ➤ Able to identify the aromatic, non-aromatic, anti-aromatic and homo aromatic organic molecules. ➤ Able to identify the structures of molecular receptors. ➤ Able to identify the structures and the reactions of intermediates. ➤ Able to understand the methods of determination of mechanisms. ➤ Able to write the conformations and conformational analysis. ➤ Able to identify the structures and reactions of heterocyclic compounds.
Physical Chemistry I (Ch-103)	<ul style="list-style-type: none"> • The student will be able to set up the Hamiltonian operator, write Schrödinger equation freeparticle, particle in a ring, particle in a three dimensional box, harmonic oscillator, rigid rotator and hydrogen atom • Will be able to solve Schrödinger equation for Helium atom using perturbation theory • Will be able to identify suitable trial functions for application of variation method for studying complex chemical systems • Derive the rate laws for the chain reaction, fast reaction, thermal and photochemical reactions. • Will develop the knowledge in the techniques used in the study of fast reaction • Will have a skills to measure BET surface area
Analytical Chemistry (Ch-104)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Know the various types of chemical analysis. ➤ Do safety measures, Fire hazards, and toxic chemicals in chemical laboratories. ➤ Estimate the chemicals by qualitative and quantitative methods. ➤ Get idea about chromatographic separations.

Mathematics for Chemistry (Ch-105)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Do mathematical analysis in chemistry. ➤ Do the mathematical calculation in chemical analysis.
Practical-I Inorganic chemistry (Ch-106)	<ul style="list-style-type: none"> ➤ To be able to identify and separate less familiar ions such as W, Mo, Ce, Th, Zr, V, U etc. ➤ Able to synthesise, tetrahedral and octahedral complexes.
Practical-II Inorganic chemistry (Ch-107)	<ul style="list-style-type: none"> ➤ Able to synthesise, coordination compounds. ➤ Able to estimate the composition of the each molecules present in the prepared complexes
Physical chemistry Practical-I (Ch-108)	<ul style="list-style-type: none"> • Will perform the kinetic experiments under the lab conditions and can calculate the rate constant values • Can estimate the ions by using the colorimetric methods • Will be able to study the thermodynamic property of a system ie partial molar volume an extensive property of the system
Physical Chemistry Practical-II (Ch-109)	<ul style="list-style-type: none"> • Can estimate the concentration of acid and salt mixtures • Can perform the precipitation reactions by conductometric titration • Can perform the potentiometric titrations • Determines the cell constant of a conductivity cell
II Semester	
Inorganic Chemistry II (Ch-201)	<ul style="list-style-type: none"> ➤ Able to apply the coordination complexes in the preparation of some useful compounds. ➤ Able to know the properties of geometry of complexes and their formation, application based on their property. ➤ Able to use suitable instrumental methods to understand the formation of complexes and their applicability.
Organic Chemistry II (Ch-202)	<p>After studying this module, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Know the various types of organic reactions. ➤ Classify the reaction types depending upon reactants and conditions. ➤ Predict the product via reaction mechanism. ➤ Amino acid and vitamin synthesis.
Physical Chemistry II (Ch-203)	<ul style="list-style-type: none"> • The student will be able to understand Statistical Mechanics, the role of Statistical Mechanics in Chemistry • Will be able understand the relationship between statistical mechanics and quantum mechanics • Will learn about different types of statistics applied to types particles present in a system • Will be able to understand Debye Hückel Theory, its postulates and its mathematical treatment, Overview of the

	<p>ionic cloud theory, the ionic cloud around the central ion,</p> <ul style="list-style-type: none"> • Will be able to study of polarography technique and understands its application • Able to understand the concepts of double layers, theories of double layers
<p>Spectroscopy I (Ch-204)</p>	<ul style="list-style-type: none"> • The student will be able to have achieved advanced knowledge about the interactions of electromagnetic radiation and matter and their applications in spectroscopy. • Able to apply formalisms based on molecular symmetry to predict spectroscopic properties. • Able to analyse and interpret spectroscopic data collected by the methods discussed in the course. • Able to solve problems related to the structure determination, and to study molecular interactions by choosing suitable spectroscopic methods and interpreting corresponding data.
<p>Green Synthesis (Ch-205)</p>	<ul style="list-style-type: none"> • Able to learn the green synthetic methods in organic synthesis. • Able to understand the use of ultra sound and microwaves in organic synthesis. • Able to learn the concept of polymer support in organic synthesis. • Able to understand the concept of phase transfer catalysis. • Able to understand the use of ionic liquids in organic synthesis as a green synthetic method. • Able to identify the mechanisms involved in various multi component reactions.
<p>Inorganic chemistry Practical-III (Ch-206)</p>	<p>➤ Enable the students to estimate the binary mixtures of metallic ions by volumetric and gravimetric methods .</p>
<p>Inorganic chemistry Practical-IV (Ch-207)</p>	<p>➤ Able to use their practical knowledge to estimate unknown alloy samples, soil samples etc.</p>
<p>Physical chemistry Practical-III (Ch-208)</p>	<ul style="list-style-type: none"> • Will perform the kinetic experiments under the different conditions and can calculate the rate constant values and understands the effect of temperature and concentration the rate constant. • Able to calculate the energy of activation, Arhenius parameter or collision frequency for the reactions • Can determination of dissociation constant of a given indicator methyl orange and methyl red by colorimetric method
<p>Physical Chemistry Practical-IV (Ch-209)</p>	<ul style="list-style-type: none"> • The student will be able to perform conductometric and potentiometric titrations • Also able to perform the conductometric titrations between of mixture of strong acid and weak acid versus strong base against bases and determine its concentration.

	<ul style="list-style-type: none"> • Also able to perform the titrations between of mixture of strong acid and weak acid versus strong base against bases and determine its concentration pH metry. • Able to determine acidic and basic dissociation constant and isoelectric point of an amino acid by pH metry • Able to determine the pKa value or dissociation constant of phosphoric acid. • Able to determine pH of acetic acid with sodium acetate buffer by potentiometric method. • Also able to determine the concentration and amount of $K_2Cr_2O_7$ and $KMnO_4$ by titrating against FAS and calculation of redox.
III Semester	
Organic Reaction Mechanisms (Ch-301)	<ul style="list-style-type: none"> • Able to write mechanisms of the aliphatic nucleophilic and electrophilic reactions. • Able to write the different methods of generation of free radicals. • Able to identify the mechanisms involved in various free radical substitution reactions. • Able to write the organic photochemical reactions of different class of compounds. • Able to identify the various pericyclic reactions. • Able to recognize the different biochemical mechanism in living things.
Chemistry of Natural Products (Ch-302)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Synthesis of various natural products. ➤ Isolation of various natural products. ➤ Classification of alkaloids, terpenoids, amino acids insect pheromones and prostaglandins. ➤ Structure elucidates various natural products.
Organic Spectroscopy (Ch-303)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Calculate the λ_{max} values for various aromatics compounds by Woodward rules. ➤ Predict the IR frequencies value various organic compounds. ➤ Do chemical shift values of various compounds. ➤ Predict fragmentation pattern of organic compounds.
Open Elective: Finance and Banking (Ch-304)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Do the financial analysis.

	<ul style="list-style-type: none"> ➤ Theoretical calculations of regarding financial services.
Organic Chemistry Practicals-I (Ch-305)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Calculate the theoretical yield of the product. ➤ Do monitoring the reaction. ➤ Predict the reaction mechanism of the product. ➤ Do the recrystallisation and purification of the product.
Organic Chemistry Practicals-II (Ch-306)	<ul style="list-style-type: none"> • Able to identify the organic molecules. • Able to write the reactions involved in the test. • Able to identify the physical constants of organic molecules. • Able to prepare the various derivatives for a particular compound.
Organic Chemistry Practicals-III (Ch-307)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Do monitoring the reaction. ➤ Identification of the completion of the product formation. ➤ Do the physical properties various products.
Organic Chemistry Practicals-IV (Ch-308)	<ul style="list-style-type: none"> • Able to estimate the amount of unknown compounds quantitatively. • Able to standardize the solutions. • Able to handle the different glass apparatus.
IV Semester	
Organometallic and Heterocyclic Chemistry (Ch-401)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Do classification of organometallic catalysts. ➤ Identify the applications organometallic catalysts. ➤ Predict the product via reaction mechanism.
Stereochemistry & Retrosynthetic Analysis (Ch-402)	<ul style="list-style-type: none"> • Able to identify the stereochemistry of various compounds. • Able to recognize the chiral centres in an organic molecule. • Able to write the conformations of different compounds. • Able to identify the different operations performed for a molecule in retrosynthesis. • Able to identify the starting material for the complex organic molecules through disconnection approach. • Able to perform the different retrosynthetic analysis for a molecule.
Organic Synthesis (Ch-403)	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Plan the various C-N and C-C bond reactions and predict the products. ➤ Do the chemo selective oxidation by using different

	<p>oxidising agents.</p> <ul style="list-style-type: none"> ➤ Reduction various functionalities by using different reducing agents.
<p>Medicinal Organic Chemistry (Ch-404)</p>	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Know the drug-receptor interaction. ➤ Identify the specific action of the drug. ➤ Synthesise the various drugs. ➤ Identify the mechanism of the drug. ➤ Classify the steroids and antibiotics. ➤ Know the adverse effects of the drugs.
<p>Organic Chemistry Practical-V (Ch-405)</p>	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Know the stiochiometry calculations of the reaction. ➤ Identification of the end product. ➤ Do the work up to isolate end product from the reaction mixture. ➤ Understand the basic steps involved in the organic synthesis.
<p>Organic Chemistry Practical-VI (Ch-406)</p>	<ul style="list-style-type: none"> • Able to recognize the molecules of extraction. • Able to identify the organic molecules of isolation. • Able to perform the isolation process. • Able to perform the chromatographic analysis.
<p>Organic Chemistry Practical-VII (Ch-407)</p>	<p>After studying this course, you shall be able to;</p> <ul style="list-style-type: none"> ➤ Do the reactions under various experiments conditions. ➤ Handling the various hazardous chemical by safely. ➤ Report and display of the final product.
<p>Organic Chemistry Practical-VIII (Ch-408)</p>	<ul style="list-style-type: none"> • Able to separate the organic molecules in a binary mixture. • Able to identify the nature of organic molecules. • Able to analyse the elements present in an organic molecules. • Able to determine the physical constants of the organic molecules. • Able to prepare the different compounds from an organic molecule.

COURSE OBJECTIVES

I Semester

Inorganic Chemistry I (Ch-101)	<ul style="list-style-type: none">➤ To make the students to understand the formation of inorganic. Compounds and their application in various branches of chemistry in particular and in science generally.➤ To make the students importance of solvents, their application in various reaction systems.➤ To make the students to understand the formation of compounds starting from elemental level to molecular level.
Organic Chemistry I (Ch-102)	<ul style="list-style-type: none">• To teach nature of bonding in organic molecules.• To convey the concept of delocalization of electrons in organic molecules.• To teach the structure and concept of molecular receptors.• To convey the concept and reactions of reactive intermediates.• To convey the concept of stereochemistry and the conformational analysis of organic molecules.• To teach the structure and reactions of heterocyclic compounds.
Physical Chemistry I (Ch-103)	<ul style="list-style-type: none">• To instil the students with skills of evaluation, interpretation and analyzing to get to the crux of the quantum mechanical problem and chemical dynamics• To teach the students basic and fundamental concepts of quantum mechanics and kinetics in chemistry• Make them appreciate the importance of quantum mechanics, rate laws, catalysis and its significances• To impart the students with the physical, evaluative and interpreting skills so as to help in solving problems and come up with lucrative solutions related to quantum mechanics and chemical dynamics.
Analytical Chemistry (Ch-104)	<p>To make the students;</p> <ul style="list-style-type: none">➤ Identify the accurate analytical method for a given sample to be analysed.➤ Declare the principles and applications of different wet chemical methods.➤ Analyze the principles, instrumentation and applications of spectroscopic methods.➤ Illustrate the principles and applications of chromatographic techniques.➤ State the principles and instrumentation of different

	<p>extraction techniques.</p> <ul style="list-style-type: none"> ➤ Describe the different analytical methods and their applications in analysis of hazardous chemicals.
Mathematics for Chemistry (Ch-105)	<p>To make the students;</p> <ul style="list-style-type: none"> ➤ Do scalar and vector triple products and their applications. ➤ Practice Characteristic equation of a square matrix, eigen values and eigenvectors. ➤ Learn the applications of differentiation.
Practical-I Inorganic chemistry (Ch-206)	<ul style="list-style-type: none"> ➤ To make students thorough in analysing the given salt mixtures.
Practical-II Inorganic chemistry (Ch-207)	<ul style="list-style-type: none"> ➤ To make the students to prepare simple coordination complexes.
Physical chemistry Practical-I (Ch-208)	<ul style="list-style-type: none"> • To impart the students with experimental skills, evaluative and interpreting skills in the chemical kinetics experiments • Train them to use various instruments and equipment's • To bring a synergistic thinking between theory concepts with the practical skills • To apply the theory in performing and designing the experiments and mathematical calculations • To help them solving problems and come up with lucrative solutions.
Physical Chemistry Practical-II (Ch-209)	<ul style="list-style-type: none"> • The main objective of the practical papers is to inculcate practical knowledge through laboratory practice • To make the student to handle colorimeter, Conductometer, potentiometer and pH meter • To have the knowledge of electrodes like glass electrode, calomel electrodes, platinum, silver, zinc and copper • To know the advantages of the instrumental methods compared to conventional practical methods
II Semester	
Inorganic Chemistry II (Ch-201)	<ul style="list-style-type: none"> ➤ To make the students to understand the stability of complexes in solution and as prepared condition. ➤ To understand the geometry of complexes. ➤ To make them to completely understand the inorganic compounds using different instrumental methods.
Organic Chemistry II (Ch-202)	<p>To make the student familiar with;</p> <ul style="list-style-type: none"> ➤ Electrophilic, nucleophilic substitution and addition reactions. ➤ Synthesis and reactions of amino acids. ➤ Elimination and rearrangement reactions. ➤ Fundamentals of the reaction mechanism and orientation

	<p>and reactivity of the various reactions.</p> <ul style="list-style-type: none"> ➤ Knowledge of the various reagents and their applications in organic synthesis.
Physical Chemistry II (Ch-203)	<ul style="list-style-type: none"> • To instill the students with skills of evaluation, interpretation and analyzing to get to the crux of the Statistical Thermodynamics and Electrochemistry • To teach the students basic and fundamental concepts of distribution laws and partition functions • Make them appreciate the importance of electrochemistry and its applications in various fields • To impart the students with the physical, evaluative and interpreting skills such that it can help them in solving problems related to Statistical thermodynamics partition function and in electrochemistry
Spectroscopy I (Ch-204)	<ul style="list-style-type: none"> • To make the student understand the basic principles of spectroscopy where electromagnetic radiation interacts with chemical substances. • To make them understand the use spectroscopic methods for qualitative and quantitative analysis. • To make them understand the essential features of the quantum theory of the rotation and vibration of diatomic molecules. • To make them understand the nature of selection rules and discuss how they are obtained for vibration-rotation excitations in diatomic molecules. • The different regions of the spectrum and the type of molecular transitions that correspond.
Green Synthesis (Ch-205)	<ul style="list-style-type: none"> • To convey the use of green synthetic methods in organic synthesis. • To teach the use of ultra sound and microwaves in organic synthesis. • To convey the concept polymer supports and phase transfer catalysts in organic synthesis. • To convey the use of crown ethers and ionic liquids in organic synthesis. • To teach the mechanisms involved in multi component reactions.
Inorganic chemistry Practical-III (Ch-206)	<ul style="list-style-type: none"> ➤ To make the students to know the analysis of metals present in a bimetallic solution.
Inorganic chemistry Practical-IV (Ch-207)	<ul style="list-style-type: none"> ➤ Application of regular practical procedure in analysing the unknown samples of alloys, ores, vegetable, fruit and water samples etc.,
Physical chemistry Practical-III	<ul style="list-style-type: none"> • The main objective of the practical papers is to inculcate practical knowledge through laboratory practice by performing the experiments related to the theory papers.

(Ch-208)	<ul style="list-style-type: none"> • To make the student understand the concept of buffers, chemical and physical properties of the indicator • Understand dependency of indicator colour on change in pH • Teach them to determine the λ_{max} and to handle colorimeter • To know the advantages of the titrometric methods compared to conventional practical methods
Physical Chemistry Practical-IV (Ch-209)	<ul style="list-style-type: none"> • The main objective of the practical papers is to inculcate practical knowledge through laboratory practice • To make the student understand the concept of buffers, • To make the student understand the concepts of ionic activity, ionic mobility, and mean ionic conductance • To know the advantages of the instrumental methods compared to conventional practical methods
III Semester	
Organic Reaction Mechanisms (Ch-301)	<ul style="list-style-type: none"> • To convey the mechanism of electrophilic and nucleophilic substitution reactions. • To teach the different methods of generation of free radicals. • To convey the mechanisms involved in various free radical substitution reactions. • To convey the concept of organic photochemistry in different class of compounds. • To teach the concept of pericyclic reactions. • To teach the various biochemical mechanisms involved in living things.
Chemistry of Natural Products (Ch-302)	<p>To make the student familiar with;</p> <ul style="list-style-type: none"> ➤ Structure elucidation of natural products. ➤ Nomenclature, classification and isolation of natural products. ➤ Biosynthesis of various natural products. ➤ Biological activity antibiotics and steroids. ➤ Commercial synthesis of various natural products. ➤ Photochemical synthesis of alkaloids and terpenoids. ➤ Solid phase synthesis of oligonucleotides. ➤ Management of pheromones in pest control.
Organic Spectroscopy (Ch-303)	<p>To make the student acquainted with;</p> <ul style="list-style-type: none"> ➤ Various spectroscopic techniques. ➤ Structure elucidation of organic molecules by use spectroscopy. ➤ Basic principles and instrumentation of various spectroscopic methods. ➤ Identification of the molecule by spectra. ➤ Mass fragmentation pattern of the compound.

Open Elective (Ch-304)	To make the student known with; <ul style="list-style-type: none"> ➤ Banking services. ➤ Financial methods of analysis. ➤ Various finance saving plans.
Organic Chemistry Practicals-I (Ch-305)	To create the student familiar with; <ul style="list-style-type: none"> ➤ Reaction set-up and monitoring. ➤ Procedure development of various chemical reactions. ➤ Post-reaction calculations. ➤ Practical report generation.
Organic Chemistry Practicals-II (Ch-306)	<ul style="list-style-type: none"> • To make the students to perform qualitative analysis. • To prepare the students to identify the organic molecules. • To make the students to write the different reactions involved in the tests. • To make the students to prepare various derivatives from the organic molecules.
Organic Chemistry Practicals-III (Ch-307)	To make the student familiar with; <ul style="list-style-type: none"> ➤ Importance of the reaction monitoring. ➤ Product yield calculations. ➤ Isolation of the product from the reaction mixture.
Organic Chemistry Practicals-IV (Ch-308)	<ul style="list-style-type: none"> • To make the students to determine the amount of compounds from unknown solutions. • To make the students to analyse the exact concentrations of solutions. • To make them to handle different glass wares carefully.
IV Semester	
Organometallic and Heterocyclic Chemistry (Ch-401)	To make the student familiar with; <ul style="list-style-type: none"> ➤ Various organometallic reagents and their applications in organic synthesis. ➤ Higher heterocyclic compounds synthesis and their synthetic applications. ➤ Mesoionic compounds and their properties. ➤ Synthesis of heterocycles with P, As, Sb and Bi.
Stereochemistry & Retrosynthetic Analysis (Ch-402)	<ul style="list-style-type: none"> • To convey the stereochemistry of various compounds. • To convey the concept of retrosynthetic analysis. • To teach the concept of protecting groups in organic synthesis. • To teach the retrosynthetic analysis of some of the complex natural products.
	To make the student familiar with;

Organic Synthesis (Ch-403)	<ul style="list-style-type: none"> ➤ Various synthetic methodologies to synthesis of various organic molecules. ➤ Oxidizing agents and their applications in organic synthesis. ➤ Reducing agents and their applications in organic synthesis. ➤ Basic knowledge of asymmetric synthesis. ➤ Enantioselective and diastereoselective synthesis.
Medicinal Organic Chemistry (Ch-404)	<p>To make the student familiar with;</p> <ul style="list-style-type: none"> ➤ Basics of Pharmacokinetics, Pharmacodynamics and theories of drug activity. ➤ Occurrence, nomenclature, basic skeleton and stereochemistry of steroids. ➤ Isolation, structure and structural elucidation of sterols, bile acids and antibiotics. ➤ Mechanism of drug action and synthesis of the various classes of drugs molecules. ➤ Recent development in cancer chemotherapy. ➤ Neurochemistry of mental diseases.
Organic Chemistry Practical-V (Ch-405)	<p>To make the student familiar with;</p> <ul style="list-style-type: none"> ➤ Synthesis of various organic molecules. ➤ Purifications of final products. ➤ Finding the physical properties of the final product. ➤ Report preparation and final submission.
Organic Chemistry Practical-VI (Ch-406)	<ul style="list-style-type: none"> • To make the students to perform the extraction process. • To make the students to carry out the isolation. • To make them to perform the separation process through chromatography.
Organic Chemistry Practical-VII (Ch-407)	<p>To make the student familiar with;</p> <ul style="list-style-type: none"> ➤ Stoichiometric calculations of the starting materials to keep reactions. ➤ Reaction set up and procedure selection. ➤ Chemical drying and purification of product.
Organic Chemistry Practical-VIII (Ch-408)	<ul style="list-style-type: none"> • To make the students to separate the organic molecules from the binary mixture. • To make the students to identify the functional groups present in the organic molecule. • To make them to carry out the elemental analysis. • To make the students to prepare derivative from the separated organic molecule.