

Outcomes of papers in Chemistry Syllabus

B.Sc. Ist year

(Semester I)

Organic and Inorganic Chemistry Paper I

After completion of syllabus students will be able to understand following outcomes.

1. Student should learn basic concept of organic chemistry, Nomenclature.
2. Student get well acquainted with functional group in organic chemistry.
3. To understand the basic concepts and differences aliphatic hydrocarbons.
4. To know about term cycloalkane , cycloalkene and diene.
5. Learn and practice about organic compounds with their names.
6. Students learn some exceptional electronic configuration, trends and Periodicity in
the following properties like atomic size, ionization energy, electron affinity & electronegativity.
7. To understand the inert gases forms compounds, different fluoride compounds of xenon.

Physical and Inorganic Chemistry Paper II

1. Learning and understanding rules of logarithm, Rules of drawing graph, Derivatives, Integration , different mathematical concept and SI units, and their use in solving numerical.
2. Learning surface phenomena at heterogeneous surfaces.
3. Student will learn the basic knowledge of gas phase, Kinetic molecular theory, critical phenomenon , liquefaction and molecular velocities.

4. To impart knowledge about solid phase, crystallography and some crystal structure.
5. General characteristics of s-block elements, oxides, hydroxide, carbonate & its complexes
6. Study the oxidation and reduction by different methods.

(Semester II)

Organic and Inorganic Chemistry Paper III

1. Student should learn the concept of aromatic hydrocarbons, Aromaticity and antiaromaticity.
2. Student should understand the phenols and synthesis of phenols
3. Student knows about the haloalkene and haloarenes compounds.
4. To know the concepts of carboxylic acids and their derivatives.
5. To know about the types of alcohols and reaction of epoxide.
6. To study the different properties of P- block elements.
7. To know the acids & Bases by different concepts.

Physical and Inorganic Chemistry Paper IV

1. To impart knowledge of atomic structure, different theories of atomic structure, rules of electronic configuration and quantum numbers.
2. Learning of properties of liquid phase as surface tension, Viscosity and parachor.
3. Student will learn the basic knowledge of colloidal state, types, preparation, properties and applications of colloidal state.
4. Learning and understanding of catalysis, types of catalysis and characteristics of catalyzed reactions.
5. To understanding the chemical bond and its different types of bonds.
6. Learning the Concept of hybridization and study of VSEPR & Molecular Orbital theory.

B.Sc. II nd year

(Semester III)

Organic and Inorganic Chemistry Paper VI

1. Learn the mechanism of name reactions.
2. Know the Synthesis, and Reactions of Aromatic Carboxylic and Sulphonic acids.
3. Know the Synthesis, and Reactions of Organometallic compounds.
4. Learn the synthesis, mechanism, applications of active methylene compounds.
5. Gathering basic knowledge of Oils, Fats, Soaps and Detergents.
6. Understand the basic principle and application of Qualitative Analysis.
7. Know the Classification, Properties of Non- aqueous solvents.

Physical and Inorganic Chemistry Paper VII

1. Write an expression of Davisson-Germer experiment.
2. Derive Schrodinger wave equation.
3. Understand De-Broglie's hypothesis and uncertainty principle.
4. Solve the numerical problems based on De-Broglie.
5. Understand concept of entropy.
6. Understand statements of first, second and third law of thermodynamics.
7. Know the meaning of phase, component and degree of freedom.
8. Know the nuclear structure & different energy of nuclear.
9. Understand the different steps & procedure in the gravimetric separation method.

(Semester IV)

Organic and Inorganic Chemistry Paper VIII

1. Learn the stereoisomerism of Chiral compounds.
2. Know the Classification, and Reactions of carbohydrates.
3. Know the Synthesis, and Reactions of Nitrogen Compounds.
4. Gathering applications of Reagents in Organic Synthesis.
5. Understand the Characteristics of d-Block Elements.
6. Know the Characteristics of d-Block Elements

Physical and Inorganic Chemistry Paper IX

1. Know the rate constant and factors affecting rate of reactions.
2. Write an expression for rate constant (K) for first order, second order reaction.
3. Know the terms cell constant, specific conductivity, equivalent conductivity and molar conductivity.
4. Know the applications of Kohlrausch's law.
5. Compare between thermal and photochemical reactions.
6. Discuss different types of photochemical process.
7. Know the preparation, properties, structure & application of different compounds.
8. Discuss different inter halogen compounds by preparation, properties, structure and uses.

Organic and Inorganic Chemistry Practical paper X

1. Learn basics of thin layer chromatography and distillation.
2. Learn fundamentals of organic qualitative analysis.
3. Learn about organic estimations.
4. Basics of volumetric analysis.

Physical and Inorganic Chemistry Practical Paper XI

1. Calculate normality and strength of the solution using potentiometer and conductivity meter.
2. Find pka value on pH meter.
3. Verify Lamberts-Beer's law colorimetrically and determine unknown concentration of the solution.
4. Determine energy of activation.
5. Determine heat of solution.
6. Study the effect of solute on CST of phenol-water system.

7. Determine the enthalpy of ionization of weak acid / weak base.
8. Determine partition coefficient.
9. Separations of elements from each other & analysis by volumetric method.

B.Sc. III rd year

Organic and Inorganic Chemistry Paper XII

1. Learn the mechanism of Electrophilic Substitution reaction of Heterocyclic Compounds
2. Know the characteristics, Classification and synthesis of Drugs and Dyes
3. Explaining theories of Color and chemical constitution of Dyes
4. Gathering basic knowledge of Alkaloids, Vitamins and Pesticides
5. Understand the basic principle and application of coordination complexes
6. Know the application of elements in Medicine

Physical and Inorganic Chemistry Paper XIII

1. Understand the concepts of molecular Spectroscopy and its applications
2. Analyze Rotational, Vibrational and Raman, Spectra
3. Interpret the theoretical and experimental methods of chemical kinetics Know the theory and application of Distribution law
4. Explain the Nomenclature, classification and application of Organometallic Compounds
5. Illustrate the classification and application of Metal Carbonyls

Organic & Inorganic Chemistry Paper-XIV

1. To learn the basic principle and terms used in UV, IR & NMR Spectroscopy
2. Acquire the fundamental knowledge of classification and Synthesis of Amino Acid and Peptides
3. Describe the types of Rearrangement
4. Postulates and limitations of VBT and CFT
5. Calculation of CFSE for Tetrahedral and Octahedral Complexes

- 6.Explain the types of electronic transition and selection rule
- 7.Apply spectroscopic techniques in analyzing the structure of simple organic Molecules

Physical & Inorganic Chemistry Paper-XV

- 1.Basic concepts of electrochemistry and its applications
- 2.Understanding the Nernst heat theorem and the Thermodynamics open system
- 3.Know the Vant-Hoff's Reaction isochore and numerical on it
- 4.Explain the types of magnetic substances and effect of temperature on it
- 5.Biological role of alkali and alkaline earth metal ions
- 6.Describe the structures and functions of Metal Cluster

SEC III (Section-A) Computer Application in Chemistry OR Applied Analytical Techniques

- 1.Able to know the use of software and Excel in Chemistry
- 2.Grasp the concept of Quality Assurance and Quality Control
- 3.Illustrate the Physical and Chemical analysis of Soil and fuel
- 4.Be able to evaluate Biological activity and toxicity of organic compounds using softwares

SEC IV (Section-B) Spectroscopic Techniques and Cosmetic Preparation OR Basic Analytical Chemistry

- 1.Be able to determine the structure by using Spectra
- 2.To train the students for the preparation of various cosmetics
- 3.Know the classification and Fatty acid composition of Oils and Fats
- 4.Analysis of Oils and Fats by physical and chemical method

M. Sc. First Year, Semester-I

Inorganic Chemistry - Paper I

1. Learn various approaches in analyzing structures of simple molecules.
2. Understand the proposed pathways for reactions taking place in coordination complexes such as substitution reactions, redox reactions etc. and the various factors affecting to rates of these reactions.
3. Learn about mechanisms proposed for reactions taking place in coordination complexes, and will be able to understand to explain the product formation based on these mechanisms.
4. Understand how to construct molecular orbital diagrams for simple molecules as well as coordination complexes.
5. Draw molecular orbital diagrams for sigma and pi bond formation in coordination complexes and will be able to understand and explain the difference between respective molecular orbital diagrams

Organic Chemistry - II

1. Understand the various types of Reaction Mechanism.
2. Adopt the concept of Bonding in Organic Molecules.
3. Learn the concept of Stereochemistry and to identify the Stereo chemical reactions.
4. Explain the various problems of aromaticity, homoaromaticity and antiaromaticity.
5. Familiarize the various types of Substitution reactions and their mechanism
6. Gain knowledge of free radical reactions.
7. Justifies the various effect of substrate.

Physical Chemistry - III

1. Explain basic concepts, laws and postulates of quantum mechanics
2. Describe different wave functions and operators

3. The Schrodinger wave equation for the calculation of Energies of rigid rotor and harmonic oscillator and solve it for hydrogen atom
4. Explain the concept of angular momentum
5. Describe the electronic structure of atoms
6. Good overview of laws of thermodynamics, partial molar properties for different systems and concept and examples of non-ideal systems
7. Discuss concept distribution with examples, they will be able to explain most probable distribution and thermodynamic probability
8. Concept of partition functions and its significance
9. Can relate and explain the entropy production in different system and understand Onsager's relations
10. Solve problems related to quantum chemistry, will have large horizon of critical thinking and analytical reasoning

Physical Method in Chemistry IV

1. Understand how to recognize symmetry elements in a molecule.
2. Assign the point group to a molecule.
3. Deal with degenerate and non-degenerate representations.

Semester-II

Inorganic Chemistry Paper : VI

1. Learn basic terms regarding electronic spectra of coordination complexes, interpretation of electronic spectra and various important parameters necessary for it, drawing of Orgel and T-S diagrams used for electronic spectra, prediction of possible electronic transitions present in electronic spectra of coordination complexes etc.
2. He/she will understand magnetic nature of complexes, measurement of magnetic moment in coordination complexes, prediction of magnetic nature of complexes using spin only formula.

3 He/she will learn the terms such as diamagnetic and paramagnetic nature of coordination complexes, difference between them, anomalous magnetic moments, spin cross over etc.

4 He/she will understand the chemistry of carbonyl and nitrosyl molecules, their application as ligand molecules in complex formation, structure and bonding present in various carbonyl and nitrosyls complexes, applications etc.

5 He/she will learn chemistry of boranes, carboranes and metal clusters, the concept of 3C-2e bond used to explain structural aspects in boranes and carboranes, polyhedral skeletal electron pair theory and its applications in explaining structures of metal clusters etc.

Organic Chemistry Paper : VII

1. Gain the knowledge of addition reaction between a hetero atom and double bonded carbon compounds.

2. Learn familiar name Reaction

3. Obtain an outline about mechanism of Aromatic Substitution reactions

4. Know synthetically the process relevant Organic–Chemical reactions and be able to discuss the mechanism of these reactions.

5. Understand the skill of solving problems of pericyclic reactions

6. Get the clear picture of about pericyclic reactions

Physical Chemistry Paper : VIII

1. Understand the basic concepts and properties of surfactants and macromolecules

2. State and apply different laws, principles, theories related to the electrochemistry of the solutions.

3. Discuss and apply the information about corrosion, its monitoring and presentation.

4. Distinguish different theories of reaction rates.

5. Understand the kinetics of complex reactions, catalysis etc.

6. Perform the calculations and solve the numerical of electrochemistry and chemical kinetics.
7. Develop skill in problems solving, critical thinking and analytical reasoning.

Principles of Spectroscopy Paper : IX

1. Explain the basic principles of rotational, vibrational, electronic and Raman spectroscopy.
2. Identify and explain factors that influence the strength and frequency of peaks in the Microwave, IR spectra.
3. Describe the selection rule for rotational, Vibrational and electronic spectroscopy.
4. Determine the vibrations for a molecule and identify whether they are active in infrared and/or Raman spectroscopy.
5. Explain the difference between Stokes and anti-Stokes lines in a Raman spectrum and justify the difference in intensity between Stokes and anti-Stokes lines.
6. Draw the Stokes and anti-Stokes lines in a Raman spectrum of a compound when given the energies of the different transitions.
7. Understand the electronic spectra of atomic and diatomic molecular systems.
8. Justify the absorption lines in atomic electronic spectra and the broad bands in molecular electronic spectra.
9. Able to interpret the molecular electronic spectra and deduce the electronic structure information in ground and excited states of diatomic molecules.
10. Importance of the Nuclear Quadrupole Resonance Spectroscopy in the characterizing organic and inorganic compounds.
11. Know how the electric fields gradient in molecules influences NQR, and ESR spectra.

Laboratory Course – I

1. Learn synthesis methods for the preparation of various coordination complexes and will understand the basic principles involved in operational procedures while synthesizing the complexes to a deeper level.

2.To characterize a synthesized complex using various characterization techniques such as melting point determination, solubility behavior in various solvents, molar conductance, magnetic susceptibility measurements, IR and electronic spectra etc.

3.While following all these methods he/she will be able to understand operation procedures, care that should be taken while using these techniques and the practical utility of these techniques.

4.Understand the basic principles lying behind inorganic analysis such as precipitation, solubility product, buffer solution, applications of buffer solution in maintaining pH,common ion effect etc. and this much information will be helpful while analyzing any inorganic compound in future.

Laboratory Course II

1.Learn the pilot separation of the binary mixture

2. Familiarize the systematic procedure of organic mixture analysis

3. The preparation involving nitration, bromination, Sandmeyer reaction, and Aldol condensation

4. Learn the test involving identification of special elements

5. Learn the confirmatory test for various functional groups

6. Understand the technique involving drying and crystallization by various methods

7. Expertise the various techniques of preparation and analysis of organic substances

8. Learn the estimation of various organic compounds.

9. Understand micro scale technique.

Laboratory Course III

1.Apply their knowledge for setting various experiments based on the instrumentations studied

2. Perform different qualitative and quantitative analysis

Laboratory Course IV

1. Understand the basic principles and theory of different instruments used during the conduction of the experiments
2. Perform the different experiments on conductometer, pH meter, potentiometer, colorimeter, polarimeter, flame photometry
3. Apply their knowledge for setting various experiments based on the instrumentations studied
4. Perform different qualitative and quantitative analysis.

M. Sc. Second Year(ORGANIC CHEMISTRY)

Semester-III

Spectroscopic Method- Paper–XV Advanced

1. Learn the structure determination of organic molecules by spectroscopic methods.
2. Know the use electronic spectroscopy to determine absorption maximum in dienes, enones and aromatic compounds.
3. Know the applications of IR spectroscopy for functional group determination.
4. Learn the structure elucidation of organic compounds by PMR spectroscopy.
5. Gathering basic knowledge to know the position of carbon in carbon compounds.
6. Recognize the molecular mass of the organic molecule by fragmentation pattern.
7. Know the complete structure of compounds using UV, IR, PMR, CMR and Mass spectroscopic methods.

Natural Products Paper–XVI

1. Structure elucidation, degradation, applications, stereochemistry of Vitamins, Terpenoids, Steroids.
2. Synthetic methods for total synthesis of natural products
3. Medicinal Application of different natural products
4. Rotenones, pyretheroids, prostoglandins and their applications

Organic Synthesis Paper–XVII,

1. To understand the Dakin reaction, Etard reaction, HVZ reaction, Umpolung synthesis and Stephen reaction .
2. To know about the Barton reaction, Jones oxidation, Oppenauer oxidation and Michel addition .
3. To familiarize the different types of reduction reaction .
4. To learn about the synthesis and applications of the organic reagents like 9-Borabicyclo(3.3.1)nonane (9-BBN) and n-butyl lithium .

5. To learn the synthesis and applications of the organic reagents like ceric ammonium nitrate (CAN), DCC, Grignard reagent, LDA, Gilman reagent, NBS and PCC.
6. To know about the complex metal hydrides, Hilman's reagent, lithium dimethyl cuprate and dicyclohexyl carbodimide, 1,3-dithiane.
7. To know the detail study of Woodward, Woodward hydroxylation, selenium dioxide, crown ethers and Peterson's synthesis, Wilkinson's catalyst and Baker yeast.

Medicinal Chemistry Paper–XVIII

1. Understand key component of drug discovery process and drug designing
2. Understanding the role of medicinal chemist in development of medicinal agents
3. Have understanding about functional group modification and their utility in SAR and QSAR.
4. Analyze the recent research articles related with drug design of antimicrobial agents and antibiotics.

Elective: Green Chemistry Paper–XVIII

1. To learn about the different enzymes participating in the chemical reactions inside the body and their functions
2. To study about the different oxygen carriers present in the body with their structure and stereochemistry
3. To study in detail about nitrogen fixation reactions and microorganisms involved in nitrogen fixation reactions
4. To know about the biological redox systems and their classifications

Semester-IV

Advanced Heterocyclic Chemistry Paper-XX, [OCH-521]

1. This course aims at giving a fundamental theoretical understanding of heterocyclic chemistry, including alternative general methods for ring synthesis and application of such methods for the preparation of specific groups of heterocyclic systems.
2. The student will get familiar with particular properties and reactions for the most important heterocycles as well as different systems of nomenclature.

Advanced Organic Chemistry- Paper-XXI

1. The basic Principles of Green Chemistry,
2. Applications and uses of Green catalysts and Reagents.
3. Use of Ionic Liquids and PTC in Green Synthesis

Organic synthesis: Retro synthetic Approach- Paper-XXII

1. To persuade the subject specific knowledge as well as relevant understanding of the Retrosynthesis
2. The academic and professional skills required for Chemistry-based professions.
3. Learning experiences gained from this Disconnection approach is important for industrial purpose.

Medicinal Chemistry- Practical Paper-XXIII

1. Understand key components of drug discovery of Anti-cancer and Anti-AIDS agents, Hypoglycemic agents, Cardiac drugs, antiviral antimalarial agents

Mixture Analysis Practical Paper-XXV

1. Learn basics practical knowledge of qualitative analysis.
2. Become skilled at organic compounds determination.

Synthesis of Organic Molecules Practical Paper-XXVI

1. Learn basics practical knowledge of multistage synthesis of organic molecules.

2. Learn fundamentals of organic synthesis in drug discovery.
3. Learn about the one-pot organic synthesis by microwave techniques.

Physico-Organic Estimations Practical Paper–XXVIII

1. Gain the knowledge of estimation of drugs by Titrimetric.
2. Learn about the Isolation of natural products.
3. Develops the techniques for the estimation of drugs by Instrumental Methods.

M. Sc. Second Year (PHYSICAL CHEMISTRY),

Semester-III

Solid State Chemistry- Paper–XVI

1. Student gets knowledge about different types of defects in solids.
2. They know about the different types of solid state reactions and factors affecting reactions.
3. Students understand about classification on solids on basis electronic structure.
4. They are now able to classify solid on basis of band structure and magnetic properties.

Chemical Dynamics Paper–XVII, [PCH-513]

1. Student are now able to calculate the mechanism of various complex reactions
2. They know about various experimental techniques to study the kinetics of fast reactions.
3. They understood the motions of molecules in liquid and gas as well as about molecular reaction dynamics
4. They know about kinetics of the complex reactions which includes chain and polymerization reactions.

Statistical Thermodynamics Paper–XVIII

1. Students will get basic knowledge about the applications of statistical thermodynamic to various systems
2. They will get the basic information of different types of Statistics used in statistical thermodynamics

3. They understated the Statistical Mechanics of a System of Independent Particles

Semester IV

Radiation Chemistry Paper–XX,

- 1.They know about different types of nuclear reactions and reactors
2. They understand about the effect of radiation on matter
3. Students understand about the about applications of radioactivity in various fields.
4. They are be able to solve numerical of different concepts of radioactivity

Photochemistry Paper–XXI,

1. Students know about different types of Photochemical Reactions
2. Students are able to write mechanism of different photochemical reactions
3. Students understand about different Photo physical process.
4. They understand about the Photophysical kinetics of Bimolecular Process
5. They learnt about some basic aspects of organic and Inorganic photochemistry

Molecular Reaction Dynamics and Biophysical Chemistry Paper–XXII

- 1.Students learnt about Biological Cell its Constituents and about Bioenergetics
2. They understand about the Statistical Mechanics in Biopolymers and about the different biopolymer Interactions
3. They understand about the Thermodynamics of Biopolymer solutions.
4. They know about the different Diffraction Methods and photo correlation spectroscopy

Electrochemistry- Paper–XXIII,

1. They acquire knowledge about the reversible and irreversible cell and their examples.

2. They now know about different processes which takes place over metal surface
3. Student know about Debye Huckel theory and its application in electrochemistry and able to solve numerical on it.
4. Students get knowledge about electrochemical theory of corrosion and method of prevention of corrosion..