

Department of Chemistry

Programme outcome

A student, after successful completion of three-year degree program in Chemistry, may go for higher studies in different branches of science, post graduate course in different universities, IITs or go for integrated PG with research work in IISER, NISER etc or may have M.Tech program by qualifying NET,GATE,CSIR entrances followed by PG and so many academic exposure like that in our country and abroad

This program helps the students to develop scientific temper among the people of the society and to create awareness regarding the prevention of water logging, disinfection of water, use of different pesticides, testing of P.H of soil for agriculture etc .

After completion a student can also get employment in science and science related sector. There is Scope for employment in different industries like soap, drug, dye, textile, Cement. Plastic, paint, fertiliser etc.

Overall this program offers adequate sensibility in students to:

PO-1. Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.

PO-2. Solve the problem and also think methodically, independently and draw a logical conclusion.

PO-3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.

PO-4. Create an awareness of the impact of chemistry on the environment, society, and development outside the scientific community.

PO-5. Find out the green route for chemical reaction for sustainable development.

PO-6. To inculcate the scientific temperament in the students and outside the scientific community.

PO-7. Use modern techniques, decent equipments and Chemistry software"s

Programme Specific Outcome

PSO-1. Gain the knowledge of Chemistry through theory and practical's.

PSO-2. To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.

PSO-3. Identify chemical formulae and solve numerical problems.

PSO-4. Use modern chemical tools, Models, Chem-draw, Charts and Equipments.

PSO-5. Know structure-activity relationship.

PSO-6. Understand good laboratory practices and safety.

PSO-7. Develop research-oriented skills.

Course Outcome

After completion of these courses students will be able to:

SEMESTER-1

INORGANIC CHEMISTRY-I (C-1)

1. know a clear-cut idea about line spectrum of hydrogen atom from Bhor's theory
2. Explains quantum mechanical model of atom.
3. Gives detail explanation of Schrodinger wave equation and its significance in H -atom.
4. Explain filling of electron in shell, sub shell and orbital.
5. Discuss different fundamental properties like Atomic radius, Ionization Enthalpy, Electron Gain Enthalpy, Electro negativity and their variation in periodic table.
6. Explain the fundamentals of chemical bonding .
7. Discuss the percentage of ionic character in covalent bond and compare different molecular behaviour based on this.
8. Provide qualitative idea of band theories of insulator and semiconductor, different weak interactions.
9. Explain VBT of H-bonding.
10. Explain the principles of redox reaction involved in volumetric analysis of Fe, Cu, and Mn.

PRACTICAL C-1

1. Prepare solution of different Molarity and Normality.
2. Explain the principle of acid base titration involving mixture.
3. Explain the redox principle involving estimation of Fe and oxalic acid and others like that.

PHYSICAL CHEMISTRY (C-2)

Course Outcome

1. Discuss kinetics model of gas and their associated parameters.
2. Explain the Maxwell Boltzmann distribution of molecular velocities.
3. Discuss the deviation of real gases from ideal behaviour, derive vander Waals' equation of state, and explain its significance.
4. Explain critical phenomena and determination of critical constants.
5. Introduce general properties of liquid state.
6. Describe in detail vapour pressure and surface tension and important applications.
7. Explain viscosity and its measurement and also discuss how molar refraction measurements are useful in the structural elucidation.
8. Explain the general principle of ionic equilibrium with pH and common ion effect.
9. Derive Bragg equation and explain Miller indices.
10. Explain rotating crystal and powder pattern method of monovalent ionic crystals.

11. Describe the structure of glass and liquid crystals.
12. Explain the principle of salt hydrolysis, buffer solution, solubility product, acid- base indicator and their application in qualitative indicator.

PRACTICAL-C-2

1. Determine surface tension, viscosity of liquids by different methods.
2. Prepare buffer solutions and determine pH of buffer.

SEMESTER -II

ORGANIC CHEMISTRY (C-3)

1. Describe very fundamentals of electron displacement mechanism in organic molecules.
2. Explain Electrophiles and Nucleophiles and stability of reaction intermediates.
3. Explain reaction mechanism of different types of basic organic reactions.
4. know and work with stereo chemical formulas are given along with geometrical (E/Z) and optical isomerism (D/L), (R/S) conventions and their resolution.
5. Understand aliphatic and aromatic, nucleophilic and electrophilic substitution with mechanism and kinetics.
6. Gain knowledge about addition and elimination reactions with mechanism and stereo chemical aspect.
7. Understand the competition between substitution and elimination reactions according to the conditions of reagents and substrate.
8. Explain Bayer strain theory and conformational analysis and energy level diagrams
9. Explain aromatic electrophilic substitution reaction in arenes and their directing effect.
10. Explain Huckels rule with examples.

PRACTICAL-C-3

1. Determine M.P and B.P of different solids and liquids.
2. Separate the mixture of organic compounds by paper chromatographic methods .

PHYSICAL CHEMISTRY(C-4)

1. Explain first law of thermodynamics and its application in different concepts like heat capacities, enthalpy of reactions.
2. Explanation of Kirchhoff's equation.
3. Discuss the second and third laws of thermodynamics and important concept of Gibbs Helmholtz equation, Joule- Thomson coefficient and Maxwell relations.
4. Explain partial molar quantities like chemical potential.
5. Explain Gibbs Duhem Equation and derive the relation between Gibbs free energy.

6. Give thermodynamic derivation of relation between equilibrium constants.
7. Introduce thermodynamic derivation of various colligative properties.
8. Acquire fundamental concept solubility from Raoult's law and Henry's law.

PRACTICAL-C-4

1. Determine enthalpy by Calorimeter experiments.

SEMESTER-III

INORGANIC CHEMISTRY (C-5)

1. Understand general principle of Metallurgy with Ellingham diagrams.
2. Get concept of acid and bases, HSAB principle and their application
3. Illustrate the chemistry of s and p block element with special reference to oxidation state, allotropy, complex formation and hydride formation.
4. Get the knowledge about chemistry and application of compounds of Boron, Silanes, oxides of Nitrogen, phosphorus and chlorine, chemistry of fluorides of xenon.
7. know the applications of Inorganic polymers.

PRACTICAL-C-5

1. perform Iodo/Iodimetric estimation of Copper and chlorine.
2. Prepare Manganese (III) Phosphate, Cuprous Chloride, Potash Alum.

ORGANIC CHEMISTRY-II(C-6)

1. Elaborate a comparative chemistry of Alkyl and Aryl halide with respect to substitution nucleophilic reaction and their solvent effect, Elimination vs. substitution reaction.
2. Know the synthetic use of organometallic compounds of Mg and Li.
3. acquire knowledge of some valuable reaction and their mechanism involving carbonyl compound, alcohol and Phenol such as Reimer Tiemann Reaction, Kolbe's Schmidt Reaction, Fries and Claisen rearrangement etc.
4. Explain preparation, properties of monocarboxylic acids, dicarboxylic acids, acid chlorides, anhydrides, esters and amides.
5. Discuss mechanism of Dieckmann, Reformatsky, Hofmann -bromamide degradation and Curtius rearrangement.

PRACTICAL-C-6

1. perform organic preparation using conventional and green approach.
2. Do practically the Bromination and Nitration of different organic compound.

PHYSICAL CHEMISTRY -III (C-7)

1. Discuss Gibbs phase rule for reactive and non- reactive system.

2. Derive Clasius Clapeyron equation.
3. Discuss phase diagram water and sulphur system, solid-liquid equilibria, Pb-Ag system, desilverisation of lead.
4. Derive Gibbs-Duhem-Margules equation and its applications.
5. Derive Nernst Distribution law and its application.
6. Explain the kinetics of fast, second, complex, opposing, parallel, consecutive reactions
7. Explain Rice-Herzfeld mechanism and steady state approximation.
8. Explain temperature dependence of reaction, collision theory of reaction rate. 9. Explain Michaelis- Menten mechanism for enzyme catalysis.
10. Discuss different Isotherms (Langmuir, Freundlich, and Gibbs).

PRACTICAL-C-7

1. Determine distribution coefficient of mixture of two components.
2. Determine rate constant of hydrolysis reaction and verification of isotherms by experimental method.

SEMESTER-IV

INORGANIC CHEMISTRY-III (C-8)

1. Acquire knowledge about bonding, stereochemistry in co-ordination compounds.
2. Explain Jahn Teller distortion in octahedral and square planar geometry.
3. Discuss qualitative aspect of MO and Ligand field theory and stereochemistry of coordination compounds.
4. r provide a review regarding chemistry of Transition metals and explanation on stability of transition state by Latimer and Bisworth diagrams.
5. Discuss the chemistry of Ti, V, Cr, Mn, Fe and Cr.
6. Discuss general chemistry of Lanthanides and Actinides and their separation.
7. Give an insight into biochemistry of different metals. Deficiency of metal ions leading to disease. Iron and its application in biological system.

PRACTICAL-C-8

1. Perform gravimetric estimation of Ni, Cu, Fe, Al and chromatographic separation of metal ions.

ORGANIC CHEMISTRY-III(C-9)

1. Discuss the chemistry of Nitrogen containing compounds such as amines, nitro compounds, nitriles.
2. Give mechanism of some important reaction Gabriel phthalimide synthesis, Carbylamines reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction.
3. Give structure elucidation and derivative preparation of polynuclear hydrocarbon.

4. Give details of preparation of heterocyclic compounds by Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis, Fischer indole synthesis and Madelung synthesis.
5. Throw light about structural analysis of Nicotine and Hygrine and give medicinal importance of Hygrine, Quinine, Morphine, Nicotine, Cocaine and Reserpine.
6. Give structural elucidation of Citral, Neral and terpineol and isoprene rule.

PRACTICAL-C-9

1. To detect hetero element and functional group present in given organic compound.

PHYSICAL CHEMISTRY -IV (C-10)

1. Apply Faradays laws, Kohlrausch's law and Ostwald's dilution law and explain Debye Huckel Onsager equation in the respective field.
2. Determine transport number by Hittorf's moving boundary methods.
3. Describe conductometric and potentiometric titrations.
4. Explain reversible cell and different types of reversible electrodes.
5. Explain the applications of emf measurements.
6. Explain Clausius-Mosotti equation and Lorenz-Laurentz equation.

PRACTICAL-C-10

1. Demonstrate and perform conductometric titration and potentiometric titration of different acids vs. bases.

SEMESTER-V

ORGANIC CHEMISTRY-V(C-11)

1. Apply Woodward Fischer rule for the calculation of λ_{\max} values of different organic systems. (Aldehyde, ketone, carboxylic acid, esters, dienes, homoannular, heteroannular dienes system).
2. Know the knowledge of Chromophore, Auxochrome, Bathochromic shift, Hypsochromic shift.
3. Analyse IR spectrum in determination of functional group, H-bonding, Finger print region.
4. Know basic principle and instrumentation of NMR spectroscopy, chemical shift, spin-spin coupling, Anisotropic effect, determination of NMR of simple compound and able to apply these in structural analysis of different organic compounds.
5. Know basic principle of mass spectroscopy, instrumentation and application.
6. Explain the biological importance of carbohydrates and their interconversion by Killiani Fischer synthesis, Ruff degradation.
7. Know the synthesis and application of some important dyes Methyl orange, Congo red, Malachite green, crystal violet, and phenolphthalein, Fluorescein, Alizarin and Indigo.

8. Introduce classification of polymer, molecular weight determination and some application of polymer compounds.

PRACTICAL C-14

1. Prepare polyacrylate, urea formaldehyde, analysis of carbohydrates.
2. Acquire the knowledge about Qualitative analysis of unknown organic compounds.

PHYSICAL CHEMISTRY -V (C-12)

1. Get idea about Quantum Mechanics.
2. Apply Schrodinger wave equation to particle in 1 D box and 3 D box and H atom
3. Explain quantum numbers and its significance.
4. Get idea about Schrodinger equation for multi electron atoms.(spherical and polar coordinates)
5. Discuss LCAO-MO and VB treatment of H₂, HF, LiF, BeH₂, and H₂O.
6. Discuss the principles Vibrational spectroscopy, Vibrational rotational spectroscopy, Electronic spectroscopy.
7. Discuss some important terms like Morse potential, overtones, P, Q, R branches, Stokes and Anti Stokes lines, Frank Condon Principle.
8. Derive and explain Laws of photochemistry and their significance, quantum yield, chemiluminescence, photo stationary reaction.

PRACTICAL-C-12

1. Determine concentration of different solution spectrophotometric titration.

INORGANIC CHEMISTRY-III(C-13)

1. Discussion on organometallic compound with special reference to metal carbonyls.
2. Suggest methods of preparation and structural elucidation of mononuclear and binuclear carbonyl of transition metals with VBT.
3. Give structure of some simple organometallic compound of Li, Al, Mg.
4. Explain theoretical principle involved in group analysis and detection of unknown radicals using solubility product, common ion effect.
5. Explain the mechanism of reaction in square planar complexes, substitution in octahedral complexes, Trans effect explained.
6. Give idea about thermodynamic and kinetic parameters are derived for reaction of metal complexes.

PRACTICAL-C-13

1. Know the technique of qualitative analysis of mixture of six radicals.

ORGANIC CHEMISTRY -V (C-14)

1. Explain structure, synthesis and reaction of Adenine, Guanine, Cytosine, Uracil and Thiamine.
2. Give salient features of mechanism of enzyme action, coenzymes and co- factors, enzyme inhibition and their biological role.
3. Give basic information about Amino acid, protein and peptides.
4. Fundamentals of hydrogenation of fats, oils and their saponification value and iodine number.
5. Give structure and importance of Paracetamol, Ibuprofen, Chloroquine, Chloroamphenicol, Vitamin - C, Ranitidine which are widely used pharmaceuticals in our day to day life.

PRACTICAL-C-14

1. Demonstrate and prepare practically the drugs such as Aspirin, Phenacetin, Divol, Aluminium hydroxide gel, Milk of magnesia.

SEMESTER-VI

POLYMER CHEMISTRY (DSE -1)

1. Explain clearly the classification of polymers, functionality and its importance.
2. Discuss the mechanism of step growth, radical chain growth, ionic chain, co- ordination polymerization, copolymerization.
3. Know procedure for crystalline M.P. determination and the factors affecting those.
4. Explain the procedures for determination of molecular weight, polydispersity index and glass transition temperatures.
5. Explain the thermodynamics of polymers solutions.
6. Know properties simple polymers including preparation .
7. Acquire a good knowledge about the Industrial Applications of Polymers
8. Identify the commercially important Polymers.

PRACTICAL (DSE-1)

1. Know the methods of preparation, purification, polymerisation of MMA, AA, Nylon 6, Nylon6.6, IPC, acrylamide, Urea Formaldehyde, Novalac resin.
2. Know the methods for determination of molecular weight by viscometry, end group analysis, and colorimetric method.

GREEN CHEMISTRY (DSE -2)

1. Get detail information of twelve principle of green chemistry.
2. Explain the process of safer design for chemical synthesis to avoid hazards like Bhopal Gas Tragedy, Flixiborough accident etc.
3. Discuss the analytical technique to prevent, minimize the generation of Hazardous waste.
4. Design some greener alternative to Strecker synthesis, Hoffmann Elimination, Diels Alder Reaction, Simmons Smith Reaction.

5. Know some green synthesis of poly lactic acid, fats, oil, Tran's fat oils, Recyclable Carpet.

6. Give suggestion for future trends in green chemistry.

PRACTICAL (DSE- 2)

1. Demonstrate and do practically the green synthesis of Vitamin-c, preparation of biodiesel from vegetable oil.

2. Calculate atom economy of some reaction.

3. Do replacement of green solvent in some reaction, microwave synthesis.

INDUSTRIAL CHEMICALS AND ENVIRONMENT (DSE-3)

1. Know industrial preparation of oxygen, nitrogen, hydrogen, acetylene, carbon monoxide, chlorine, sulphur dioxide, argon, neon.

2. Acquire the idea of preparation and hazards in handling HCl, HNO₃, H₂SO₄, NaOH, H₂O₂, NaCl, Potash alum, K₂Cr₂O₇, KMnO₄.

3. Discuss the procedure for preparation of metals for semiconductor.

4. Discuss about biogeochemical cycles, source, and nature of air pollution.

5. Describe the photochemical smog, greenhouse effect, ozone layer depletion.

6. Explain elaborately the Hydrological cycle, source and nature of water pollution and ways of treatment of polluted water.

7. Discuss the effluent treatment process in electroplating, textile, tannery, dairy, petrochemical and fertilizer industry. 8. Explain water quality parameter.

PRACTICAL (DSE- 3)

1. Give experimental methods for determination of DO, BOD, COD, dissolve CO₂, in water and SPM in air.

2. Know Procedure for estimation of chlorine, chloride, sulphate and salinity of water by titration method.

(DSE-4) DISSERTATION WORK

During this work, studens

1. Will have to find a problem whose basis has been thought him/her in past years, but not in the exact shape, and do necessary field work with the guidance of teacher to solve, correlate and provide its conclusive results for the concern of others.
2. Express their creativity and develop higher order thinking skills.
3. Will have a team work to give more innovative ideas.
4. Learn to expose themselves with modern ICT and power point presentation.
5. Develop an aptitude for doing research.
6. Gets preliminary ideas for writing a thesis.
7. For analysis and interpretation of data they will use more resources.