Department of Chemistry

Programme outcome

This programme provides

1. Knowledge of chemistry by which one can go for higher studies, research activities in different fields, act as chemists, pharmacists etc.
2. Vital opportunities in science stream and most science students opt for this subject.
3. The skills of observations and drawing logical inferences from the scientific experiments.
4. Analyze the given scientific data critically and systematically and the ability to draw the objective conclusions.
5. To think creatively (divergently and convergent) to propose novel ideas in explaining facts and figures or providing new solution to the problems.
6. Realize how chemistry subject helps in the development of other science subjects and vice-versa and how interdisciplinary approach helps in providing better solutions and new ideas for the sustainable developments.

Programme Specific Outcome

1. Have sound knowledge about the fundamentals and applications of chemical and scientific theories in chemistry.
2. Every branch of Science and Technology is related to Chemistry.
3. Easily assess the properties of all elements discovered.
4. Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.
5. Become familiar with the different branches of chemistry like analytical, organic, inorganic, physical, environmental, polymer and biochemistry
6. Help in understanding the causes of environmental pollution and can open up new methods for environmental pollution control.
7. Develop analytical skills and problem solving skills requiring application of chemical principles.
8. Acquire the ability to synthesise, separate and characterize compounds using laboratory and instrumentation techniques.
9. Acquire the ability to develop the green methods for hazardous chemical reactions.
10. Become familiar with doing project work as part of a pilot research project.

SEMESTER-1

INORGANIC CHEMISTRY-I (C-1)

Course Outcome

1. Discuss Bohr's theory of atom and spectrum of hydrogen atom.

2. Explains quantum mechanical model of atom.

3. Gives detail explanation of Schrodinger wave equation and its significance in H –atom.

4. Explains 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. Explains the bonding fundamentals for both ionic and covalent compounds including electro negativities, bond distances and bond energies using MO diagrams and thermodynamic data.

7. Discuss the percentage of ionic character in covalent bond and its determination and rules associated with it.

8. Provides 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. Give the way of preparation of solution of different Morality and Normality.

2. Explain the principle of acid base titration involving mixture.

3. Explain the redox principle involving estimation of Fe and oxalic acid.

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. Determination method for surface tension, viscosity by different methods.

2. Preparation method for buffer solutions and pH metric titration.

SEMESTER -II

ORGANIC CHEMISTRY (C-3)

Course Outcome

1. Describe the different types of electron displacement in organic compounds.

2. Explain Electrophiles and Nucleophiles and stability of reaction intermediates.

3. Explain reaction mechanism of different types of basic organic reactions.

4. Different stereo chemical formulas are given along with geometrical (E/Z) and optical isomerism (D/L), (R/S) conventions and their resolution.

5. To understand aliphatic and aromatic, nucleophilic and electrophilic substitution with mechanism and kinetics.

6. To develop an ability to understand addition and elimination reactions with mechanism and stereo chemical aspect.

7. To 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. Determination of M.P and B.P of different solids and liquids.

2. Paper chromatographic methods for mixture of organic compounds.

PHYSICAL CHEMISTRY(C-4)

Course Outcome

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. Discuss Raoults law and Henrys law.

PRACTICAL-C-4

1. Introduce Calorimeter experiments to determine enthalpy of different process.

SEMESTER-III

INORGANIC CHEMISTRY (C-5)

Course Outcome

1. Explain different general principle of Metallurgy with Ellingham diagrams.

2. Introduces concept of acid and bases, HSAB principle and their application.

3. Discuss the chemistry of s and p block element with special reference to oxidation state, allotropy, complex formation and hydride formation.

4. Discuss the chemistry of compounds of Boron, Silanes, oxides of Nitrogen, phosphorus and chlorine.

5. Discuss the chemistry of fluorides of xenon.

6. Explain VBT and MO treatment of XeF_2 .

7. Explain the chemistry of Inorganic polymers their structure, applications.

PRACTICAL-C-5

1. Iodo/Iodimetric estimation of Copper and chlorine.

2. Preparation of Manganese (III) Phosphate, Cuprous Chloride, Potash Alum.

ORGANIC CHEMISTRY-II(C-6)

Course Outcome

1. Elaboration of chemistry of Alkyl and Aryl halide with respect to substitution nucleophilic reaction and their solvent effect, Elimination vs. substitution reaction.

2. Brief introduction to organometallic compounds of Mg and Li.

3. Discuss the general preparation of $1^0,2^0,3^0$ alcohols.

4. Discuss the Chemistry of glycol, Pinacol-Pinacolone rearrangement.

5. Discuss some name reaction of Phenol, Reimer Tiemann Reaction, Kolbe's Schmidt Reaction, Fries and Claisen rearrangement and their mechanism.

6. Explain mechanism of important reaction of carbonyl compound and their mechanism.

7. Explain preparation, properties of monocarboxylic acids, dicarboxylic acids, acid chlorides, anhydrides, esters and amides.

8. Discuss mechanism of Dieckmann, Reformatsky, Hofmann –bromamide degradation and Curtius rearrangement.

PRACTICAL-C-6

1. Give methods of organic preparation using conventional and green approach.

2. Bromination and Nitration of different organic compound.

PHYSICAL CHEMISTRY –III (C-7)

Course Outcome

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

2. Derivation Clasius Clapeyron equation.

3. Discussion on phase diagram water and sulphur system , solid-liquid eqilibria, Pb-Ag system, desilverisation of lead.

4. Derivation of Gibbs-Duhem-Margules equation and its applications.

5. Derivation of 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. Determination of rate constant of hydrolysis reaction and verification of isotherms by experimental method.

SEMESTER-IV

INORGANIC CHEMISTRY-III (C-8)

Course Outcome

1. Detailed discussion on CBT and CFT of 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. Review of 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. Give procedure for gravimetric estimation of Ni, Cu, Fe, Al and chromatographic separation of metal ions.

ORGANIC CHEMISTRY-III(C-9)

Course Outcome

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. Suggest structure elucidation of Nicotine and Hygrine and give medicinal importance of Hygrine, Quinine, Morphine, Nicotine, Cocaine and Reserpine.

6. Give structure elucidation of Citral, Neral and terpineol and isoprene rule.

PRACTICAL-C-9

1. Give methods for detection of extra element and detection of functional group.

PHYSICAL CHEMISTRY –IV (C-10)

Course Outcome

1. State Faradays laws, Kohlrausch's law and Ostwald's dilution law and explain Debye Huckel Onsagar equation.

2. Determination of 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. Gives methods for conductometric titration and potentiometric titration of different acids vs. bases.

SEMESTER-V

ORGANIC CHEMISTRY-IV(C-11)

Course Outcome

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.

PRACTICAL-C-11

1. Give preparation methods for Aspirin, Phenacitin, Divol, Aluminium hydroxide gel, Milk of magnesia.

PHYSICAL CHEMISTRY –V (C-12)

Course Outcome

1. State the postulates of 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. Apply Schrodinger equation for multi electron atoms.(spherical and polar coordinates)

5. Discuss LCAO-MO and VB treatment of H_2, HF, LiF, BeH_2, 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. Discuss Laws of photochemistry and their significance, quantum yield, chemiluminiscence, photo stationary reaction.

PRACTICAL-C-12

1. Determination of concentration different solution spectrophtometric titration.

INORGANIC CHEMISTRY-III(C-13)

Course Outcome

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 sq planar complexes, substitution in octahedral complexes, Trans effect explained.

6. Thermodynamic and kinetic parameters are derived for reaction of metal complexes.

PRACTICAL-C-13

1. Procedure for semi micro qualitative analysis of mixture of six radical is given.

ORGANIC CHEMISTRY –IV (C-14)

Course Outcome

1. Woodward Fischer rule for calculation of [illegible] of different organic systems. (Aldehyde, ketone, carboxylic acid, esters, dienes, homoannular, heteroannular dienes system).

2. Give definition and example of Chrmophore, Auxochrome, Bathochromic shift, Hypsochromic shift.

3. Application of IR spectrum in determination of functional group, H-bonding, Finger print region.

4. Discussed basic principle of NMR spectroscopy, chemical shift, spin-spin coupling, Anisotropic effect, determination of NMR of simple compound.

5. Discussed 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. Given 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. Procedure given for preparation of polyacrylate, urea formaldehyde, analysis of carbohydrates.

2. Qualitative analysis of unknown organic compound.

SEMESTER-VI

POLYMER CHEMISTRY (DSE -1)

Course Outcome

1. Discuss classification of polymers, functionality and its importance.
2. Discuss the mechanism of step growth, radical chain growth, ionic chain, co ordination polymerization, co polymerization.
3. Procedure for crystalline M.P. determination, factors affecting is given.
4. Explain the procedures for determination of molecular weight, polydispersity index and glass transition temperatures.

5. Explain the thermodynamics of polymers solutions.
6. Properties simple polymers including preparation are explained.
7. A good knowledge about the Industrial Applications of Polymers
8. Identify the commercially important Polymers.

PRACTICAL (DSE-1)

1. Procedure given for preparation, purification, polymerisation of MMA, AA, Nylon 6,6/6, IPC, acrylamide, Urea Formaldehyde, Novalac resin.
2. Determination of molecular weight by viscometry, end group analysis, and colorimetric method.

GREEN CHEMISTRY (DSE -2)

Course Outcome

1. Give detail information of twelve principle of green chemistry.
2. Explain the process of safer design for chemical synthesis to avoid Bhopal Gas Tragedy, Flixiborough accident.
3. Discuss the analytical technique to prevent, minimize the generation of Hazardous waste.
4. Designing some greener alternative to Strecker synthesis, Hoffmann Elimination, Diels Alder Reaction, Simmons Smith Reaction.
5. Designing 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. Methods given for green synthesis of Vitamin-c, preparation of biodiesel from vegetable oil.

2. Calculation of atom economy of some reaction.

3. Replacement of green solvent in some reaction, microwave synthesis.

INDUSTRIAL CHEMICALS AND ENVIRONMENT (DSE-3)

Course Outcome

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

2. Given preparation and hazards in handling HCl, HNO_3, H_2SO_4, NaOH, H_2O_2, NaCl, Potash alum,$K_2Cr_2O_7$, $KMnO_4$.
3. Discuss the procedure for preparation of metals for semiconductor.
4. Elaborately discuss about biogeochemical cycles, source, and nature of air pollution.
5. Give notes of photochemical smog, green house effect, ozone layer depletion.

6. Elaborately explain 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, diary, petrochemical and fertilizer industry.
8. Explain water quality parameter.

PRACTICAL (DSE- 3)

1. Give experimental methods for determination of DO, BOD, COD, dissolve CO_2, in water and SPM in air.

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

(DSE-4) DISSERTATION WORK

Course Outcome

1. Students express their creativity and develop higher order thinking skills.

2. Team work gives more innovative ideas.

3. Learn to prepare power point presentation.

4. Develops an aptitude for doing research.

5. Gets preliminary ideas for writing a thesis.

6. For analysis and interpretation of data they will use more resources.

GENERIC –I

Course Outcome

1. 1. Discuss Bohr's theory of atom and spectrum of hydrogen atom.

2. Explains quantum mechanical model of atom.

3. Gives detail explanation of Schrodinger wave equation and its significance in H –atom.

4. Explains filling of electron in shell, sub shell and orbital.

1. Describe the different types of electron displacement in organic compounds.

2. Explain Electrophiles and Nucleophiles and stability of reaction intermediates.

3. Explain reaction mechanism of different types of basic organic reactions.

4. Different stereo chemical formulas are given along with geometrical (E/Z) and optical isomerism (D/L), (R/S) conventions and their resolution.

5. Give details of calculation of lattice energy by Born Lande equation and Born Haber cycle.

6. VB and MO approach of homo diatomic molecule is explained.

7. Chemistry of alkynes, alkanes, alkenes are discussed.

GENERIC –II

Course Outcome

1. Explain the general principle of ionic equilibrium with pH and common ion effect

2 Explain the principle of salt hydrolysis, buffer solution, solubility product, acid- base indicator and their application in qualitative indicator.

3.Discussed the laws of thermodynamics and derived Kirchhoff's law.

4. Explained thermodynamic approach to derivation of law of chemical equilibrium.

5.General chemistry of alkyl and aryl halide with special emphasis of Benzyne mechanism.

6. General chemistry of alcohol, phenol, ether, acid chloride, nitriles.

Principal
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