ANNAMALAI UNIVERSITY

205. B.Sc. Industrial Chemistry

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted in Affiliated Colleges   
in the academic year 2022 -2023 ONLY)

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| --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Code** | **Part** | **Study Components & Course Title** | **Hours/ Week** | **Credit** | **Maximum Marks** | | |
| **CIA** | **ESE** | **Total** |
|  |  | **SEMESTER – I** |  |  |  |  |  |
| **22UTAML11** | I | **Language Course - I : Tamil-I** | 5 | 3 | 25 | 75 | 100 |
| **22UENGL12** | II | **English Course - I : Communicative English I** | 5 | 3 | 25 | 75 | 100 |
| 22UICHC13 | III | Core Course - I :General Chemistry-I | 4 | 4 | 25 | 75 | 100 |
| 22UICHC14 | Core Course - II :General Chemistry-II | 4 | 4 | 25 | 75 | 100 |
|  | Core Practical – I :Volumetric Analysis | 3 | - | - | - | - |
| 22UICHA01 | Allied - I : Paper – 1 : Industrial Chemistry-I | 4 | 3 | 25 | 75 | 100 |
|  | Allied Practical – I : Industrial Chemistry Practicals-I | 3 | - | - | - | - |
| **22UENVS18** | IV | **Environmental Studies** | 2 | 2 | 25 | 75 | 100 |
|  | **Total** | | **30** | **19** |  |  | **600** |
|  |  | **SEMESTER – II** |  |  |  |  |  |
| **22UTAML21** | I | **Language Course - II : Tamil-II** | 5 | 3 | 25 | 75 | 100 |
| **22UENGL22** | II | **English Course - II : Communicative English II** | 5 | 3 | 25 | 75 | 100 |
| 22UICHC23 | III | Core Course – III : General Chemistry-III | 4 | 3 | 25 | 75 | 100 |
| 22UICHP24 | Core Practical – I : Volumetric Analysis | 3 | 3 | 40 | 60 | 100 |
| 22UICHA02 | Allied – I: Paper -2 :Industrial Chemistry-II | 3 | 3 | 25 | 75 | 100 |
| 22UICHP01 | Allied Practical – I : Industrial Chemistry Practicals-I | 3 | 3 | 40 | 60 | 100 |
| 22UICHE26 |  | Internal Elective-I | 3 | 3 | 25 | 75 | 100 |
| **22UVALE27** | IV | **Value Education** | 2 | 1 | 25 | 75 | 100 |
| **22USOFS28** | **Soft Skill** | 2 | 1 | 25 | 75 | 100 |
| 22UNMSD01 |  | **SKIL DEVELOPMENT COURSE-I EFFECTIVE ENGLISH** | - | 2 | 25 | 75 | 100 |
|  | **TOTAL** | | 30 | **25** |  |  | **1000** |
|  |  | **SEMESTER – III** |  |  |  |  |  |
| **22UTAML31** | I | **Language Course – III : Tamil-III** | 5 | 3 | 25 | 75 | 100 |
| 22UENGL32 | I | English Course – III : English Through Literature-I | 5 | 3 | 25 | 75 | 100 |
| 22UICHC33 | III | Core Course – IV :General Chemistry-IV | 4 | 4 | 25 | 75 | 100 |
| 22UICHP34 | Core Practical – II :Inorganic Qualitative Analysis | 3 | - | - | - | - |
| 22UICHA03 | Allied - II : Paper -1-Industrial Chemistry-III | 3 | 3 | 25 | 75 | 100 |
|  | Allied Practical – II : -Industrial Chemistry Practicals-II | 3 | - | - | - | - |
| 22UICHE36 | Internal Elective – I | 3 | 3 | 25 | 75 | 100 |
|  | IV | Non-Major Elective – I : | 2 | 2 | 25 | 75 | 100 |
| 22UICHS38 | Skill Based Subject – I : -Water Treatment And Analysis | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total** | **30** | **20** |  |  | **700** |

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|  |  | **SEMESTER – IV** |  |  |  | |  |  |
| **22UTAML41** | I | **Language Course - IV: Tamil-IV** | 5 | 3 | 25 | | 75 | 100 |
| 22UENGL42 | I | English Course – IV : English Through Literature-II | 5 | 3 | 25 | | 75 | 100 |
| 22UICHC43 | III | Core Course – V : General Chemistry-V | 4 | 3 | 25 | | 75 | 100 |
| 22UICHP44 | Core Practical – II : Inorganic Qualitative analysis | 4 | 3 | 40 | | 60 | 100 |
| 22UICHA04 |  | Allied – II : Paper – 2-Industrial Chemistry-IV | 3 | 3 | 25 | 75 | | 100 | |
| 22UICHP02 | Allied Practical – II : -Industrial Chemistry Practicals-II | 3 | 3 | 40 | 60 | | 100 | |
|  | IV | Non-Major Elective – II : | 2 | 2 | 25 | 75 | | 100 | |
| 22UICHS48 | Skill Based Subject – II :-Food Chemistry | 2 | 2 | 25 | 75 | | 100 | |
| 22UNMSD02 |  | MS-Office Essentials |  | **2** | 25 | 75 | | 100 | |
|  |  | **Total** | **30** | **24** |  |  | | **900** | |
| **SEMESTER – V** |  |  |  |  | |  | |
| 22UICHC51 | I II  III | Core Course – VI : -Inorganic Chemistry-I | 4 | 4 | 25 | 75 | | 100 | |
| 22UICHC52 | Core Course – VII :Organic Chemistry-I | 4 | 4 | 25 | 75 | | 100 | |
| 22UICHC53 | Core Course – VIII : Physical Chemistry-I | 4 | 4 | 25 | 75 | | 100 | |
| 22UICHC54 | Core Course – IX : Analytical Chemistry | 5 | 4 | 25 | 75 | | 100 | |
|  | Core Practical – III : Gravimetric Analysis and Organic Preparations | 3 | - | - | - | | - | |
|  | Core Practical – IV : Organic Qualitative analysis | 3 | - | - | - | | - | |
| 22UICHE58 | Internal Elective – III : | 3 | 3 | 25 | 75 | | 100 | |
| 22UICHS59 | IV IV | Skill Based Subject – III:-Applied Chemistry | 2 | 2 | 25 | 75 | | 100 | |
| **22UGENS57** | **Gender Studies** | 2 | 1 | 25 | 75 | | 100 | |
|  |  |  |  |  |  |  | |  | |
|  |  | **Total** | **30** | **22** |  |  | | **700** | |
|  |  | **SEMESTER – VI** |  |  |  |  | |  | |
| 22UICHC61 | III | Core Course – X :-Inorganic Chemistry-II | 5 | 4 | 25 | 75 | | 100 | |
| 22UICHC62 | Core Course – XI :-Organic Chemistry-II | 5 | 4 | 25 | 75 | | 100 | |
| 22UICHC63 | Core Course – XII : -Physical Chemistry-II | 5 | 4 | 25 | 75 | | 100 | |
| 22UICHP64 | Core Practical – III :Gravimetric Analysis and organic Preparations | 3 | 4 | 40 | 60 | | 100 | |
| 22UICHP65  22UICHP66 | Core Practical – IV: Organic Qualitative Analysis  Core Practical-V-Physical Chemistry Practicals | 3  3 | 4  4 | 40  40 | 60  60 | | 100  100 | |
| 22UICHE68 | Internal Elective – IV | 4 | 3 | 25 | 75 | | 100 | |
| 22UICHS69 | IV | Skill Based Subject – IV :-Dairy Chemistry | 2 | 2 | 25 | 75 | | 100 | |
| **22UEXTA67** | V | **Extension Activities** | - | 1 | 100 | - | | 100 | |
| 22UNMSD03 |  | EMPLOYABILITY REDINESS  (NAANDI/UNNATI/SKILLS BUILD) |  | 0 | 25 | 75 | | 100 | |
|  |  | **Total** | **30** | **30** |  |  | | **1000** | |
|  |  | **Grand Total** | **180** | **140** |  |  | | **4900** | |

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**Internal Elective Courses**

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| --- | --- | --- |
| 22UICHE26-1  22UICHE26-2  22UICHE26-3 | Internal Elective - I : | Health Chemistry |
| Phrmaceutical Chemistry |
| Textile Chemistry |
| 22UICHE36-1  22UICHE36-2  22UICHE36-3 | Internal Elective - II : | Agricultural Chemistry |
| Green Chemistry |
| Bio Chemistry |
| 22UICHE58-1  22UICHE58-2  22UICHE58-3 | Internal Elective - III : | Polymer Chemistry |
| Spectroscopy-I |
| Basics Of Computer Programming in C And its Applications |
| 22UICHE68-1  22UICHE68-2  22UICHE68-3 | Internal Elective - IV | Nano Chemistry |
| Spectroscopy-II |
| Organic Synthesis |

**Allied Courses**

|  |  |  |
| --- | --- | --- |
| 22UICHA01 | Theory | Industrial Chemistry-I |
| 22UICHA02 | Theory | Industrial Chemistry-II |
| 22UICHP02 | Practical | Industrial Chemistry Practicals-I |
| 22UICHA03 | Theory | Industrial Chemistry-III |
| 22UICHA04 | Theory | Industrial Chemistry-IV |
| 22UICHP04 | Practical | Industrial Chemistry Practicals-II |

**(Allied courses are only for B.Sc Industrial Chemistry Program)**

**Non-Major Elective Courses (NME)**

(Department of Industrial Chemistry offers the following NME to other Departments)

|  |  |
| --- | --- |
| 22UICHN37 | Medicinal chemistry |
| 22UICHN47 | Chemistry In Today’s World |

**Credit Distribution**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Part** | **Study Components** | **Papers** | **Credits** | **Total Credits** | **Marks** | **Total Marks** |
| Part I | Languages | 4 | 3 | 12 | 100 | 400 |
| Part II | Communicative English & English | 4 | 3 | 12 | 100 | 400 |
| Part III | Core Courses | 12 | 4 | 48 | 100 | 1200 |
|  | Core Practical | 5 | 4 | 20 | 100 | 500 |
|  | Allied Courses | 4 | 3 | 12 | 100 | 400 |
|  | Allied Practical | 2 | 3 | 6 | 100 | 200 |
|  | Internal Electives | 4 | 3 | 12 | 100 | 400 |
| Part IV | Environmental Studies | 1 | 2 | 2 | 100 | 100 |
|  | Value Education | 1 | 1 | 1 | 100 | 100 |
|  | Soft Skill | 1 | 1 | 1 | 100 | 100 |
|  | Gender Studies | 1 | 1 | 1 | 100 | 100 |
|  | Non Major Electives | 2 | 2 | 4 | 100 | 200 |
|  | Skill Based Courses | 4 | 2 | 8 | 100 | 400 |
| Part V | Extension Activities | 1 | 1 | 1 | 100 | 100 |
|  |  | **46** |  | **140** |  | **4600** |

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| SEMESTER: I  PART: III | 22UICHC13: GENERAL CHEMISTRY – I | CREDIT: 4  HOURS: 4/W |

COURSE OBJECTIVES

1. To provide basic idea about regarding atomic structure
2. To impart knowledge about Periodic Properties, Bonding Concepts, Ionic Bond, VSEPR and MO Theories.
3. To acquire in-depth knowledge about Nomenclature of Organic Compounds, Hybridisation, Reaction Intermediates.
4. To inculate interest in Gaseous State, Kinds of velocities, Virial equation of state.
5. Make the students to understand aboutLiquid state, Liquid crystals, Solid state, X-ray diffraction.

UNIT-I ATOMIC STRUCTURE HOURS: 12

**1.1**Quantum numbers n, l, m and s – Pauli’s exclusion principle – Energy distribution and orbitals - Hund’s rule of maximum multiplicity - Aufbau's principle – Electronic Configuration of elements - Stability of Half-filled and completely filled orbitals. Shapes of s, p, d and f orbitals.

**1.2**Classification of elements – General characteristics of s, p, d and f- Block elements – Periodicity of properties- Definition and Periodicity of the following properties – Atomic radii and Ionic radii - Factors affecting the atomic radii and Ionic radii.

**1.3** Ionisation potential, Electron affinity and Electronegativity - Factors affecting the Ionisation potential, Electron affinity and Electronegativity – Pauling scale – Mulliken electronegativity scale – Applications of Electronegativity regarding the Bonding nature. Trends in periodic table and applications in predicting and explaining the chemical behavior.

UNIT- II CHEMICAL BONDING HOURS: 12

**2.1** Ionic bond - Conditions for the formation of ionic bond - General properties – Energetics of formation of NaCl from Na+ and Cl- - Hydration energy, Lattice energy and their applications – Born-Haber cycle - Polarisation of ions- Fajan's rule - Transition from ionic to covalent character.

**2.2** Covalent bond - Conditions for the formation of covalent bond - General properties -Polarity of bonds - Orbital overlap - Bond lengths and Bond energies - Hybridisation -Sigma and Pi bonds - VSEPR theory - Geometries of BeCl2, BF3, NH3, CH4, SF4, ICl2-, H2O, PCl5, ClF3, XeF6, SF6 and IF7 molecules - Partial ionic character of covalent bond - Percentage of ionic character from dipole moment and electronegativity difference.

**2.3**Molecular Orbital theory – Bonding and Anti-bonding orbitals - Relative order of Energies of molecular orbitals - MO diagram of H2, He2, O2, O2+, O2-, N2, F2, HF and CO - Bond Order - Stability and Magnetic properties of the molecules - Comparison of VB and MO theories. Hydrogen bonding-types, examples and effect on properties.

UNIT- III BASIC CONCEPTS OF ORGANIC CHEMISTRY HOURS: 12

**3.1**Classification of Organic Compounds – nomenclature of Organic Compounds – Functional Groups - Homologous Series - IUPAC Recommendations for Naming Simple Aliphatic and Alicyclic Compounds.

**3.2** Basic concepts of bonding in organic chemistry - Hybridisation – Definition – Geometry of Molecules - Methane, Ethane, Ethylene, Acetylene and Benzene - Electron displacement effects - Inductive - Inductomeric - Electromeric – Mesomeric Effect - Resonance - Hyperconjugation and Steric Effects.

**3.3** Cleavage of bonds - Homolytic and Heterolytic fission of carbon-carbon bond – Methods to determine the Reaction Mechanism - Reaction intermediates - Structure and Stability of Carbocations, Carbanions and Free radicals.

UNIT-IV STATES OF MATTER-I HOURS: 12

**4.1** Gaseous state - Kinetic gas equation - Postulates and Derivation - Gas laws from the kinetic gas equation.

**4.2** Kinds of velocities - Mean, RMS, Most Probable Velocities - Calculation of molecular velocities - Maxwell's distribution of Molecular Velocities.

**4.3** Effect of Temperature on velocity distribution - Equipartition of energy - Heat capacity on molecular basis - Virial equation of state - Boyle temperature - Coefficient of Compressibility and Thermal expansion.

UNIT-V STATES OF MATTER-II HOURS: 12

**5.1**Liquid state - Density – Diffusion - Viscosity – Evaporation - Surface tension Determination using Stalagmometer - Effect of temperature on surface tension - Parachor - Definition and Applications only - Coefficient of Viscosity- determination using Oswald’s Viscometer- Effect of Temperature and Pressure.

**5.2** Liquid crystals - Classification and Applications.

**5.3** Solid State - Crystal lattices - Symmetry elements in crystals - Unit cell- Seven crystal systems - Space lattice - Bravais lattices - Laws of Crystallography-law of constancy of inter facial angles and Rational Indices- Miller indices, X-ray diffraction by crystals.

COURSE OUTCOMES

1. Recollect the Chemistry of Quantum Numbers.
2. Discuss various types of bonding through VB & MO theories.
3. Name simple Aliphatic and Aromatic Compounds and Illustrate and apply electron displacement effects and reaction mechanisms.
4. Understand Gaseous state, kinds velocities.
5. Elaborate the basic concepts of solid and liquid states.

Text Books

1. P.L. Soni,2000, “Text book of Inorganic Chemistry”, 20th revised edition, Sultan Chand & Sons, New Delhi.
2. Bahl, B.S. and Bahl, A.,2010, Advanced Organic Chemistry, (12th edition), Sultan Chand & Co., 12th Edition,New Delhi.
3. Puri B.R., Sharma L.R. and Pathania M.S.2013, Principles of Physical Chemistry, Shoban Lal Nagin chand and Co.,35th Edition,New Delhi.

Supplementary Readings

1. J.D. Lee, 2000 ‘Concise Inorganic Chemistry’, Sultan Chand & Sons, 20th revised Edition, New Delhi.
2. Morrison, R.T. and Boyd, R.N., Bhattacharjee, 2011, S. K. Organic Chemistry, Pearson, India, 7th Edition, New Delhi.
3. Glasstone S. and Lewis D.,1963, Elements of Physical Chemistry, London, Mac Millan & Co Ltd; 1st Edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 2 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: I  PART: III | 22UICHC14: GENERAL CHEMISTRY – II | CREDIT: 4  HOURS: 4/W |

COURSE OBJECTIVES

To give insights into chemistry experiments for a beginner in

1. Lab safety and Nature of chemicals.
2. Types of titrations and Concentration terms.
3. Semimicro analysis and precipitation techniques.
4. Organic analysis
5. Logarithm, drawing graph, rules of differentiation and integration.

UNIT- I LAB SAFETY, CHEMICALS AND GLASSWARES HOURS: 12

1.1 Philosophy of lab safety – first–aid techniques – general work culture inside the chemistry lab– importance of wearing lab coat, eye glasses. Personal protection.

1.2 Nature of chemicals – toxic, corrosive, explosive, inflammable, carcinogenic, other hazardous chemicals – safe storing and handling of chemicals – disposal of chemical wastes – glassware – handling of glassware – handling of different types of equipment’s like Bunsen burner, centrifuge machines Kipp’s apparatus, etc. – ventilation facilities.

1.3 Heating methods, stirring methods filtration techniques. Calibration of pipette, standard measuring flask and burette. Weighing principle in chemical balance and single pan balance.

UNIT - II TITRIMETRIC METHODS OF ANALYSIS HOURS: 12

2.1 General Introduction General principle: Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, formality, normality, wt% ppm, milli equivalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, end point and equivalence point.

2.2 Acid-base Equilibria pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from Ka and Kb values. Neutralisation titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

2.3 Complexometric titrations Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics. Precipitation titrations Argentometric titrations, indicators for precipitation titrations involving silver. Determination of chloride by Volhard's method. Adsorption indicators.

UNIT–III SEMIMICRO METHODS AND GRAVIMETRIC METHODS HOURS: 12

3.1 Laboratory methods in semi-micro qualitative analysis – Filtration of precipitates – washing of precipitates – heating and evaporation – transferring residue – methods 7 of precipitating sulphides – types of reactions involved in qualitative analysis – spot test analysis – removal of interfering ions.

3.2 General Separation Techniques Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

3.3 Methods of obtaining the precipitate – conditions for precipitation – choice of precipitants – advantages and disadvantages of using organic precipitants – types of organic precipitants – specific and selective precipitants – sequestering agents.

UNIT-IV BASICS OF ORGANIC ANALYSIS HOURS: 12

4.1 Principle of distillation –Detection of elements – Lassaigne's test - nitrogen, sulphur, halogens.

4.2 Estimation of nitrogen by Kjeldahl method – estimation of halogens by Carius method.

4.3 Qualitative tests to identify organic functional groups – aliphatic and aromatic, test for unsaturation, phenols, aldehydes, ketones, esters, carbohydrates, amines, amides, carboxylic acids (any one test for each).

UNIT-V Chemical Mathematics HOURS: 12

5.1. Logarithm: Rules of logarithm, Characteristic and mantissa, change of sign and base, Problems based on pH and pOH.

5.2. Graphical representation of equations: Rules for drawing graph co-ordinates etc., Equation of straight line, slope and intercept, plotting the graph from the data of chemical properties and problems.

5.3. Derivative:Rules of differentiation and partial differentiation, Algebraic, logarithmic and exponential functions and problems. Rules of integration, Algebraic and exponential functions and problems.

COURSE OUTCOMES

1. How to be safe in chemistry laboratory and handle chemicals carefully.
2. Exposed to handling burette, pipette etc and various types of titrations.
3. How qualitative methods are useful in finding inorganic radicals.
4. Gain knowledge about organic analysis.
5. Use of taking logarithm, drawing graphs in various experiments in Chemistry.

Text Books

1. U.N. Dash, 2005, Analytical Chemistry: Theory and Practice, Sultan Chand and sons. Educational Publishers, 2nd Edition, New Delhi,
2. J.Bassett, R.C.Denney, G.H.Jerrey and J.Mendham, 1994,Vogel’s Text Book Of Inorganic Quantitative Analysis, ELBS, 5th Edition, London.

Supplementary Readings

1. Svehla, 2012, Vogel’s Qualitative Analysis, Pearson Education, 7th Edition,New Delhi.
2. Venkateswaran V, Veeraswamy R, Kulandaivelu A R, 1997,Basic Principles Of Practical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi.
3. D.A. Skoog, D.M. West and F. J.Holler, 1990, Analytical chemistry,Saunders college publishing, 5th Edition, Philadelphia.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 2 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

|  |  |  |
| --- | --- | --- |
| SEMESTER: I  PART:III  ALLIED: I | 22UICHA01: INDUSTRIAL CHEMISTRY – I | CREDIT: 3  HOURS: 4/W |

COURSE OBJECTIVES

1. To enable the learners to understand the significance of Inorganic Cementing Materials.
2. To know the details of, Portland cement, Glass, Ceramics, and Plasticity of Clay.
3. To impart knowledge of Refractoriness and Portland cement.
4. To be familiar with the details of adhesives.
5. To understand the basic concepts and application of an Abrasives, Pulp and paper.

UNIT-I: INORGANIC CEMENTING MATERIALS HOURS: 12

Introduction - Lime and its manufacture - Gypsum Plaster - Cement - Types of cement. - Chemical Composition Manufacture of Portland cement - Chemical Composition of Portland Cement - Setting and Hardening of Portland Cement. The Heat of Hydration of Cement - Special Cement – Concrete and RCC - Decay of Concrete.

UNIT-II: GLASS AND CERAMICS HOURS: 12

Introduction - Manufacture of Glass - Varieties of Glasses. **2.2** Plasticity of Clay - White wares - Glazing - applications - Earthenware ‘sand stoneware’ – Optical Fibres.

UNIT-III: REFRACTORIES HOURS: 12

Introduction - Classification - Manufacture of Refractoriness - Cermets - Insulating refractoriness - Requirements of a refractory.

Combustion - Mass analysis from volume analysis and vice-versa Flue gas analysis- efficiency of combustion.

UNIT-IV: ADHESIVES HOURS: 12

Introduction - Classification of adhesives - Adhesive Action - Development of Adhesive Strength. Solvent Responsive, Adhesives - Uses of Solvent Responsive, Adhesives. Chemically reactive, adhesives.

Preparation of adhesives - Synthetic resin adhesives – Rubber - based adhesives - Cellulose and silicate adhesives - Uses of adhesives.

UNIT-V: ABRASIVES HOURS: 12

Introduction - Natural Abrasives - Artificial Abrasives – Grinding Wheels. Pulp and paper - Introduction - Manufacture of pulp - Sulphate pulp - Soda pulp - Rag pulp - Beating, refining, filling, sizing and colouring - manufacture of paper.

COURSE OUTCOMES

1. Describe the distinction between Mass analysis from volume analysis and vice-versa.
2. Write down the Applications of Glasses, ceramics.
3. Describe the Chemical Composition of Setting and Hardening of Portland Cement.
4. Write down Development of Adhesive Strength. Solvent Responsive.
5. Describe the Manufacture of pulp and Paper.

Text Books

1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd,London.
2. J. A. Kent, 1997, Riegelís Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi.
3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi.

Supplementary Readings

1. [Ullmann's Encyclopedia of Industrial Chemistry, Vol. B1, Fundamentals of Chemical Engineering,](https://www.amazon.com/dp/3527201319?tag=uuid10-20)[Hans-Jürgen Arpe](https://bookauthority.org/author/Hans-J%C3%BCrgen-Arpe).
2. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 2 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

|  |  |  |
| --- | --- | --- |
| SEMESTER:II  PART:III | 22UICHC23: GENERAL CHEMISTRY – III | CREDIT: 3  HOURS: 4/W |

COURSE OBJECTIVES

1. To obtain a comprehensive overview on s and p block elements.
2. To understand the properties and reactions of alkanes, alkenes and alkynes.
3. To impart knowledge regarding the basics of dienes and cycloalkanes.
4. To understand the various terminologies and reactions related to Quantum Chemistry and Thermodynamics.
5. To understand the laws and reactions related to Thermochemistry.

UNIT-I s- AND p- BLOCK ELEMENTS HOURS: 12

**1.1** Alkali metals - Li, Na, K, Rb and Cs - Occurrence - Comparative study of Elements with respect to Oxides, Halides, Hydroxides and Carbonates - Exceptional property of Lithium - Diagonal Relationship of Li with Mg.

**1.2** Alkaline earth metals - Be, Mg, Ca, Sr and Ba - Occurrence - Comparative study of the elements with respect to Oxides, Hydroxides, Halides, Sulphates and Carbonates - Exceptional property of Beryllium - Diagonal relationship of Be with Al - Comparison of Alkaline Earth Metals with Alkali Metals - Magnesium acting as bridge element between II A and II B groups - Magnesium resembles Zinc.

**1.3** p- Block elements - Boron family - Group discussion - Anomalous behaviour of Boron - Diagonal Relationship between Boron and Silicon - Electron deficiency and Electron acceptor behaviour of Boron trihalides - Bonding in Diborane (Hydrogenbridge structure) - Preparation, Properties, structure and Uses of Borazine, NaBH4, LiAlH4 and boron nitride.

UNIT-II HYDROCARBONS HOURS: 12

**2.1** Alkanes - Methods of preparation of alkanes - Wurtz method, Kolbe’s method and Reduction of alkyl halides - Physical and Chemical Properties of alkanes - Mechanism of Free Radical Substitution in alkanes – Halogenation and Reactivity.

**2.2** Alkenes - Properties of alkenes – Electrophilic and Free radical addition - Addition reactions of Alkenes with mechanism - Addition of Hydrogen, Halogens, Hydrogen Halide (Markownikoff'’s rule) - Hydrogen bromide (Peroxide effect) - Sulphuric Acid, Water, BH3, Ozonolysis, Hydroxylation with KMnO4 - Allylic substitution by NBS.

**2.3** Alkynes - Acidity of alkynes - Addition of hydrogen - Hydroboration - Hydrohalogenation - Addition of hypohalous acid, Hydration - Addition of water with HgSO4 catalyst - Oxidation with KMnO4 – Ozonolysis - Formation of Acetylides.

UNIT-III DIENES AND CYCLOALKANES HOURS: 12

**3.1** Dienes – Classification - Conjugated, Isolated and Cumulative Dienes - Stability of Dienes - 1, 2- and 1, 4- Addition reactions of H2 and HX with mechanisms –Synthesis of dienes – 1, 3 - Butadiene, Isoprene and Chloroprene - Diels-Alder reaction.

**3.2** Cycloalkanes - Preparation using Wurtz's reaction, Dieckmann's ring closure and Reduction of aromatic hydrocarbons - Substitution and Ring opening reactions.

**3.3** Stability of Alkanes, Alkenes and Cycloalkanes - Bayer's strain theory - Theory of Strainless rings.

UNIT-IV QUANTUM CHEMISTRY AND THERMODYNAMICS HOURS: 12

**4.1**Planck's Quantum theory of radiation - Photoelectric Effect - Compton Effect - Wave mechanical concept of the atom - de Broglie's relationship – Davisson and

Germer experiment - Wave nature of electron - Heisenberg’s Uncertainty Principle.

**4.2** Schrodinger wave equation (Without derivation) - Significance of wave functions ψ and ψ2 - Shapes of s, p and d- orbitals.

**4.3** Thermodynamics - Definition and Explanation of terms - System, Boundary, Surroundings - Homogeneous and Heterogeneous systems – Open, Closed and Isolated systems -Intensive and Extensive properties - State of a system - Independent state variables - Dependent state variables - Thermodynamic functions - State and Path functions.

UNIT-V THERMODYNAMICS AND THERMOCHEMISTRY HOURS: 12

**5.1** Thermodynamic processes - Types of processes - Cyclic - Reversible – Irreversible - Isothermal – Adiabatic Process - Exact and Inexact Differentials - Concept of Heat and Work - Zeroth Law of Thermodynamics.

**5.2** First law of Thermodynamics - Statement and Equation – Cp and Cv Relationship -Calculation of w, q, ΔE and ΔH for the Expansion of Ideal Gases under Reversible, Isothermal and Adiabatic Conditions.

**5.3** Thermochemistry - Heat of a reaction - Exothermic and Endothermic reactions - Calculation of ΔH from ΔE and vice versa - Thermochemical equations - Bond dissociation energy - Calculation from thermochemical data - Variation of Heat of a reaction with temperature - Kirchoff’s Equation and Its significance.

COURSE OUTCOMES

1. Compare basic properties of elements and their Compounds of s & p block elements.
2. Explain the reaction mechanisms of alkanes, alkenes and alkynes and predict the products.
3. Classify dienes and analyze the stability of alkanes, alkenes and cycloalkanes.
4. Recollect the basic concepts of Quantum Theory and Thermodynamics.
5. Calculate thermodynamic parameters using thermochemical equations and data.

Text Books

1. P.L. Soni, 2000, Text book of Inorganic Chemistry, Sultan Chand & Sons, 20th revised edition, New Delhi.
2. Bahl, B.S. and Bahl, A., 2010, Advanced Organic Chemistry, Sultan Chand & Co., 12th Edition, New Delhi.
3. Puri B.R., Sharma L.R. and Pathania M.S., 2013, Principles of Physical Chemistry, Shoban Lal Nagin Chand and Co., 35th edition, New Delhi.

Supplementary Readings

1. J.D. Lee, 2000, Concise Inorganic Chemistry, Sultan Chand & Sons, 20th Revised Edition, New Delhi.
2. MorrisonR.T. and Boyd R.N., Bhattacharjee, S. K., 2011, Organic Chemistry, PearsonIndia, 7th Edition, New Delhi.
3. Glasstone S. and Lewis D.,1963, Elements of Physical Chemistry, London, Mac Millan & Co Ltd; 1st Edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: II  PART: III  CORE PRACTICAL: I | 22UICHP24: VOLUMETRIC ANALYSIS | CREDIT: 3  HOURS: 3/W |

COURSEOBJECTIVES

1. To enhance the knowledge and principles behind volumetric analysis.
2. To impart skills in weighing.
3. To understand the principles of standardizing the solution using the analytical technique known as titration.
4. To know about the uses of various indicators.
5. To invoke the basic knowledge of various primary standard salts and their significance.

1. VOLUMETRIC PRACTICALS: HOURS:30
2. Calibration of volumetric kits: burette, pipettes and standard flasks.
3. Acid - Base titrations:
4. Estimation of HCl - Standard Oxalic acid
5. Estimation of Borax - Standard sodium carbonate.

Redox titrations:

1. Permanganometry:
2. Estimation of Ferrous sulphate - Standard:FAS
3. Estimation of Oxalic acid - Standard Oxalic acid

b. Iodometry;

1. Estimation of K2Cr2O7 - Standard K2Cr2O7
2. Estimation of Copper - Standard Copper Sulphate
3. Dichrometry:

Estimation of Fe2+ using diphenyl amine as indicator.

Complexometric titrations:

* + 1. Estimation of calcium using EDTA.
    2. Estimation of magnesium using EDTA.

Precipitation Titration

Estimation of Chloride in neutral medium (Demonstration Experiment).

B. INORGANIC PREPARATIONS: HOURS:15

1. Preparation of FAS.
2. Preparation of tetraamminecopper (II) sulphate.
3. Preparation of potassium trioxalatoaluminate.
4. Preparation of potassium trioxalatoferrate.
5. Preparation of micro cosmic salt
6. Preparation of Tris(thiourea) copper (II) Chloride.

COURSE OUTCOMES

1. Analyse the given unknown solution and assess its normality.
2. Evaluate the amount of substance from normality.
3. Able to plan experimental projects and execute them.
4. Orient towards the important concepts of redox and precipitation titrations.
5. Understand the laboratory techniques behind inorganic preparations.

Text Books

1. Sundaram, Krishnan, Raghavan,1996, Practical Chemistry (Part III), S.Viswanathan Co. Pvt., Ltd;, Chennai.
2. B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, 2005, Vogel's Text Book of Practical Chemistry, Pearson Education, 5th Edition, New Delhi.
3. N.S.Gnanapragasam and G.Ramamurthy, 1998, Organic Chemistry - Lab manual, S.Viswanathan Co. Pvt., Chennai.
4. Anbusrinivasan.P,2021,volumetry and Inorganic Chemistry Practicals-Principals and Procedures,Shri Publications,1st edition,Chidambaram,Tamil Nadu.

Supplementary Readings

1. Vogel,A.I., Vogel's Text Book of Quantitative Chemical Analysis, Prentice Hall, New Jersey.
2. Mendhan. J., 2009, Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi.

SCHEME OF EVALUATION

Internal assessment: 40 Marks

External assessment: 60 Marks

Total: 100 Marks

Record: 10 Marks

Preparation: 5 Marks(Quantity:10, Quality: 5)

Short Procedure: 5Marks

Errorupto 2 %: 30 Marks

2.1– 3%: 25 Marks

3.1– 4%: 20 Marks

4.1– 5%: 15 Marks

>5%: 10 Marks

Forincompleteorwrongcalculationdeduct20%oftotalmarksscored.

Fornocalculationdeduct40%oftotalmarksscored.

Foreacharithmeticerrordeduct1mark.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 3 |
| CO5 | 3 | 3 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: II  PART: III | 22UICHA02: INDUSTRIAL CHEMISTRY – II | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To understand the elaborate study of Fuels Introduction.
2. To study the basic concepts and Classification of Coal by Rank.
3. To know about the basic concepts of coking and gaseous fuels.
4. To have a knowledge of Liquid fuels and Refining of Gasoline.
5. To know the details of Residual fuel oils, Power alcohol.

UNIT-I: FUELS AND COMBUSTION HOURS: 9

Introduction - Classification of Fuels - Calorific Value – Theoretical Calculation of Calorific Value of a Fuel Gross calorific value and net calorific value – Characteristics of a Good Fuel - Solid fuels - Wood.

**Coal** - Classification of Coal by Rank - Selection of Coal - Analysis of Coal and its significance

UNIT-II: SOLID AND GASEOUS FUELS HOURS: 9

**Types of coking** - Types of Carbonization of Coal - Role of Sulphur in Coal - Role of Ash in coal.

**Gaseous fuels** - Producer Gas - Water Gas - Natural Gas – Oil Gas - Biogas - Components - Composition - preparation – advantages - disadvantages and applications of Coal gas - Gobar gas – LPG

UNIT-III: LIQUID FUELS HOURS: 9

Petroleum-Cracking - Advantages of catalytic cracking over thermal cracking - Synthetic Petrol.

**Refining of Gasoline** – Reforming - Knocking - Octane number of Gasoline - Diesel Engine Fuels - Diesel - Octane number of Diesel Oil - Diesel index.

UNIT-IV: RESIDUAL FUEL OILS AND ANALYSIS OF FUELS HOURS: 9

Asphalt - Aviation fuel - advantages -Kerosene as a fuel.

**Analysis** and testing of liquid and gaseous fuels - Utilization of fuels - Solar power.

UNIT-V HOURS: 9

**Other sources of energy** – Electricity Power - Modern Concept of Fuel - Fuels for Metallurgy.

**Power Alcohol** - Recent Advances In Fuel Technology. Alternative Fuels – Alcohols – Promising Bio fuel: An Alternative Source to Diesel and Gasoline - Control of Pollution in Refineries.

COURSE OUTCOMES

1. Describe the types of Calorific Value of Fuels. The Octane number of fuels.
2. Demonstrate knowledge acquired in solar power.
3. Write down applications of Gaseous fuels.
4. Classify Alternative Fuels based on their function.
5. Describe the advantages of Residual fuel oil.

Text Books

1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd; UK
2. J. A. Kent, 1997, Riegelís Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi.
3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi.
4. A.K.De, Environmental Chemistry, New Age International Pvt; Ltd; 2nd edition, New Delhi.
5. S.P. MAHAJAN: Pollution control in process industries, Tata McGraw-Hillpublishing Company Limited, New Delhi.

Supplementary Readings

1. C.k. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai.
2. Rachida El Morabet, in Encyclopedia of Environmental Health,Vol-II (Second Edition), Future industrial coal utilization: forecasts and emerging technological and regulatory issues,
3. J.K. Alderman, in The Coal Handbook: Towards Cleaner Production: Coal Utilisation, 2013.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 2 | 3 | 3 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: II  PART:III  ALLIED PRACTICAL: I | 22UICHP01: INDUSTRIAL CHEMISTRY | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To enable the learners to apply the principle in total dissolved solids, and suspended solids in the given water sample.
2. To analyze samples with the best utilization of techniques that provides structural information.
3. To get in-depth knowledge to determine the acid-neutralizing power of a commercially available antacid tablet.
4. To understand the principles of standardizing a solution of the base using the analytical technique known as titration.
5. To know about the practical applications of calcium in chalk - Permanganometry and pH .
6. To enable the learners to acquire knowledge on an acid-base scale.

EXPERIMENTS

1. Estimation of total dissolved solids in the given water sample (**TDS**) (Only for demonstration)
2. Estimation of total suspended solids in the given water sample (**TS**S) (Only for demonstration).
3. Determination of total permanent and temporary hardness of water using EDTA.
4. Determination of acetic acid in commercial vinegar using NaOH.
5. Determination of alkali content in antacid tablet using HCl.
6. Estimation of calcium in chalk - Permanganometry.
7. Limit test for Sulphate, Chloride, Iron & Lead

COURSE OUTCOMES

1. Understand the basic concepts of water pollution.
2. Understand different types of solids in the given water sample.
3. Understand various environmental factors that effect on water.
4. Analyse alkali content of antacid tablet.
5. Educated in various measurements and monitoring techniques of analytical titration

Text Books

1. Sundaram, Krishnan, Raghavan,1996,Practical Chemistry (Part III), S.Viswanathan Co. Pvt., Ltd;Chennai.
2. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK
3. W. D. Kingery, H. K. Bowen, D. R. Uhlmann, Introduction to Ceramics, Wiley Publishers, New Delhi.
4. J. A. Kent, Riegelís Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
5. P. C. Jain, M. Jain, 2019, Engineering Chemistry, Dhanpat Rai & Sons, 17th Edition, New Delhi.

Supplementary Reading

1. Felder R. M., and RousseuR. W., 2000, Elementary Principles of Chemical Processes, Wiley Publications, 3rd Edition, New York.
2. Sanders R. J., 1976, The Anatomy of Skiing. Denver, CO: Golden Bell Press, New Delhi.
3. CrynesB. L.,FoglerH. S., 1981, AICHE Modular Instruction Series E: Kinetics, Vols. 1 and 2., New York.
4. Austin G. T., 1984, Shreve’s Chemical Process Industries, McGraw-Hill, 5th Edition, New York.
5. Vogel,A.I., Vogel's Text Book of Quantitative Chemical Analysis, Prentice Hall, New Jersey.

SCHEME OF VALUATION

Internal assessment: 40 marks

External assessment: 60 marks

Total: 100 marks

Record: 10 marks

Limit test: 10 marks

Estimation: 40 marks

Error upto 2% 40 marks

2.1- 3% 30 marks

3.1-4% 20 marks

4.1- 5% 10 marks

> 5% 5 marks

For incomplete or wrong calculation, deduct 20% of total marks scored.

For no calculation, deduct 40% of total marks scored.

For each arithmetic error, deduct 1 mark.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: II  PART: | 22UICHE26-1: HEALTH CHEMISTRY | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

|  |
| --- |
| 1. To recognize the causes of common diseases, their control and treatment |
| 2. To understand the first aid for accidents |
| 3. To study the organic pharmaceutical aids |
| 4. To know about organic diagnostic agents |
| 5. To have an idea about diabetes and cancer. |

UNIT- I:CAUSES, CONTROL AND TREATMENT OF COMMON DISEASES HOURS: 9

Insect borne diseases- Malaria, Filariasis, Plague.

Air-borne diseases-Diphtheria, whooping cough, influenza, measles, mumps, tuberculosis (TB), and common cold,

Water borne diseases**-** cholera, typhoid, dysentery. Some other common diseases-Jaundice, Asthma, Epilepsy, Piles, Leprosy.

UNIT-II: FIRST AID FOR ACCIDENTS HOURS: 9

Important rules of First Aid – Cuts and Wounds, Abrasions, Bruises, Bleeding , Fractures, Burns, Fainting Poisonous bites. First Aid Box.

Detection of Hallucinogens and poisons-Antidotes for Poisoning-Some common Poisons-Symptoms and their antidotes-Acid poisoning, Alkali poisoning, Disinfectant poisoning, Alcohol poisoning, Mercury poisoning and Salicylate poisoning.

UNIT-III: ORGANIC PHARMACEUTICAL AIDS HOURS: 9

Preservatives, Antioxidants, Emulsifying agent, Sequestrants, Colouring, Flavouring and Sweetening agent, Ointment bases, Solvents, Stabilizing and Suspending agents

UNIT-IV: ORGANIC DIAGNOSTIC AGENTS HOURS: 9

Drug used as X-rays contrast media, Drugs used to test organ functions, Drugs used to determine blood volume, Hemopoietic functions, Drugs used for miscellaneous diagnostic tests.

UNIT- V: DIABETES AND CANCERHOURS: 9

Diabetes and hypoglycemic drugs: Blood sugar level –Diabetes –causes, symptoms and control- Preliminary ideas about the structure and sources of insulin- oral hypoglycemic drugs- sulphonyl ureas and biguanides (synthesis not expected)

Antineoplastic drugs**:** Causes of cancer- treatment methods-alkylating or cytotoxic agent- antimetabolite drugs

COURSE OUTCOMES

|  |
| --- |
| 1. Describe the causes, control and treatment of common diseases. 2. Understand the concepts of first aid for accidents. 3. Classify different organic pharmaceutical aids. 4. Explain organic diagnostic agents. 5. Describe diabetes, cancer and their control and treatment. |

Text Books

1. Jayashree Ghosh, 2003, A Text Book of Pharmaceutical Chemistry, S.Chand & Company Ltd, 3rd revised Edition, New Delhi.
2. Lakshmi S, 1995, Pharmaceutical Chemistry, S.Chand & Company Ltd, 1st edition, New Delhi.
3. L. Leninger, 1998, Biochemistry, Kalyani Publishers, 2nd Edition, Ludhiana

Supplementary Readings

1. Chatwal G.R, 1991, Pharmaceutical Chemistry-Organic-Volume II, Himalaya Publishing House, New Delhi.
2. Ashutoshkar and Mehta S.C, 2018, Essentials of Pharmacology, New Age International Publishers, New Delhi.
3. Gurdeep Chatwal, 2012 , Medicinal Chemistry, Himalaya Publishing house private Ltd., Mumbai.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: II  PART: | 22UICHE26-2: PHARMACEUTICAL CHEMISTRY | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To know the basics of pharmaceutical chemistry

2. To realize the role of Indian medicinal plants and blood

3. To have an idea about alkaloids and sulphonamides

4. To distinguish about antibiotics and analgesics

5. To learn anaesthetics, antiseptics and disinfectants

UNIT- I: INTRODUCTION, HETEROCYCLICS AND QUINOLINES HOURS: 9

Definition of the following terms - Drug, Pharmacophore, Pharmacology, Pharmacopoeia, Bacteria, Virus, Chemotherapy and Vaccine.

Chemistry of Heterocyclics: A brief introduction - drugs derived from pyridine derivatives, Tripelennamine and mepyramine. Quinoline derivatives: Chloroquine, amodiaquine and primaquine, Pyrimidines – Ureides and barbiturates.

UNIT- II: STUDY OF INDIAN MEDICINAL PLANTS AND BLOOD HOURS: 9

Indian Medicinal Plants and Their Uses - Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothuvelai.

Composition of blood plasma: Analysis of serum proteins, Functions of plasma, Osmotic regulation, function of hemoglobin. Transport of Oxygen and maintenance of pH of blood. Analysis of hemoglobin in blood. Rh factor. Blood pressure- normal, high and low Blood pressure and their control. Causes, Detection and Control of Anaemia and Diabetes Diagnostic test for sugar, salt and cholesterol in serum and urine.

UNIT- III: ALKALOIDS AND CHEMISTRY OF SULPHONAMIDES HOURS: 9

Alkaloids: General methods of extraction from a plant source, colour reactions and detection. Morphine and Quinine with special reference to structure relationship (SAR) and uses.

Chemistry of sulphonamides: Mode of action of Sulpha drugs - Sulphadiazine, Sulphapyridine, phthalyl sulphathiazole, sulpha furazole, and prontosil – Preparation and uses.

UNIT- IV: ANTIBIOTICS AND ANALGESICS HOURS: 9

Antibiotics - Definition – Gram positive and Gram-negative bacteria. Pharmacological action – structural elucidation synthesis, assay and uses of chloramphenicol, Streptomycin and penicillin.

Analgesics: Classification, Narcotic analgesic– Morphine and derivatives. synthetic analgesics – pethidine and methadones. Antipyretic analgesics. Salicylic acid derivatives, indolyl derivatives and p-aminopheno derivatives, synthesis, action and uses.

UNIT- V: ANAESTHETICS, ANTISEPTICS AND DISINFECTANTS HOURS: 9

Anaesthetics – Definition – Classification - Local and General – Volatile – Uses of volatile liquids as Inhalation Anaesthetics – Chloroform, halothane, trichloroethylene - Gaseous Anaesthetics - Nitrous Oxide, Ether and Cyclopropane - Uses and Disadvantages – Intravenous Anaesthetic Agents – Thiopental sodium, Methohexitol and Propanidid. Local anaesthetics – cocaine and its derivatives. Drugs affecting CNS - Definition, Distinction and Examples for Tranquilizers, Sedatives (Phenobarbital, Diazepam) - Hypnotics, Psychedelic Drugs.

Antiseptics and disinfectants: phenols and related compounds, Organic mercurials. Dyes, cationic surfaceactive agents, miscellaneous agents like chloramines – T, Chlorhexidine, dequalinium chloride, formaldehyde and nitrofurazone.

COURSE OUTCOMES

|  |
| --- |
| 1. Realize the role of pharmaceutical chemistry 2. Understand the role of Indian medicinal plants and blood 3. Describe alkaloids and sulphonamides 4. Explain antibiotics and analgesics 5. Describe anaesthetics,antiseptics and disinfectants |

Text Books

1. Jayashree Ghosh.S, 2003, A Text Book of Pharmaceutical Chemistry -S. Chand Company Ltd, 3rd revised Edition, New Delhi.
2. S. Lakshmi, 1995, Pharmaceutical Chemistry , S.Chand & Company Ltd;, 1st Edition, New Delhi.
3. A. L. Leninger, 1998, Biochemistry, Kalyani Publishers,2nd Edition, Ludhiana.

Supplementary Readings

1. Asuthosh Kar, 2013, Medicinal Chemistry, New Age International Publishers, 5th Edition, New Delhi.
2. O. D. Tyagi,A Text Book Of Synthetic Drugs, Ammol Publications.
3. Gurdeep Chatwal, 2012, Medicinal Chemistry, Himalaya Publishing house private Ltd., Revised Edition, Mumbai.
4. Ahluwalia, 2012, Medicinal Chemistry, Ane Books Pvt. Ltd;, 2nd Edition, New Delhi.
5. Rasheeduz Zafar, 2000, Medicinal Plants of India, CBS Publishers and Distributors.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 2 |
| CO3 | 2 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: II  PART: | 22UICHE26-3: TEXTILE CHEMISTRY | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To know the basics of fibres.
2. To realize the properties of fibres.
3. To learn processing of fibres.
4. To understand dye chemistry.
5. To learn dyeing process.

UNIT- I: INTRODUCTION TO FIBRES HOURS: 9

General Classification of Fibers – Chemical structure – Production – Properties – Count, Denier, Tex, Staple Length, Spinning Properties, Strength, Elasticity and Creep. Applications of the following Natural Cellulose Fibres (Cotton and Jute).

Natural Protein Fibres (Wool and Silk) – General characteristics.

UNIT- II: PROPERTIES OF FIBRES HOURS: 9

Chemical Structure, Production and properties of the following Synthetic Fibres – Man-made Cellulose Fibres (Rayon and Modified cellulose fibres).

Polyamide Fibres (Different types of Nylons) - Preparation – Nylon degradation – Polyester Fibres – Preparation - Degradation – Polyacrylonitrile fibre - Preparation and Properties – Viscose fibre - Preparation and Properties. Identification tests for Cellulose, Cotton, Wool, Silk, Rayon, Acrylic, Viscose, Polyamide and Polyester Fibres.

UNIT-III: PROCESSING OF FIBERS HOURS: 9

Impurities in Raw Cotton and Grey Cloth, Wool and Silk. General principles of the Removal, Scouring - Purpose, Alkali Scouring and Acid Scouring – Bleaching (Methods - Hypochlorite, Peroxide and Bleaching Powder) - Desizing (Hydrolytic and Enzymatic), Kier Boiling and Chemicking.

Dyeing of Polyester and Blends – Functions of Dispersing agents - Fibre swelling – Carrier dyeing - High temperature dyeing - Selection of dyestuff.

UNIT- IV: DYE CHEMISTRY HOURS: 9

Colour and Constitution – A general treatment – Chromophores – Auxochromes - Bathochromes and Hypso-chromes.

Classification of dyes – Acidic, Basic, Direct, Mordant, Azoic, Ingrain, Vat and Reactive Dyes - Classification as per Chemical constitution – Azo dyes – Triphenyl Methane Dyes, Phthalein Dyes, Indigo and Anthraquinone Dyes.

Structure, Preparation and Uses – Methyl Orange, Phenolphthalein and Malachite Green.

UNIT- IV: DYEING PROCESS HOURS: 9

Dyeing - Dyeing of Wool and Silk – Fastness properties of dyed materials.

Dyeing of Nylon, Terylene and other Synthetic Fibres – Finishing – Finishes given to Fabrics – Mechanical finishes on Cotton, Wool and Silk.

Method used in process of Mercerizing – Anticrease and Antishrink finishes – Water Proofing.

COURSE OUTCOMES

|  |
| --- |
| 1. Understand the basics of fibers 2. Realize the properties of fibers 3. Describe processing of Fibers 4. Explain dye chemistry 5. Describe dyeing process |

Text Books

1. F. Sadov, M. Horchagin and A. Matetshy, 1973,Chemical Technology Of Fibrous Materials, Mir Publishers, 1st edition, Moscow.
2. R. H. Peters, 1963, Textile Chemistry-Vol-II, Elsevier, 1st Edition,New York.

Supplementary Readings

1. E.R.Trotman, Dyeing and Chemical Technology of Textile Fibres , Charles Griffin &Co Ltd, London.
2. V.A.Shenai, Chemistry of dyes & Principles of Dyeing, Sevak Publications, Chennai.
3. E. R. Trotman, Scouring and Bleaching, Charles Griffin & Co Ltd., London.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 2 |
| CO4 | 2 | 3 | 2 | 3 | 2 |
| CO5 | 3 | 2 | 3 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: III  PART: III | 22UICHC33: GENERAL CHEMISTRY – IV | CREDIT: 4  HOURS: 4/W |

COURSE OBJECTIVES

1. To gain knowledge about p- Block Elements
2. To understand the importance of halogen family-classification, interhalogen compounds
3. To develop knowledge about aromaticity and electrophilic substitution reactions
4. To enlighten the students about nucleophilic substitution reactions
5. To expose the students to Second Law of Thermodynamics, Derivation of Equations, Related Problems and Applications wherever necessary.

UNIT-I - p- BLOCK ELEMENTS HOURS: 12

**1.1** Carbon family – Group study - Comparative study of Elements with respect to Valency, Oxides, Halides, Hydrides and Oxyacids - Catenation - Comparison of Properties of Carbon and Silicon – Silicates - Classification and Structure - Silicones- Preparation, Properties and Uses.

**1.2** Nitrogen family - Group study - Comparative study of N, P, As, Sb and Bi with respect to Oxides, Oxyacids, Halides and Hydrides – Hydrazine and Hydroxylamine - Hydrazoic acid – Preparation and uses of NaBiO3.

**1. 3** Oxygen family - Group study - Comparative study of O, S, Se and Te with respect to Catenation, Oxides, Halides, Hydrides and Oxyacids - Anomalous Behavior of Oxygen - Oxyacids of Sulphur (Structure only) - Peracids of Sulphur - Preparation, Properties and Structure - Differences Between Permonosulphuric Acid and Perdisulphuric Acid.

UNIT-II- HALOGEN FAMILY HOURS: 12

**2.1** Halogens – Group discussion - Comparative study of F, Cl, Br, I and at – Reactivities, hydracids, and oxides– Oxyacids of Halogens (Structure only).

**2.2** Classification of Halides - Comparison of Fluorine with Oxygen-Fluorides of oxygen-Exceptional properties of Fluorine.

**2.3** Interhalogen compounds - Preparation, Properties and Geometry of AX, AX3, AX5 and AX7 type of Compounds – Pseudohalogens and pseudohalides - Cyanogen and Thiocyanogen – Comparison of Pseudohalogens and Halogens - Basic Properties of Iodine - Evidences.

UNIT-III- AROMATIC ELECTROPHILIC SUBSTITUTION AND ORIENTATION EFFECTS HOURS:12

Aromaticity - Modern Theory of Aromaticity - Huckel's (4n +2) Rule and Its Simple Applications to Benzenoid and Non- benzenoid Compounds.

Electrophilic substitution reactions in Aromatic Compounds - Mechanisms of Nitration, Halogenations, Sulphonation, Friedel-Crafts Acylation and Alkylation.

Directive influence - Orientation - Ortho/Para ratio - Nuclear and Side chain Halogenation.

UNIT-IV NUCLEOPHILIC SUBSTITUTION REACTIONS HOURS: 12

Aliphatic Nucleophilic Substitutions - Mechanisms of SN1, SN2 and SNi Reactions – Effect of Structure of Substrate, Solvent, Nucleophile and Leaving Group.

Elimination reactions - Mechanism of E1 and E2 reactions - Hoffmann and Saytzeff’'s rules - Cis and Trans Eliminations.

Aromatic Nucleophilic Substitutions - Unimolecular Nucleophilic Substitution,

Bimolecular Nucleophilic Substitution and their Mechanism.

UNIT-V- THERMODYNAMICS HOURS: 12

Second Law of Thermodynamics - Need for the II Law of Thermodynamics - Spontaneous Process – Criteria of Spontaneity - Different Forms of Statements of the Second Law – Cyclic Process – Definition - Heat Engines.

Carnot's cycle - Efficiency - Carnot's theorem (Statement only) - Concept of Entropy - Definition and Mathematical Statement - Randomness and Entropy – Standard Entropy -Derivation of Entropy from Carnot Cycle.

Entropy change of an Ideal Gas during Isothermal Process - Entropy changes in Cyclic, Reversible and Irreversible Processes - Entropy Changes in Physical Transformations - Calculation of Entropy Changes with Changes in T, V and P - Entropy of Mixing of Ideal Gases – Physical Significance of Entropy.

COURSE OUTCOMES

1. Ability to compare the properties of Carbon, Nitrogen and Oxygen elements and their compounds.
2. To compare the properties of Halogens and their compounds.
3. Apply Huckel’s rule and predict the Aromaticity of compounds.
4. To discuss the mechanism of substitution and elimination reactions of aliphatic and aromatic compounds.
5. Ability to explain the thermodynamic second law and predict the spontaneity of a process.

TEXTBOOKS: (IN API STYLE)

1. P.L. Soni, “Text book of Inorganic Chemistry”, 20th revised edition, Sultan Chand & Sons, 2000.
2. Bahl, B.S. and Bahl, A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
3. Puri B.R., Sharma L.R. and Pathania M.S. Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin chand and Co. (2013).

SUPPLEMENTARY READINGS

1. J.D. Lee, ‘Concise Inorganic Chemistry’, 20th revised edition, Sultan Chand & Sons, 2000.
2. Morrison, R.T. and Boyd, R.N., Bhattacharjee, S. K. Organic Chemistry (7th edition), Pearson, India, (2011).
3. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 2 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: III  PART:III | 22UICHA03: INDUSTRIAL CHEMISTRY - III | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To enable the students' in-depth study of high polymers and mechanisms.
2. To know the details of the structure, Physical and Mechanical Properties of Polymers.
3. To understand the concept of Introduction to Rubber and Synthetic rubbers.
4. To understand the principles of quantum chemistry and Macromolecules.
5. To enable the learners to acquire knowledge in plastic materials.

UNIT-I: HIGH POLYMERS HOURS: 9

**HIGH POLYMERS** - Introduction - Nomenclature - Classification of Polymers - Homo and hetero chain polymers - Addition polymerization - Condensation polymerization.

**Mechanism of Addition Polymerization** - Cationic - Anionic polymerization - Free radical and Co-ordination or Ziegler-Natta polymerization.

UNIT-II: PROPERTIES OF POLYMERS HOURS: 9

Physical and Mechanical Properties of Polymers - Crystallinity in Polymer - PolymerReaction.

**Polymer structure and properties** - Strength, plastic deformation - chemical resistance– Physical state of polymer – Glass Transition Temperature

UNIT-III: RUBBER HOURS: 9

**Introduction to Rubber**– Latex – Processing Latex – Compounding of Rubber - Vulcanizations of Rubber – Degradation stability.

**Synthetic rubbers** - Preparation and applications of SBR - Butyl rubber - Nitrile rubber –

Neoprene and Silicone rubber.

UNIT-IV: PLASTIC MATERIALS HOURS: 9

**Plastic Materials** – Classification of Plastics (or Resins) - Moulding Constituents of a Plastic- Fabrication techniques used for thermoplastic resin (Moulding process).

Important thermo plastic Resins – Natural resins - Polyethylene -

UNIT-V: RESINS HOURS: 9

**Important thermosetting resins** - Phenol Formaldehyde Resin or Phenolic Resin –Amino Resins and Plastics - Epoxy Resins - Acrylic Resins and Plastics - Polyester resins.

**Silicone Resins** – Silicone fluids – Silicone greases –Polyurethane - Foamed or cellular Plastics.

COURSE OUTCOMES

1. Isolate the key design features of a product which relate directly to the material(s) used in its construction.
2. Indicate how the properties of polymeric materials can be exploited by a product designer.
3. Describe the role of rubber-toughening in improving the mechanical properties of polymers.
4. Identify the repeat units of particular polymers and specify the isomeric structures which can exist for those repeat units.
5. Estimate the number- and weight-average molecular masses of polymer samples given the degree of polymerisation and mass fraction of chains present.
6. Students will able to appraise the mechanism and kinetics of copolymer free radical the synthesis techniques for polymer.

TEXTBOOKS: (IN API STYLE)

1. 1. 1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd,London.
2. 2. J. A. Kent, 1997, Riegelís Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi.
3. 3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi.
4. 4. Practicals and Calculation in Engineering Chemistry ñ S.S. Dara
5. 5. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2ndEdition, New Delhi.
6. 6. S.P. Mahajan, Pollution control in process industries, Tata McGraw-Hillpublishing Company Limited, New Delhi. ,.C.k. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai,

SUPPLEMENTARY READINGS

1. Michael Ash, Irene Ash,1998, **Encyclopedia of Plastics Polymers and Resins:** Chemical Publishing Company,USA.
2. Brydson's Plastics Materials, Eighth Edition.
3. [**www.umich.edu/~elements/5e/index.html**](http://www.umich.edu/~elements/5e/index.html) .
4. CRYNES, B. L., and H. S. FOGLER, eds., 1981, **AICHE Modular Instruction Series E**: **Kinetics**, Vols. 1 and 2. New York.
5. AUSTIN, G. T., 2018, **Shreve’s Chemical Process Industries**, Mc Graw Hill, 8th ed. New York.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 3 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: III  PART: III | 22UICHE36-1: AGRICULTURAL CHEMISTRY | CREDIT: 3  HOURS: 3/W |

(INTERNAL ELECTIVE- II)

COURSE OBJECTIVES

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| --- |
| 1. To know the importance of agricultural chemistry |
| 2. To understand the role of fertilizers. |
| 3. To have an idea about the effect of fertilizers and manures |
| 4. To know about pesticides |
| 5. To study fungicides and herbicides |

UNIT- I: SOIL SCIENCE HOURS: 9

Soil-Definition of soil, Properties of soil – Physical Property Components – Soil Structure and texture. Soil water, Soil air and Soil temperature.Chemical properties – Soil mineral matter – Soil colloid, ion- Exchange reactions – Soil fertility and its evaluations, Soil organic matter and their transformation into soil

Soil reactions – Soil pH – soil acidity and buffer action

UNIT -II:FERTILIZERS HOURS: 9

Fertilizers-Primary nutrients -Nitrogen fertilizers: Effect of Nitrogen on plant growth and development. deficiency of nitrogeneous fertilizers classification – of nitrogenous fertilizers – Nitrates, urea and cynamide. Commercial method of preparing urea.

Phosphate fertilizers: Effect of phosphorus on plant growth and development – kinds of phosphate fertilizers – Super phosphate – Bone meal – basic slag – rock phosphate – dicalcium phosphate – tricalcium phosphate and other phosphates – Manufacture of super phosphate.

UNIT-III: FERTILIZERS AND MANURES HOURS: 9

Potassium fertilizers: function of potassium on plant growth and developement – classification into chloride and nonchloride forms manufacturing processes and properties of potassium fertilizers.

Complex fertilizers and mixed fertilizers: their manufacture and composition. Secondary nutrients – micronutrients – their function in plants – materials containing micronutrients.

Manures: bulky organic manures – Farm yard manure handling and storage – method of composting green manuring, concentrated organic manures and their chemical composition – oil cakes Blood meal – fish manures.

UNIT- IV: PESTICIDES AND INSECTICIDES HOURS: 9

Pesticides: Classification of Pesticides – mode of action – general methods of application and toxicity, safety measures when using pesticides.

Insecticides: plant products – Nicotine, pyrethrum, rotenone, and petroleum oils, Inorganic pesticides – arsenical fluorides, borates. Organic pesticides – organochlorine compounds – D.D.T. B.H.C., methoxychlor, chlordane, and endosulfon

UNIT-V: FUNGICIDES AND HERBICIDES HOURS: 9

Fungicides: Inorganic – Sulphur compounds – Copper compounds – Mercuric compounds Organic – dithiocarbamates – Dithane, Bordeaux mixture.

Herbicides: Inorganic herbicides – Arsenical compounds Boron compounds – Cyanamide – Cyanides and thiocyanates chlorates and sulphamates. Organic herbicides and Nitro – compounds – chlorinated compounds – 2 ,4D compounds –Propionic and acid derivatives – urea herbicides.

COURSE OUTCOMES

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| --- |
| 1. Understand the basics of soil. 2. Classify and explain plant nutrients and fertilizers 3. Differentiate fertilizers and manures. 4. Explain the classification of pesticides. 5. Describe the Fungicides and herbicides. |
|  |

TEXTBOOKS:(IN API STYLE)

1. Nelson S.L., Beaton, W.L. TisdaleJ. D, 1990, Soil Fertility and Fertilizers, Macmillian Publishing Company, New York.
2. Buchel K.H., 2008, Chemistry of Pesticides, John Wiley & Sons, New York.

SUPPLEMENTARY READINGS

1. N.C. Brady, 1984, The Nature and properties of soils, Eurasia publishing House (P) Ltd., 9th Edition
2. U.S.Jones, 1987, Fertilizers and soil Fertility Prentice, Hall of India, 2nd Edition, New Delhi.
3. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd Edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: III  PART: III | 22UICHE36-2: GREEN CHEMISTRY | CREDIT: 3  HOURS: 3/W |

**(INTERNAL ELECTIVE- II)**

COURSE OBJECTIVES

1. To know the basics of Green Chemistry and its developments.
2. To know the principles of green chemistry.
3. To know the goals of Green Chemistry.
4. To understand Limitations of green chemistry.
5. To study the obstacles in the pursuit of the goals of Green Chemistry.

UNIT-I: GREEN CHEMISTRY – INTRODUCTION HOURS: 9

Need for green chemistry – principles of green chemistry – atom economy – definition with example (ibuprofen synthesis) – green oxidant – hydrogen peroxide.

Microwave assisted organic synthesis – apparatus required – examples of MAOS (synthesis of fused anthroquinones, Leukart reductive amination of ketones) – advantages and disadvantages of MAOS.

Organic reactions by sonication method – apparatus required – examples of sonochemical reactions (Heck, Hundsdiecker and Wittig reactions).

UNIT-II: PRINCIPLES OF GREEN CHEMISTRY HOURS: 9

Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples: Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts, maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

UNIT-III: GREEN REACTIONS HOURS: 9

Acetylation of primary amine, base catalyzed aldol condensation (synthesis of dibenzalpropanone), halogen addition to C=C bond (bromination of trans-stilbene), [4+2] cycloaddition reaction (Diels-Alder reaction between furan and maleic acid).

Electrophilic aromatic substitution reactions (nitration of phenol, bromination of acetanilide) – green oxidation reactions (synthesis of adipic acid, preparation of manganese (III) acetylacetonate) – zeolite catalyzed Friedel-Crafts acylation.

UNIT-IV: GREEN SOLVENTS HOURS: 9

Ionic liquids: simple preparation – types – properties and application – ionic liquids in organic reactions (Heck reaction, Suzuki reactions, epoxidation), industrial (battery) and analytical chemistry (matrices for MALDI-TOF MS, gas chromatography stationary phases – advantages and disadvantages.

Super critical CO2 – preparation, properties, applications and environmental impact.

UNIT-V: FUTURE TRENDS IN GREEN CHEMISTRY HOURS: 9

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry in sustainable development.

COURSE OUTCOMES

1. Able to understand the need of green chemistry.
2. Able to explain the principles of green chemistry.
3. Able to explain green synthesis and reactions.
4. Able to understand about green solvents.
5. Able to explain the future trends in green chemistry.

TEXTBOOKS: (IN API STYLE)

1. R. Sanghi and M.M.Srinivastava, Green Chemistry: Environmental alternatives, Narosa Publishing House, New Delhi.
2. V.K. Ahluwalia, M.Kidwai, 2007,New Trends in Green Chemistry, Anamaya Publishers, 2nd Edition, New Delhi.

SUPPLEMENTARY READINGS

1. P. Tundo, A. Perosa, F. Zechini, 2007, Methods and Reagents for Green Chemistry, John Wiley & Sons Inc., New Jersey.
2. Ahluwalia, Kidwai, 2005, New Trends in Green Chemistry, Anamalaya Publishers, Puducherry.
3. AnastasP.T. WarnerJ.K. 1998, Green Chemistry -Theory and Practical, UniversityPress, London.
4. Cann M.C., Connely M.E.,2000, World Cases in Green Chemistry, American Chemical Society, Washington.
5. Ryan, M.A. and Tinnesand,2002, M., Introduction to Green Chemistry, American Chemical Society, Washington.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER –III  PART - III | 22UICHE36-3: BIOCHEMISTRY | CREDIT: 3  HOURS: 3/W |

(INTERNAL ELECTIVE – II)

COURSE OBJECTIVES

1. To provide basic knowledge about cells and Nucleic acids.
2. To Familiarize the students about enzymes.
3. To enhance the knowledge in Carbohydrate and protein metabolism.
4. To inculcate an interest to have an idea about Vitamins.
5. To make the students familiar in the deficiency diseases caused by vitamins.

UNIT - I CELLS AND NUCLEIC ACIDS HOURS: 9

Cell structure and Functions-Prokaryotic and Eucaryotic cells, cell Organelles-Structure and Functions of Cell membrane, Nucleus, Mitochondria, Ribosomes, Endoplasmic Reticulum, Golgi bodies, Lysosomes and Centrioles.

Nucleic Acids-Introduction-Structure of Nucleosides and Nucleotides, DNA-Watson and Crick Model, RNA- Ribosomal, transfer and messenger RNAs-Function of DNA and RNA-Biosynthesis of Protein

UNIT- II: ENZYMES HOURS: 9

Enzymes-Introduction-chemical nature of enzymes- Classificaton of enzymes, Factors affecting enzyme activity.

Mechanism of Enzyme Action-Inhibition-Competitive Inhibition, Non- Competitive Inhibition, Allosteric, Substrate Inhibition and Feedback Inhibition.

UNIT- III: METABOLISM OF CARBOHYDRATES HOURS: 9

Metabolic Concepts-Catabolism and Anabolism. Metabolism of Carbohydrates-Digestion and absorption of Carbohydrates-Storage of Carbohydrates- Glycogenesis.

Oxidation of Carbohydrates- Glycolysis (Embden-Meyerhof Pathway), Citric acid cycle, Pentose Phosphate Pathway (HMP Shunt), Glyconeogenesis, Cori’s Cycle.

UNIT- IV: METABOLISM OF PROTEINS HOURS: 9

Metabolism of Proteins-Digestion and absorption, Metabolic Nitrogen Pool, Nitrogen balance, Transamination, Deamination-Oxidative Pathway.

Disposal of Nitrogen-Synthetic Pathway, Glutamine Pathway, Direct Excretion, Formation of Urea, creatine and creatinine.

UNIT-V: VITAMINS HOURS: 9

Vitamins – Classification –Fat soluble, water soluble vitamins, sources, functions and deficiency diseases of vitamins A, D, E, K, C and B complex – B1, B2, B3,B5,B6 and B12. Structural elucidation of riboflavin only.

Vitamin and Mineral requirements in human nutrition. A comparative study of the functions and deficiency diseases of vitamins A, D, E, K, C and B complex – B1, B2, B3,B5,B6 and B12.

COURSE OUTCOMES

1. Relate the basic concept of cell structure and their functions.
2. Knowledge about the concept of enzymes and their activity.
3. Identify the metabolism of carbohydrate.
4. Assess the structural elucidation of riboflavin.
5. Able to understand the importance of vitamins.

TEXTBOOKS:(IN API STYLE)

1. G.R.Agarwaal, O.P.Agarwaal, Text Book of Biochemistry, Goel Publishing House, 7thEdition, New Delhi.
2. J.L. Jain, 1995, Fundamental of Biochemistry,Sultan Chand and Company, 4th revised edition, New Delhi.
3. U.Sathyanarayana, U.Chakrapani, 1960,Essential of Biochemistry, Books and Allied Publishers, 2nd Edition, Kolkata.
4. A.L. Lehinger, 1998, Biochemistry, Kalyani Publishers, 2nd Edition, Ludhiana.

SUPPLEMENTARY READINGS

1. Ambika Shanmugam, 2016, Fundamentals of Biochemistry for Medical Students,Wolters Kluwer Lippincott Williams and Wilkins, 8thEdition, Chennai.
2. P.L.Soni, H.M. Chawla, 2002, Text Book of Organic Chemistry, Sultan Chand and Company Ltd., 28th Edition, New Delhi.
3. S.C.Rastogi, 1993, Biochemistry, Tata – McGraw Hill Publishing Company Ltd., New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 2 | 3 |
| CO2 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: III  PART: IV  NON-MAJOR ELECTIVE: I | 22UICHN37: MEDICINAL CHEMISTRY | CREDIT: 2  HOURS: 2/W |

COURSE OBJECTIVES

1. To impart knowledge about Health and Nutrition
2. To understand the composition of blood, urine and serum.
3. To know about the common ailments like blood pressure, Diabetes etc.
4. To understand the significance of Indian medicinal plants in the treatment of chronic diseases.
5. To learn the basic idea of drugs and names of common drugs.

UNIT-I: HEALTH AND NUTRITION HOURS: 5

Definition - Nutrition, Health and Disease -WHO standard.

Under Nutrition, Over Nutrition and Malnutrition; Diet recommendation for optimal health

Body Mass Index (BMI) - Calculation, Limitations, Body fat and its distribution.

UNIT-II: BLOOD AND HEMATOLOGICAL AGENTS: HOURS: 5

Composition of Blood - Normal Values - Blood pH, Blood Sugar, Blood grouping and Rhfactor

Biochemical Analysis of Urine and Serum - Presence of sugar in blood and urine, Cholesterol in Urine.

Diabetes - Types-Hypoglycemic agents-Sugar substitutes- Glucose tolerance test.

UNIT-III: COMMON DRUGS HOURS: 5

Antibiotics, Antipyretics, Anti-inflammatory agents, Sedatives, Antiseptics, Antihistamines and Analgesics-Examples, Uses and Side effects.

Tranquilizers, Hypnotics and Antidepressant drugs-Definition, Examples, Uses and Side effects

Neutraceuticals: Vitamins - Water and Fat soluble, Antioxidants, Micro Nutrients - Minerals and trace elements.

UNIT-IV: HERBAL MEDICINE HOURS: 5

IndianMedicinalPlants-Palak,Vallarai,KizhanelliandThumbai-ChemicalConstituentsandMedicinal Uses.

Hibiscus, Adadodai, Thoothuvalai–Chemical Constituents and Medicinal Uses.

Nochi, Thulasi, AloeVera -Chemical Constituents and Medicinal Uses.

UNIT V: VITALAILMENTSAND TREATMENT: HOURS: 5

Bloodpressure-HypertensionandHypotension-Cause,Diet,Prevention,Antihypertensive Agents-Aldomet, Reserpine.

Cancer-Causes-Types-Treatments-Antineoplastic Drugs. AIDS,HIV- 1,

HIV 2-Awareness,Prevention and Treatment.

Common Diseases: Insect borne - Malaria, Air borne - Whooping Cough, Measles, Common cold and TB, Water borne- Cholera, Typhoid, Dysentry , Corona virus-Covid19- Etiology, Symptoms, Prevention and Remedy.

COURSE OUTCOMES

1. Understand the composition of blood and biochemical analysis of Urine and Serum
2. Gain knowledge about uses and side effects of Antibiotics, Antipyretics, Analgesics and tranquilizers.
3. Explain the causes, symptoms and treatment of Blood pressure, Diabetes, Cancer and AIDS.
4. Classify and understand the sources and diseases caused by deficiency of Vitamins.
5. Analyse the therapeutic importances of Indian Medicinal plants

TEXTBOOKS: (IN API STYLE)

1. JayashreeGhosh, 2008,Applied Chemistry, SutanChandandCompany Ltd.,Reprint-3rdEdition, New Delhi.
2. S. C.Rastogi, 2003,Biochemistry,TataMcGrawHillPublishing Co., 2nd Edition, New Delhi.
3. RasheeduzZafar, 2000, Medicinal Plants Of India, CBS Publishers and Distributors, Chennai.
4. A. H. Beckett, J.B. Stenlak, 2000, Practical Pharmaceutical Chemistry Volume I, CBS Publishers and Distributors, Chennai.

SUPPLEMENTARY READINGS

1. Sundari, K. Bagavathi,2006, Applied chemistry, Chennai, MJP Publishers, 6th Edition, Chennai.
2. Graham, Patrick,2001, An Introduction To Medicinal Chemistry, Oxford University Press, London.

OUTCOME MAPPING

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| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER –III  PART – IV  SKILL BASED SUBJECT – I | 22UICHS38  WATER TREATMENT AND ANALYSIS | CREDIT: 2  HOURS: 2/W |

COURSE OBJECTIVES

1. To learn about various methods of water treatment.
2. To impart knowledge about water analysis.
3. To enhance the knowledge in water softening methods.
4. To instill an interest about the process involved in RO methods.
5. To make the students familiar in effluent treatment.

UNIT-I: HOURS: 6

Introduction – Characteristics of water – Alkalinity – Hardness – Total solids – Oxidation

– Transparency – Silica content.

Purification of Water – Potability of water – Clarification –Coagulation - Sterilization &

Disinfection of water – Precipitation – Aeration – Ozonization & Chlorination.

UNIT-II: HOURS:6

Water Softening methods – Clark’s process – Lime Soda process – Permutit (or) Zeolite process Ion Exchange process – Demineralisation of water.

Determination of Hardness of water – Titration Method – Complexometric method using EDTA – Expressing Hardness.

UNIT-III: HOURS:6

Water in Industry – Pollution of water by Fertilizers, Detergents, Pesticides and Industrial wastes

Desalination of Brackish water – Electro dialysis – Reverse Osmosis – Removal of Fe, Mn and Silicic acid – Effluent treatment of water from Paper Industry, Petrochemicals and Fertilizer Industry

UNIT-IV: HOURS: 6

Water Analysis – Sampling of water for Analysis – Chemical substances affecting Potability – Colour, Turbidity, Odour, Taste, Temperature,pH and Electrical Conductivity.

Analysis of solids present in water – Suspended Solids – Dissolved solids – Total Acidity – Alkalinity - Free Co2 – Free chlorine – Ca, Mg, Fe, Mn, Ag, Zn.

UNIT – V HOURS: 6

Analysis of Chemical substances affecting Health – NH3 , Nitrate, Nitrite, Cyanide, Sulphate, Sulphide, Chloride, Fluoride – Measurement of Toxic Chemical substances – Analysis of chemical substances indicative of Pollution – Dissolved Oxygen (DO) – Bio – Chemical Oxygen Demand (BOD) – Chemical Oxygen Demand (COD) .

Bacteriological Examination of water – Total Count Test – E. coli test – Most Probable Number method – Biological Examination of water.

COURSE OUTCOMES

1. Able to understand the concepts to make the water potable.
2. Understand Electro dialysis and R O Methods to desalinate water.
3. Able to determine hardness of water.
4. Ability to classify the water.
5. Able to do Bacteriological Examination of water.

TEXTBOOKS:(IN API STYLE)

1. B.K. Sharma, 2008, Industrial Chemistry (including Chemical –Engineering), Goel Publishing house,13th Edition, Meerut.
2. Chemistry of Engineering Materials – JAIN & JAIN – DHANPAT RAT PUBLISHING COMPANY (P) LTD, (K.K.Group), New Delhi.

SUPPLEMENTARY READINGS

1. S.P.Mahajan, 1991, Pollution Control in Process Industries, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
2. C.K.Varashney, 1991, Water Pollution and Management –– Wiley Eastern Ltd., Chennai.

OUTCOME MAPPING

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| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 2 | 3 |
| CO3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: IV  PART: III | 22UICHC43: GENERAL CHEMISTRY – V | CREDIT: 3  HOURS: 4/W |

COURSE OBJECTIVES

1. To give better understanding of Noble gases,
2. To study about Carboxylic Acids, Amines,
3. To learn about Alcohols, Phenols, Naphthol, Important Name Reactions, Mechanism,
4. To expose the students to III law of Thermodynamics
5. To understand about Partial Molar Properties, Chemical Potential, Related Problems and Applications.

**UNIT-I****: NOBLE GASES HOURS: 12**

Noble gases - Electronic Configurations – Position of Noble Gases in the Periodic

Table - Chemical inertness of Noble gases – Reason.

Compounds of Xenon - Hybridization and Geometry of XeF2, XeF4, XeF6 XeOF2, XeO3 and XeOF4 (Preparation, Properties – Not necessary).

Clathrates **-** Definition and Applications - Uses of Noble gases.

UNIT-II: ACIDS AND AMINES HOURS: 12

Monocarboxylic acids – Acetic acid and Benzoic acid – Preparation by Grignard method – Conversion of Acids to their derivatives – Amide, Ester, Anhydride and Acid Chloride – Strength of Carboxylic Acids – Effect of Substituents on the Strength of Acids.

Dicarboxylic acids – Oxalic acid, Malonic acid, Succinic acid, Glutaric acid and Adipic acid - Preparation – Properties – Action of Heat on Dicarboxylic acids.

Amines – Ethylamine and Aniline – Preparation – Basicity of Amines – Effect of Substituents on Basicity - Reactivity of Amines – Distinction between Primary, Secondary and Tertiary Amines.

UNIT-III: ALCOHOLS HOURS: 12

Alcohols – Preparation by Grignard method – Oxidation of alcohols – Difference between Primary, Secondary and Tertiary alcohols – Preparation and Properties of Allyl alcohol.

Phenols - Acidic character of phenols - Kolbe's reaction, Reimer-Tiemann reaction, Gattermann, Lederer-Manasse, Houben-Hoesh, Friedel-Crafts, Schotten-Baumann and Liebermann’s Nitroso Reaction.

Preparation, Properties and Uses of Alpha- and Beta- Naphthol.

UNIT-IV: THERMODYNAMICS- II HOURS: 12

Free energy and Work function - Gibbs free energy – Helmholtz free energy –Relationship between Gibbs free energy and Helmholtz free energy –Their variations with Temperature, Pressure and Volume – Free energy change as criteria for Equilibrium and Spontaneity. Difference between Free Energy and standard Free Energy.

Maxwell’s Relations – Thermodynamic Equation of State.

Gibbs-Helmholtz equation - Derivation and Applications - Clausius-Clapeyron equation - Derivation and Applications.

UNIT-V: THIRD LAW OF THERMODYNAMICS HOURS: 12

Third Law of Thermodynamics - Entropy at Absolute Zero - Nernst Heat Theorem –Statement of III law of thermodynamics – Planck’s formulation of III law of thermodynamics.

Evaluation of Absolute Entropy from Heat Capacity Measurements - Exceptions to III law – Applications of III law.

Partial molar properties - Chemical Potential – Definition - Effect of Temperature and Pressure on Chemical Potential - Gibbs-Duhem equation.Fugacity- Variation with Temperature and Pressure.

COURSE OUTCOMES

1. Assess the compounds of noble gases.
2. Describe the preparations, properties of carboxylic acids and amines.
3. Justify the concept of equilibrium constant and free energy change.
4. Analyse various applications of second law of thermodynamics.
5. Illustrate the types of alcohols and their chemical properties.

TEXTBOOKS: (IN API STYLE)

1. P.L. Soni,2000, “Text book of Inorganic Chemistry”, 20th revised edition, Sultan Chand & Sons, New Delhi.
2. Bahl, B.S. and Bahl, A.,2010, Advanced Organic Chemistry, (12th edition), Sultan Chand & Co., 12th Edition,New Delhi.
3. Puri B.R., Sharma L.R. and Pathania M.S.2013, Principles of Physical Chemistry, Shoban Lal Nagin chand and Co.,35th Edition,New Delhi.

SUPPLEMENTARY READINGS

1. J.D. Lee, 2000 ‘Concise Inorganic Chemistry’, Sultan Chand & Sons, 20th revised Edition, New Delhi.
2. Morrison, R.T. and Boyd, R.N., Bhattacharjee, 2011, S. K. Organic Chemistry, Pearson, India, 7th Edition, New Delhi.
3. Glasstone S. and Lewis D.,1963, Elements of Physical Chemistry, London, Mac Millan & Co Ltd; 1st Edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 |
| CO3 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: IV  PART: III | 22UICHP44  INORGANIC QUALITATIVE ANALYSIS | CREDIT: 3  HOURS: 4/W |

COURSE OBJECTIVES

1. To describe the methodologies which aid in analysing the inorganic salt mixture
2. To identify both interfering and non-interfering anions.
3. Toenablethestudentstodevelopanalyticalskill and perform a systematic qualitative analysis.
4. Toappreciatethevariouscoloredchemicalreactionsofmetalions.
5. To be aware of principle behind the reactions.

SEMI MICROQUALITATIVEANALYSIS:

1. Trainingsessionsforthreeclasses:

Mixtureofanionscontaininganinterferinganionanditseliminationtechnique.

Mixtureofcationsofsimpleradicalstofamiliarizewiththeintergroupseparationt techniques.

1. Semimicroqualitativeanalysisofinorganicsaltmixturescontainingoneinterferingacidradical.
2. Simpleanions: Carbonate,Nitrate,Sulphate,Sulphide,Sulphite,ChlorideandBromide.
3. Interferinganions:

Borate,Fluoride,Oxalate,Phosphate,ArseniteandChromate.

5. Cations:

Group Ications: Lead,

Group IIcations: Copper, Cadmium, Bismuth,.

GroupIIIcations: Aluminium, Ferrous,Ferric, Chromium.

Group IVcations: Cobalt, Nickel, Manganese, zinc.

GroupVcations: Barium, Srontium, Calcium

GroupVIcations: Magnesium,Ammonium.

COURSE OUTCOMES

1. Perform inorganic Analysis systematically and independently.

2. Analyze inorganic salt mixture containing an interfering anion.

3. Describe the methodologies which aid in analysing the inorganic mixture.

4. Apply the solubility product principle to qualitative analysis.

5. Identify the groups where the cations belong along with theory behind the reactions.

TEXTBOOKS:(IN API STYLE)

1. V.V.Ramanujam,1974,InorganicSemiMicroQualitativeAnalysis,TheNationalPublishingCompany, 3rdEdition,Chennai.
2. Vogel, 1974, Vogel’sTextBookofInorganicQualitativeAnalysis, ELBS, ,4thedition,London.
3. Anbusrinivasan.P, 2021, Volumetry and Inorganic Chemistry Practicals-Principle and Procedures,Shri Publications,1st edition,Chidambaram,Tamil Nadu.

SUPPLEMENTARY READINGS

1. Vogel, 1989, Vogel’s Text Book of Quantitative Chemical Analysis, , ELBS/ Longman, 5th Edition, England.

SCHEME OF EVALUATION

Internal assessment: 40 Marks

External assessment: 60Marks

Total: 100marks

Record: 15Marks

Analysis:45Marks.

Eachradicalwithprocedure: 10 Marks

For eliminating procedure: 5 Marks

(Spottingforeachradical-5Marks;Fixingthegroup -5Marks)

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: IV  PART:III | 22UICHA04  INDUSTRIAL CHEMISTRY - IV | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To enable the learners to learn the principle of corrosion, galvanic corrosion, and its control.
2. To enable the students' in-depth study of metals and alloys, factors influencing corrosion.
3. To know the details of protective coatings.
4. To Provide an introduction to theory of Colour, classification of Inorganic pigments and its reaction chemistry, synthesis and its application. Understand the principles of chemical conversion, paints, and pigments.
5. To enable the learners to acquire knowledge in electrical insulating materials.

UNIT-I: CORROSION AND ITS CONTROL HOURS:12

Introduction - Economic aspects of corrosion - Dry or Chemical Corrosion - Wet or electrochemical corrosion - Mechanism of Electrochemical Corrosion. Galvanic Corrosion - Concentration Cell Corrosion - Differential aeration corrosion - Pitting Corrosion - Underground or soil corrosion - Passivity.

UNIT-II: FACTORS INFLUENCING CORROSION HOURS: 12

Microbiological Corrosion, Atmospheric corrosion – Corrosion Control - Proper designing - Using pure metal - Using metal alloys.

Chemical conversion – Coating - Phosphating - Chromising - Treatment of metal surfaces hot dipping - Use of inhibitors.

UNIT-III: PROTECTIVE COATINGS HOURS: 12

Introduction - Metallic Coatings - Various methods of cleaning articles before electrode position – Electroplate and - Electroplating methods.

Pre-treatment of the surface – Metallic Coatings - Hot Dipping -Cementation or Impregnated Coatings - Sprayed Metal Coatings - Cladding – Vapour Deposition.

UNIT-IV: PAINTS HOURS:12

Ingredients and their functions Required Properties of Paint, Constituents and their Functions - Manufacturer of Paint.

Types of Pigments - Characteristics of pigment - Oils - Uses in Paint Emulsion Paints – Special Paints - Paint Remover Varnishes.

UNIT-V: ELECTRICAL INSULATING MATERIALS HOURS: 12

Dielectric properties - Requirements of an Electrical Insulating Material - Classification of insulating material - Electrical Rigid Insulations.

Semiconductors - Introduction - Classification – Degenerate semiconductors – Superconductors.

COURSE OUTCOMES:

1. Develop the availability of source, classification, modification of vegetable oils and its application in surface coating industry.
2. Understand Chemistry, Properties and Applications of White pigments like Titanium Dioxide, Zinc Oxide etc.
3. Understanding of various modern engineering materials and their properties.
4. Understanding ofPrinciples of coating deposition and surface modification methods.
5. Appraisal of the Fundamental coating properties and their relationship - Introduction to corrosion and wear protection, and various functionalities obtainable by coatings and surface treatments.

TEXTBOOKS: (IN API STYLE)

1. E. Stocchi: 1990, Industrial Chemistry, Vol-I, Ellis Horwood Ltd,London.
2. J. A. Kent, 1997, Riegelís Handbook of Industrial Chemistry, CBS Publishers, 9th edition, New Delhi.
3. P. C. Jain, M. Jain, Engineering Chemistry, Dhanpat Rai & Sons, 15th edition, New Delhi.
4. A.K. De, Environmental Chemistry, New Age International Pvt Ltd., 2nd edition, New Delhi.
5. S.P. Mahajan, Pollution control in process industries, Tata McGraw-Hill Publishing Company Limited, New Delhi.
6. C. K. Varshney: Water Pollution and Management, Wiley Eastern Limited, Chennai.

SUPPLEMENTARY READING

1. Felder R. M., and RousseuR. W., 2000, Elementary Principles of Chemical Processes, Wiley Publications, 3rd Edition, New York.
2. Sanders R. J., 1976, The Anatomy of Skiing. Denver, CO: Golden Bell Press, New Delhi.
3. CrynesB. L.,FoglerH. S., 1981, AICHE Modular Instruction Series E: Kinetics, Vols. 1 and 2., New York.
4. Austin G. T., 1984, Shreve’s Chemical Process Industries, McGraw-Hill, 5th Edition, New York.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 2 | 3 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: IV  PART: III | 22UICHP04  INDUSTRIAL CHEMISTRY PRACTICAL -II | CREDIT: 3  HOURS: 3/W |

COURSE OBJECTIVES

1. To know the percent purity of two commercially available aspirin tablets using an acid-base titration.
2. To understand the percentage of purity of sodium bicarbonate by conversion to sodium carbonate.
3. To enable the learners to learn the principle of Thermo-gravimetric analysis, accurate and responsive method of moisture.
4. To knowthe basic concepts of Volumetric analysis.
5. To train the students to become skilled person in saponification and also know the principles of chemical kinetics and to use them for stability testing and determination of expiry date of formulations.

EXPERIMENTS

1. Percentage of Sulphated ash in Aspirin tablet
2. Percentage purity of Sodium bicarbonate
3. Percentage purity of oxalic acid
4. Loss of moisture from any drug
5. Assay of Hydrogen peroxide
6. Assay of Sodium chloride or Potassium chloride
7. Assay of Zinc

|  |
| --- |
| 1. Determination of saponification value of oil.   \* Only for demonstration purpose.  COURSE OUTCOMES:   1. Understand the chemical kinetics, physical and chemical properties, nature ofpharmaceutical products their stability. 2. Designed a method for the determination of hydrogen peroxide in aqueous solutions containing 20% to 705 hydrogen peroxide. 3. Exposed to experimental details of Assay of various chemical compounds. 4. Describe the steps involved Determine the purity of Sodium bicarbonate. 5. Determine Loss of moisture from any drug and also find out the Percentage of available chlorine present in the bleaching powder. |
| TEXTBOOKS:(IN API STYLE)   1. [[Samuel Rideal](https://bookauthority.org/author/Samuel-Rideal), 2017, Industrial Chemistry- Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries,](https://www.amazon.com/dp/1332617417?tag=uuid10-20) 2. [[James A. Audley](https://bookauthority.org/author/James-A.-Audley), 2018,Industrial Chemistry,Being a Series of Volumes Giving a Comprehensive Survey of the Chemical Industries,](https://www.amazon.com/dp/1332315801?tag=uuid10-20) 3. [[Cory Simmons](https://bookauthority.org/author/Cory-Simmons),2019, Handbook of Industrial Chemistry,](https://www.amazon.com/dp/1632386534?tag=uuid10-20) 4. [Ullmann's Encyclopedia of Industrial Chemistry, Vol. B1, Fundamentals of Chemical Engineering,](https://www.amazon.com/dp/3527201319?tag=uuid10-20)[Hans-Jürgen Arpe](https://bookauthority.org/author/Hans-J%C3%BCrgen-Arpe),2021 5. [[Kent J.A.](https://bookauthority.org/author/Kent-J.A.), Riegel's Handbook of Industrial Chemistry,](https://www.amazon.com/dp/8123905440?tag=uuid10-20) 6. [Clerk Ranken, 2015, Industrial Chemistry,](https://www.amazon.com/dp/1298791278?tag=uuid10-20) 7. [[Dr. Darshan V Chaudhary](https://bookauthority.org/author/Dr.-Darshan-V-Chaudhary), 2015, Industrial Chemistry,](https://www.amazon.com/dp/1517220157?tag=uuid10-20) 8. [[John A. Tyrell](https://bookauthority.org/author/John-A.-Tyrell), 2014, Fundamentals of Industrial Chemistry,Pharmaceuticals, Polymers, and Business,](https://www.amazon.com/dp/1118617568?tag=uuid10-20) |
|  |
|  |

SUPPLEMENTARY READINGS

1. Vogel’s textbook of chemical analysis
2. A.O.Thomas, 2003, Practial Chemistry, Scientific Book Centre, 8th Edition, Cannanore.
3. PracticalChemistry-3 Volumes-S.Sundaramandothers.
4. Felder R. M., and Rousseu R. W., 2000, Elementary Principles of Chemical Processes, Wiley Publications, 3rd Edition, New York.
5. Crynes B. L., Fogler H. S., 1981, AICHE Modular Instruction Series E: Kinetics, Vols. 1 and 2., New York.

SCHEME OF VALUATION

Internal assessment: 40 marks

External assessment: 60 marks

Total: 100 marks

Record: 10 marks

Estimation: 50 marks

Error upto 2% 50 marks

2.1- 3% 40 marks

3.1-4% 30 marks

4.1- 5% 20 marks

> 5% 10 marks

For incomplete or wrong calculation, deduct 20% of total marks scored.

For no calculation, deduct 40% of total marks scored.

For each arithmetic error, deduct 1 mark.

OUTCOME MAPPING

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| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 3 | 2 | 3 |
| CO3 | 3 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 2 | 2 | 3 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: IV  PART: IV  NON-MAJOR ELECTIVE: II | 22UICHN47: CHEMISTRY IN TODAY’S WORLD | CREDIT: 2  HOURS: 2/W |

**COURSE OBJECTIVES:**

1. To help students visualize the importance of chemistry in today's world.
2. To know artificial sweetening agents and food preservatives.
3. To know about water treatment and industrial materials.
4. To understand the crux of chemistry in the field of cosmetology and its various implications.
5. To create awareness regarding fertilizers and manuring.

**UNIT I - CHEMISTRY OF WATER: HOURS: 6**

1.1. Water - Sources - impurities in natural water - air in water - Physical properties of water - DO - BOD - COD

1.2. Hardness - Unit of hardness - Total Solids - Disadvantages - Softening of water -

Potable water.

1.3. Purification of water - Distillation - Deionisation - Reverse Osmosis.

**UNIT II - FOOD ADDITIVES HOURS: 6**

2.1. Food Colours - Permitted and Non permitted, Artificial sweeteners - Aspartame,

Saccharin and cyclamate.

2.2. Preservatives - Natural & synthetic. Flavours - Monosodium glutamate - Stabilising and Suspending Agents - Gelatin, pectin. Toxic effects of Food additives.

2.3. Adulterants in milk, ghee, oil, coffee powder, Tea, Asafoetida, chilli powder, pulses and turmeric powder - identification.

**UNIT III - INDUSTRIAL PRODUCTS HOURS: 6**

3.1. Paints, Varnishes, Lacquers and Adhesives - types - constituents - applications;

Ceramics - Glasses.

3.2. Plastics, Polythene, PVC, Bakelite, Polyesters, Resins and their applications.

3.3. Inks - Types - Printing inks - ingredients - additives - Properties of inks - Basics of LED, LCD.

**UNIT IV - COSMETICS HOURS: 6**

4.1. Skin products, Soaps and Shampoos - Creams and Lotions. Lipstick and Hairdye - General formulation and constituents.

4.2. Perfume - General formulation, Deodorants and Anti perspirants - Chemical

constituents.

4.3. Toxicology of cosmetics.

**UNIT V - FERTILIZERS. HOURS: 6**

5.1. Fertilizer - Classification - natural manures - organic manures - Chemical fertilizer - biofertilizer.

5.2. Effect of excess fertilizing and manurity - agro chemicals.

5.3. Insecticides - herbicides - fungicides - rodenticides -nematicides.

**COURSE OUTCOMES:**

1. Appreciate the significance of food additives.
2. Use cosmetics safely.
3. Discuss the role of agro chemicals and quality of water.
4. Know the use of fertilizer.
5. Create awareness about Food Adulterants.

**TEXT BOOKS: (IN API STYLE)**

1. R.Gopalan, S.Sundaram,1998, Fundamentals of Chemistry, SultanChand and Sons, New Delhi.
2. B.N.Chakravarthy, Industrial Chemistry , Oxford and IBH Publishing Co, New Delhi.
3. B.K.Sharma,1995, Industrial Chemistry, Goel Publishing and Co, New Delhi.
4. G.D.GemNathew,2009, Chemistry in everyday life, Vishal Publishing Co, Jalandhar, New Delhi.

**SUPPLEMENTARY READINGS:**

1.SrilakshmiB, 2014, Nutrition Science, New Delhi, New Age International, New Delhi.

2. SwaminathanM. 2006, Text book of Food Chemistry, Printing and Publishing Company, Bangalore.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 2 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: IV  PART: IV  (SKILL BASED SUBJECT-II) | 22UICHS48: FOOD CHEMISTRY | CREDIT: 2  HOURS: 2/W |

COURSE OBJECTIVES

|  |
| --- |
| 1. To learn about the food and cereals. |
| 1. To recognize the importance of sugar, vegetable and fruits. |
| 1. To identify various beverages, appetizers. |
| 1. To acquire knowledge about food preservation. 2. To know about food additives. |

UNIT - I: FOOD, CEREALS. HOURS: 6

Food:Definition – classification – Energy yielding – Body building and protective foods, functions. Nutrients – Types of nutrients – Proteins, Carbohydrates, Fats, Minerals and Vitamins – Importance of nutrients.

Cereals - Definition – Classification - Processing - Structure of Cereals - Composition and Nutritive value – Pulses - Definition - Classification - Processing - Structure of Pulses - Composition and Nutritive Value - Toxic Constituents in Pulses - Medicinal value of Cereals and Pulses.

UNIT - II: SUGAR, VEGETABLES AND FRUITSHOURS: 6

Sugar - Structure and Properties - Nutritive value - Sugar composition in different food items. Sugar related products - Classification and Nutritive value - Artificial sweeteners – Examples – Saccharin and Cyclamate - Advantages and Disadvantages.

Vegetables and Fruits - Classification - Composition and Nutritive values. Importance and Nutritive value of some common foods - Milk, Egg and Soyabeans.

UNIT -III: BEVERAGES, APPETIZERS HOURS: 6

Beverages - Definition - Examples – Classification. Fruit Beverages - Milk Based Beverages - Malted Beverages - Examples – Alcoholic and Non-Alcoholic Beverages – Examples. Appetizers - Definition - Classification - Examples - Water - Functions and Deficiency.   
**UNIT-IV: FOOD PRESERVATION AND PRESERVATIVES HOURS: 6**

Food preservation -Definition- Classification - Food Spoilage. Preservatives-Sodium benzoate - Benzoic acid - Sodium chloride, Sugar – Acetic acid – Sulphur dioxide – Sorbic acid. Methods of preservation and processing – By heat – Canning and Pasteurisation – Drying – Advantages – Methods of drying – vacuum drier.

UNIT -V: FOOD ADDITIVES HOURS: 6

Food additives- meaning-Direct and Indirect additives-Functions of food additives – Anti-oxidants- Emulsifying agents-Humectants-Stabilizers-Surface active agents-Artificial Sweeteners-Flavouring agents-Anti-caking agents. Food Colours – Restricted use – Spurious Colours – Taste Enhancers – MSG – Vinegar.

COURSE OUTCOMES

|  |
| --- |
| 1. Describe the food and cereals. |
| 1. Analyse sugar, vegetable and fruits. |
| 1. Know about beverages, appetizers. |
| 1. Explain food preservation. |
| 1. Analyse food additives. |

TEXTBOOKS: (IN API STYLE)

1. Curtis P. A. (2013), An operational Text Book, Guide to Food Laws and regulations, Wiley Blackwell publishers, 2nd Edn.,UK.
2. Negi J. (2016), Food & Beverage Laws - Food Safety and Hygiene. ABD Publishers : Distribution, India.
3. Alex Ramani V (2009) Food Chemistry-MJP Publishers,Chennai.
4. Food Chemistry (2004) Lillian Hoagland Mayer, CBS Publishers and Distributers, Delhi.
5. Food Science (2005), B. Srilakshmi, III Edition, New Age International Publishers.

SUPPLEMENTARY READINGS

1. Foods Facts and Principles by N.Shakuntala Manay & M. Shadaksharaswamy, Wiley Eastern Ltd, New Delhi.
2. Food Chemistry by Seema Yadev, Anmol Publication, New Delhi.
3. Applied Chemistry by Jayashree Ghose
4. Fundamentals of Foods and Nutrition - Mudambi R. Sumathi, and Rajagopal, M. V., - Wiley Eastern Ltd., Madras.
5. Handbook of Food and Nutrition - M. Swaminathan - Bangalore Printing and Publishing Co. Ltd., Bangalore.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER:V  PART:III | 22UICHC51  INORGANIC CHEMISTRY-I | CREDIT:4  HOURS:4/W |

COURSEOBJECTIVES

1. Toknowthetendencyoftransitionmetalsandtoknowthecatalyticpropertiesoftransitionmetalsandindustrialapplicationsof their compounds.
2. ToexposethestudentsaboutthebasicconceptsofcoordinationcomplexesandtheIsomerismofcoordinationcomplexes.
3. TounderstandthetheoriesofCoordinationCompoundsandtheirProperties.
4. To help the students to understand the facts of reactions and reaction mechanism in complexes.
5. Toknowthe roleandfunctions ofconductors, superconductors andsolidstatematerials.

UNIT-I: TRANSITIONELEMENTS(d-BLOCKELEMENTS) HOURS:12

Electronic configuration – group study of titanium, vanadium, chromium, manganese andiron metals – comparative study of zinc group metals – Important uses of transitionmetalsand theiralloys.

Horizontal comparison with Fe, Co, Ni groups – toxicity of Cd and Hg – oxides, mixedoxides,halides,andoxohalidesoftransitionmetals-–synthesisandreactivityofvanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate,permanganate– polycations

Interstitial compounds – nitrides, carbides, hydrides, borides of Ti, V, Cr, W and theirindustrial uses.

UNIT-II:COORDINATION CHEMISTRYI HOURS:12

IUPAC nomenclature – Definition of terms used- Classification of Ligands- Chelation andEffect ofChelation-Coordination NumberandStereochemistryof Complexes.

StructuralIsomerisminComplexes-Ionisationisomerism,HydrateIsomerism,LinkageIsomerism, Ligand Isomerism, Coordination Isomerism, Coordination position Isomerism andPolymerisationIsomerism.

GeometricalandOpticalIsomerismin4-and6-CoordinatedComplexes

UNIT-III:COORDINATIONCHEMISTRYII HOURS:12

WernerandSidgwicktheory-EANrule

Valence bond Theory – Postulates of VBT – Hybridization, Geometry and Magnetic properties -FailureofVBT.

Crystal Field theory- Crystal field splitting in octahedral, tetrahedral and square planar fields –factors influencing the magnitude of crystal field splitting – CFSE in weak and strong fieldscalculations; pairing energy-Magnetism and Colour: spin only magnetic moments of dn ions .Jahn-Tellerdistortion-Comparison ofVBTandCFT.

UNIT-IV:COORDINATION CHEMISTRYIIIAND Pi-ACCEPTORLIGANDS HOURS:12

Pi-Acceptor ligands- Bonding, Hybridization and Structure of Carbonyls of Ni, Cr, Fe, Co, Mn,W andV

Labile and inert complexes, stability of coordination compounds – thermodynamic and kineticstability,relationshipbetweenstepwiseformationconstantandoverallformationconstant,factorsaffectingthe stabilityof complexes.

Substitutionreactiononsquareplanercomplexes,transeffect–(exampleandapplications).–substitutionreactionsin octahedralcomplexes–SN1 and SN2mechanisms .

UNIT-V: SOLIDSTATECHEMISTRY HOURS:12

The nature of the Solid State – Amorphous and Crystalline – Differences - Close Packing inCrystals – Examples for Cubic, BCC and FCC Lattices - Bragg’s law – Application of XRD toCrystalstudies– Structureof NaCl, CsCl, CaF2and ZnS.

BandtheoryofSolids,Metals,Semiconductors,Insulators -superconductors.

Defects in solids – Scottky Defect and Frenkel Defect – Metal Excess and Metal DeficiencyDefect –Typesofmagneticbehavior,dia,para,ferro,antiferroandferrimagnetism–Hysterisis.

COURSE OUTCOMES

|  |
| --- |
| 1. Explain the tendency, catalytic properties of transition metals and their industrial applicationsoftheir compounds 2. NamethecoordinationcompoundsusingIUPACnomenclatureandexplainthevarioustypes of Isomerismexhibitedbycoordinationcomplexes. |
| 1. Discussthevarioustheoriesof coordinationcompounds. |
| 1. Explainthemechanismandratesofreactionsofcoordinationcomplexes. |
| 1. Assessthenature andtypesofsolidsand explainthebandtheoryanddefects ofsolids |

TEXTBOOKS:(IN APISTYLE)

1. B.R.Puri,L.R. Sharma,K. C.Kalia, 2016,Principles ofInorganic Chemistry, ShobanLalNagin Chand and Co., 33rd Edition, New Delhi.
2. J.D.Lee, 1996,ConciseInorganic Chemistry,BlackwellScience,5thEdition,London.
3. R.Gopalan, 2008,ConciseCoordinationChemistry,Sultan Chand and Sons, New Delhi.

SUPPLEMENTARYREADINGS

1. J.E.Huheey,E.A.Kieter, R.L.Keiter, 1993,Inorganic Chemistry,HarperCollins,4thEdition,New York.
2. F. A. Cotton, G.Wilkinson, C.Murillo, M.Bochman, 1999,Advanced Inorganic Chemistry, 6th Edition, JohnWiley, New York.
3. LesleySmart, ElaineMoore, 2021, Solid State Chemistry, ChapmanHall, 5th Edition, London.

OUTCOME MAPPING

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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 2 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 2 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER:V  PART:III | 22UICHC52  ORGANIC CHEMISTRY – I | CREDIT:4  HOURS:4/W |

COURSE OBJECTIVES

1. To effectively impart knowledge about carbohydrates.
2. To enable the students to understand various stereoisomerisms and projection formulae for stereoisomers.
3. To acquire an in-depth knowledge of conformational analysis and their stability.
4. To cohesively understand the various reactions concerning nitro and amino compounds.
5. To acquire a comprehensive overview of heterocyclic compounds.

UNIT-I: CARBOHYDRATES HOURS:12

**1.1** Carbohydrates **-** Classification – Aldoses and Ketoses, Reducing and Non-reducing Sugars - Reactions of Glucose and Fructose - Osazone formation, Mutarotation and their Mechanism - Structural elucidation of Glucose and Fructose - Pyranose and Furanose forms – Haworth’s method.

**1.2** Determination of Ring Size- Haworth Projection Formula - Configuration of Glucose and Fructose - Epimerization - Chain lengthening and chain shortening of Aldoses - Inter conversion of Aldoses and Ketoses – Uses of Glucose.

**1.3** Disaccharides and Polysaccharides - Reactions and Structural elucidation of Sucrose and Maltose - Properties, Structure and Uses of Starch and Cellulose.

UNIT-II: STEREOCHEMISTRY HOURS:12

**2.1** Stereoisomerism – Definition - Classification into Optical and Geometrical isomerism. Conditions for Optical Activity – Asymmetric centre – Chirality – Achiral molecules -Meaningof(+)and(-)andD-andL-notations–Elementsofsymmetry-Projectionformulae Fischer, Flying Wedge, Sawhorse and Newmann projection formulae - Notation of optical isomers-Cahn-Ingold-Prelogrules-R,SnotationofOpticalisomerswithoneAsymmetric carbon atoms – Erythro and Threo representation.

**2.2** Optical activities in Compounds not containing Asymmetric Carbon Atoms - Biphenyl, Allenes and Spiranes - Racemisation - Methods of Racemisation (By substitution and Tautomerism) – Resolution - Methods of Resolution (Mechanical, Biochemical and Conversion To Diastereomers) - Asymmetric Synthesis (Partial and Absolute Synthesis) -Walden inversion.

**2.3** Geometrical isomerism **-** Cis - Trans, Syn - Anti and E-Z Notations - Geometrical Isomerism in Maleic and Fumaric Acids and Unsymmetrical Ketoximes - Methods of Distinguishing Geometrical Isomers using Melting Points, Dipole Moment, Dehydration, Cyclisation, Heat of Hydrogenation and Combustion.

UNIT- III: CONFORMATIONAL ANALYSIS HOURS:12

**3.1** Conformational analysis **-** Introduction of terms - Conformations, Configuration, Dihedral Angle, Torsional Strain - Differences between Conformational isomers and Configurational isomers.

3.2 Conformational analysis of Ethane and n-Butane including energy diagrams.

**3.3** Conformations of Cyclohexane (Chair, Boat and Twist-Boat forms) - Axial and Equatorial bonds - Ring flipping showing Axial and Equatorial bonds Interconversions – Conformations of Methyl Cyclohexane.

UNIT-IV: NITRO, AMINO COMPOUND AND CONDENSATION REACTION HOURS:12

**4.1** Nitroalkanes–Preparation–Properties–Structure–Nitro-AcinitroTautomerism–Uses of Nitroalkanes – Differences between Primary, Secondary and Tertiary Nitroalkanes.

**4.2** Aliphatic Amines – Preparation – Properties of Primary, Secondary and tertiary amines – Basic character of amines – Aromatic amines – Aniline, Nitroaniline, Phenylene diamines – Preparation and Properties. Mechanism of Aldol, Perkin and Benzoin condensations - Knoevenagel, Claisen, Wittig, Cannizzaro, Reformatsky and Michael addition reactions.

**4.3** Mechanismof Aldol,Perkinand Benzoincondensations-Knoevenagel,Claisen, Wittig, Cannizzaro, Reformatsky and Michael addition reactions.

UNIT-V: HETEROCYCLICCOMPOUNDS HOURS:12

**5.1** Heterocyclic compounds - Huckel’s rule – Aromaticity of Heterocyclic compounds -Preparation, Properties, Structure and Uses of Furan, Pyrrole and Thiophene.

**5.2** Preparation and properties of Pyridine and Piperidine - Comparative studyof Basicityof Pyrrole, Pyridine and Piperidine with Amines – Nucleophilic and Electrophilic substitution reactions of Pyridine.

**5.3** Condensed Five and Six Membered Heterocyclic Compounds - Preparation of Indole, Quinoline and Isoquinoline – Fischer-Indole synthesis, Skraup Quinoline synthesis and Bischler-Napieralski synthesis - Electrophilic substitution reactions.

COURSE OUTCOMES

1. Elucidate the structures of saccharides.
2. Assign the stereo configuration of Organic Compounds and conformation of cyclohexanes.
3. Explain the preparation, properties and uses of Nitro alkanes and amines.
4. Explain the mechanism of Organic named reactions.
5. Explain the synthesis and properties of five and six membered heterocyclic compounds and condensed heterocyclic compounds.

TEXTBOOKS: (IN API STYLE)

1. R. T. Morrison and Boyd, 2016, Organic Chemistry, Pearson India, 16th Edition,New Delhi.
2. L. Finar, 2002, Organic Chemistry- Volume I and II, Pearson Education India, 5th Edition, New Delhi.
3. P. L. Soni, 2007, Text Book of Organic Chemistry, Sultan Chand & Sons, 29th Edition, New Delhi.
4. Bahl and Arun Bahl, 2021, Advanced Organic Chemistry, Sultan Chand and Sons,22nd Edition, New Delhi.
5. Kalsi, 1993, Stereochemistry, Conformations and Mechanisms, Wiley Eastern Limited, 2nd Edition, Chennai.
6. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, 2017, A Text Book of Organic Chemistry,Vikas Publishing House, 4th Edition, Noida.
7. Jerry March, 1992, Reaction, Mechanism and Structure, John Wiley and Sons, New York.
8. E. I. Eliel, 2019, Stereochemistry of Carbon Compounds, Tata Mcgraw Hill Education, 8th Edition, New Delhi.
9. N. Tewari, 2016, Advanced Organic Reaction Mechanism (Problems and Solutions), Books and Allied (P) Ltd, 4th Edition, Kolkata.

SUPPLEMENTARY READINGS

1. D. Nasipuri, 2018, Stereochemistry of Organic Compounds, New Age International Publishers, 4th Edition, New Delhi
2. M. K. Jain, S. C. Sharma, 2016, Modern Organic Chemistry, Vishal Publications, 4th Edition, New Delhi.
3. N. Pillai, 2009Text Book of Organic Chemistry, Universities Press,1st Edition, London.

OUTCOME MAPPING

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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 3 |
| CO3 | 2 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: V  PART: III | 22UICHC53  PHYSICAL CHEMISTRY-I | CREDIT:4  HOURS:4/W |

COURSE OBJECTIVES

1. To impart knowledge in essential topics in Physical Chemistry such as Solution and Ionic Equilibria.
2. To gain knowledge about Phase Rule and its applications.
3. To educate the students about Colligative Properties.
4. To have an idea about Chemical Equilibrium.
5. To understand the importance of Electrochemistry and its applications.

UNIT-I:SOLUTIONS HOURS: 12

**1.1** Solutions - Solutions of liquids in liquids – Ideal solution and Raoult’s law - Vapour pressure of ideal solutions -– Activity of a component in an ideal solution – Gibbs-Duhem-Margules equation – Thermodynamics of Ideal Solutions ∆Gmix, ∆Hmix, ∆Vmix and ∆Smix.

**1.2** Non-Ideal Solution - Deviation from Raoult’s law – Vapour pressure of non-ideal solutions – Vapour Pressure-Composition and Temperature-Composition Curves of Ideal and Non-ideal Solutions - Lever rule- Fractional distillation of Binary liquid solutions – Azeotropic mixtures - Distillation of immiscible liquids.

**1.3** Partially miscible liquids - CST and effect of impurity on CST -Phenol - Water, Triethylamine – Water and Nicotine – Water systems – Solutions of Gases in Liquids – Factors influencing the solubility of a gas – Henry’s Law - Nernst distribution law – Definition - Thermodynamic derivation – Applications.

UNIT-II: PHASE RULE HOURS: 12

**2.1** Definition of the terms - Phase, Components and Degrees of freedom – Derivation of Gibbs phase rule

**2.2** Applications of phase rule - One component system - Water and Sulphur system – Reduced phase rule - Two components system - Simple eutectic system – Lead-silver system, KI-water system - Freezing mixtures.

**2.3** Thermal analysis and cooling curves, Compound formation with congruent melting point – Zn-Mg, FeCl3- Water system - Compound formation with incongruent melting point - Na-K System – Solid-Gas Equilibria.

UNIT-III: COLLIGATIVE PROPERTIES AND CHEMICAL EQUILIBRIUM HOURS:12

**3.1** Colligative properties - Lowering of vapour pressure - Osmosis and osmotic pressure-Determination of Molar mass from osmotic pressure measurement -Relation between Vapour pressure lowering and Osmotic pressure- Thermodynamic Derivation of Elevation of boiling point and Depression of freezing point – Determination of molar mass – Abnormal results and Van’t Hoff factor.

**3.2** Chemical Equilibrium - Law of Chemical Equilibrium - Thermodynamic derivation of Law of Chemical Equilibrium - Relationship between Kp, Kc and Kx for reactions involving Ideal Gases.

**3.3** Van’t Hoff Reaction Isotherm - Temperature Dependence of Equilibrium Constant – Van’t Hoff Isochore - Le Chatelier’s Principle and Its Applications.

UNIT-IV: ELECTROCHEMISTRY - I HOURS: 12

**4.1** Conductance in metal and in electrolytic solution – Faraday’s Laws- Specific, Equivalent and Molar conductance - Measurement of equivalent conductance - Variation of Equivalent Conductance and Specific Conductance with Dilution – Arrhenius theory of electrolytic dissociation and its limitation - Ostwald’s Dilution Law and Its Limitations.

**4.2** Debye-Huckel’s theory of Strong Electrolytes - Onsagar equation (No derivation) - Verification and Limitations - Wein effect and Debye-Falkenhangen effect – ionic strength – activity and activity coefficients of strong electrolytes -Kohlrausch law and its applications.

**4.3** Migration of ions - Ionic Mobility - Ionic Conductance - Transport Number and its determination – Hittorff’s method and Moving Boundary method - Effect of Temperature and Concentration on Conductance.

UNIT-V: ELECTROCHEMISTRY-II AND IONIC EQUILIBRIA HOURS: 12

**5.1** Applications of Conductometric Measurements - Determination of Degree of Dissociation of Weak Electrolytes, Ionic Product of Water - Solubility Product of sparingly soluble salt - Conductometric Titrations.

**5.2** Concept of pH - Buffer solutions, Buffer action - Henderson equation - Applications of Buffer Solutions.

**5.3** Hydrolysis of Salts - Expressions for Hydrolysis Constant, Degree of Hydrolysis and pH of aqueous salt solutions.

COURSE OUTCOMES

1. Differentiate the ideal and non-ideal solutions.
2. Uses the Lever rule for two-
3. Recognize, use and compare the colligative prope
4. Understand the theories on weak and strong electroly
5. Gain knowledge about various applications of conductance measurements.

TEXTBOOKS: (IN API STYLE)

1. Puri B.R., Sharma L.R and Pathania M.S., 2016, Principles of Physical Chemistry, Vishal Publishing Company, 47th Edition, Jaladhar, New Delhi.
2. Atkins P.W., 1994, Physical chemistry, Oxford University press, 5th Edition, London.
3. Sharma K.K, Sharma.L.K, 2016, A Text book on physical Chemistry, Sultan Chand and Sons, 6th Edition, New Delhi.
4. Negi A.S., and Anand S.C, 1985, A textbook of physical Chemistry, New Age International Publishers, 2nd Edition, New Delhi.
5. Maron S.H. and Lando J.B, 1974, Fundamentals of Physical Chemistry, Macmillan, Stuttgart, Germany.
6. Glasstone S. and Lewis. D., 1963, Elements of Physical Chemistry, Macmillan, 2nd Edition, Chennai.

SUPPLEMENTARY READINGS

1. S. Glasstone, 1971, An Introduction to Electrochemistry, Affiliated East West Press, 1st Edition, New Delhi.
2. Bahl B.S., Arun Bahl, Tuli G.D, 2009, Essentials of Physical Chemistry, First Multicoloured Revised Edition, Sultan Chand and Sons, New Delhi.
3. Moore W. J., 1972, Physical chemistry, Orient Longman Ltd., 5th Edition, Chennai.

OUTCOME MAPPING

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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 3 | 2 | 2 |
| CO3 | 2 | 3 | 2 | 3 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 3 |
| CO5 | 2 | 3 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER:V  PART:III | 22UICHC54  ANALYTICAL CHEMISTRY | CREDIT:4  HOURS:5/W |

COURSEOBJECTIVES

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| 1. Toprovidethebasicidea ofanalyticaltechniquesandto knowaboutimportant   terminologiesinvolvedinErroranalysis, |
| 1. Tostudyabout the principlesandclassificationofseparationmethods |
| 1. Toexposethe students theconceptsofvarious chromatographictechniques. |
| 1. Toimpartwideknowledgeaboutprinciplesofgravimetricanalysisandpurification   methods. |
| 1. ToenlightenthestudentsabouttheconceptsandapplicationsofThermoanalytical   methodsandElectrochemicalTechniques |

UNIT-I:BASICCONCEPTS OF ANALYTICALCHEMISTRYANDDATAANALYSIS HOURS:15

Role of Analytical Chemistry. Classificationofanalyticalmethods –classicalandinstrumental.Typesofinstrumentalanalysis.Selectingananalyticalmethod-Neatnessandcleanliness- Laboratoryoperations and practicals.

Analyticalbalance-Techniquesofweighing,errors,cleaningandcalibrationofglassware.Selectingandhandlingofreagents.Laboratorynotebooks.Safetyintheanalyticallaboratory.

Errors and their Evaluation Definition of terms mean and median. Precision-standarddeviation, relative standard deviation. Accuracy-absolute error, relative error. Types oferrorsinexperimentaldatadeterminate(systematic),indeterminate(orrandom)andgross. Sources of errors and the effects upon the analytical results. Methods for reportinganalyticaldata.Statisticalevaluation ofdata-indeterminateerrors.Theuses ofstatistics.

UNIT-II:SEPARATIONTECHNIQUES-SOLVENTEXTRACTIONANDCHROMATOGRAPHYTECHNIQUES-I HOURS:15

Solvent extraction: Principles and process of solvent extraction – Distribution law and thepartitioncoefficient– Batchextraction – Continuous extraction.

PrinciplesandTechniquesofColumn,andThinLayerChromatography-ColumnChromatography-PreparationofColumn-Adsorption-Adsorbents-Elution-RecoveryofSubstances.

TLC-ChoiceofAdsorbentandSolvents-PreparationofChromatogramandApplications-Rfvalue

UNIT-III:CHROMATOGRAPHYTECHNIQUES-II HOURS:15

Paper Chromatography - Solvents used - Factors affecting Rf value - Separation ofAminoAcid Mixtures-Radial PaperChromatography-Applications-

Ionexchangechromatography-Principle-ExperimentalTechniques-TypesofResins-Requirement of a Good Resin - Action of Ion Exchange Resins - ExperimentalTechniques and Applications - Separation of Zinc- Magnesium, Cobalt - Nickel andCadmium -Zinc ions.

HighPressureLiquidChromatographyandGasChromatography-PrincipleandApplications – Mass Spectrophotometer (GC-MS) - Liquid Chromatography - MassSpectrophotometer(LC-MS)-Principleand Applications

UNIT-IV:PURIFICATIONMETHODSANDGRAVIMETRICTECHNIQUES HOURS:15

Purification of Solid Organic Compounds – Solvent extraction – Recrystallisation - Useofimmisciblesolvents–Soxhletextraction–Crystallization–Useofmisciblesolvents

FractionalCrystallization andSublimation.

Purificationofliquids – ExperimentalTechniques ofDistillation–Fractional Distillation

VacuumDistillation–SteamDistillation –TestsofPurity.

Gravimetric techniques Gravimetric Analysis – Characteristics of Precipitating Agents –conditionofPrecipitation–TypesofPrecipitants–PurityofPrecipitate–Co-precipitationandPostprecipitation–PrecipitationfromHomogeneousSolution–Digestion and Washing of precipitate – Ignition of precipitate – Uses of SequesteringAgents

UNITV:THERMOANALYTICALMETHODSANDELECTROCHEMICALTECHNIQUES HOURS:15

PrincipleinvolvedinThermogravimetricanalysis(TGA)andDifferentialThermalAnalysis (DTA) - Instrumentation- Discussion of Various Components with BlockDiagram–

CharacteristicsofTGA(CaC2O4.H2O,CuSO4.5H2O)andDTAcurves-FactorsaffectingTGAandDTACurves-ThermometricTitrations-PrincipleandApplications

Polarography - Principle - DME - Advantages and Disadvantages - Ilkovic equation andits significance (No Derivation) - Polarography as an Analytical tool in Quantitative andQualitativeAnalysis-Amperometric Titrations.

COURSE OUTCOMES

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| 1. Studentscanhandletheinstrumentswiththeproperanalyticalknowledgealongwith proper safetymeasures. |
| 1. Recommendpropermethodfortheseparation ofmixtureofcompounds. |
| 1. Describethebasicprinciplesandproceduresofvariouschromatographictechniques. |
| 1. Applytheprinciplesofgravimetricanalysistoperformgravimetricexperiments. |
| 1. UsethermogravimetricandElectrochemicalTechniquesanalysisandexaminethe   themogramandvoltammogramrespectively. |

TEXTBOOKS:(IN APISTYLE)

1. R.Gopalan,P.S.SubramanianandK.Rengarajan, 1991,Elements Of Analytical Chemistry, Sultan Chand andSons, 2ndEdition, New Delhi.
2. D.A.Skoog, D.M.West, 1996,FundamentalofAnalyticalChemistry,Saunders College Publishing, 7th Edition, Philadelphia,Holt, London,
3. G.D.Christian,1994, AnalyticalChemistry,JohnWiley,5thEdition,1994.
4. V.K.Srivastava,K.Kishore,1991, IntroductiontoChromatography:Theoryand Practice.Sutan Chand and Sons, New Delhi.

**SUPPLEMENTARYREADINGS**

1. L.G.Hargis, 1998,AnalyticalChemistry:PrinciplesandTechniques,PrenticeHall,United States.
2. D.A.Skoog, 1985,PrinciplesofInstrumentalAnalysis,Saunders CollegePub.Co,3rd Edition, Philadelphia,Holt, London.
3. U.N. Dash, 2005, Analytical Chemistry, Sultan Chand and Sons, 2nd Edition, New Delhi.
4. F.Settle, 1997,HandbookofInstrumentalTechniquesforAnalyticalChemistry,PrenticeHall, United States.

OUTCOME MAPPING

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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 2 | 3 | 2 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 3 | 2 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: V  PART: III | 22UICHE58-1  POLYMER CHEMISTRY | CREDIT: 3  HOURS:3/W |

(INTERNAL ELECTIVE-III)

COURSE OBJECTIVES

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| 1. To know the chemistry of polymers and polymerisation |
| 2. To understand the properties and reactions of polymers |
| 3. To study the plastics and resins |
| 4. To know about chemistry of commercial polymers |
| 5. To have an idea about advances in polymers |

UNIT- I: POLYMERS AND POLYMERISATION HOURS: 9

1.1Introduction to Polymers – Monomers, Oligomers, Polymers and their Characteristics - Classification of Polymers – Addition and Condensation Polymers – Natural and synthetic – Linear, Branched, Cross-Linked and Network – Plastics – Elastomers – Fibres – Homopolymers and Copolymers.

1.2Bonding in Polymers – Primary and Secondary bond forces in Polymers – Cohesive energy and Decomposition of Polymers.

1.3Polymerization Techniques - Bulk, Solution, Suspension and Emulsion Polymerisation - Melt Polycondensation - Chain Growth Polymerisation – Cationic, Anionic and Free radical polymerisation – Stereoregular polymers – Ziegler Natta polymers – Step Growth Polymers.

UNIT-II: PROPERTIES AND REACTIONS OF POLYMERS HOURS: 9

2.1Molecular weight of polymers – Number average – Weight average – Sedimentation and Viscosity – Average molecular weight - Molecular weight and Degree of Polymerisation – Methods of determination of Molecular Weight – Gel permeation chromatography – Ultracentrifugation.

2.2Reactions – Hydrolysis – Hydrogenation –Addition – Substitution – Cross linking – Vulcanisation – Cyclisation.

UNIT-III: PLASTICS AND RESINS HOURS: 9

3.1Plastics and Resins – Definitions – Thermoplastic and Thermosetting Resins – Constituents of Plastic Fibres – Dyes, Pigments, Plasticisers, Lubricants and Catalysts. 3.2 Important Thermoplastic Resins – Acrylics, Polyvinyl and Cellulose Derivatives - Important Thermosetting Resins – Phenolic resins – Epoxy resins. 3.3 Adhesives – Shellac resins – Vegetable glues and Animal glues.

UNIT- IV: CHEMISTRY OF COMMERCIAL POLYMERS HOURS: 9

4.1Chemistry of Commercial Polymers - General methods of Preparation and Uses of the following - Teflon, Polyethylene, PTFE, Polystyrene, Polycarbonates and PVC.

4.2Textile fibres – Definition and Polymer requirement for fibres – Polyamides – Nylon 66 - Nylon 6 – Polyesters – Terylene – Cellulose acetate – Viscose rayon.

4.3Natural and Synthetic Rubber – Constitution of Natural rubber – Natural Rubber – Isoprene – Synthetic Rubber - Butyl, Buna, Buna- S, SBR, Thiokol, Neoprene, Polyurethane and Silicone Rubber – Ebonite.

UNIT-V: ADVANCES IN POLYMERS HOURS: 9

5.1Advances in Polymers - Biopolymers, Biomaterials, Polymers in Medical Field, High temperature and Fire -Resistant Polymers – Applications of Silicones.

5.2Conducting Polymers – Elementary idea – Examples – Polysulphur Nitriles, Poly-para-phenylene, Polypyrrole, Polythiophene, Polyaniline and Polyacetylene.Acrylic polymers – Polymers of Acrylic Acid, Methacrylic Acid and Polyacrylates.

COURSE OUTCOMES

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| 1. Describe polymers and polymerization 2. Explain the properties and reactions of polymers 3. Classify plastics and resins 4. Understand the chemistry of commercial polymers 5. Describe bio polymers and conducting polymers |

TEXTBOOKS:(IN API STYLE)

1. Bhat Nagar M.S, 2018, A Text Book of Polymer Chemistry, Sutan Chand and Sons, Reprint 1st Ediiton,New Delhi.
2. Billmeyer F.W., 2019, Text book of polymer science, John Wiley and Sons, 3rd Edition, New Jersey, United States.
3. Bhavath Sundari K, 2006, Applied Chemistry, MJP Publishers, Chennai.

SUPPLEMENTARY READINGS

1. Gowariker V.R., Viswanathan N.V., Jayader Sreedhar, 2019, Polymer Science, Wiley Eastern Ltd., 3rd Edition, New Delhi.
2. Sharma, B.K, 2020, Polymer Chemistry, Goel Publishing House, Meerut.
3. Arora M.G., Singh M, Yadav M.S.1998, Polymer Chemistry, Anmol Publications Private Ltd., 2nd Revised Edition, New Delhi.

OUTCOME MAPPING

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| CO3 | 3 | 2 | 3 | 3 | 2 |
| CO4 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 22 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: V  PART: III | 22UICHE58-2  SPECTROSCOPY – I | CREDIT: 3  HOURS: 3/W |

(INTERNAL ELECTIVE- III)

COURSE OBJECTIVES

1. To impart knowledge about various spectroscopic techniques.
2. To understand the principle of UV, IR, Raman spectral techniques.
3. To know the instrumentation of the above spectral techniqueS.
4. To analyze simple compounds using the above spectral techniques
5. To understand the structure simple compounds using the above spectral techniques

UNIT-I: INTRODUCTION TO SPECTROSCOPY HOURS: 9

Electromagnetic radiation, Definition of various parameters like wavelength, wave number and frequency. Electromagnetic spectrum, Interaction of electromagnetic radiation with matter, Quantization of different forms of energies in molecules (translational, rotational, vibrational and electronic), Energy level diagram, Born-Oppenheimer approximation.

Microwave Spectroscopy - Theory of microwave spectroscopy, Selection rules, Calculation of moment of inertia and bond length of diatomic molecules.

UNIT-II: UV-VISIBLE SPECTROSCOPY HOURS: 9

Definitions of Absorbance & Transmittance, Absorption laws- Beer Lambert’s law, Instrumentation - Block diagram, Theory-Types of electronic transitions, Chromophore and Auxochromes, Absorption bands and intensity - Factors governing absorption maximum and intensity, Shifts & Effects- Effect of polarity of solvent, Applications of UV-visible spectroscopy.

UNIT-III: INFRARED SPECTROSCOPY- FUNDAMENTALS HOURS: 9

Various IR regions, Principle of IR, types of vibrations- stretching and bending vibrations, Fundamental & non-fundamental modes of molecular vibrations- modes of vibration of diatomic, triatomic linear (CO2) and nonlinear triatomic molecules (H2O) - Selection rules, Hook’s Law, Factors affecting vibrational frequencies (electronic factors, ring strain & hydrogen bonding).

UNIT-IV: INFRARED SPECTROSCOPY- INSTRUMENTATION & APPLICATIONS HOURS:9

IR Instrumentation – Block diagram, Sampling techniques - solids, liquids & gases, Applications of IR Spectroscopy – interpretation of the spectra of aliphatic and aromatic alcohols, aldehydes, ketones and esters, Distinction between inter and intra molecular hydrogen bonding.

UNIT-V: RAMAN SPECTROSCOPY HOURS: 9

Theory of Rayleigh Scattering and Raman effect, Selection rules-(vibrational-rotational), Stokes and anti-stokes lines, Instrumentation- Block diagram, Types of Laser sources, Differences between Raman and I.R. Spectroscopy, Mutual exclusion principle (CO2& N2O), Applications of Raman spectroscopy.

COURSE OUTCOMES

1. Will be able to explain the basic principles of various spectral techniques.
2. Able to understand the relevant terms and definitions of various spectral techniques.
3. Able to explain the working instrumentation of various spectral techniques.
4. Able to interpret the spectra of simple organic compounds.
5. Able to characterize the simple organic compounds from spectral knowledge.

TEXTBOOKS:(IN API STYLE)

1. R. Gopalan, P.S. Subramanian, K. Rengarajan, 2003, Elements of Analytical Chemistry, Sultan Chand and sons, 3rd Edition, New Delhi.
2. Y. R. Sharma, 2013, Elementary Organic Spectroscopy, Principles and chemical applications, S. Chand and Company Private Limited, New Delhi.
3. B.K. Sharma, 2011, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media P Ltd, 1st Edition, Meerut.

SUPPLEMENTARY READINGS:

1. D.A Skoog,1985, Principles of Instrumental Methods of Analysis, Saunders College publications, 3rd Edition, New York.
2. S.M. Khopkar, Analytical Chemistry, New Age International, 2ndEdition, New Delhi.
3. AnandChatwaal, 2014, Instrumental Methods of Chemical Analysis, Himalaya Publishing House, Mumbai.
4. S.Usharani, 2020 Analytical Chemistry,Lakshmi Publications Pvt. Ltd., 1st Edition, Chennai.
5. Willard Merit Dean, Settle, 1986, Instrumental Methods of Analysis, Saunders College Publication, 7th Edition, New York.
6. D.A. Skoog, D.M. West, 1982Fundamentals of Analytical Chemistry, Holt Reinhard and Winston Publication, 4th Edition, New York.
7. C.N. Banwell, 2017, Fundamentals of Molecular Spectroscopy, McGraw Hill Education, 4th Edition, New Delhi.

OUTCOME MAPPING

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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 2 | 2 | 2 |
| CO4 | 2 | 3 | 3 | 3 | 3 |
| CO5 | 3 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER:V  PART:III | 22UICHE58-3  BASICS OF COMPUTER PROGRAMMING IN C AND ITS APPLICATIONS | CREDIT: 3  HOURS: 3/W |

(INTERNAL ELECTIVE- III)

COURSE OBJECTIVES

1. To acquire knowledge about the basic components of a computer and the operating system.
2. To understand Hardware and Software.
3. To understand Algorithm and Flowchart.
4. To familiarize the students in C language.
5. To understand the applications of computer software in Chemistry.

**UNIT – I: BASIC COMPUTER ORGANISATION HOURS: 9**

BasicComputerOrganisation-Types of Data-Simple Model Of A Computer-Data Processing Using a Computer,Desktop Computer.

Input Unit ,Output Unit, Data Storage, Random Access,Memory,Read Only Memory,Seconary Storage-Central Processing Unit.

Coputer Software-Programming Languages-Classification Of Programming Languages based on applications-Planning the Computer Program-Algorithm and Floecharts.

**UNIT–II: INTRODUCTION TO C PROGRAMMING**   **HOURS:9** Computer Languages – Machine Language, Assembly Language, Assembler, Compiler, Interpreter and Programming Languages.

Clanguage–Introduction-CCompiler-OperatingSystemsandPreprocessorDirectives.

Variables,Constants,Operators,InputandOutputFunctions.

UNIT – III: C PROGRAMMING CONTROL STRUCTURES AND FUNCTIONS HOURS:9

Control Structures –Conditional, Looping, Goto, Break,Switchand Continue Statements Functions, Arrays and Pointers.

UNIT – IV: APPLICATIONS IN CHEMISTRY-I HOURS: 9

ApplicationsinChemistry–CalculationoftheRadiusofthefirstBohrorbitforan Electron.

CalculationofHalf-lifeTimeforanintegralorderreaction-CalculationofMolarity, Molality and Normality of a solution.

CalculationofPressureofIdealGasesandVanderWaal’sgases-CalculationofElectronegativity of an Element using Pauling’s relation.

UNIT – V: APPLICATIONS IN CHEMISTRY-II HOURS:9

ApplicationsinChemistry-CalculationofEmpiricalFormulaeofHydrocarbons-Calculation of Reduced Mass of a few Diatomic Molecules.

Determination of the Wave Numbers of Spectral lines of Hydrogen atom - Calculation of Work of Expansion in Adiabatic Process.

CalculationofpH,SolubilityProductandBondEnergyusingBorn-Landeequation-Calculation of Standard Deviation and Correlation Coefficient.

COURSE OUTCOMES

1. The students will be able to understand the basic computer architecture.
2. The students will be able to understand about the operating system.
3. The students will be able to understand the algorithm and programme.
4. The students will be able to describe the basic terminologies used in C language and explain the basic concepts of programming.
5. The students will be able to understand the applications of computer software in various areas in Chemistry.

TEXTBOOKS: (IN API STYLE)

1. K.V.Raman, 2005, Computers In Chemistry,TataMcGrawHillPublishers, 8th edition, New Delhi.
2. VenugopalandPrasad, 1971,Programmimng with C, TataMcGrawHillPublishers 11thEdition, New Delhi.
3. E.Balaguruswamy,2017, Programming in C, TataMcGrawHillPublishers,2ndEdition, New Delhi.

SUPPLEMENTARY READINGS

1. Yashavan Kanetkar, Authentic guide to C programming, BPB Publications, 18th Edition, New Delhi.
2. Byron Gottfried, Programming with C, McGraw Hill Education, 4th Edition, New Delhi.

OUTCOME MAPPING

|  |  |  |  |  |  |
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|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 2 | 3 | 2 |
| CO2 | 3 | 3 | 2 | 2 | 2 |
| CO3 | 3 | 2 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 3 |
| CO5 | 2 | 3 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER – V  PART – IV  SKILL BASED SUBJECT: III | 22UICHS59  APPLIED CHEMISTRY | CREDIT: 2  HOURS: 2/W |

(SKILL BASED SUBJECT – III)

COURSE OBJECTIVES

1. To impart Knowledge about Petrochemicals.
2. To learn about the process involved in paper and pulp technology.
3. To instill an interest about the process of sugar industry.
4. To enhance the knowledge about explosives.
5. To create an interest in leather chemistry.

UNIT – I: PETROLEUM HOURS:6

Introduction – Petroleum-Origin-Composition of Petroleum-Inorganic, Engler and Modern Theories-Classification-Refining-Cracking-Thermal and Catalytic-Knocking-Octane Rating-Antiknock Compounds - Cetane Rating-Synthetic Petrol-LPG - Gobar gas-Production-Feasibility and Importance of Biogas.

Petrochemicals-Definition-Chemicals from Natural Gas, Petroleum-Light Naphtha and Kerosene-Origin-Composition-Synthetic Gasoline.

UNIT – II: PULP AND PAPER TECHNOLOGY HOURS:6

Pulp and Paper technology-Introduction-Manufacture of Pulp-Mechanical Process-Chemical Process - Sulphate Pulp, Sulphite Pulp and Rag Pulp.

Various Processes-Beating, Refining, Filling, Sizing and Colouring - Manufacture of Paper- Calendering - Uses

UNIT – III: SUGAR HOURS:6

Sugar-Introduction-Manufacture of Cane Sugar-Extraction of Juice-Purification of Juice-Concentration – Crystallization - Separation of Crystals-Refining of crystals.

Recovery of Sugar Molasses – Bagasse - Preparation of alcohol from Molasses.

UNIT – IV: EXPLOSIVES HOURS:6

Explosives-Introduction-Classification-Detonating or High Explosives-Deflagrating or Low Explosives-Characteristics of Explosives-Nitrocellulose, TNB,TNT, Picric acid, Cordite, Nitroglycerine and Gun Powder, Lead Azide-Precautions during storage of Explosives.

Introduction to Rocket Propellants-Characteristics of a Good Propellants-Classification of Propellants.

UNIT – V: LEATHER CHEMISTRYHOURS:6

Leather Chemistry-Main Process Used in leather Manufacture-Structure of Hide and Skin,Leather Processing-Process before tannage. .

Tanning Process-Vegetable tanning and Chrome tanning- Tannery Effluent and by product-treatment.

COURSE OUTCOMES

1. Able to understand the concept of Petrochemicals.
2. Prepare alcohol from Molasses.
3. Understand the processes involved in paper technology.
4. Extensive Knowledge about the Explosives and Leather Chemistry.
5. Able to understand the concepts involved in tanning process.

TEXTBOOKS: (IN API STYLE)

1. B.K. Sharma, 2008, Industrial Chemistry including Chemical engineering, Goel Publishing house, 13th Edition, Meerut.
2. Jain and Jain, 2019 Chemistry of Engineering Materials, Dhanpat Rai Publishing Company (P) LTD, (K.K.Group), 17th Edition, New Delhi.

SUPPLEMENTARY READINGS

1. Jayashree Ghosh, 2006, Fundamentals Concepts of Applied Chemistry,Sultan Chand and Sons, 1st Edition, New Delhi.
2. W.L.Jolly, Modern InorganicChemistry,McGraw HillBookCompany,NY,1989.
3. D.F.ShriverandP.W.Atkins,Inorg.Chem. ,Longford,OxfordUniversityPress,1990
4. [Glasstone, Samuel,](https://archive.org/search.php?query=creator%3A%22Glasstone%2C%2BSamuel%2C%2B1897-1986%22)Sourcebook on atomic energy., 2nd ed Princeton, N.J., VanNostrand,Canada,1958.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 3 | 2 | 3 | 3 | 3 |
| CO2 | 2 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 3 | 2 |
| CO5 | 3 | 3 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER:VI  PART:III | 22UICHC61  INORGANIC CHEMISTRY-II | CREDIT: 4  HOURS:5/W |

# COURSEOBJECTIVES

1. ToknowthetendencyofInnertransitionelementsandtoknowthevariousprocessesinvolvedin metallurgy.
2. Tointroducethestudentsaboutthecompositionandstabilityofthenucleusandtypesofnuclearmodels.
3. Tohelpthestudentstounderstandthedifferenttypesof radioactivityandtheirapplications.
4. Tohelp thestudents tounderstand the development anduses of bioinorganiccompounds.
5. Todevelopanappreciationforthescope,diversity,andapplicationoforganometallicchemistry.

UNIT-I:INNERTRANSITION ELEMENTS(f-BLOCKELEMENTS)ANDMETALLURGY HOURS: 15

Lanthanides: lanthanide series, abundance and natural isotopes, occurrence, oxidationstates,magneticproperties,colourandelectronicspectraoflanthanidecompounds.Lanthanidecontraction, similarityin properties.

Separation of lanthanides: solvent extraction, ion exchange method- Actinides: actinideseries, abundance and natural isotopes, occurrence, , oxidation states, general properties,thelateractinide elements-Comparativestudyof Lanthanides and Actinides

General metallurgy and Metallurgical processes – Methods of Concentration – Gravityseparation,Frothfloatationprocess,Magneticseparation–Reductionmethods–Smelting, Calcination, Goldschmidt Aluminothermic process - Purification methods –Zone refining, Van Arkel method and Electrolytic refining- metallurgy of Ti, Mo andUranium(Occurrence and Extraction)

UNIT-II:NUCLEARCHEMISTRY I HOURS: 15

Introduction - Composition of Nucleus – Fundamental Particles of Nucleus - NuclearForcesoperatingbetweentheNucleons-nuclearstability–massdefect–bindingenergy

–packingfraction –N/P ratio–magicnumbers

Isotopes, Isobars and Isotones – Detection of Isotopes- Geiger Muller and ionizationcounter. Separation of isotopes– Gaseous diffusion method-Thermal diffusion method-Fractional distillation and evaporationmethod-Electromagneticmethod.

Nuclearmodels–liquiddrop–Shellandcollectivemodel-hazardsofradiations.

UNIT-III:NUCLEARCHEMISTRY II HOURS:15

Natural and induced radioactivity – radioactive decay – half-life period – radioactivedisplacement law -Natural radioactivity –– group displacement law-radioactive seriesincludingneptunium series

Rate of disintegration and half-life period – Average life period. Artificial radioactivity –induced radioactivity -nuclear energy – nuclear reactors – nuclear fission and fusion –-spallation --energysourceof thesun andstars –

Carbon dating – rock dating- radioactive waste disposal – applications of nuclear scienceinagriculture, biologyand medicine–Atomicpower projects inIndia.

UNIT-IV:BIO-INORGANICCHEMISTRY HOURS:15

Metal ions in biology and their vital role in the active site, Structure and functions ofMetallo proteins and enzymes. Structures and characteristic features of Hemoglobin andmyoglobin–Vitamin B12.Biological functionsofhemoglobinand myoglobin.

Structure and characteristic features of cytochromes, ferredoxins, caboxy peptidase andcarbonicanhydrase.

Biological nitrogen fixation, Photosynthesis: Photo system-I-Ion transport mechanism incellmembrane–NaandK pumps.

UNIT-V:ORGANOMETALLICCHEMISTRY HOURS:15

Nomenclature of organometallic compounds, 16- and 18- electron rule- transition metalalkyls,carbenes, andcarbynes,and metallocenes.

Oxidativeaddition,reductiveeliminationandinsertionreaction.

Wilkinson’scatalyst,oxo-process.Wacker’sprocess,Zeigler-Nattacatalystandpolymerizationofolefins, Monsanto aceticacid synthesis.

COURSE OUTCOMES

1. Explainthechemistryoff-block elements
2. Discussaboutnuclear subatomicparticlesandnuclearstability.
3. Outlineradioactivityand usesof radioisotopes.
4. Discusstheroleof metalions inbiological systems.
5. Explain thefundamental reaction types of organometallic compounds and theirapplicationsin homogeneous catalysis

TEXTBOOKS: (INAPISTYLE)

1. B.R.Puri,L.R.Sharma,K.C.Kalia, 1996, Principles of Inorganic Chemistry, ShobanLal Nagin ChandandCo., 33rd Edition, New Delhi.
2. J.D.Lee, 1996, ConciseInorganicChemistry,BlackwellScience,

5th edition,London.

1. R.Gopalan,2001,ConciseCoordinationChemistry,Vikas Publishing House, 1st Edition, Noida.
2. H.J.Arnikar, 1995,Essentials of Nuclear Chemistry, New Age International, 4th edition, New Delhi.

SUPPLEMENTARY READINGS

1. J.E. Huheey, E.A. Kieter and R. L. Keiter, 1993, Inorganic Chemistry, Harper Collins, 4th edition, New York.

2. F. A. Cotton, G.Wilkinson, C.Murillo and M.Bochman, 1999, Advanced Inorganic Chemistry, John Wiley, 6th edition, NewYork,

3. W.L.Jolly, 1989, Modern InorganicChemistry,McGraw HillBookCompany, 2nd Edition, New York.

4. D.F.ShriverandP.W.Atkins, 1990, Inorganic Chemistry, OxfordUniversityPress, 7th Edition, Longford

5. [Glasstone & Samuel,](https://archive.org/search.php?query=creator%3A%22Glasstone%2C%2BSamuel%2C%2B1897-1986%22) 1958, Sourcebook on atomic energy, Princeton, N.J., 2nd Edition, VanNostrand, Canada.

OUTCOME MAPPING

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| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 3 |
| CO4 | 3 | 2 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 3 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER:VI  PART: III | 22UICHC62  ORGANIC CHEMISTRY – II | CREDIT:4  HOURS:5/W |

COURSE OBJECTIVES

1. To acquire an in-depth knowledge of molecular rearrangements and their mechanisms.
2. To kindle interest in students in learning Bio-organic chemistry through the introduction of topics such as Proteins, Nucleic acids, Terpenes, Alkaloids etc.
3. To effectively impart knowledge about structural determination and isolation of alkaloids from plant sources.
4. To understand about antibiotics and terpenes and analyse their structures.
5. To provide comprehensive introduction to organosulphur compound and aromatic sulphanic compounds.

UNIT – I: MOLECULAR REARRANGEMENTS HOURS:15

**1.1**Rearrangements - Classification – Anionotrpic, Cationotropic and Free Radical Rearrangements - Intermolecular and Intramolecular Rearrangements – Examples – Cross over experiment – Differences between Intermolecular and Intramolecular rearrangements.

**1.2** Mechanisms, Evidences, Migratory Aptitude, Intermolecular or Intramolecular nature of the following rearrangements - Pinacol-Pinacolone, Benzil-Benzilic acid and Beckmann rearrangement.

**1.3**Mechanism of Hoffmann, Curtius, Baeyer-Villiger, Claisen (Sigmatropic), Fries rearrangement, Cope and Oxy-Cope rearrangements.

UNIT – II: AMINO ACIDS AND POLYPEPTIDES HOURS:15

**2.1**Amino acids – Classification - Essential and Non- Essential amino acids – Acidic, Basic and Neutral Amino Acids – Alpha, Beta and Gamma- Amino acids - Preparation of alpha amino acids – Gabriel’s Phthalimide synthesis, Strecker synthesis and Erlenmeyer Azlactone synthesis - Glycine, Alanine and Tryptophan.

**2.2** General properties of Amino acids - Reactions of Amino acids due to Amino group and Carboxyl group - Zwitterions - Isoelectric point.

**2.3**Peptides - Synthesis - Bergmann Method - Structural Determination of Polypeptides - End Group Analysis – N-Terminal and C-Terminal Amino Acids Determination.

UNIT – III: PROTEINS AND NUCLEIC ACIDS HOURS:15

**3.1** Proteins - Definition - Classification based on Physical Properties, Chemical Properties and Physiological Functions - Primary and Secondary Structure of Proteins - Helical and Beta Sheet Structures (Elementary Treatment Only) – Denaturation of Proteins.

**3.2** Nucleic acids – Nucleoproteins - Definition - Types of Nucleic Acids – RNA and DNA -Nucleoside, Nucleotide, Degradation of Nucleotide Chain - Components of RNA and DNA.

**3.3** Differences between DNA and RNA - Structures of Ribose and 2- Deoxyribose – Double Helical Structure of DNA - Biological functions of Nucleic Acids - Elementary ideas on Replication and Protein Synthesis.

UNIT – IV: CHEMISTRY OF NATURAL PRODUCTS HOURS:15

**4.1** Antibiotics – Definition – Structural elucidation of Penicillin and Chloramphenicol – Uses of Penicillin and Chloramphenicol.

**4.2** Alkaloids – Classification – Isolation of alkaloids – General methods of Determination of structure of Alkaloids - Synthesis and Structural Elucidation of Piperine, Coniine and Nicotine.

**4.3** Terpenoids – Definition – Classification – Isoprene rule – Synthesis and Structural elucidation of Citral, Menthol and Alpha- pinene.

UNIT – V: ORGANOSULPHUR COMPOUNDS HOURS:15

**5.1** Thioalcohols – Structure – Nomenclature – Methods of Preparation – Physical and Chemical Properties – Thioethers – Structure – Nomenclature - Physical and Chemical Properties – Organosulphur compound Vs Organs oxygen compounds.

**5.2** Mustard gas – Preparation and properties – Aromatic Sulphanic acid – Nomenclature – General chemical Properties – Derivatives of sulphanic acid – Aromatic sulphanyl chlorides – Preparation, Properties and used – Sulphanamides – Preparation, properties and uses.

**5.3** Saccharin, Chloramine-T and Dichloroamine-T – Preparation, Properties and uses. Sulphanilic acid – Physical, Properties and coupling reaction.

COURSE OUTCOMES

1. Explain the mechanisms of inter and intra molecular rearrangements.
2. Classify amino acids and explain their preparation and properties and synthesis of Peptides.
3. Differentiate between DNA and RNA.
4. Explain primary and secondary structures of proteins.
5. Elucidate the structures of Antibiotics, Alkaloids and Terpenoids.

TEXTBOOKS: (IN API STYLE)

1. R. T. Morrison and Boyd, 2016, Organic Chemistry, Pearson India, 16th Edition,New Delhi.
2. L. Finar, 2002, Organic Chemistry- Volume I and II, Pearson Education India, 5th Edition, New Delhi.
3. P. L. Soni, 2007, Text Book of Organic Chemistry, Sultan Chand & Sons, 29th Edition, New Delhi.
4. Bahl and Arun Bahl, 2021, Advanced Organic Chemistry, Sultan Chand and Sons,22nd Edition, New Delhi.
5. O. P. Agarwal, 2015, Organic Chemistry of Natural Products - Volume I and II, Krishna Prakashan Media Pvt. Ltd., 3rd Edition, Meerut.
6. Peter Sykes, 2003, A Guide Book to Mechanisms in Organic Chemistry, Pearson Education India, 6th Edition New Delhi.
7. Gurdeep Chatwal, 2019, Chemistry of Natural Products, Himalaya Publishing House 5th Edition, Mumbai.
8. Gurdeep Chatwal, 2019 Organic Reaction Mechanism and Reagent in Organic Chemistry, Himalaya Publishing Hous, 5th Edition,Mumbai.
9. K. S. Tewari, N. K. Vishnoi, S. N. Mehrotra, 2017, A Text Book of Organic Chemistry,Vikas Publishing House, 4th Edition, Noida.
10. David L Nelsan, Michael MCox, 2021, Lehninger Principles of Biochemistry, Macmillan Worth Publishers, 8th Edition, Chennai.
11. Jain, Sanjay Jain, Nitin Jain, 2016 Fundamental of Biochemistry, Sultan Chand and Sons, 7th Edition, New Delhi.

SUPPLEMENTARY READINGS

1. M. K. Jain and S. C. Sharma, 2014, Modern Organic Chemistry, Vishal Publications, Golden Jubilee Year Edition, Jaladhar, New Delhi.
2. N. Pillai, 2009Text Book of Organic Chemistry, Universities Press,1st Edition, London.
3. Parmar and Chawla, 2016, Organic Reaction Mechanisms, Sultan Chand and Sons, 1st Edition, New Delhi.
4. T. W. Graham Solomon, C. B. Fryhle, S. A. Dnyder, 2016, Organic Chemistry, John Wiley & Sons, 12th Edition,
5. N. Tewari , 2016, Advanced Organic Reaction Mechanism (Problems and Solutions), Books and Allied (P) Ltd, 4th Edition, Kolkata.
6. OUTCOME MAPPING

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| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 2 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 2 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 3 |

1. (1-Low, 2-Moderate, 3-High)

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| SEMESTER: VI  PART: III | 22UICHC63  PHYSICAL CHEMISTRY – II | CREDIT:4  HOURS: 5/W |

COURSE OBJECTIVES

1. To equip the students to understand about Surface Chemistry.
2. To inculcate interest in Chemical Kinetics.
3. Enable the students to acquire an indepth understanding on Photo Chemistry.
4. To understand the importance of about Surface Chemistry.
5. To invoke the basic knowledge of symmetrical elements and point group.

UNIT- I: ELECTROCHEMISTRY - III HOURS: 15

**1.1** Galvanic cells - Daniel cell - Reversible and Irreversible Cells – EMF of a Cell and its Measurement - Standard Weston Cadmium Cell – Evaluation of Thermodynamic Quantities - ΔG, ΔH and ΔS from emf data.

**1.2**Types of reversible electrodes - Electrode reactions - Electrode potentials. Reference electrodes-SHE and Calomel electrode - Standard Electrode Potential

**1.3** Derivation of Nernst equation for Electrode Potential and Cell emf -Sign conventions - Electrochemical Series and its Applications - Formation of cells – electrode and cell reactions.

UNIT- II: ELECTROCHEMISTRY – IV HOURS: 15

**2.1** Concentration cells – Electrode and electrolyte concentration cell – Types of Electrolyte concentration cells - Concentration cells With Transference and Without Transference - Liquid Junction Potential.

**2.2** Applications of Concentration cells – Determination of Valency of ions, Solubility and Solubility Product, Activity Coefficient of electrolytes, Transport number - Determination of pH using Hydrogen, Quinhydrone and Glass electrodes – Potentiometric titrations.

**2.3** Polarization – Decomposition potential – over-voltage – storage cells – lead-acid battery - Fuel Cells (H2-O2 Cell) – mechanism of discharging and recharging – fuel cells (H2-O2).

UNIT- III: CHEMICAL KINETICS HOURS: 15

3.1 Definitions of the terms – Order and Molecularity – Rate of the reaction - Derivations of expressions for Zero, First, Second (Identical Reactants and two different reactants) and Third-order rate equations - derivation of half-life period - Study of kinetics by Volumetric, Polarimetric and Spectrophotometric methods - Methods of Determination of Order of a reaction.

**3.2** Effect of Temperature on reaction rate - Arrhenius equation - Theories of reaction rates – Bimolecular Collision Theory – Derivation of rate constant of a bimolecular reaction – Limitations of Collision theory – Lindmann’s theory of Unimolecular Reactions.

**3.3** Theory of absolute reaction rate - Thermodynamic treatment of ARRT – Eyring equation - Comparison of Collision Theory and ARRT, Significance of free energy of activation and entropy of activation.

UNIT- IV: SURFACE CHEMISTRY AND CATALYSIS HOURS: 15

**4.1** Adsorption – Characteristics of adsorption – Physisorption and Chemisorption – Differences between Physical and Chemical Adsorption – Factor influencing adsorption of Gases on Solids – Different Types of Isotherms - Freundlich adsorption isotherm - Langmuir theory of adsorption – Derivation - BET Theory (no derivation) - Applications of Adsorption.

**4.2** Catalysis – Definition - General Characteristics of Catalytic Reactions Different types – Homogenous and Heterogenous– Acid-Base catalysis –Auto catalysis – Theories of Catalysis- Intermediate compound formation theory and adsorption theory - Enzyme catalysis – Michaelis-Menton Equation – Effect of Temperature and pH on Enzyme Catalysis - Enzyme Inhibition.

**4.3** Homogeneous catalysis – Function of a catalyst in terms of Gibb’s free energy of activation - Heterogeneous catalysis - Kinetics of Unicellular Surface Reactions – Langmuir – Hinshelwood Mechanism

UNIT- V: PHOTOCHEMISTRY AND GROUP THEORY HOURS: 15

**5.1** Laws of photochemistry - Grothus-Draper law, Stark-Einstein’s law – Primary and Secondary processes – Quantum yield and its determination – Chemical actinometry - Jablonski diagram – radiative and nonradiative transitions - Theory of Fluorescence, Phosphorescence, Chemiluminescence and Bioluminescence - Energy Transfer reaction – Photosensitization and Quenching.

**5.2** Kinetics of Photochemical Reactions - H2-Cl2 and H2-Br2 reactions – Decomposition of HI - Photodimerization of Anthracene – Lasers – Uses of Lasers.

**5.3** Symmetry elements and symmetry operations - Identity, proper axis of rotation, plane of symmetry, Improper axis of rotation, centre of symmetry- Importance of symmetry. Group postulates, types of groups – Abelian, non-abelian and cyclic group, subgroup – Definition and example-Point groups - Identifying the point group of the molecules - H2O, NH3, BF3.

COURSE OUTCOMES

1. Draw electrochemical cells, labelling the anode, cathode, and directions of ion and electron movement.
2. Understand the Electrochemical Series and its Applications.
3. Recognize the chemical reaction used in a lead-acid storage battery and H2/O2 fuel ce
4. Explain the laws of photo chemistry and express the kinetics of photochemical reactions.
5. Understand the concepts of symmetrical elements and basics of group theory.

TEXTBOOKS: (IN API STYLE)

* + - 1. Puri B.R., Sharma L.R and Pathania M.S., 2016, Principles of Physical Chemistry, Vishal Publishing Company, 47th Edition, Jaladhar, New Delhi.
      2. Atkins P.W., 1994, Physical chemistry, Oxford University press, 5th Edition, London.
      3. Sharma K.K, Sharma.L.K, 2016, A Text book on physical Chemistry, Sultan Chand and Sons, 6th Edition, New Delhi.
      4. Maron S.H. and Lando J.B, 1974, Fundamentals of Physical Chemistry, Macmillan, Stuttgart, Germany.
      5. Negi A.S., and Anand S.C, 1985, A textbook of physical Chemistry, New Age International Publishers, 2nd Edition, New Delhi.
      6. Dr. S. Swarna Lakshmi, Ms. T. Saroja, R.M. Ezhilarasi, 2008, A Simple Approach to Group Theory in Chemistry, Universities Press, London
      7. Gurdeep Chatwal R, 2010, Organic Photochemistry, Himalaya Publishing House, 1st Edition, Mumbai.

SUPPLEMENTARY READINGS

* + - 1. Glasstone S. and Lewis. D., 1963 Elements of Physical Chemistry. Macmillan, 2nd Edition, Chennai.
      2. G.L. Agarwal, 1990, Basic Chemical Kinetics, Tata McGraw Hill, 2nd Edition, New Delhi.
      3. S. Glasstone, 1971, An Introduction to Electrochemistry, Affiliated East West Press, 1st Edition, New Delhi.
      4. K. J. Laidler, 1973, Chemical Kinetics, Tata Mc Graw Hill, 2nd Edition, New Delhi.
      5. K. V. Raman, 1994, Group Theory and its Application to Chemistry, Tata McGraw Hill, 1st Edition, New Delhi.
      6. K.K. Rohatgi Mukherjee, 1978, Fundamentals of Photochemistry, Wiley Eastern, 1st Edition, New Jersey, USA.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 2 | 2 | 3 | 2 |
| CO5 | 2 | 3 | 3 | 2 | 3ss |

(1-Low, 2-Moderate, 3-High)

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| SEMESTER: VI  PART: III | 22UICHP64 GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATIONS | CREDIT: 4  HOURS:3/W |

COURSE OBJECTIVES

1. To enable the students to acquire basic skills in gravimetric analysis
2. To enhance the skills in various Organic Preparation methods
3. To understand simple Analytical Techniques like refluxing,recrystalisation and filtration etc;
4. To train the students to handle various types of crucibles used in Gravimetry.
5. To expose the students to various techniques like precipitation,digestion,filtration,drying etc

1. GRAVIMETRIC ESTIMATIONS: HOURS: 30

1.Estimation of sulphate as barium sulphate.

2.Estimation of barium as barium sulphate

3.Estimation of barium as barium chromate.

4.Estimation of copper as copper thiocyanate.

5.Estimation of lead as lead chromate.

6.Estimation of calcium as calcium oxalate monohydrate.

7.Estimation of copper in an alloy.

2. ORGANIC PREPARATIONS: HOURS: 15

Single stage organic preparations involving bromination, hydrolysis, nitration, oxidation and benzoylation.

Benzoylation

1. BenzoylationofAnilineorPhenol.

Nitration

1. Preparation ofm-Dinitrobenzene (Or) p-Nitroacetanilide

Bromination

3. Preparation ofp-Bromoacetanilide (Or) 2,4,6-Tribromophenol

Oxidation

4. PreparationofBenzoicAcidfromTolueneorBenzaldehyde.

# Hydrolysis

5. HydrolysisofEthylBenzoate(Or) MethylSalicylate(Or)Benzamide.

COURSE OUTCOMES

1. The students should be able to plan experimental projects and execute them.
2. Know the basic concepts of organic reactions.
3. Understand the estimation of inorganic ions as compounds or complexes.
4. Exposed to various techniques in Gravimetry.
5. Find out the amount of elements like Lead,Barium etc; in commercial products.

TEXTBOOKS: (IN API STYLE)

1. Sundaram, Krishnan, Raghavan, 1996Practical Chemistry (Part III), S.Viswanathan Co. Pvt., Chennai.
2. Vogel A.I, 2012, Text Book of Quantitative Inorganic Analysis, Pearson education. 7th Edition, New Delhi.
3. Anbusrinivasan. P, 2021, Gravimetry and Physical Chemistry Practicals- Concept and Procedures, Shri Publications, 1st Edition, Chidambaram, Tamil Nadu.

SUPPLEMENTARY READINGS

1. A.I.Vogel, 1996, QualitativeInorganicAnalysis,PrenticeHall,7thEdition, United States.
2. A.I.Vogel, 2013, QuantitativeChemicalAnalysis, PrenticeHall, 6thEdition, United States.

SCHEME OF EVALUATION

Internalassessment: 40 Marks

Externalassessment: 60Marks

Total: 100marks

Record: 10 Marks

Preparation: 15 Marks (Quality-5;Quantity-10)

|  |  |  |
| --- | --- | --- |
| Errorupto | 2% | :35 |
|  | 2.1–3% | :30 |
|  | 3.1–4% | :25 |
|  | 4.1–5% | : 20 |
|  | >5% | :10 |

1. Amongthe duplicateresults,thevaluemorefavorabletothecandidatemustbetaken.
2. Whennoduplicateresultisgivendeduct 5marks.
3. Ifthetworesultsdifferbymorethan2% deduct5marks.
4. Foreachindependentarithmeticalerrordeduct 1mark.
5. Forincompleteorwrong calculationdeduct20%.
6. Fornocalculation deduct40%.

Iftheexperimentis not completed duetoanaccident,award5marks.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 2 | 3 |
| CO4 | 2 | 3 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 3 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

|  |  |  |
| --- | --- | --- |
| SEMESTER: VI  PART: III  CORE PRACTICAL: IV | 22UICHP65 ORGANIC QUALITATIVE ANALYSIS | CREDIT: 4  HOURS:3/W |

COURSE OBJECTIVES

1. To enable the students to develop analytical skills in organic qualitative analysis.
2. To enable the students to check the purity of Organic Compounds by determining Melting and Boiling Points.
3. To understand the techniques behind Boiling Point and Melting Point Determination.
4. To indetify acidic,basic,phenolic and neutral organic substances by solubility tests.
5. To know how to detect special elements like nitrogen,sulpher and halogens.

ORGANIC EXPERIMENTS

1. \*Determination of melting and boiling points of organic substances for two sessions
2. Organic analysis:
3. Identification of Acidic, Basic, Phenolic and Neutral organic substances.
4. Detection of N, S and Halogens.
5. Test for Aliphatic and Aromatic nature of substances.
6. Test for Saturation and Unsaturation.
7. Identification of Functional groups.

i) Carboxylic acids (Mono and Di) ii)Phenols(simple and higher) iii) Aldehydes iv) Ketones v) Esters vi) Carbohydrates (Reducing)

vii) Aromatic primary Amine viii) Aromatic Amide x) Diamide xi)Anilide.

F) Preparation of derivatives for the functional groups.

(\* For internal assessment only.)

COURSE OUTCOMES

1. Can identify special elements.
2. Know about the procedure for analyzing the compounds.
3. Know about the Reaction mechanisms.
4. Evaluate the nature of given organic compounds by identifying different functional groups present.
5. Identify the given organic compound by preparing their derivatives and know the chemical reactions behind them.

TEXTBOOKS:(IN API STYLE)

1. 1.N.S.Gnanapragasam and G.Ramamurthy, Organic Chemistry - Lab manual, S.Viswanathan Co. Pvt., 1998.
2. B.S.Furniss, A.J.Hannaford, P.W.G.Smith, A.R.Tatchell, Vogel's Text Book of Practical Organic Chemistry, 5th edition., Pearson Education, 2005.
3. J.N.Kurthu and R.Kapoor, Advanced Experimental Chemistry (Organic), S.Chand and Co, 1987.
4. Anbusrinivasan. P, 2021, Organic Chemistry Practicals- Concept and Procedures, Shri Publications, 1st Edition, Chidambaram, Tamil Nadu.

SUPPLEMENTARY READINGS

1. Vogel’sTextBookofChemicalAnalysis
2. PracticalChemistry-A.O.Thomas-ScientificBookCenter,Cannanore.
3. PracticalChemistry-3 Volumes-S.Sundaramandothers.
4. TextBookofPracticalOrganicChemistry–A.I.Vogel,A.R.Tatchell,B.S.Furnis, A.J.HannafordandP.W. G.Smith–5thEdition-1996.
5. ComprehensivePracticalOrganicChemistry-PreparationandQuantitativeAnalysis- V.K.Ahluwalia,RenuAgarwal –UniversitiesPress –2013.

SCHEME OF EVALUATION

Internal assessment: 40 Marks

External assessment: 60 marks

Total:100marks

Record: 15Marks

Analysis: 45 Marks

Preliminaryreaction: 4 Marks

Aliphatic/Aromatic: 4 Marks

Saturated/Unsaturated: 4Marks

Tests for elements: 9Marks

Functional groups: 10 Marks

Confirmatorytests: 10 Marks

Derivative/Colouredreaction: 4 Marks

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 3 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: VI  PART: III  CORE PRACTICAL: V | 22UICHP66  PHYSICAL CHEMISTRY PRACTICALS | CREDIT: 4  HOURS:3/W |

COURSE OBJECTIVES

1. To enable the students to acquire analytical (both qualitative and quantitative)and psychometer skills.

2. To train the students to handle various electrical instruments.

1. To learn the important concepts of Distribution law.
2. To inculcate the practical skills in both electrical and non- electrical instruments.
3. To introduce the principles behind kinetics experiments.

EXPERIMENTS

1. KINETICS

Determination of rate constant

i. I order kinetics - Acid catalysed hydrolysis of an ester

ii. Zero order kinetics - Acid catalysed iodination of acetone.

Determination of Kfand Molecular Weight by Rast’s Macro method

2. PHASE RULE

i.\* CST of Phenol-water system

ii. Effect of electrolyte on CST of phenol –water system and determination of

concentration of the electrolyte.

iii. Determination of transition temperature of hydrated salts- Sodium acetate, sodium thiosulphate, strontium chloride (any one)

3. ELECTROCHEMISTRY

Conductivity

i. Determination of cell constant

ii. Equivalent conductance of strong and weak electrolyte solutions of atleast five different concentrations and to determine Λ∞ for strong electrolyte

iii. Strong acid Vs Strong base - HCl against NaOH

iv. \*Dissociation constant of a weak acid

4. POTENTIOMETRY

Acid base titration – HCl against NaOH

5. \*DISTRIBUTION LAW

Determination of

i. \*Distribution coefficient of iodine between water and CCl4

ii. \*Equilibirium constant of the equilibrium KI +I2 = KI3

iii. \*Association factor of benzoic acid in benzene.

Determination of pKa of acetic acid using pH meter.

\* For Internal Assessment only.

COURSE OUTCOMES:

1. At the end of the course, the students should be able to plan the experimental projects and execute them.
2. Gain expertise in the Instrumental Analysis.
3. Apply conductometric and potentiometric techniques for the estimation of unknown ions present in commercial products.
4. Investigate the rate of unknown solution.
5. Evaluate Critical Solution temperature,Transition Temperature and Rate Constant.

TEXTBOOKS:(IN API STYLE)

1. 1.J.N.Kurthu and R.Kapoor,1987, Advanced Experimental Chemisry, S.Chand and Co, New Delhi.
2. A.O.Thomas, 2003, Practial Chemistry, Scientific Book Centre, 8th Edition, Cannanore.
3. 3.David P. Shoemaker, Carl W. Garland, Joseph W. Nibber, Experiments In Physical Chemistry, 5th Edition, McGraw. Hill Book Company, New Delhi.

SUPPLEMENTARY READINGS:

* + - 1. J.B.Yadav, 1976, Advanced Practical Physical Chemistry, Goel Publishing House, 2nd Edition, New Delhi.
      2. Anbusrinivasan.P, 2021, Gravimetry and Physical Chemistry Practicals- -Concept Of Procedures, Shri Publications, Chidambaram.
      3. Dr.S.Sundaram, Dr.P.Krishnan, Dr.P.S.Raghavan, 2007, PracticalChemistry-Part-II, S.Viswanathan(Printers&Publishers),Pvt.Ltd, Chennai.

SCHEME OF EVALUATION

Internal assessment: 40Marks

External assessment: 60Marks

Total: 100Marks

Record: 10 Marks

Experiment: 40Marks

Manipulation, TabulationandCalculation:10Marks

1) Kinetics

Graph : 10Marks

Belowafactorof10 30 Marks

Byafactorof10 25 Marks

Morethanafactorof 10 10 Marks

2) Molecularweight

Errorupto 10%: 40 Marks

20%: 35 Marks

30%: 30 Marks

>30%:10 Marks

1. EffectofelectrolyteonCST

Graph: 10 Marks

Errorupto 10%:30 Marks

20%: 25 Marks

30%: 20 Marks

>30:10 Marks

4) Transitiontemperature

Graph: 10Marks

Errorupto2oCdifference:30 Marks

7oCdifference: 25 Marks

>7oCdifference: 15 Marks

5) Conductance:

**Equivalentconductance:25marksCellconstant :15marks**

Errorupto10% - 25 Marks Errorupto10%- 15 Marks

Upto15% - 15 Marks Upto15%- 10 Marks

>15%:-10 Marks >15%- 5 Marks

6)Conductometrictitration

Graph: 10Marks

Upto2 %: 30 Marks

2.1to 3%: 25 Marks

3.1to4%: 20 Marks

4.1to5%: 15 Marks

>5%: 10 Marks

7) Potentiometric titration:

Graph:10Marks

Upto2 %: 30 Marks

2.1to 3%: 25 Marks

3.1to4%: 20 Marks

4.1to5%: 15 Marks

>5%: 10 Marks

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 2 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 2 | 2 |
| CO3 | 3 | 2 | 2 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 2 | 2 |
| CO5 | 2 | 3 | 2 | 3 | 3 |

(1-Low, 2-Moderate, 3-High)

|  |  |  |
| --- | --- | --- |
| SEMESTER: VI  PART: III  INTERNAL ELECTIVE- IV | 22UICHE68-1 NANO CHEMISTRY | CREDIT: 3  HOURS:4/W |

COURSE OBJECTIVES

1. To introduce the basics of nanotechnology.
2. To learn about the types of nano particles.
3. To learn about various synthetic techniques of nano particles.
4. To learn about the applications of nano particles.
5. To learn the instrumental techniques used in characterization of nano materials.

UNIT-I: BASICS OF NANO CHEMISTRY HOURS: 12

Introduction, definition, length scales, importance of nanoscale and its technology, self-assembly of materials, self-assembly of molecules, porous solids, nanowires, nanomachines and quantum dots.

UNIT-II: NANO PARTICLES HOURS: 12

Introduction – types of nanoparticles – preparation, properties and uses of gold, silicon, silver, zinc oxide, iron oxide, alumina and titania nanoparticles.

UNIT-III: SYNTHETIC TECHNIQUES HOURS: 12

Techniques to synthesize nanoparticles, top-down and bottom-up approaches, common growth methods, characterization of nanoparticles, applications and toxic effects of nanomaterials.

UNIT-IV: NANO MATERIALS HOURS: 12

Preparation, properties and applications of carbon nanotubes, nano rods, nano fiber and nano clay.

UNIT-V: INSTRUMENTAL TECHNIQUES HOURS: 12

Electron microscopes – scanning electron microscopes (SEM), transmission electron microscopes (TEM), scanning probe microscopy, atomic force microscopy (AFM), scanning tunneling electron microscope (STEM) – basic principles only.

COURSE OUTCOMES

1. Able to explain the fundamentals of nano chemistry.
2. Understand the various types of nano particles.
3. Able to explain the various methods of synthesis of nano particles.
4. Understand the various types of nano materials.
5. Able to explain the various instrumental techniques of characterization of nano particles.

TEXTBOOKS:(IN API STYLE)

* + - 1. S.Shanmugam, 2011, Nanotechnology, MJP Publishers, 10th Edition, Chennai.
      2. Patrick Salomon, 2008, A Handbook on Nanochemistry, Dominant Publishers and Distributers, 1st Edition, New Delhi.
      3. S. Balaji, 2021, Nanobiotechnology, MJP Publishers, 1st Edition, Chennai.

SUPPLEMENTARY READINGS

* + - 1. CNR Rao, A Muller, A.K. Cheetham, 2004, The Chemistry of Nanomaterial: Synthesis, Properties and Applications, Vol. I and II, Wiley, New Jersey, USA.
      2. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, 2005, Nanotechnology: Basic Science and Emerging Technologies, Overseas Press, Tamil Nadu.
      3. G. B. Segreev, 2006, Nanochemistry, Elsevier, Science, 1st Edition, New York.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 3 | 2 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 2 | 3 | 3 | 2 | 3 |
| CO5 | 3 | 2 | 2 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: VI  PART:III  INTERNAL ELECTIVE- IV | 22UICHE68-2  SPECTROSCOPY – II | CREDIT:3  HOURS:4/W |

COURSE OBJECTIVES

1. To impart knowledge about various spectroscopic techniques.
2. To understand the principle of UV, IR, Raman spectral techniques.
3. To know the instrumentation of the above spectral techniques.
4. To analyze simple compounds using the above spectral techniques.
5. To understand the structure simple compounds using the above spectral techniques.

UNIT-I: NMR SPECTROSCOPY - FUNDAMENTALS HOURS: 12

Principle of NMR, Basic instrumentation, Number of signals, Chemical shift - shielding and deshielding. Relaxation processes, Spin-spin coupling and coupling constant. TMS as NMR standard.

UNIT-II: NMR SPECTRUM – INTERPRETATION HOURS: 12

Interpretation of NMR spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

UNIT-III: MASS SPECTROMETRY - FUNDAMENTALS HOURS: 12

Basic principles, instrumentation, molecular ion peak, base peak, meta stable peak, isotopic peak & their uses. Fragmentation types, Mc-Lafferty Rearrangement, Nitrogen rule, Ring rule, Determination of molecular formulae, mass spectrum of simple organic compounds – Identification of alcohols, aldehydes, aromatic hydrocarbons.

UNIT-IV: MASS SPECTRUM- INTERPRETATION HOURS: 12

Interpretation of mass spectra of simple organic compounds such as Acetone, Anisole, Benzaldehyde, Ethyl acetate, Ethylamine, Ethyl Bromide, Toluene and Isopropyl phenyl ketone.

UNIT-V: ESR SPECTROSCOPY HOURS: 12

Criteria and theory, Distinction between ESR and NMR, hyperfine splitting, Instrumentation-Block diagram, ESR spectra of simple radicals such as CH3, CD3 and Naphthalene only, Applications.

COURSE OUTCOMES

1. Will be able to explain the basic principles of various spectral techniques.
2. Able to understand the relevant terms and definitions of various spectral techniques.
3. Able to explain the working instrumentation of various spectral techniques.
4. Able to interpret the spectra of simple organic compounds.
5. Able to characterize the simple organic compounds from spectral knowledge.

TEXTBOOKS: (IN API STYLE)

1. R. Gopalan, P.S. Subramanian, K. Rengarajan, 2003, Elements of Analytical Chemistry, Sultan Chand and sons, 3rd Edition, New Delhi.

1. Y. R. Sharma, 2013, Elementary Organic Spectroscopy, Principles and chemical applications,S. Chand and Company Private Limited, New Delhi.
2. B.K. Sharma, 2011, Instrumental Methods of Chemical Analysis, Krishna Prakashan Media P Ltd, 1st Edition, Meerut.

SUPPLEMENTARY READINGS:

1. S.M. Khopkar, 2017, Basic Concepts of Analytical Chemistry, New Age International (P) Limited, 4th Edition, New Delhi.

2. A.K. Srivastava, 2008, Instrumental Approach to Chemical Analysis,S Chand, 4th Edition, New Delhi.

3. R. M. Silverstein, G. C. Bassler and T. C. Morrill, 1991, Spectrometric identification of organic compounds,Wiley, 5th Edition, New York,

4. W. Kemp, 2019, Organic Spectroscopy,Macmillan, 2nd Edition, Stuttgart, Germany.

5. D Williams & I. Fleming, 1995, Spectroscopic Methods in Organic Chemistry, McGraw-Hill Education, 5th Edition, New Delhi.

6. C.N. Banwell, 1994, Fundamentals for Molecular Spectroscopy, McGraw Hill Education, 4th Edition, New Delhi.

7. John R. Dyer, 2009, Applications of Absorption Spectroscopy of Organic Compound, Prentice Hall India Learning Private Limited, 2nd Edition, New Delhi.

8. P.S.Kalsi, 2020 Spectroscopy of Organic Compounds, New Age International Private Limited, 8th Edition, New Delhi.

9. D.A. Skoog, D.M. West and F.J. Holler, 2013 Analytical Chemistry: An Introduction, Brooks/Cole, 9th Edition, United States.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 2 | 2 | 2 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 3 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 2 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER: VI  PART: III (INTERNAL ELECTIVE- IV) | 22UICHE68-3: ORGANIC SYNTHESIS | CREDIT: 3  HOURS:4/W |

COURSE OBJECTIVES

1. To introduce the basics of disconnection approach.
2. To learn about protecting groups.
3. To introduce one group C-C disconnections.
4. To introduce two group C-C disconnections.
5. To learn about ring synthesis.

Unit 1: DISCONNECTION APPROACH HOURS: 12

An introduction to synthons and synthetic equivalent. Disconnection approach, functional group interconversion, The importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections. Chemo selectivity, reversal of polarity.

Unit 2: PROTECTING GROUPS HOURS: 12

Principle of protection of alcohol group and amine group. Principle of protection of carbonyl group and carboxyl group. Activation of functional group.

Unit 3: ONE GROUP C-C DISCONNECTIONS HOURS: 12

Alcohols and carbonyl compounds. Regioselectivity and Alkene synthesis. Use of acetylenes and aliphatic nitro compounds in organic synthesis.

Unit 4: TWO GROUP C-C DISCONNECTIONS HOURS: 12

Diels-Alder reaction, 1, 3 - difunctionalised compounds. α, β unsaturated carbonyl compounds, Control in carbonyl condensations. 1, 5 - difunctionalised compounds, Michael addition and Robinson annulation.

Unit 5: RING SYNTHESIS HOURS: 12

Saturated heterocycles. Synthesis of 3-,4-,5- and 6- membered rings, aromatic heterocycles.in organic synthesis. Application of the above in the synthesis of camphor, longifolene, cortisone & reserpine.

COURSE OUTCOMES:

1. To describe methods for organic synthesis.
2. To understand transformation of the most common functional groups.
3. To understand the principles of disconnection approach.
4. To learn strategic approaches for organic Synthesis.
5. To provide theoretical understanding of heterocyclic chemistry which includes various methods for ring synthesis.

Text Books: (IN API STYLE)

* + - 1. Herbert O House, 1965, Modern synthetic reactions, W.A. Benjamin, 1st Edition, New York.
      2. Warren Stuart, 2008, Organic Synthesis: The Disconnection Approach, Wiley, 2nd Edition, New Jersey, USA.
      3. W. Carruthers, 1987, Some modern methods of Organic synthesis, Cambridge University Press, 3rd Edition, UK.

Supplementary Readings

1. Michael B. Smith, 1994, Organic Synthesis, McGraw-Hill Inc., 1st Edition, US
2. C.K. Charles, 2012, Organic Synthesis, Alpha Science International Ltd, 1st Edition, Oxford, UK.
3. F.A.Carey and R.J. Sundberg, 1977, Advanced Organic Chemistry, Part-B, Plenium Press, 1st Edition, New York.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 2 | 3 | 3 |
| CO3 | 3 | 3 | 3 | 3 | 2 |
| CO4 | 2 | 2 | 2 | 2 | 3 |
| CO5 | 3 | 3 | 3 | 3 | 2 |

(1-Low, 2-Moderate, 3-High)

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| --- | --- | --- |
| SEMESTER – VI  PART – IV  SKILL BASED SUBJECT: IV | 22UICHS69  DAIRY CHEMISTRY | CREDIT: 2  HOURS: 2/W |

(SKILL BASED SUBJECT – IV)

COURSE OBJECTIVES

1. To impart knowledge in Chemical composition of Milk.
2. Make the students to understand the Milk processing techniques.
3. Familiarize the students with the concepts of Milk product.
4. To teach the students about the properties of Milk.
5. To educate the students about Fermented Milk product.

UNIT – I: COMPOSITION OF MILK HOURS:6

Introduction – Definition-Composition of Milk –Milk Lipids, Milk Proteins, Vitamins and Minerals-Factors affecting the composition of Milk-Adulterants, Preservatives, Neutralizer-Examples and their detection.

UNIT – II: PROPERTIES OF MILK HOURS:6

Properties of Milk - Flavour and Aroma, Acidity, Specific Gravity, Viscosity and Conductivity.

Elimination of Fat, Acidity and Total Solids in Milk.

UNIT – III: PROCESSING OF MILK HOURS:6

Processing of Milk-Effect of heat on Milk, Chemical changes taking place in milk due to Processing, Sterilization, Homogenization and Pasteurization - Vacuum pasteurization and Ultra high temperature Pasteurization.

UNIT – IV: MILK PRODUCTS HOURS:6

Milk Products-Cream-Definition-Chemistry of Creaming Process-Butter-Definition-Composition-Theory of Churning, Desibutter, Salted Butter-Ghee-Major Constituents, Common Adulterants and their detection.

UNIT – V: FERMENTED MILK PRODUCTS HOURS: 6

Fermented Milk Products - Fermentation of Milk - Definition and Conditions. Ice Creams

Definition - Composition-Types-Manufacture of Ice cream, Stabilizers-Emulsifiers and their

Role. Milk Powder-Definition-Process of Making milk powder.

COURSE OUTCOMES

1. Able to understand the concepts of milk Processing.
2. Knowledge about Milk Products.
3. Wide Knowledge about Fermented Milk Products.
4. Able to know the concepts involved in Pasteurization.
5. Identify the changes and effect of heat on Milk.

TEXTBOOKS: (IN API STYLE)

1. K.Bagavathi, Sundari, 2006, Applied Chemistry, MJP Publishers, 1st Edition, New Delhi.
2. Robert Jenness, Stuart Patton, 2018, Principles of Dairy Chemistry, Medtec, 1st Edition.

SUPPLEMENTARY READINGS

1. Rangappa K S, Acharya K T, 1975, Indian Diary Products, Asia Publishing House, 2nd Edition, Mumbai.
2. Sukumar De, 2001, Outlines of Dairy Technology, Oxford University Press, 1st Edition, UK.
3. T.Jacob, 2006, Applied Chemistry for Home Science &Allied Science, MacMillan, 2nd Edition, Germany.
4. Word F O R, 2013, Fundamentals of Dairy Chemistry, Springer, 4th Edition, New York.

OUTCOME MAPPING

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 |
| CO1 | 2 | 3 | 3 | 3 | 3 |
| CO2 | 3 | 3 | 3 | 3 | 3 |
| CO3 | 2 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 3 | 2 |
| CO5 | 3 | 2 | 2 | 2 | 2 |

(1-Low, 2-Moderate, 3-High)