

CHEMISTRY

PAPER- I
(Common paper)

S.NO	SUBJECT NAME	SUBJECT CODE
1	ADVANCED INSTRUMENTAL METHODS FOR CHEMICAL CHARACTERIZATION AND ANALYSIS	10CY101

CHEMISTRY**PAPER II**
(Choose Any ONE Subject)

S.NO	SUBJECT NAME	SUBJECT CODE
1.	ANALYTICAL CHEMISTRY	10CY201
2.	CHEMISTRY OF LIFE	10CY202
3.	CHEMISTRY OF MACROMOLECULES	10CY203
4.	CHEMISTRY OF SYNTHETIC DRUGS & PHARMACEUTICAL FORMULATIONS	10CY204
5.	INORGANIC CHEMISTRY - I	10CY205
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9.	ORGANIC CHEMISTRY-II	10CY209
10.	HETEROCYCLICS AND NATURAL PRODUCTS	10CY210
11.	PHYSICAL CHEMISTRY-I	10CY211
12.	PHYSICAL CHEMISTRY-II	10CY212
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15.	INDUSTRIAL WASTE TREATMENT	10CY215

**ADVANCED INSTRUMENTAL METHODS FOR CHEMICAL CHARACTERIZATION
AND ANALYSIS**

Unit-1: UV-Visible Spectroscopy:

Introduction; Absorption Laws; Formation of Absorption bands ;Theory of Electronic Spectroscopy; Theory of Electronic Transitions; Chromophore concept; Auxochrome; Types of Absorption bands; Solvent effect; Instrumentation; Woodward - Fischer rules for calculating absorption maxima in dienes and α,β -unsaturated carbonyl compounds; Steric hindrances and co-planarity; Estimation of ligand-metal ratio in complexes; Applications.

Unit-2: Atomic Absorption Spectroscopy:

Introduction and importance; Atomization; Flame atomization; Graphite furnace atomization; Instrumentation; Hollow cathode lamp, Detectors, Monochromators; Interferences - Chemical & Spectral; Qualitative analysis; Quantitative analysis; Applications of Atomic Absorption Spectroscopy.

Unit-3: Atomic Emission Spectroscopy:

Introduction; Emission spectra; Flame emission spectroscopy; Evaluation methods; Evaluating flame emission spectroscopy; Plasma emission spectroscopy; Direct current plasma; Inductively coupled plasma; Sample introduction; ICP instrumentation; Applications; Determining alkali metals by flame photometry.

Unit-4: Polarography and Amperometry:

Introduction; Dropping Mercury Electrode; Measurement; Polarographic wave; Half wave potential; Maxima suppressors; Quantitative analysis; Qualitative analysis; Inorganic applications; Organic applications; Cyclic Voltammetry; Amperometry- Instrumentation, measurement; Amperometric titrations.

Unit-5: Magnetic resonance spectroscopy

High resolution NMR - chemical shift- Spinning coupling - Frequency lock- double resonance- applications of proton NMR - quantitative analysis - qualitative analysis.

Unit-6: Gas Chromatography:

Introduction and importance; Instrumentation - sample injection, carrier gas, capillary columns, bonded phase, dual detection; Temperature programming; Commercial Gas Chromatograms; Qualitative analysis; Quantitative analysis; Applications.

Unit-7: HPLC:

Instrumentation: Sample injection, Detectors, Qualitative analysis; Quantitative analysis; Applications.

Unit-8: Electron Spin Resonance Spectroscopy:

Introduction; Instrumentation; Quantitative analysis; Study of free radicals; Structure determination; Analytical applications.

Recommended Books:

1. “*Vogel’s Text Book of Quantitative Chemical Analysis*”, by J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Pearson Education Pvt. Ltd., New Delhi, (2002).
2. “*Instrumental Methods of Chemical Analysis*”, by G.Chatwal & S.Anand, Himalaya Publishing House, New Delhi, (2000).
3. “*Instrumental Methods of Chemical Analysis*”, by B.K. Sharma, Goel Publishing House, Meerut, (1998).
4. “*Organic Analytical Chemistry*”, by Jag Mohan, Narosa Publishing House Pvt. Ltd., New Delhi, (2003).
5. “*Analytical Chemistry - Problems & Solutions*”, by S.M.Khopkar, New Age International Pvt. Ltd., New Delhi, (2002).
6. “*Analytical Chemistry*” by G.L. David Krupadanam, D. Vijaya Prasad, K.Varaprasada Rao, K.L.N Reddy and C.Sudhakar, University Press (India) Ltd., Hyderabad (2001).
7. “*Applications of Absorption Spectroscopy of Organic Compounds*” by John R.Dyer, Prentice-Hall of India Pvt. Ltd., New Delhi (1969).
8. “*Molecular Spectroscopy- Principles and Chemical Applications*” by P.R. Singh and S.K. Dikshit, S. Chand & Co., New Delhi (1988).

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ANALYTICAL CHEMISTRY

- 1. Liquid - Liquid Extractions and Separations:**
 - i. Distribution constant and Distribution Ratios.
 - ii. Rates Liquid - Liquid Extractions.
 - iii. Counter current Liquid-Liquid Extraction.
 - iv. Continuous Liquid-Liquid counter current extraction.
 - v. Selected application of Extraction.

- 2. Reaction Rates in Chemical Analysis:**
 - i. Rates of reactions
 - ii. Single component analysis
 - iii. Mixtures simultaneous analysis
 - iv. Precision of measurements
 - v. Application

- 3. Oxidation and Reduction Equilibria:**
 - i. Galvanic Cell
 - ii. The nearest Equation
 - iii. Types of Electrodes
 - iv. Equilibrium constants from Standard Potentials
 - v. Formal potentials and other approximations
 - vi. Titration curves
 - vii. Feasibility of Redox titrations
 - viii. Redox indicators and its structural chemistry
 - ix. Reagents used for Preliminary Redox reactions
 - a. Potassium permanganate
 - b. Compounds of Cerium
 - c. Potassium Dichromate
 - d. Iodine
 - e. Periodic acid
 - f. Potassium Bromide
 - g. Reducing agents
 - h. Potentiometric methods of analysis indicator Electrodes - Direct potentiometry potentiometry titration.

- 4. Complex Formation titrations:**
 - i. Stability of complexes
 - ii. Chelometric
 - iii. Metal ion buffers
 - iv. Titrations involving unidentate ligands

- 5. Solubility Equilibria:**
 - i. Precipitation titrations
 - ii. Indicators for precipitation titrations involving silver
 - iii. Separators by precipitation
 - iv. Factors affecting solubility

Books:

1. Quantitative Analysis - R.A.Day & A.L.Underwood, Erinoice silver of India Pvt. Ltd.
2. Fundamental of Analytical Chemistry - S.Koog & West
3. Instrumental Methods of Analysis - Hobart H.Will and D.U.Merritt & J.R.J.A.Dean, C.E.S Pu8blishers and distributors.
4. Text book of Quantitative Inorganic Analysis - B.K.Logel.

CHEMISTRY OF LIFE

Unit-1: Cell Chemistry:

Introduction to cell as the basic unit of Life; Types of cells; Procaryotes and Eucaryotes - examples; Characteristics of Plant & Animal cells; Structure of Cell and its Organelles and their functions; A Chemical probe into the Cell: - Cell Walls composition - (G+) & (G-) Procaryotes, Plant and Animal cells i) Minerals ii) Carbohydrates iii) Proteins iv) Lipids v) Nucleic acids vi) Enzymes vii) Vitamins viii) Hormones, etc. their biological functions.

Unit-2: Lipids and Membranes:

Introduction: Lipid Structure - Acyl glycerol, Phospho glycerides (Phospholipids), ether lipids and sphingolipids. Bio-synthesis of lipids. Biological membranes - their role, structural complexity and compositions; Plasma membrane, Membrane lipids, Membrane proteins; Lipid bilayers, Fluid Mosaic Model of biological membrane. Dynamic nature of lipid bilayers and membrane. Protein and Glycoprotein components of membrane. Membrane transport pores and channels, active transport and passive transport.

Unit-3: Enzymes:

Definition, classification and nomenclature; Factors affecting the enzyme catalysed reactions. Advantages and limitations of enzymes in organic synthesis - mechanistic aspects of enzyme catalysis - Lock and Key mechanism, Induced - Fit mechanism, Desolvation and Solvation - substitution theory, Three- point attachment rule. Factors affecting the enzyme catalysed reactions. Enzyme selectivity - chemo, regio, diastereo and enatio selectivity - illustration with suitable examples. Regulation of enzyme activity - Allosteric enzymes. Enzyme inhibition - reversible inhibition - competitive, non-competitive and uncompetitive inhibition of enzymes. Immobilised enzymes - immobilization by physical and chemical methods. Co-Enzymes involved in Oxidation-Reduction processes. Role of metal ions in biological processes, physiology of digestion.

Unit-4: Bio-Chemistry of Carbohydrates:

Classification of Carbohydrates; Stereoisomerism; Optical isomerism; Optical activity projection and perspective formulas; D-glyceride as a reference compound; Cyanohydrin synthesis; Structure of glucose; monosaccharides, disaccharides and polysaccharides; Polysaccharides and Glycoproteins in cells.

Unit-5: Catabolic and Anabolic processes:

Energy transfer processes, role and significance of ATP; The electron transport system - Oxidative phosphorylation; Photosynthesis and its mechanism (cyclic and non-cyclic).

Unit-6: Respiration and Carbohydrate Metabolism:

Glycolysis and Krebs's Cycle; Physiology of respiration in mammals, respiratory exchange and transport of respiration at cellular level. Interconversion of glycogen and glucose in liver and the role of insulin.

Unit-7: Chemistry and Bio-Chemistry of Amino Acids & Proteins:

General properties of Amino acids; Proteins - Classification and Function; Structure of Proteins - Primary, Secondary, Tertiary and Quaternary Structure of Proteins. Synthesis of Peptides and Poly Peptides. Determination of Structure of Poly Peptides -N-terminal and C- terminal residue analysis.

Unit-8: Bio-Chemistry of Nucleic Acids:

Introduction; Hydrolysis of Nucleic acids; Structure, Physical and Chemical properties of Heterocyclic bases - Adenine, Guanine, Uracil and Thymine; Structure of DNA: Primary, Secondary, Tertiary structures of DNA. A,B,C and Z forms of DNA. Structure of RNA - types of RNA - mRNA, rRNA and tRNA.; Definition and explanation of Replication, Transcription, Translation. Genetic Code - Codons - Protein synthesis.

Recommended Books:

1. “*Outlines of Bio-Chemistry*”, by E.E. Conn & Stumpf, John Wiley & Sons, New York, (2000).
2. “*Text Book of Bio-Chemistry*”, by West, Todd et.al..
3. “*Priciples of Bio-Chemistry*” by White, Handler, Smith et.al.
4. “*Bio-Chemistry*”, by Lehninger
5. “*Bio-Chemistry*” by L.Stryer and W.H.Freeman.
6. “*Organic Chemistry*”, by R.T.Morison and R.N.Boyd, Allyn & Bacon Inc., (printed in Singapore) (2001).

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CHEMISTRY OF MACROMOLECULES**Unit -1: Organic Polymers:**

Definition and Classification; Principles of Polymerization; Addition polymerization - Free radical, Anionic and Cationic types; Co-ordination polymerization - Zeigler Natta Catalysts; Miscellaneous polymerizations; Inhibitors; Condensation polymerization; Types of polymers based on structural types and Tacticity.

Unit- 2: Elastomers:

Natural rubber; Its structure and Processing; Synthetic rubbers - Thiokol, Neoprene, Buna-S, Buna-N etc. - Their methods of preparation, properties and uses; Compounding and vulcanization of rubber.

Unit -3: Plastics-I:

Definition and classification: Thermoplastic materials; Preparation, properties and uses of Polyethylenes, Teflon, Polyvinyl acetate, Polyvinylchloride, Polystyrene and Polymethyl methacrylate.

Unit- 4: Plastics-II:

Preparation, Properties and uses of Thermoset plastics such as Phenol-Formaldehyde resins, UreaFormaldehyde resins, Melamine-Formaldehyde resins. Alkyd resins, Epoxy resins, Polyurethanes etc; Compounding of plastics and Fabrication techniques.

Unit- 5: Chemical Fibers:

Classification and properties of fibers; Natural fibers like Cotton, Wool, and Silk; semi- synthetic fibres - Preparation, properties and uses of Cuprammonium rayon, Acetate rayon, Viscose rayon; Preparation, properties and uses of Synthetic fibers - Nylon 6, Nylon 6,6, Kevular, Polyethyleneterephthalate, Polyacrylonitrile, Vinyon.

Unit- 6: Inorganic Polymers:

General Survey of Inorganic Polymers; Preparation, Properties and uses of Polyphosphazenes, Poly(Carboranes-Siloxanes), Poly (Sulphur Nitride); Elemento- organic polymers - Silicones.

Unit -7: Physical Chemistry of Polymers - I:

Molecular weight and Size; Number Average and Weight Average molecular weights; Sedimentation and Viscosity average molecular weights; Experimental methods for the determination of average molecular weights of polymers by Viscometry, Osmometry, Ebulliscopy, Cryoscopy, Sedimentation and Light scattering methods.

Unit- 8: Physical Chemistry of Polymers - II:

Degree of Polymerization; Polydispersity and molecular weight distribution in polymers; Practical significance of polymer molecular weight; Concepts of Phase, Super- Cooled liquids and Quenching; Glass transition temperature - Its determination and significance.

Recommended Books:

1. "Polymer Science" by V.R. Gowrikar, N.V. Viswanathan and J. Sreedhar, Wiley Eastern Ltd., New Delhi, Hyderabad. (1988).
2. "Introductory Polymer Chemistry" by G.S.Misra, New Age International Pvt.Ltd., Hyderabad. (1996).
3. "Synthetic Drugs and Polymers" by D. Dasharath, Sri Vani Publishers Mumbai (2002).
4. "Text Book of Polymer Science" by F.W. Billimeyer.
5. "Polymer Chemistry" by P.J. Flory.
6. "Organic Polymer Chemistry" by K.L. Saunders.
7. "Engineering Chemistry", 15th Edition, by P.C. Jain and Monika Jain, Dhanpat Rai Publishing Company, New Delhi (2005).
8. "A Text Book of Polymers Vols. I, II & IIP", by M.S. Bhatnagar, S. Chand & Co., New Delhi (2004).

Subject Code: 10CY204**CHEMISTRY OF SYNTHETIC DRUGS & PHARMACEUTICAL FORMULATIONS****Unit-1: General:**

Introduction and Historical background; Paul Ehrlich's development of arsephenamine and his concept of Chemotherapy; Sulphas as wonder drugs; Importance of heterocyclic chemistry in drug synthesis; Natural Products as Lead molecules; Medicinal Chemistry and drug development.

Unit-2: Anti-bacterial Drugs:

Sulphonamides; Sulphamethoxazole - Synthesis and mechanism of action, dosage forms; Trimethoprim, synthesis and dosage forms, its mechanism of action; Norfloxacin and Ciprofloxacin - Synthesis, dosage forms, structure-activity relationships.

Unit-3: Anti-inflammatory Agents - I:

Antipyretics, Analgesics and anti-inflammatory agents - General study; Non-steroidal anti-inflammatory agents: Ibuprofen, structure, synthesis, dosage forms and activity studies.

Unit-4: Anti-inflammatory Agents - II:

Indomethacin & Piroxicam - Synthesis, dosage forms & mechanism of action. Steroidal antiinflammatory agents like betamethasone.

Unit-5: Antihistamines and Antifungal agents:

Antihistaminic agents; Diphenhydramine (benadryl) - synthesis, therapeutic use and dosage forms; Cimetidine & Ranitidine - synthesis, dosage forms and applications; Mebendazole & Thiabendazole - Synthesis and applications.

Unit-6: Antiemetic Agents and Antiamoebic Agents:

Trimethobenzamide, Diphenidol, Metaclopramide - synthesis and therapeutic uses; Metronidazole - synthesis, uses & dosage forms.

Unit-7: Sedatives, Hypnotics and Anti-Cancer Agents:

Definition and Classification of Sedative and hypnotic agents; Chlorodiazepoxide, Diazepam, Nitrazepam etc.; Chemotherapy of Cancer; Synthesis and uses of Fluorouracil.

Unit-8: Pharmaceutical Formulations:

Introduction; Need for the conversion of drugs into medicines; Additives & their role; Route - wise and Form - wise dosage forms; Solid dosage forms, liquid dosage forms & semi-solid dosage forms; Ointments and Creams.

Books Recommended:

1. "Chemistry of Synthetic Drugs" by N. Evers and D. Caldwell, Ernest Benn Ltd. London.
2. Berger's "Medicinal Chemistry", Vols. I & II.
3. "Essentials of Medicinal Chemistry", by A. Kotolkavas and J.H. Burckhalter, Wiley Interscience.
4. "Medicinal Chemistry", by Ashutosh Kar, New Age International Ltd.
5. "Drugs" by G.L. David Krupadanam, D. Vijaya Prasad, K. Varaprasada Rao, K.L.N. Reddy and C. Sudhakar, Universities Press (India) Ltd., Hyderabad (2001).
6. "Synthetic Drugs and Polymers" by D. Dasarath, Sri Vani Publishers, Mumbai (2002).
7. "Principles of Organic Medicinal Chemistry" by Rama Rao Nadendla, New Age International (P), Ltd., Publisher, New Delhi, Hyderabad (2005).

INORGANIC CHEMISTRY - I

Unit-1: Chemistry of Non -Transition Elements-I:

General discussion on the properties (Size, Ionization energies, Electronegativity, electron affinity, electro-positive character etc.) of the non-transition elements; Allotropy of Carbon, Graphitic compounds, Carbides, Carboranes (Clos- & Nido), Oxides and Oxy - acids of Phosphorous: Phosphorous acid & Phosphoric acid, Phosphazenes (Phosphonitrilic compounds).

Unit-2: Chemistry of Non-Transition Elements-II:

Electronic structure and Oxidation states of Halogens; Interhalogen Compounds (AX , AX_3 , AX_5 , AX_7); Pseudohalogens and Pseudohalides; Chemistry of Xenon; Structure and Bonding in Xenon compounds.

Unit-3: Chemistry of Transition Elements-I:

Co-ordination chemistry of Transition elements (Theories dealing with the formation of Coordination Compounds); Coordination Theory, Sidgwick's EAN rule, Valence Bond Theory, Crystal Field Theory, Splitting of d-orbitals, Jahn - Teller Effect; Stability constants of Transition metal complexes and their determination by Job's Method.

Unit-4: Chemistry of Transition Elements-II:

Magnetic Properties of Transition elements (Dia-, Para-, Ferro- & Anti-Ferro Magnetism); Interpretation of electronic spectra of Transition metal complexes: Charge Transfer spectra with reference to Tetrahedral and Octahedral complexes; Spectrochemical Series (Effect of various ligands on the splitting energy of d-orbitals); Spin-Orbit Coupling & L-S Coupling or R-S Coupling.

Unit-5: Chemistry of Lanthanides and Actinides:

Position of Lanthanides & Actinides in the Periodic Table; General Properties (Size, Atomic Size, Electronegativity, Electropositive Character etc); Lanthanide Contraction -Consequences of Lanthanide Contraction; Magnetic Properties (Dia-, Para-, Ferro- & Anti-Ferro Magnetism) & Spectral Characteristics of Lanthanide and Actinide Complexes; Use of Lanthanide elements as Shift reagents in NMR Spectroscopy.

Unit-6: Inorganic Reaction Mechanisms:

Substitution Reactions: SN_1 & SN_2 with respect to Octahedral, Square Planar & Tetrahedral Complexes; Redox reactions or Electron Transfer Reactions: Inner Sphere and Outer Sphere Mechanism in Octahedral & Tetrahedral Complexes; Fluxionality: Molecular non-rigidity of Complexes; Nephelauxetic or Cloud Expanding Effect in Transition Metal Complexes; Trans-Effect; Trans-Effect Series; Uses of Trans-Effect; Theories of Trans-Effect.

Unit-7: Bio-Inorganic chemistry-I:

Metal ions in biological systems (Macro & Micro elements); Importance of Na, K, Mg, Ca in Biological Processes; Photosynthesis: Light Reaction (Cyclic & Non-Cyclic Photo-hosphorylation) & Dark Reaction (C_3 Cycle).

Unit-8: Bio-Inorganic chemistry-II:

Nitrogen Fixation: Mechanism of reduction of N_2 ; Oxygen uptake proteins: Haemoglobin, Myoglobin; Oxygen transport by Haemoglobin; Co-operativity; Geometric and Magnetic aspects of Dioxygen binding.

Books Recommended:

1. “*Advanced Inorganic Chemistry*”, F.A. Cotton, G. Wilkinson, C.A. Murillo and M. Bochmann, 6th Edition, Wiley-Interscience, New York (1999).
2. “*Inorganic Chemistry*”, J.E. Huheey, E.A. Keiter & R.L. Keiter, 4th Edition, Pearson Education Asia, (2001).
3. “*Mechanism of Inorganic Reactions*”, M.L. Tobe and J. Burgess, Addison Wesley Longmann, (1999).
4. “*Bio-inorganic Chemistry*”, Inorganic Elements in the Chemistry of Life, W. Kaim and B. Schwederski, John Wiley & Sons, NY (1999).
5. “*Outlines of Bio-Chemistry*” by E.E. Cohn and Stumpf, John Wiley & Sons, NY, (2000).
6. “*Selected Topics in Inorganic Chemistry*”, W.U. Malik, G.D. Tuli & Madan, S. Chand & Co., Delhi (2002).

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INORGANIC CHEMISTRY - II**Unit-1: Organometallic Compounds - I:**

Classification of Organometallics based on hapticity; Classification of Organometallics based on Polarity; σ bonded organometallics and π bonded organometallics; General methods for the preparation of Main-group and Transition metal organometallics.

Unit-2: Organometallic Compounds - II:

Nature of M-C bond; Synthesis, Bonding and Uses of Organometallics of bonded organic ligands; Two electron ligands (Olefinic & Acetylenic complexes); Three electron ligands (Allylic complexes); Four electron ligand (Butadiene and Cyclobutadiene complexes); Five electron ligand (Ferrocene complex).

Unit-3: Bonding involving π -donor ligands:

Concept of back-bonding; Transition metal to Carbon multiple bonded compounds (Carbenes & Carbynes); Metal Carbonyls; Uses of Transition Metal Organometallics; Homogeneous and Heterogeneous Catalysis; Hydroboration; Hydroformylation; Hydrogenation; Isomerization; Polymerization with Tolman Catalytic loops.

Unit-4: Symmetry of Molecules:

Concept of Symmetry in Chemistry; Symmetry Operations; Symmetry elements; Properties of a Group; Abelian and Non-Abelian groups; Molecular Point Groups; Group Multiplication Tables; Great Orthogonality Theorem and its applications.

Unit-5: Reactions in Non-aqueous Media - I:

Classification of Solvents - General Properties of Ionizing solvents - Liquid Ammonia as solvent (advantages, disadvantages, chemical properties); H_2SO_4 as solvent (chemical properties); BrF_3 and N_2O_4 as solvents (auto-ionization reactions, chemical reactions involving them); Reactions in Molten Salts.

Unit-6: Reactions in Non-aqueous Media - II:

Reactions in Solvents of high dielectric constant such as ethanol, acetic acid, pyridine etc.; Reactions in solvents like DMF, CH_3CN , DMSO etc.; Solubilization of salts either alone or in the presence of PTC etc.

Unit-7: Nuclear Chemistry:

Radioactive decay and equilibrium; Nuclear reactions; Q value, Cross sections, Types of reactions; Chemical effects of Nuclear transformation; Fission and Fusion; Fission products and Fission yields; Radioactive techniques: Tracer technique, Neutron Activation Analysis; Counting Techniques: GM Ionization and Proportional Counter.

Unit-8: Supramolecular Chemistry:

Definition - Molecular Recognition - Supramolecular Reactivity and Catalysis - Self-Assembly - Supramolecular Photochemistry.

Books Recommended:

1. "Organometallic Chemistry", by R.C. Mehrotra & A. Singh, 2nd Edition, New Age International (P) Limited, New Delhi (2000).
2. "Symmetry and Spectroscopy of Molecules", by K. Veera Reddy, New Age International (P) Limited, (2000).
3. "Group Theory and its Chemical application", - P.K. Bhattacharya, Himalaya Publishing House, New Delhi, (1986).
4. "Selected Topics in Inorganic Chemistry", by Madan, Malik, Tuli, S. Chand & Co., Delhi, (2002).

INORGANIC CHEMISTRY III

UNIT - 1: Co-ordination chemistry: Theory and structure:

Valence Bond theory-Crystal field theory-Molecular orbital theory-The Angular overlap method - π Bonding and molecular orbital theory - Measurement of π Bonding effects - Summary of Molecular orbital theory - A closer look at spectra (Orgel diagrams, Tanular-sugam diagrams). Co-ordination number 2, Co-ordination number 3, Co-ordination number 4, Co-ordination number 5, Co-ordination number 6, Co-ordination number 7, Co-ordination number 8, Higher Co-ordination numbers, Linkage Isomerism, Other types of Isomerism, Structural equilibria of complexes, The chelate effect.

UNIT - 2: Bonding Models in Inorganic Chemistry:

The Ionic Bond, Ionic Energy, size effects, the predictive power of thermochemical calculations in Ionic compounds, the covalent Bond, a preliminary approach, Valence Bond theory, Hybridization, Delocalizations, Covalent character in predominant Ionic Bonds, Charge distribution in molecules, Experimental measurement of charge distribution on molecules.

UNIT - 3: Chemistry of Transition Elements:

Co-ordination chemistry of transition metal ions; Stability constants of complexes and their determination; stabilization of unusual oxidation states. Stereochemistry of co-ordination compounds. Ligand field theory, splitting of d-orbitals in low-symmetry environments, Jahn-Teller effect; Interpretation of electronic spectra including charge transfer spectra; spectrochemical series, nephelauxetic series. Magnetism: dia-, para-, ferro- and antiferromagnetism, quenching of orbital angular momentum, spin-orbit, coupling, inorganic reaction mechanisms; Substitution reactions, trans effect and electron transfer reactions, photochemical reaction of chromium and ruthenium complexes, Fluxional molecules and iso-and heteropolyacids; metal clusters, Spin crossover in co-ordination compounds.

UNIT - 4: Chemistry of Lanthanides and actinides:

Spectral and magnetic properties; Use of lanthanide compounds as Schiff bases.

UNIT - 5: Organometallic Chemistry of Transition Elements:

Synthesis, structure and bonding, organometallic reagents in organic synthesis and in homogeneous catalytic reactions (hydrogenation, hydroformylation, isomerization and polymerization); π -acid metal complexes. Activation of small molecules by co-ordination.

UNIT -6: Bioinorganic chemistry:

Metal ions in Biology, Molecular mechanism of ion transport across membranes; ionophores, photosynthesis, PSL, PSH; nitrogen fixation, oxygen uptake proteins, cytochromes and ferredoxins.

Books:

1. F.A.Cotton and Wilkinson : Advances in inorganic Chemistry,1989.
2. S.F.A.Kettle: Chemistry of Co-ordination Compounds, 1984
3. J.Ferguson : Progress in Inorganic Chemistry,1989.
4. J.E.Huheey : Inorganic chemistry, 1983
5. Greenwood: Chemical Elements, 1984.
6. Theroold Moiller: Inorganic chemistry, 1990.

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ORGANIC CHEMISTRY-I

UNIT-1: Stereochemistry-I (Optical Isomerism):

Introduction, significance and classification of isomers into structural and stereo types - Normal and Dynamic types - Optical Isomerism - Elements of symmetry and chirality - Configuration of optically active molecules - DL and RS notations - Relative and Absolute configurations- Resolution of Racemic mixtures. Absolute asymmetric synthesis Asymmetric induction - Stereospecific and Regiospecific synthesis - Cram's rule - Optical Isomerism of Nitrogen compounds - Concept of dynamic enantiomerism.

UNIT-2: Stereochemistry-II (Geometrical & Conformational Isomerism):

Cis-Trans isomerism; E-Z configuration - Interconversion of geometrical isomers and determination of their configuration - Stereo chemistry of oximes and Beckmann rearrangement - Conformational analysis of acyclic systems like ethane and n-butane and cyclic systems like cyclohexane.

UNIT-3: Aromaticity-I (Benzenoid Aromatic hydrocarbons):

Aromaticity - Huckel's ($4n+2\pi$ electron rule) and its limitations - Classification of cyclic conjugated hydrocarbons as alternant and non- alternant, Benzenoid hydrocarbons-Aromatic properties and general methods of synthesis of Naphthalene, Phenanthrene and Anthracene. Homo-aromatic and Anti-aromatic systems - Steric inhibition of resonance and Valency isomers.

UNIT-4: Aromaticity-II (Non-Benzenoid Aromatic hydrocarbons):

General methods of synthesis and properties of Non-Benzenoid aromatic compounds - Cyclopropenium salts, Cyclopentadienyl salts, Cycloheptatrienyl cation, Tropinone, Tropolone, Ferrocene and Azulenes.

UNIT-5: Reactive Intermediates-I:

Classical and Non-Classical carbocations, Structure, stability, shape & Reactivity of Carbonium ions; Stability, shape & generation of Carbanions; use of Carbanions in organic synthesis; Acetoacetic ester & Malonic ester synthesis; Free radicals - stability, shape & Detection of free radicals.

UNIT-6: Reactive Intermediates-II:

Radical anions- Radical cations - Carbenes - Nitrenes and Arynes - Their general methods of generation, Detection and reactivity; Singlet oxygen - Generation and reaction with organic substrates.

UNIT-7: Study of Organic Reaction Mechanisms:

Introduction and significance; General methods of study of mechanisms of Organic Reactions, Kinetic and non-kinetic methods; Use of isotopes; Cross-over experiments; Intermediate trapping; evidence based on stereochemistry etc; Examples.

UNIT-8: Physical Organic Chemistry:

Thermodynamics and Kinetics; Acids and Bases; HSAB principle; Kinetic versus Thermodynamic control, Hammett equation; Linear free energy - relationships, Hammond's postulate.

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Recommended Books:

- 1) “*Stereochemistry of Carbon Compounds*” by Ernest L.Eliel, Tata-Mc Graw Hill Co., New Delhi (1975).
- 2) “*Stereochemistry- Conformation and Mechanism*”, by P.S. Kalsi, Wiley Eastern Ltd., New Delhi, Hyd. (1991).
- 3) “*Carbocyclic Non-Benzenoid Aromatic Compounds*”, by Douglas Lloyd, Elsevier Publishing Company, Amsterdam, London, New York (1966).
- 4) “*Advanced Organic Chemistry*”, by Jeprry March, John Wiley & Sons, New York, London. (2001).
- 5) “*Organic Chemistry*”, by R.T.Morison and R.N.Boyd, Allyn & Bacon Inc., (printed in Singapore) (2001).
- 6) “*University Chemistry*”, Vols II & III by C.P.Murthy, S.F.Mehidi Ali and P.K. Dubey, New Age International (P) Ltd., New Delhi, Hyderabad (1996).
- 7) “*Organic Chemistry*”, Vol.I, by S.M.Mukherji, S.P. Singh and H.P. Kapoor, Wiley Eastern Ltd., New Delhi, Hyderabad. (1985).
- 8) “*Organic Chemistry*”, by Paula Yurkanis Bruice, Pearson Education (Singapore) Pvt. Ltd., Delhi (2001).
- 9) “*Organic Reaction Mechanisms*”, by Raj K. Bansal, Tata-Mc Graw Hill Co., New Delhi (1998).
- 10) “*A Guide-book to Mechanism in Organic Chemistry*”, by Peter Sykes Orient Longmans Ltd., New Delhi (1976).
- 11) “*Mechanism and Theory in Organic Chemistry*”, by T.H.Lowry and K.S. Richardson, Harper & Row Publishers, London (1988).
- 12) “*Organic StereoChemistry*” by Henri Kagan, Edward Arnold Publishers, London (1979).

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ORGANIC CHEMISTRY-II

Unit-1: Electrophilic Aromatic Substitution - I:

Electrophilic aromatic substitution in benzene; formation of σ and π complexes; Orientation and Reactivity in benzene ring containing more than one substituent ; Directing effect of substituent already on benzene ring; Effect of electrophile; Effect of leaving group ; Orientation and Reactivity in naphthalene, phenanthrene and Anthracene;

Unit-2: Electrophilic Aromatic Substitution - II:

Electrophilic aromatic substitution in activated benzene derivatives; Riemeier - Tiemann reaction; Vilsmeier - Haack formylation; Houben - Hoesch reaction; Diazo - Coupling; Hofmann - Martius rearrangement.

Unit-3: Nucleophilic Aromatic Substitution:

Definition and Classification; Aryl halides; Low reactivity of aryl and vinyl halides; SN_1 , SN_2 and benzyne mechanisms; Reactivity and Orientation in nucleophilic aromatic substitution; Nucleophilic substitution - aliphatic and aromatic; Von Richter rearrangement and Sommelet - Hauser rearrangement.

Unit-4: Elimination Reactions:

Definition and Classification; Anti and Syn eliminations; E_1 , E_2 and E_{1cb} eliminations; Pyrolytic Syn eliminations; Mechanism and evidences; Orientation in elimination reactions; Hofmann and Saytzeff eliminations.

Unit-5: Addition to Carbon - Hetero atom multiple bonds - I:

Addition reactions of Carbonyl compounds like aldehydes and ketones; Addition of Oxygen nucleophiles like water, alcohols, glycol etc.; Addition of Carbon nucleophiles like cyanide and carbanion etc.; Addition of Sulphur nucleophiles like thiols and $NaHSO_3$.

Unit-6: Addition to Carbon - Hetero atom multiple bonds - II:

Addition reactions of Carbonyl compounds like aldehydes and ketones; Addition of nitrogen nucleophiles like ammonia, amine, phenyl hydrazine, 2,4-dinitrophenyl hydrazine etc.; Addition of hydride ion - Reduction of aldehydes and ketones with $NaBH_4$ and $LiAlH_4$.

Unit-7: Addition to Carbon - Hetero atom multiple bonds - III:

Addition of hydrogen to aldehydes & ketones; Reduction of compounds containing C=N linkages; Oxidation of aldehydes to carboxylic acids; Tollen's reaction.

Unit-8: Condensation reactions of Carbonyl compounds:

Aldol condensation; Cannizzaro reaction; Dieckmann condensation; Benzoin condensation; Reformatsky reaction; Knoevenagel condensation; Addition of Grignard reagents to aldehydes and ketones.

Recommended Books:

- 1) “*Advanced Organic Chemistry*”, by Jerry March, John Wiley & Sons, New York, London. (2001).
- 2) “*Organic Chemistry*”, by R.T.Morison and R.N.Boyd, Allyn & Bacon Inc., (printed in Singapore) (2001).
- 3) “*University Chemistry*”, Vols II & III by C.P.Murthy, S.F.Mehidi Ali and P.K. Dubey, New Age International (P) Ltd., New Delhi, Hyderabad (1996).
- 4) “*Organic Chemistry*”, Vol.I, by S.M.Mukherji, S.P. Singh and H.P. Kapoor, Wiley Eastern Ltd., New Delhi, Hyderabad. (1985).
- 5) “*Organic Chemistry*”, by Paula Yurkanis Bruice, Pearson Education (Singapore) Pvt. Ltd., Delhi (2001).
- 6) “*Organic Reaction Mechanisms*”, by Raj K. Bansal, Tata-Mc Graw Hill Co., New Delhi (1998).
- 7) “*A Guide-book to Mechanism in Organic Chemistry*”, by Peter Sykes Orient Longmans Ltd., New Delhi (1976).
- 8) “*Mechanism and Theory in Organic Chemistry*”, by T.H.Lowry and K.S. Richardson, Harper & Row Publishers, London (1988).
- 9) “*Advanced Organic Chemistry*” by Maya Shankar Singh, Pearson Education (Singapore) (P) Ltd., Delhi (2005).
- 10) “*A Text Book of Organic Chemistry*” by Arun Bahl and B.S. Bahl, S.Chand & Company, New Delhi (2005).

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HETEROCYCLICS AND NATURAL PRODUCTS

UNIT - 1: Heterocyclic Synthesis and Properties:

Synthesis and reactivity of furan, thiophene, pyrrole, pyridine, piperidine, quinoline, isoquinoline, and Indole.

UNIT - 2: Molecular Rearrangements & Named reactions:

Nucleophilic, electrophilic and free radical rearrangements - Wagner - Meerwein, Pinacol, Benzil-benzilic acid, Favorski, Fries, Nebee, Hofmann Curtius, Beckmann, Schmidt, Baeyer - Villiger, Perkin, Stobbe, Dickmann condensations.

UNIT - 3: Natural Products

Alkaloids - source and classification, extraction and general method for determining structure. Structure elucidation of papavarine. Terpenoids, Steroids and Hormones-classification and structure santonine, squalene, lanosterol and cholesterol, estrone, testosterone, and cortisone. Structural determination of cholesterol. Prostaglandins - Nomenclature, biosynthesis, metabolism and biological effects of prostaglandins. Synthesis of PG E1 & E2.

UNIT - 4: Photochemistry

Photochemistry of carbonyl compounds - n- π , π - π transitions, Norrish type I and Norrish type II cleavages, Peteno-Buchi reactions, rearrangements of α : β - unsaturated ketones and cyclic hexadienes, photochemistry of p-benzoquinones photochemistry of unsaturated system - olefins, cis-trans isomerism and addition acetylenes dimerisation, dienes - photochemistry of 1,3-butadienes (2+2) additions leading to cage structures and photochemistry of cyclohexadienes.

UNIT - 5: Pericyclic Reactions:

Introduction, Huckel aromaticity, anti-Huckel aromaticity, Electrocyclic, cycloaddition reactions and Sigmatropic rearrangements.

UNIT - 6: Fertilizers and Insecticides:

Types and classification of fertilizers. Sources of fertilizers and their importance (viz., nitrogen, phosphoric and potash fertilizers). Insecticides: Classification of insecticides - organic insecticides and mode of action - DDT, BHC, Pyrethrins and parathion etc.,

Reference:

1. Advanced organic chemistry: reaction mechanism and structure (McGraw Hill and Kogakush) by Jerry March.
2. Molecular reactions and photochemistry (Prentice Hall) by Charles Dupey and
3. O.Chapman.
4. Organic Chemistry, 5th edition (Prentice Hall of India) by R.T.Morrison and R.N.Boyd.
5. Organic chemistry vol. I & II(ELBS Longmann group Ltd., London) by I.L.Finar.
6. Organic chemistry, 5th edition, (John Wiley and Sons, New York, 1992) by T.W.Graham Solomons.
7. Organic polymer chemistry by K.J.Sanders, Whapman and Hall.
8. Organic chemistry of synthetic high polymers by R.W.Lenz, Interscience Publishers. New7 York Principles of Polymerization by G.Odion. John-Wiley, New York.

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PHYSICAL CHEMISTRY-I

Unit-1: Thermodynamics-I:

Introduction to the laws of thermodynamics (first, second & third); Free energy and Entropy of mixing; Partial Molar Properties - Partial Molar Free Energy, Partial Molar Volume, Partial Molar Heat Content (P.M.H.C); Determination of these quantities by Direct method , Graphical method (i.e., intercept method); Apparent Molar Properties.

Unit -2: Thermodynamics -II:

Chemical potential and its physical significance; Variation of chemical potential with temp & pressure; Gibbs -Duhem equation; Concept of Fugacity of gases; Determination of Fugacity by Graphical method and Approximate calculation method; Change of fugacity with temperature and pressure.

Unit-3: Distribution law:

Nernst Distribution Law; Temperature coefficient; Derivation of Distribution law (Hit & Trial method & Logarithmic method); Applications of Distribution law.

Unit-4: Photochemistry:

Types of Photochemical reactions; Laws of Absorption (Grothuss-Draper law & Einstein's law); Quantum yield; Primary & Secondary Photochemical processes; Joblonski Diagram: Fluorescence, Phosphorescence, Delayed Fluorescence, Inter-System Crossing; Internal Conversion-Vibrational Cascade and Chemiluminescence.

Unit-5: Chemical Dynamics-I:

Theories of Reaction Rates: Collision theory of reaction rates; Steric factor; Theory of unimolecular reactions-Lindemann's theory; Theory of absolute reaction rates.

Unit-6: Chemical Dynamics-II:

Kinetics of Photochemical reactions; Dissociation of HI; Reaction between Hydrogen and Chlorine; Reaction between Hydrogen and Bromine; Reaction between Hydrogen and Oxygen; Explosion limits.

Unit-7: Catalysis:

Types of Catalytic Reagents; Types of Catalysis (Homogeneous and Heterogeneous catalysis); Catalytic Coefficient; Acidity Functions; Theory of Homogeneous catalysis; Theory of Heterogeneous catalysis (Chemical theory & Adsorption theory); Kinetics of heterogeneous reactions.

Unit-8: Enzyme Catalysis:

Specificity in Enzyme Catalyzed reactions; Michaelis- Menten mechanism; Influence of Concentration on Enzyme-Catalyzed reactions; Influence of Temperature on Enzyme Catalyzed reactions; Acid-base catalysis.

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Recommended Books:

1. “*Advanced Physical Chemistry*” by Gurudeep Raj; Goel Publishing House, Meerut (24th Edition, 1999).
2. “*Physical Chemistry*” by Samuel Glasstone and D. Lewis; Mc Millan India ltd. New Delhi (2nd Edition, 1984).
3. “*Physical Chemistry*” by Peter Atkins and J.D.Paula; ELBS, Low Price Edition (7th, Edition, 2002).
4. “*Chemical Kinetics*” by K.J.Laidler; Tata Mc Graw- Hill Publishing Company Ltd, New Delhi (2nd Edition, 1984).
5. “*Principles of Physical Chemistry*” by Maron and Prutton; Oxford and IBH Publishing Co Pvt Ltd (New Delhi) and Calcutta (4th Edition, 1966).
6. “*Catalysis Principles and Applications*” by B.Vishwanathan, S.Sivasanker; Narosa Publications, New Delhi (2002).
7. “*Physical Chemistry through problems*” by S.K.Dogra and S.Dogra; New Age International Pvt Ltd, New Delhi and Hyderabad (4th Edition, 1996).
8. “*Chemical Kinetics and Catalysis*” by G.M. Panchenkov and V.P.Lebedev. “*Foundation of Chemical Kinetics*” by E.N. Yeremin.
10. “*Physical Chemistry*” by Bahl, Tuli and Arun bahl; S. Chand and Company Ltd. New Delhi (23rd Edition, 1995).

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PHYSICAL CHEMISTRY-II**UNIT-1: Quantum Mechanics-I:**

Introduction to Quantum Mechanics: Postulates of Quantum Mechanics; Schrödinger wave equation and its derivation; Physical significance of wave function; Eigen values and Eigen functions; Particle in a box (one dimensional) behavior; Normalization; Orthogonality; Degeneracy.

UNIT-2: Quantum Mechanics-II:

Variation method & Perturbation theory; Applications to the Helium atom; Anti -symmetry and exclusion principle; Slater's determinantal wave functions.

Unit-3: Quantum Mechanics-III:

Born-Oppenheimer approximation; Hydrogen molecule ion; LCAO-MO and VB treatments of the Hydrogen molecule; electron density; Huckel's pi-electron theory.

Unit-4: Phase rule:

Definition of Phase rule; Terminology in Phase rule; Phase diagram of two & three component systems; Stokes and Roozboom representation for three component systems.

Unit-5: Chemical Kinetics-I:

Fast reactions; Rate constants of fast reactions; Their determination by Stopped flow method, Relaxation method, Flash photolysis and Nuclear Magnetic Resonance methods.

Unit-6: Chemical Kinetics-II:

Ionic reactions; Influence of solvent on the rate of reactions (single & double sphere A.C. model); Primary salt effect; Secondary salt effect; Influence of frequency factor; Influence of ionic strength.

Unit-7: Electrochemistry:

Electro chemical cell reactions; Nernst equation; Electro kinetic phenomena: Electro-Osmosis; Streaming potential; Electrophoresis; Zeta- Potential - Method of determination of Zeta Potential.

Unit-8: Surface Chemistry:

Adsorption; Factors influencing adsorption; Surface tension and its measurements; Adsorption isotherm curves; Langmuir's adsorption isotherm- its limitations; B.E.T. Adsorption isotherm-its applications; Negative adsorption; Positive adsorption; Chemisorptions; Physisorption and Determination of surface area.

Recommended Books:

1. "Advanced Physical Chemistry" by Gurudeep Raj, 24th Edition, Goel Publishing House, Meerut. (1999).
2. "Physical Chemistry" by Peter Atkins and J.D.Paula, 2nd Edition, Mc Millan India Ltd. New Delhi (1984).
3. "Chemical Kinetics" by K.J.Laidler, 2nd Edition, Tata Mc Graw- Hill Publishing Company Ltd, New Delhi (1984).
4. "Quantum Chemistry" by A.K.Chandra, 3rd edition, Tata Mc Graw-Hill Publishing Pvt Ltd.,New Delhi (1988).
5. "Quantum Chemistry" by R.K.Prasad, 3rd edition, New Age International Publications (1997).
6. "Electro Chemistry" by Glasstone, 2nd edition, Mc Millan India Ltd., New Delhi (1984).
7. "Physical Chemistry" by B.D Khosla, 7th edition, R.Chand & Co, New Delhi (1975).
8. "Physical Chemistry through problems" by S.K.Dogra and S.Dogra, 4th edition, New Age International Pvt. Ltd (1996).
9. "Chemical Kinetics and Catalysis" by G.M.Panchenkov and V.P.Lebedev.
10. "Quantum Chemistry" by H.Eyring, John Walter, G.E.Kimball.
11. "Quantum Chemistry" by I.N. Levine, 4th edition, Prentice Hall of India Pvt Ltd (1994).

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Subject Code: 10CY213

PHYSICAL CHEMISTRY -III

UNIT - 1: Electronics

Electrode-electrolytic interface-electrical double layer-Helmoltz double layer-Gouy chapmann diffuse double layer- stern model-modern theory of electrical double layer-electrode polarisation-overpotential-charge transfer reaction-the basic electrodic equation-the Butter-Volmer equation - its derivation-the high field approximation-tafel equation-mechanism of hydrogen evolution reaction

UNIT - 2: Electro-kinetic phenomena

Electro-osmohs, streaming potential, electrophoresis, zeta potential,method of determining the zeta potential

UNIT - 3: Polarography

Transport in the electrolyte effects change transfer at the interface - migration current -diffusion current-concentration overpotential-Nernst hypothesis-thickness of diffusion layer-Fick's first law of diffusion-dropping mercury electrode-three electrode assembly-Ilkovic equation -derivation of the equation of a reversible polarographic wave-determination of number of electrodes involved in the change transfer reaction-kinetic currents-application of polarography-qualitative and quantitative estimations of cations-stability constants of a complex ion-cyclic voltametry-principle involved and application

UNIT - 4: Technological aspects of electrochemistry:

Corrosion and the stability of metals - change-transfer reactions-are the origin of the instability of a surface-the mechanism of the corrosion- thermodynamics and the stability of metals

UNIT - 5: Potential - pH (or pourbaix) diagrams:

The corrosion current and the corrosion potential-The basic electrodes of corrosion in the absence of oxide films-the influence of air and pH upon the rate of corrosion-some common examples of corrosion-principles of differential aeration - Passivation: the transportation from a corroding and unstable surface to a passive and stable surface-the mechanism of passivation

UNIT - 6: Electrochemical energy conversion

Nickel -Cadmium battery-silver-zinc cells -dry cells-fuel cells-the important quantities in electricity storage-electricity storage density-energy density-the lead - acid storage battery.

Books:

1. J O'M.Bockris and A.K.N.Reddy Modern electrochemistry (Vol.2)Plenum press, New York,1990.
2. Philip H.Reiger, Electrochemistry, Prentice - Hall, Inc., New Delhi,1987
3. Christophor M.Brett, Anamavia Oliveira and Brett, Electrochemistry,1987.
4. Principles methods and applications, Oxford University press, London 1993.

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Subject Code: 10CY214**ENVIRONMENTAL CHEMISTRY****Unit-1: Chemistry of Air Pollution-I:**

Introduction to environmental pollution; Concept, nomenclature and segments; Composition of atmosphere; Pollution of atmosphere; Types of air pollutants; Oxides of Carbon, Sulphur, Nitrogen and Hydrocarbons etc; Effect on health and environment; Green house effect, Acid rain and Photochemical smog.

Unit-2: Chemistry of Air Pollution-II:

Effect of Ozone on Health & Environment; Chlorofluorocarbons; Effect of Gasoline on air pollution; Presence of Lead in the atmosphere; Reducing toxic emission from the fuel combustion in vehicles; Control of NO emission; Catalytic control device for automobiles.

Unit-3: Chemistry of Water Pollution:

Environmental role of water; The Hydrological cycle of water; Classification of water pollutants; Measurement of BOD, COD, TOC; Waste chemicals; Oil spills, Heavy metals; Waste water treatment - Primary, Secondary (Aerobic & Anaerobic) and Tertiary treatments.

Unit-4: Chemistry of Soil Pollution:

Soil pollution; Classification of Soil Pollutants; Source and Classification of Solid Waste; Disposal of Solid Waste on land and sea; Techniques of recycling of Solid Waste.

Unit-5: Pollutants from Industry:

Polymers and Plastics; Sugar and Distillery; Drugs and Pharmaceuticals; Paper and Pulp; Metallurgical industries; Nuclear Power Plants Chernobyl and Minimata disasters.

Unit-6: Pesticide pollution:

Classification of Pesticides; Environmental implication of Pesticides; Alternate methods of Pest Control; Control methods of Pesticide Pollution; Bhopal gas disaster.

Unit- 7: Water Treatment:

Characteristics of Municipal water; Stages involved in the purification of drinking water; Removal of micro-organisms; Break-point chlorination; Desalination of Brakish water; Electro dialysis; Reverse-osmosis; Chemical analysis of water; Estimation of Free Chlorine; Dissolved oxygen; Alkalinity of water.

Unit-8: Analytical methods:

Environmental evaluation- Applications of the following methods for measurement of environmental condition; Atomic Absorption Spectroscopy, GC-MS and Chemical methods.

Recommended Books:

1. "Engineering Chemistry", 15th Edition, by P.C.Jain and Monika Jain, Dhanpat Rai Publishing Company, New Delhi (2005)
2. "Environmental Chemistry", by V.P. Kudesia, Pragathi Prakashan, Meerut, (2003).
3. "Fundamental Concepts of Environmental Chemistry", by G.S. Sodhi, Narosa Publishing House Pvt. Ltd., New Delhi, (2002).
4. "A Text Book in Environmental Science", by V. Subramanian, Narosa Publishing House Pvt. Ltd., New Delhi, (2002).
5. "Environmental Chemistry", by A.K. De, New Age International Publishers, New Delhi, (2003).
6. "An Introduction to Environmental Pollution", by B.K. Sharma and H. Kaur, Goel Publishing House, Meerut, (1999).
7. "Environmental Chemistry", by S.K. Banerji, Prentice - Hall of India, New Delhi, (1999)

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Subject Code: 10CY215

INDUSTRIAL WASTE TREATMENT

UNIT - 1

Different water quality requirements of various Industries for different pressure boiler feed waters, cooling water and process water. Waste generation and characterization from different tanneries, textile, dairy, fertilizer, sugar mill, steel, oil refinery, petrochemical and pharmaceutical industries.

UNIT - 2

Treatment methods for water and waste: Volume reduction, strength reduction, Neutralization, equalization and precipitation: Basic Processes of treatment: Pretreatment - Primary Treatment - Sedimentation - Flotation - Secondary Treatment - Design of Conventional biological treatment - Activates Sludge - Trickling Filters - Sludge digestion - Disposal of treated effluent and sludge.

UNIT - 3

Tertiary Treatment systems - Removal of Dissolved Solids-Nitrogen, Phosphorous.

UNIT - 4

Generation of air pollutants - characterization - stack height - dispersal mechanisms.

UNIT - 5

Control methods-sources, correction methods-cleaning of gaseous effluents-particulate emission control-gravitational setting chambers-cyclone separators-fabric filters-electrostatic precipitators-wet scrubbers-selection a particulate collector-control of gaseous emissions - adsorption by solids- absorption by liquids-combustion.

UNIT - 6

Generation and treatment of sludge and solid wastes - identification of hazardous wastes - disposal methods. TSDF cradle to grave concept - waste minimization and environmental facility assessment and audit.

BOOKS:

1. Air Pollution and Control Technologies - Prof. V. Anjaneyulu, Allied Publishers.
2. Hazardous Waste Management - Prof. V. Anjaneyulu, Allied Publishers.
3. Waste Water Treatment, M.N.Rao and A.K.Dutta, 1987, Oxford & IBH Pub. Co.
4. Environmental Pollution Control, C.S.Rao, 1993, Wiley Eastern Ltd.
5. Industrial wastes their disposal and treatment W. Rudolfs 1997.
6. Industrial environment, assessment and strategies S.K.Agarwal 1996.
7. Hazardous waste management, Charles A. Wertz. 2nd edition.
8. Integrated solid waste management George Tchobanoglous, Hilary Theisen & Samuel A. Vigil.
9. Hazardous waste management Micheal La. Grege, Philip Buckingham, Jeffery Evans.

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