

GULBARGA UNIVERSITY, GULBARGA



Department of P.G. Studies and Research in Chemistry

Syllabus for

M.Sc. Course in Organic Chemistry Under Choice Based Credit System (CBCS) From Academic Year 2011-12 onwards



Gulbarga



University

Department of Studies and Research in Chemistry

**Course Outline and Syllabus for Master of Science (M. Sc) in ORGANIC CHEMISTRY
Under CBCS and CAGP (Effective from the academic year 2011-2012)**

Semester	Code	Title of the Course	Semester Exam	IA	Total	L	T	P	Credits
		Hard Core							
First	HCT1.1	Inorganic Chemistry-I	80	20	100	4	0	0	4
	HCT1.2	Organic Chemistry-I	80	20	100	4	0	0	4
	HCT1.3	Physical Chemistry-I	80	20	100	4	0	0	4
		Soft-Core (Any One)							
	SCT1.1	Analytical Chemistry-I	80	20	100	4	0	0	4
	SCT1.2	Pharmaceutical Chemistry	80	20	100	4	0	0	4
		Practical							
	HCP1.1	Inorganic Chemistry Practical –I	40	10	50	0	0	2	2
	HCP1.2	Organic Chemistry Practical –I	40	10	50	0	0	2	2
	HCP1.3	Physical Chemistry Practical-I	40	10	50	0	0	2	2
		Soft-Core (Any One)							
	SCP1.1	Analytical Chemistry Practical –I	40	10	50	0	0	2	2
	SCP1.2	Pharmaceutical Chemistry Practical	40	10	50	0	0	2	2
		Total for First Semester	480	120	600				24
		Hard Core							
Second	HCT2.1	Inorganic Chemistry-II	80	20	100	4	0	0	4
	HCT2.2	Organic Chemistry-II	80	20	100	4	0	0	4
		Soft Core (Any One)							
	SCT2.1	Analytical Chemistry-II	80	20	100	4	0	0	4
	SCT2.2	Physical Chemistry-II	80	20	100	4	0	0	4
		Open Elective (Any One)							
	OET2.1	Chemistry-I (Analytical)	80	20	100	4	0	0	4
	OET2.2	Chemistry-II (Physical)	80	20	100	4	0	0	4
		Practical							
	HCP2.1	Inorganic Chemistry Practical –II	40	10	50	0	0	2	2
	HCP2.2	Organic Chemistry Practical –II	40	10	50	0	0	2	2
		Soft Core (Any One)							
	SCP2.1	Analytical Chemistry Practical-II	40	10	50	0	0	2	2
	SCP2.2	Physical Chemistry Practical –II	40	10	50	0	0	2	2
		Open Elective (Any One)							
	OEP2.1	Chemistry Practical-I (Analytical)	40	10	50	0	0	2	2
	OEP2.2	Chemistry Practical-II (Physical)	40	10	50	0	0	2	2

Semester	Code	Title of the Course	Semester Exam	IA	Total	L	T	P	Credits
		Hard Core							
Third	HCT3.1	Spectroscopy	80	20	100	4	0	0	4
	HCT3.2	Reaction Mechanisms	80	20	100	4	0	0	4
		Soft-Core (Any One)							
	SCT3.1	Natural Products	80	20	100	4	0	0	4
	SCT3.2	Heterocyclic Chemistry	80	20	100	4	0	0	4
		Open Elective (Any One)							
	OET3.1	Chemistry-III (Inorganic)	80	20	100	4	0	0	4
	OET3.2	Chemistry-IV (Organic)	80	20	100	4	0	0	4
		Practical							
	HCP3.1	Synthesis & Spectral Analysis	40	10	50	0	0	2	2
	HCP3.2	Multistep Synthesis	40	10	50	0	0	2	2
		Soft-Core (Any One)							
	SCP3.1	Isolation & Characterization of Natural Products	40	10	50	0	0	2	2
	SCP3.2	Synthesis of Heterocycles	40	10	50	0	0	2	2
		Open Elective (Any One)							
	OEP3.1	Chemistry Practical-III (Inorganic)	40	10	50	0	0	2	2
	OEP3.2	Chemistry Practical-IV (Organic)	40	10	50	0	0	2	2
		Total for Third Semester	480	120	600				24
Fourth		Hard Core							
	HCT4.1	Recent Methods in Organic Chemistry	80	20	100	4	0	0	4
	HCT4.2	Special Topics in Org. Chem.	80	20	100	4	0	0	4
		Soft Core (Any One)							
	SCT4.1	Applied Organic Chemistry	80	20	100	4	0	0	4
	SCT4.2	Medicinal Chemistry	80	20	100	4	0	0	4
		Practical							
	HCP4.1	Separation & Identification	40	10	50	0	0	2	2
	HCP4.2	Analysis of Elements and Functional groups	40	10	50	0	0	2	2
		Soft Core (Any One)							
	SCP4.1	Spectrophotometric Analysis	40	10	50	0	0	2	2
	SCP4.2	Synthesis of Drugs	40	10	50	0	0	2	2
	HCMP4.3	Major Project	120	30	150	0	0	6	6
		Total Fourth Semester	480	120	600				24
		Total Second Semester	480	120	600				24

L = Lecture; T = Tutorials; P = Practical; 4 Credits of Theory = 4 hours teaching per week

2 Credits of Practical = 4 hours per week; Scheme of Practical Exam: Expts-30 Marks, Viva-voce-5 Marks, Record-5 Marks = 40 Marks;
Major Project: Project Evaluation-90 Marks & Viva-voce-30 Marks = 120 Marks

ORGANIC CHEMISTRY (CBCS Scheme)
SEMESTER – I
HCT 1.1: INORGANIC CHEMISTRY – I

Types of Bonding, Stereochemistry of Coordination Compounds, Acid-base Concepts (64 Hours)

UNIT – I

Ionic bonding: Properties of ionic compounds, lattice energy, Born-Land's equation, Born-Haber cycle and its applications, Kapustinskii equation, Solvation energy, dissolution of ionic compounds in polar solvents and their energetics. The predictive power of thermochemical calculations of ionic compounds, covalent character in ionic compounds. Radius ratio and structure of ionic compounds and efficiency of packing of crystal lattices.

Covalent bonding: Valence bond theory, orbital overlap, molecular orbital theory, symmetry and overlap, molecular orbital diagrams of diatomic molecules (homo- and hetero- nuclear), triatomic molecules, linear (CO_2 , N_2O) and angular (NO_2), Walsh diagrams, Bent rules, some reactions of covalently bonded molecules, Resonance, hybridization, VSEPR theory, molecular geometries. **[16 Hours]**

UNIT – II

Metallic bonding: Characterization of metallic states, VB approach, band theory, conductors, insulators, semiconductors, defects in solids.

Metal π -Complexes: Preparation, structure, bonding and important reactions of metal carbonyls, metal nitrosyls, dinitrogen and dioxygen complexes. **[16 Hours]**

UNIT – III

Stereochemistry of Coordination Compounds: Coordination geometry, types of isomerism (geometrical & optical). Review of bonding theories; Molecular orbital theory/Ligand field theory (octahedral, tetrahedral and square planar complexes), MO theory applied to complexes with π -bonding. Evidences for metal-ligand orbital overlap, spectrochemical series and Jahn-Teller distortion in coordination compounds.

Magnetism: Types of magnetism; magnetic susceptibility; spin only moment; orbital contribution to spin only moment. **[16 Hours]**

UNIT – IV

Review of Acid-Base Concepts: Introduction, different definitions, types of reactions, solvent system and leveling effect. A generalized acid-base concepts (basicity of metal oxide, hydration and hydrolysis). Measurement of Acid-Base strengths, Steric effect (back strain, front strain and Internal strain). Solvation effects with reference to liquid ammonia, anhydrous sulfuric acid, acetic acid and liquid sulfuredioxide. Hard-Soft Acids and Bases; classification, strength of hardness and softness; Irving William series; theoretical basis of hardness and softness.

[16 Hours]

Books Recommended:

1. Advanced Inorganic chemistry - F.A.Cotton and Wilkinson, John-Wily and sons
2. Chemistry of the Elements - N.N.Greenwood and A. Eamshaw, Pergamon
3. Concise Inorganic Chemistry - J.D. LEE, ELBS
4. Inorganic Chemistry, Principles and Reactivity – J.E.Huheey, Harper and Row
5. Modern aspects of Inorganic Chemistry – H.J. Emuleus and A.G.Sharpe ELBS
6. Theoretical Inorganic Chemistry - M.C.Day, Jr. an J.Selbin East-West press
7. Concept and Model's in Inorganic Chemistry – Dougals, McDanial and Alexander John Wiley and sons.
8. Inorganic Qualitative Analysis - A.I.Vogel ELBS
9. Fundamentals of Analytical Chemistry - D.A.Skoog, D.M.West and F.T.Holler, Saunder college publishing
10. Inorganic Quantitative methods - Alexeev Mir publications
11. Principles of Inorganic Chemistry – Puri, Sharms and Kalia-Shobanlal-Nagin.
12. An Introduction to Inorganic Chemistry – Purcell and Kotz-Holt-Saunders
13. Coordination Chemistry-S.F.A. Kettle.
14. Comprehensive coordination Chemistry – G. Wilkinson, R.D. Gillars and J.A.Mcclevertry, Pergamon

HCP 1.1: INORGANIC CHEMISTRY PRACTICAL-I

(64 Hours)

Part-A

Semimicro qualitative inorganic analysis of a mixture.

Mixture containing three cations and three anions including one less common cations such Mo, Ti, Zr, Ce, V and Li and one interfering anion.

Part-B

i) Determination total hardness of water.

ii) Determination of Nickel by complexometry (by back titrations).

iii) Preparation of hexamine nickel (II) chloride complex.

Books Recommended:

1. Chemical Semi micro analysis- V.N.Alexeyev Mir Publishers (Mascow)
2. Vogel's Qualitative Inorganic analysis, Revised by G.Suchla Longarman group ltd.
3. Vogel's Text book of Quantitative Inorganic Analysis – J.Basett, R.C.Denney, G.H.Jeffery and J.Mendhaman, Longamans Green and Company Ltd.

HCT 1.2: ORGANIC CHEMISTRY-I

(64 Hours)

UNIT-I

Bonding in organic molecules and Aromaticity:

Localized chemical bonding: Hybridization index, Bonding in cyclopropane, Bond distances, Bond angles, Bond energies, Calculation of heats of reactions and Bond order.

Delocalized chemical bonding, Conjugation, Cross conjugation, Hyper conjugation, Resonance, Tautomerism, Valence tautomerism and bonding in fullerenes.

Bonding weaker than covalent: Hydrogen bonding and Inclusion compounds.

Aromaticity: Aromaticity and Huckel's rule-HMO theory, Benzenoid and Non benzenoid aromatic compounds. Tropones, Tropolones, Perylum cation, Ferrocene. Alternant and nonalternant hydrocarbons. Aromaticity of charged rings (3 to 8 membered), non aromatic, antiaromatic and homo aromatic systems, methods for their determination: X-ray, UV and NMR techniques. Annulenes and Hetero annulenes [10-18].

[16 Hours]

UNIT-II

Reaction Mechanism:

Classification of Organic Reactions – meaning and importance of reaction mechanism. Methods of determination of reaction mechanisms.

Kinetic Methods: Order and Molecularity.

Non-Kinetic Methods: Product identification, Cross over experiments, Study of intermediates, Isotopic labeling, Kinetic Isotope effects, Stereochemical studies. Mechanisms of aliphatic nucleophilic substitutions, SN^2 , SN^1 and SN^i , SRN^1 pathways. Rearrangements in SN^1 reactions. Structure, Stability and reactions of the following reactive intermediates: Carbocations (Classical and non-classical), Carbanions, Free radicals, Carbenes, Arynes, Nitrenes, Ylides and Enamines

[16 Hours]

UNIT-III

Stereochemistry and Conformational analysis:

Elements of symmetry and Symmetry operations and Point groups in small molecules.

Configurational notations of simple molecules, DL and RS configurational notations.

Optical isomerism: Optical activity, Chirality and Specific rotations. Molecules with two Chiral centers: Fischer, Saw-horse, Newman projections and their transformations. Enantiomers, Diastereomers, Epimers, Racemisation, Stereochemical correlation. Pseudo-asymmetric compounds.

Geometrical Isomerism: E-Z Nomenclature, Configuration of Geometrical Isomers, Syn and Anti isomers.

Conformational Analysis: Elementary account of conformational equilibria of ethane, butane and Curtin-Hammett principles.

[16 Hours]

UNIT-IV

Molecular rearrangements:

Classification and general mechanistic pattern for electrophilic, free radical and nucleophilic rearrangements.

Mechanism of the following rearrangement reactions:

C-C migration: Pinacol-Pinacolone, Dienone-Phenol, Benzil-Benzilic acid, Favorskii, Neber, Sommelet-Hauser, Anderson, Stevens, Smiles, Shapiro, Fritch-Butenberg-Wiechell rearrangements.

C-N migration: Benzidine, Hofmann, Curtius, Lossen and Beckmann rearrangements.

C-O migration: Baeyer-Villiger rearrangements.

O-C migration: Baker-Venkataraman, Fries and Wittig rearrangements. **[16 Hours]**

Books Recommended:

1. Organic Chemistry- P. Y. Bruice, Pearson, Education Pvt Ltd., New Delhi (2002).
2. Organic Chemistry- S. H. Pine, McGraw-Hill, London (1987)
3. Organic Chemistry- R. T. Morrison and R. T. Boyd, Prentice Hall, New Delhi, (1994).
4. Organic Chemistry- T. W. Graham, Solomonos, Fourth Edition, John-Wiley and Sons (1988).
5. Organic Chemistry- G. M. Loudon, Fourth Edition, Oxford University Press, New York (2002).
6. Organic Chemistry- M. A. Fox and J. K. Whitusell, Second Edition, Jones and Bartlett Publishers, London (1997).
7. Organic Chemistry- F. A. Carey, Fourth Edition, McGraw- Hill (2000).
8. Advanced Organic Chemistry, Reactions, Mechanism and Structure- J. March, Third Edition, Wiley-Eastern Ltd., (2004).
9. Stereochemistry-Conformation and Mechanism-P. S. Kalsi, Wiley-Eastern Ltd., New Delhi (1992).
10. Guide book to Mechanism in Organic Chemistry- P. Sykes, Orient Longman, London.
11. Organic Chemistry Vol-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
12. Stereochemistry of Organic Cmpounds, E. L. Eliel et. Al John Wiley and sons Inc.
13. Stereochemistry of Organic compounds, Principles and Applications- D. Nasipuri, Wiley Eastern Ltd. (1992).

HCP 1.2: ORGANIC CHEMISTRY PRACTICAL-I

(64 Hours)

PART - I: Preparation of following Organic compounds:

1. Benzoic acid and Benzyl alcohol from Benzaldehyde (Cannizarro reaction).
2. P-Chlorobenzoic acid from p-toluidine.
3. Aniline from Benzene.
4. m-Nitroaniline from Nitrobenzene.
5. m-Nitro benzoic acid from Ethyl benzoate.
6. P-Bromoaniline from Acetanilide.
7. p-Nitroaniline from Acetanilide.
8. Microscale experiments involving organic preparations.

PART – II: Quantitative Estimation of the following Organic compounds:

1. Acid.
2. Acid + Amide.
3. Acid + Ester.
4. Glucose.
5. Molecular weight determination by base hydrochloride method.

Books Recommended:

1. Vogel's Textbook of Practical Organic Chemistry revised- B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, 5th Edition, Addison Wesley Longman Limited, UK, 1997.
2. A Hand book of Organic Chemistry- H. T. Clarke.
3. A Laboratory Manual of Organic Chemistry- B. B. Dey and M. V. Govindachari.
4. Experimental Organic Chemistry- L. M. Harwood and C.J.Moody, Blackwell Scientific, London, 1989.
5. Practical Organic Chemistry – W. Kemp, McGraw Hill, London, 1962.

HCT 1.3: PHYSICAL CHEMISTRY-I

(64 Hours)

UNIT - I

Quantum Chemistry:

A brief review of black body radiation, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Heisenberg's uncertainty principle., Concept of operator - Addition, Subtraction, Multiplication of operators, Commutative, Linear, Del, Hermitian operators and their properties , Hamiltonian operators, eigenvalue and Eigen function. Postulates of quantum mechanics Schrödinger wave equation - wave function and its interpretation, elementary application to a particle in one dimensional box, particle in a ring and hydrogen atom. One dimensional harmonic oscillator. Conditions for orthogonality and normalization of wave functions Kronecker's delta. Criteria for the formation of atomic and molecular orbitals: Pauli's exclusion principle. Concept of σ , σ^* , π , π^* orbitals with characteristics. Hybrid orbitals. Comparison of M.O and V B. [16 Hours]

UNIT - II

Electrochemistry and Thermodynamics:

Activity and Activity co-efficient, Mean activity co-efficient, Debye-Huckel limiting law (qualitative aspect only) and assumptions. Ionic strength, thickness of ionic atmosphere. Basic concept of acids and bases, pH, pKa, pKw. Buffer action and capacity. Buffer solutions. Henderson-Hasselbalch equation and its application in preparation of buffer. Importance of buffer in biological system.

Brief resume of concepts of laws of thermodynamics. Free energy, chemical potential and entropy. Gibbs-Helmholtz equation, Gibbs-Duhem and Maxwell's relation. Fugacity and its variation and determination of Duhem-Margules Equation and its application to thermodynamics of ideal and non-ideal solutions. [16 Hours]

UNIT - III

Polymer Chemistry:

Review of polymers, Basic concepts and classification of polymers - Monomer, Repeat units, Linear, Branched, Cross Linked, Straight, Copolymers and Networks and interpenetrating networks (IPN). Degree of polymerization. Molecular weight distribution - Average molecular weight concepts, Number Average, Weight Average, Viscosity Average and Z - Average molecular weights. Determination of molecular weights, Osmotic pressure method, viscosity method, light scattering (Debye and Zimm plots), Ultra centrifugation method, Polydispersity and molecular weight distribution, Practical significance of polymer molecular weight, Glass transition temperature (T_g) and Melting point and relation between them. Commercial importance of polymers. Size of Polymer molecules. [16 Hours]

UNIT - IV

Chemical Dynamics-1:

A brief review of basic concepts and terminology in reaction kinetics. Methods of determining rate laws. Steady state approximation, Arrhenius equation. Collision state theory for bimolecular reaction rates, Transition state theory. Comparison between collision and transition state theories. Lindemann and RRKM theories of unimolecular reaction rates. Concepts and significance of energy of activation.

Dynamics in solution: Ionic reactions, effect of ionic strength. Primary and secondary salt effects. Dynamics of Fast reactions, Relaxation methods, Flow methods (stopped flow and plugged flow), Flash photolysis methods. [16 Hours]

Books Recommended:

1. Molecular Quantum Chemistry P.W Atkins
2. Problems in Quantum Mechanics by G. L. Squires.
3. Introduction to Quantum Chemistry by A. K. Chandra, 4th Edn. TMH New Delhi.
4. Valence by C. A. Coulson.
5. Physical Chemistry by P. W. Atkins, ELBS London 1990.
6. Quantum Chemistry by Ira N. Levine, Prentiss Hall of India, New Delhi, India.
7. Quantum Chemistry by R. K. Prasad.
8. Electrochemistry by S. Glasstone.
9. Modern Electrochemistry by S. Bockris and A K N Reddy, Vol. 1 and 2, Butterworth London, 2006.
10. Thermodynamics by L. M. Koltz and R. M. Rosenberg.
11. An introduction to Chemical Thermodynamics by R. P. Rastogi and S. S. Mishra, Vikas publishing house Pvt limited, New Delhi.
12. Chemical Kinetics by K. J. Laidler, Pearson edition.
13. Polymer science by Gowrikar, New Age Pvt Limited publishers, Chennai.
14. Polymer chemistry by Flory.
15. Polymer chemistry by A. Tager.
16. Introduction to polymer chemistry Billmeyer(Jr)

HCP 1.3: PHYSICAL CHEMISTRY PRACTICAL - I

(64 Hours)

PART-I

1. Determination of rate constant and energy of activation of a first order reaction.
2. Comparison of acid strengths.
3. Determining adsorption isotherm.
4. Determination of Molecular weight of polymer by viscometer.

PART-II

1. Determination of dissociation constant of a monobasic acid potentiometrically.
2. Determination of percentage composition of a given acid mixture conductometrically.
3. Determine the equivalent conductance of a strong electrolyte at several dilutions and hence verify the Onsager's equation.
4. Determination of amount of CuSO_4 present in the given solution using Spectrophotometer.
5. Conductometric titration of a weak acid with weak base and a strong acid with weak base.

Books Recommended:

1. Frindeleys practical physical chemistry by B. P. Levitt.
2. Advanced practical physical chemistry by G. B. Yadhav.
3. Experiments in practical physical chemistry by Shomaker.
4. Systematic experimental physical chemistry by S. W. Rajbhoj and T. K. Chondeker.
5. Senior physical chemistry practicals by Khosla et. al.
6. Experiments in physical chemistry by Daniel alberty and Williams's et.al.

SCT 1.1: ANALYTICAL CHEMISTRY-I

Treatment of quantitative results, Gravimetry, Titrimetry, Ion exchange and Solvent extraction (64 Hours)

UNIT-I

Statistical Treatment of Analytical Data and Sampling: Limitations of analytical methods. Classification of errors-systematic errors-sources, effects and their reduction. Random errors-sources and distribution. Accuracy and precision. Measures of central tendency and variability. Reliability of results-confidence interval. Comparison of results-Student's t-test, comparing the two means and standard deviations: F-test, t-test and paired t-test. Rejection of a result Q-test. Number of replicate determinations. Control charts. Correlation and regression-correlation coefficient, linear regression, errors in slope and intercept, error in the estimate of concentration. Detection limits, sampling and sample handling-representative sample, sample storage, sample pretreatment and sample preparation. Hazards in sampling. Quality in analytical laboratories-quality control and quality assurance and accreditation system. [16 Hours]

UNIT-II

Gravimetric analysis: General principles, stoichiometry, calculation of results from gravimetric data. Properties of precipitates. Nucleation and crystal growth, factors influencing completion of precipitation. co-precipitation and post-precipitation, purification and washing of precipitates. Precipitation from homogeneous solution, a few common gravimetric determinations-chloride as silver chloride, sulphate as barium sulphate, aluminium as the oxinate and nickel as dimethyl glyoximate.

Acid base titrations: Principles of titrimetric analysis, titration curves for strong acid-strong base, weak acid-strong base and weak base-strong acid titrations, poly protic acids, poly equivalent bases, determining the equivalence point-theory of acid base indicators, colour change range of indicator, selection of proper indicator.

Applications of acid-base titrations: Determination of nitrogen, sulphur, ammonium salts, nitrates, and nitrites, carbonates and bicarbonates, and organic functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carboxyl groups, air pollutants like SO₂.

Acid-base titrations in non-aqueous solvents: Role of solvent in Acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines. [16 Hours]

UNIT-III

Precipitation titrations: Titration curves, feasibility of precipitation titrations, factors affecting shape-titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

Complexometric titrations: Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA-acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA titration curves, effect of other complexing agents, factors affecting the shape of titration curves-completeness of reaction, indicators for EDTA titrations-theory of common indicators, titration methods employing EDTA-direct, back and displacement titrations. Indirect determinations,

titration of mixtures, selectivity, masking and demasking agents, typical applications of EDTA titrations-hardness of water, magnesium and aluminum in antacids, magnesium, manganese and zinc in a mixture, titrations involving unidentate ligands-titration of chloride with Hg^{2+} and cyanide with Ag^+ . [16 Hours]

UNIT-IV

Ion Exchange methods: Introduction, Definitions, principle, cation exchangers, anion exchangers and their synthesis, regeneration, ion exchange columns used in chromatographic separation, selection of suitable systems, ion exchange capacity, ion exchange technique: Batch method, column method. Application of ion exchangers: separation of similar ion from one another, removal of interfering radicals, softening of hard water, complete demineralization of water, separation of lanthanides, separation of actinides, purification of organic compounds extracted in water, separation sugars, separation of amino acids, preparation of pure reagents, hydro metallurgy.

Solvent extraction: General discussion, principle, factors affecting solvent extraction, quantitative treatment of solvent extraction, synergistic extraction, ion association complex, extraction reagents: acetyl acetone, 8-hydroxy quinoline, Dimethyl glyoxime, 1-nitroso-2-naphthal, cupferron, dithiazole, sodium diethyl dithiocarbamate, ammonium pyrrolidinedithiocarbamate, tri-*n*-butylphosphate, poly (macrocylic) compounds, cetyltrimethyl ammonium bromide. Some practical considerations: choice of the solvent, extraction, stripping, completion of the analysis, automation of solvent extraction. Some applications: Determination of iron as 8-hydroxy quinolate, determination of lead by dithiazone method, determination of molybdenum by thiocyanate method. [16 Hours]

Books Recommended:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint.2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Instrumental Methods of Chemical Analysis, Chatwal and Anand - 5thEdn.
7. Chromatography, E. Heftman (ed). 5th Edition, Part A. and Part B. Elsevier Science Publishers, 1992.
8. Chromatography Today, C. F. Poole & S. K. Poole, Elsevier Science Publishers (1991).
9. Analytical chemistry by Alka L. Guptha, A pragathi edition.
10. Separation methods by M. N. Sastri, Himalaya publisher.
11. Modern analytical chemistry, Harvey, Harcourt publishers.
12. An introduction to chromatography, theory and practical, V. K Srivastav and K. K. Srivastav
13. Instrumental methods of chemical analysis, Gurudeep R Chatwal, Sharma K Anand. Himalaya publishers.
14. Chromatography by B. K. Sharma, GOEL publishers.
15. Basic concepts of Analytical chemistry, S. M. Khopakr, New Age International publications 3rd edition.

SCP 1.1 ANALYTICAL CHEMISTRY PRACTICAL-I

(64 Hours)

PART-I

1. Determination of total hardness of water.
2. Analysis of sodium carbonate and sodium bicarbonate in baking soda by acid-base titration.
3. Determination of acid content of vinegar.
4. Determination of magnesium and aluminum in antacid tablets by EDTA titrations.
5. Determination of chloride in solid samples by Mohr's method.
6. Estimation of Ni^{+2} as Ni-DMG.
7. Estimation of Al^{+3} as oxinate.

Books Recommended:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint.2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Experiment on water pollution, D. I. Williams and D. Anglesia, Wayland, Publishers Ltd, England, 1978.
7. Laboratory manual of organic chemistry by Raj K. Bansal. Wiley eastern limited.

SCT 1.2: PHARMACEUTICAL CHEMISTRY

(64 Hours)

UNIT-I

Cell Structure and Functions

Structure of prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview of metabolism process-catabolism and anabolism. ATP the biological energy currency; cyclic AMP; their biological significance. Origin of life-Unique properties of carbon, chemical evolution and rise of living system. Introduction of bio-macromolecules, building blocks of bio-macromolecules.

Pharmaceutical Microbiology

Isolation, cultivation, identification and classification of microorganisms, microorganism diseases, microbial ecology related to manufacturing process, disinfection, sterilization, preservation, microbial spoilage of formulated products, detection of microorganisms in raw materials and manufacturing items. [16 Hours]

UNIT-II

Drug Design– A Rational Approach

Introduction, concept of lead compound-crude drugs and analogues, factors governing drug design, rational approach to drug design, tailoring of drug. A brief introduction to quantitative structure activity relationship (QSAR), prodrug, combinatorial chemistry and computer aided drug design (CADD). Molecular modelling, Molecular mechanics, Molecular dynamics, Modelling of known and unknown receptors. [16 Hours]

UNIT-III

DRUG METABOLISM: Absorption, Distribution, Elimination, Dissolution of drugs and factors affecting these properties. Passage of drugs across biological membrane, Construction of diffusion equation for complex systems, Factors influencing drug metabolism and drug availability. Phase-I reaction – active and inactive metabolites and Phase-II reaction (Discuss Phase I & Phase-II reactions by taking examples from various categories of drug molecules).

PHARMACOKINETICS: Pharmacokinetics of one compartment and two compartment models, some applications of pharmacokinetics. Principle of multidosing, dose adjustment and bioavailability. Drug interactions-illustrate with examples. [16 Hours]

UNIT-IV

Industrial Pharmacy

Manufacturing, Quality control, Standard presentation, Labelling, Packing and Storage of formulations belonging to categories of Solid (Tablets and Capsules), Liquids (Syrup, Emulsions, Suspensions), Parental dosage forms, Acts and schedules in Pharmacy.

Introduction to Industrial Processing, Extraction: Methods of extraction, Continuous extraction. Distillation: Theory of distillation, azeotropic distillation, steam distillation, extractive distillation. Drying: Classification and types of dryers, factors affecting drying, tray dryer, freezer dryer, fluidized bed dryer, freezer dryer, spray dryer. [16 Hours]

Books Recommended:

1. Burger's Medicinal Chemistry, Ed, M. E. Wolff, Wiley-interscience.
2. Principles of Medicinal Chemistry, W.O.Foye, Varghese publishing house, Dadar, Mumbai.
3. Drug Design Dr. V. M. Kulkarni and Dr. K. G. Bothara, Nirali prakashan.
4. Wilson and Gisvold's Text book of Organic, Medicinal and Pharmaceutical Chemistry.
5. Principles of Bio-Chemistry, A. L. Lehninger, Worth publishers.
6. Medicinal Chemistry by Ashutosh kar, Wiley-Eastern Ltd.
7. Introduction to Drug Design- H. J. Smith and H. Williams.
8. Bentley's text book of Pharmaceutics-P. A. Rawling.
9. Pharmacological basis on therapeutics-Goodman and Gilman.
10. Industrial Pharmacy-Lachman.
11. Medicinal Chemistry by Hrikishan Singh.

SCP 1.2: PHARMACEUTICAL CHEMISTRY PRACTICAL

(64 Hours)

1. **Assays:** Aspirin, Paracetamol, Analgin, Ibuprofen, Chloroquin, Calcium gluconate, Pheneramine maleate, Suphadiazine Ascorbic acid Isonicotinic acid, Benzyl penicillin, Metronidazole, Dapsone.
2. **Preparation of Medicinally Important Compounds OR Intermediates Required for Synthesis of Drugs:**
 - a) Benzimidazole from o-phenylene diamine.
 - b) PABA from p-nitro benzoic acid
 - c) Sulphacetamide from Sulphanilamide
 - d) INH from Isonicotinic acid
 - e) Benzocaine
 - f) Coumarin derivatives
3. **Instrumental Methods for Estimation of the Following:**
 - a) Creatinine
 - b) Uric acid
 - c) Chloramphenicol
 - d) Cholesterol

Books Recommended:

1. Vogel's Text book of Practical Organic Chemistry
2. Commercial Methods of Analysis by F. D. Snell & B. M. Betteff
3. Medicinal Chemistry Vol-I, Vol-II & Vol-III by Burger
4. Indian Pharmacopeia
5. British Pharmacopeia

SEMESTER-II

HCT 2.1: INORGANIC CHEMISTRY – II

Non-transition and Transition Metal Chemistry, Metal Atom Clusters, Organometallic Chemistry

(64 Hours)

UNIT – I

Chemistry of Non-Transition Elements

Polymorphism of Carbon, Phosphorous and Sulfur, Synthesis, Properties and Structures of Boranes.; Carboranes and Metallocarboranes; Silicones, Phosphazones, Sulfur-nitrogen ring compounds; Peroxy acids of nitrogen, phosphorous, sulfur & halogens; Interhalogen compounds; Chemistry of noble gas compounds (Xenon fluorides). [16 Hours]

UNIT – II

Metal Atom Clusters:

Low valency and high valency clusters; low nuclearity (tri and tetra atomic) carbonyl clusters (LNCCs) and high nuclearity carbonyl clusters (HNCCs); Isoelectronic and Isolobal relationships; structural patterns of high nuclearity carbonyl clusters; Electron count schemes of HNCCs – Wade's rules; the capping rule; HNCCs of Fe, Ru and Os group, Co, Rh and Ir group, Ni Pd and Pt group; Octahedral metal halide and chalcogenide clusters; Chevrel phases; Compounds with metal-metal multiple bonds-Edge sharing, Face sharing bioctahedra; tetragonal prismatic and trigonal antiprismatic structures; Quadruple bond; One dimensional solids. [16 Hours]

UNIT – III

Reaction Mechanism of Transition Metal Complexes:

Energy profile of a reaction, reactivity of metal complexes, Inert and labile complexes. Substitution reactions in octahedral and square planar complexes and other complexes. Trans effect, mechanism of substitution reactions. Redox reactions, electron transfer reactions, mechanism of one electron, two electrons, complimentary & non-complimentary reactions, outer sphere and inner sphere type of reactions. [16 Hours]

UNIT – IV

Organometallic Chemistry:

18 electron and 16 electron rules; reactions of metal alkyls, aryls and olefin complexes. Reactions of organometallic complexes-substitution reactions, oxidative addition and reductive elimination reactions; insertion and elimination reactions.

Catalysis by Organometallic complexes: Alkene hydrogenation (Wilkinson's catalyst),; Hydroformylation; Water-Gas shift reaction; Monosanto acetic process; The Wacker process; Synthetic gasoline and Ziegler-Natta catalysis. [16 Hours]

Books Recommended:

1. Chemistry of Elements – N.N.Greenwood and Earnshaw - Pergamon
2. Concise Inorganic Chemistry - J.D. LEE, ELBS
3. Advanced Inorganic chemistry - F.A.Cotton and Wilkinson, John-Wily and sons
4. Chemistry of the Elements– N.N.Greenwood and A. Eamshaw, Pergaman
5. Inorganic Chemistry, Principles and Reactivity –J.E.Huheey, Harper and Row
6. Modern aspects of Inorganic Chemistry – H.J. Emuleus and A.G.Sharpe ELBS
7. Theoretical Inorganic Chemistry- M.C.Day, Jr. an J.Selbin East-West press
8. Concept and Model's in Inorganic Chemistry – Dougals, McDanial and Alexander John Wiley and sons.
9. Inorganic Qualitative Analysis- A.I.Vogel ELBS
10. Fundamentals of Analytical Chemistry- D.A.Skoog, D.M.West and F.T.Holler, Saunder college publishing
11. Inorganic Quantitative methods- Alexeev Mir publications
12. Principles of Inorganic Chemistry – Puri, Sharms and Kalia-Shobanlal-Nagin.
13. An Introduction to Inorganic Chemistry – Purcell and Kotz-Holt-Saunders
14. Coordination Chemistry-S.F.A. Kettle.
15. Comprehensive coordination Chemistry – G. Wilkinson, R.D. Gillars and J.A.Mcclevertry, Pergamon
16. Organometallic Chemistry – principles, structure and reactivity, 3rd ed. James E Huhee 1999.
17. Organgometallic Chemistry A Unified Approach - R.C.Mehrotra, A. Singh, New age international publishers
18. Organometallic compounds - Dr. Indrajeet kumar, pragathi prakashan

HCP 2.1: INORGANIC CHEMISTRY PRACTICAL-II

(64 Hours)

a) Quantitative Analysis:

Separation and Determination of two metal ions involving volumetric and gravimetric methods from the following

- i) Fe + Ni
- ii) Cu + Fe
- iii) Ca + Fe

b) Preparation of Complexes:

- i) Chloropentammine cobalt(III) chloride
- ii) Tris (acetylacetonate) copper (II) sulphate
- iii) Mercuric tetrathicyrato cobalate (II).

Books Recommended:

1. Vogel's Text book of Quantitative Inorganic Analysis – J.Basett, R.C.Denney, G.H.Jeffery and J.Mendhaman, Longamans Green and Company Ltd.
2. Practical Inorganic Chemistry-G.Pass and H.Sutchliff, Chpman and Hall Ltd. (1968).
3. General Chemistry Experiment- A.J.Elias, University press

HCT 2.2: ORGANIC CHEMISTRY– II

(64 Hours)

UNIT-1

Reaction Mechanism:

Aliphatic Electrophilic Substitutions: Bimolecular pathways. SE^2 , SE^1 and SE^i mechanisms. Reactions involving double bond shifts.

Aromatic Electrophilic Substitutions: Halogenation, Isotope effects, Energy profile diagrams. Kinetic and Thermodynamic control.

Aromatic Nucleophilic Substitutions: $SNAr$, $SN1$ and Aryne pathways. Meisenheimer complexes, Various Nucleophilic displacement.

Addition Reactions: Electrophilic addition across alkenes and dienes.

Substitution Reactions: Mannich Reactions, Chloromethylation and Vilsmeier-Haack reaction.

Elimination reactions: E_2 , E_1 , E_1C_B pathways, Stereochemistry, Hydrolysis of Esters, Mechanism: BA_{C2} and AA_{C2} . [16 Hours]

UNIT-II

Advanced Stereochemistry:

Prochirality: Homotopic, Enantiotopic and Diastereotopic atoms, groups and faces. Optical activity due to molecular dissymmetry: Allenes, Spiranes, Biphenyles, Atropisomerism, Molecular Crowding.

Conformational Analysis of Cyclohexane. Cis and Trans Decalins. 1,2 and 1,3 disubstituted Cyclohexane.

Stereo selective synthesis: Classification, terminology, Cram's rule (open chain, cyclic and chelet and dipolar models), Prolog's rule and principle of stereoselectivity. Strategy of stereoselective synthesis. Acyclic stereoselection. Enantioselective synthesis, diastereoselection in cyclic compounds. Catalytic hydrogenation, alkylation. Stereoselective formation of double bond, stereoselective cyclisation of polyenes. [16 Hours]

UNIT-III

Chemistry of Heterocycles:

Nomenclature, Structure, Reactivity, Synthesis and Chemical reactions of Indole, Quinoline, Isoquinolines, Pyrazole, Imidazole, Benzimidazole, α -Pyrone, γ -Pyrone, Coumarins, Chromones and Flavones. [16 Hours]

UNIT-IV

Oxidations, Reductions and Reagents:

Oxidations: Oxidations of Organic compounds using $KMnO_4$, OsO_4 , HIO_4 , SeO_2 , $Pb(OAc)_4$, and Oppenauer oxidation.

Reductions: Reductions of Organic compounds using the following reagents: $LiAlH_4$, $NaBH_4$, Carbonyl reduction. Birch reduction and Wolf-Kishner reduction.

Reagents: Methods of preparation, mechanism of reaction and applications of the following reagents in Organic synthesis.

a) DCC b) 1,3-Dithiane c) LDA d) DDQ e) Wilkinson catalyst f) Crown ethers g) Maryfield resins. [16 Hours]

Books Recommended:

1. Advanced Organic Chemistry Part A and B- F. A. Carey and R. J. Sundberg, 4th edition, Plenum publishers (2000).
2. Advanced Organic Chemistry, Reactions, Mechanism and Structure- J. March, Third Edition, Wiley-Eastern Ltd., (2004).
3. Guide Book to Mechanism in Organic Chemistry-Peter Sykes, Orient-Longman (1985).
4. Stereochemistry of Organic compounds, Principles and Applications- D. Nasipuri, Wiley Eastern Ltd. (1992).
5. Organic Chemistry Vol-II, III- S. M. Mukherji, S. P. Singh and R. P. Kapoor, New Age Internt, Ltd, New Delhi.
6. Organic Chemistry Vol-I, II- I. L. Finar, 6th Edition, ELBS London (2004).
7. Heterocyclic Chemistry- T. L. Gilchrist, 3rd Edition, Pearson Education Delhi, (2005).
8. Heterocyclic Chemistry- J. A. Joule and G. F. Smith, 2nd Edition, Van Nostrand London, (1978).
9. Heterocyclic Chemistry-R. K. Bansal, 3rd Edition, New-Age International, New Delhi, 2004.
10. Stereochemistry of Organic Cmpounds, E. L. Eliel et. Al John Wiley and sons Inc.

HCP 2.2: ORGANIC CHEMISTRY PRACTICAL-II **(64 Hours)**

Qualitative analysis:

Separation of a binary mixture and identification of compounds containing two functional groups. (Any one with derivative)

Books Recommended:

1. Vogel's Textbook of Practical Organic Chemistry revised- B. S. Furniss, A. J. Hannaford, P. W. G. Smith, A. R. Tatchell, 5th Edition, Addison Wesley Longman Limited, UK, 1997.
2. A Hand book of Organic Chemistry- H. T. Clarke.
3. A Laboratory Manual of Organic Chemistry- B. B. Dey and M. V. Govindachari.
4. Experimental Organic Chemistry- L. M. Harwood and C.J.Moody, Blackwell Scientific, London, 1989.
5. Practical Organic Chemistry – W. Kemp, McGraw Hill, London, 1962.

SCT 2.1 ANALYTICAL CHEMISTRY-II

Chromatography, Emission and Absorption spectroscopic Techniques (64 Hours)

UNIT-I

Basic Concepts of Chromatography: General description, definitions, terms and parameters used in chromatography Classification of chromatographic methods. Criteria for selection of a stationary and mobile phase-nature of adsorbents, factors influencing the adsorbents, nature and types of mobile phases.

Elution chromatography: Theories, rate theory. Band broadening, eddy diffusion, longitudinal diffusion and resistance to mass transfer. Column efficiency, plate theory and rate theory approach. Van Deemter's equation and its modern version. Inter relationship- capacity factor, selectivity factor and column resolution.

Thin layer Chromatography: Principle, methodology, determination of R_f value and its significance, variables that affect R_f value and applications. [16 Hours]

UNIT-II

Paper chromatography (PC): Definitions, theory and principle, techniques: one, two-dimensional and circular PC, mechanism of separation, structure of cellulose and types of paper, methodology-preparation of sample, choice of solvents, location of spots and measurement of R_f value, factors affecting R_f value, advantages and applications.

Gas chromatography (GC): Principle, comparison of GSC and GLC, instrumentation, columns-packed and tubular, study of detectors-thermal conductivity, flame ionization, electron capture and mass spectrometry, factors affecting separation, applications, GC-MS and its applications.

High pressure liquid chromatography (HPLC): Apparatus, pumps, column packing, characteristics of liquid chromatography detectors-UV, IR, refractometer and fluorescence detectors, advantages and applications, HPTLC and its applications.

Exclusion chromatography: Theory and principle of size exclusion chromatography, experimental techniques for gel-filtration chromatography (GFC) and gel-permeation chromatography (GPC), materials for packing-factors governing column efficiency, methodology and applications.

Affinity chromatography: Definitions, separation mechanism-matrices, matrix activation, role of spacer arms and applications [16 Hours]

UNIT-III

Ultracentrifugation: Principle, sedimentation constant, sedimentation equilibrium, sedimentation velocity, methodology and applications.

Electrophoresis: Overview, types, the basic of electrophoretic separations, migration rates and plate heights, electro osmotic flow, instrumentation, capillary zone electrophoresis, capillary gel electrophoresis, capillary isoelectrophoresis, capillary isoelectric focusing.

Capillary electrochromatography: Packed column electrochromatography, micellar electro kinetic electro chromatography, capillary electro chromatography and applications.

Supercritical fluid chromatography: Properties of supercritical fluids, instrumentation and operating variables, comparison of supercritical to other types of chromatography, applications.

Supercritical fluid extraction: Advantages of supercritical fluid extraction, instrumentation, supercritical fluid choice, off-line and on-line extractions, typical application of supercritical fluid extraction. [16 Hours]

UNIT-IV

Flame photometry and Atomic absorption spectrometry: Energy level diagram – atomic absorption spectra. Flame characteristics, flame atomizers and electrothermal atomization. Comparison of spectral interferences, chemical and physical interferences in Flame Photometry and AAS. Use of organic solvents. Quantitative techniques – calibration curve procedure and the standard addition technique. Typical commercial instruments for Flame Photometry and AAS, Applications. Qualitative analysis and quantitative evaluations. Relative detectabilities of atomic absorption and flame emission spectrometry.

Inductively coupled plasma-Atomic emission spectroscopy: Limitations of flame emission spectroscopy, principles of plasma spectroscopy, process of atomisation and excitation, plasma as an excitation source, inductively coupled plasma source, ICP-AES instrumentation, applications of plasma spectroscopy, comparison of ICP-AES with AES, comparison of AFS, AAS and ICP-AES. [16 Hours]

Books Recommended:

1. Fundamental of Analytical Chemistry. D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry. G.D. Christian, 5th ed., 2001 John Wiley & sons, Inc, India
3. Quantitative analysis: R. A. Day and A. L. Underwood, 6th edition, 1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Text Book of quantitative chemical analysis, J. Mendham, R.C. Denney, J. D. Barnes and M. J. K. Thomas, 6th edition, Third Indian reprint 2003, Pearson education Pvt. Ltd., New Delhi.
5. Analytical chemistry principles, John H. Kennedy, 2nd edition, saunders college publishing, California, 1990.
6. Analytical chemistry, Alka. L. Gupta, A Pragati edition,
7. Introduction to chromatography, theory and practice by V. K. Srivastava and K. K. Srivastava., S. Chand and Co. Ltd.
8. Chromatography by B. K. Sharma, Goel publishing house, Meerut.
9. An introduction to practical biochemistry, 3rd edition by David T Plummer., Tata McGraw-Hill publishing company limited.
10. Principles of instrumental analysis, 5th edition, skoog, Holler and Nieman, Harcourt Asia PTE. LTD.
11. Modern analytical chemistry by David Harvey, McGraw-Hill publishing company limited.
12. Modern methods of chemical analysis, P. L. Descok, L. D. Shields, T. Carins and F. G. Milliam (II edn).
13. Industrial methods of chemical analysis, F. D. sneel (Encyclopedia)

14. Instrumental methods of analysis.L.L.Merutt, J.A.Dean, F.A., settle 6thEdn. (Van Nostnoand).
15. Principles of Instrumental Analysis.D.S.Kooj (Sander Colley).
16. Fundamentals of Analytical Chemistry.Skoog, West, Holler, 7thEdn. Harcourt Agra. Publication Harcourt College Publishers.
17. Principles of instrumental analysis.Skoog, Haller, Nieman, 5thEdn. Harcourt Agra. Publication Harcourt College Publishers.
18. Text Book of quantitative chemical analysis.A.I. Vogel (ELBS)
19. Standard Methods of chemical analysis.Wekin E. J.
20. Instrumental methods of chemical analysis, by Gurudeep R. Chatwal and Sham. K. Anand. Himalaya Publishing House.
21. Separation Chemistry. by R.P.Budhiraj, New age International(P) Limited, Publisher
22. Basic concepts of Analytical Chemistry, S.M. Khopkar, New age International(P) Limited, Publisher

SCP 2.1 ANALYTICAL CHEMISTRY PRACTICAL-II

(64 Hrs)

1. Thin layer chromatographic separation of nitro anilines
2. Separation of metal ions of group IV by ascending chromatography.
3. Separation of metal ions of group I by ascending chromatography.
4. Separation of the components in the indicator by TLC/ Paper chromatography.
5. Separation of amino acids by paper chromatography.
6. Determination of Molybdenum by solvent extraction using KSCN as reagent.
7. Determination of iron by solvent extraction using 8-hydroxy quinoline as reagent.

Books Recommended:

1. Fundamental of Analytical Chemistry. D.A. Skoog, D. M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Vogel's Text Book of quantitative chemical analysis, J., Mendham, R.C. Denney, J. D. Barnes and M. J. K. Thomas, 6th edition, Third Indian reprint 2003, Pearson education Pvt. Ltd., New Delhi.
3. Introduction to chromatography, theory and practice by V. K. Srivastava and K. K. Srivastava., S. Chand and Co. Ltd.
4. Chromatography by B. K. Sharma, Goel publishing house, Meerut.

SCT 2.2: PHYSICAL CHEMISTRY-II

(64 Hours)

UNIT-I

Chemical Dynamics-2:

Chain reactions, Examples of chain reactions, General aspects of Chain reactions, elementary and complex reactions - parallel, consecutive and opposite reactions. Chain initiation, chain propagation and chain termination steps. Kinetics of formation of HBr, HI, HCl. Pyrolysis of acetylaldehyde, decomposition of ethane, ozone and N_2O_5 molecules. Kinetics of inhibition, chain transfer, kinetics of branching chain reaction and explosion limits.

Kinetics of polymerization: Kinetics of linear step(Condensation) polymerization, Kinetics of condensation polymerization, Free radical, cationic and anionic polymerization and Co-polymerization. [16 Hours]

UNIT-II

Diffraction Studies:

X-ray diffraction: Crystallographic systems, Space lattice, Reciprocal lattice, Bravais lattice, Unit cell, Weiss indices, Miller indices, Bragg's equation, Single crystal rotation methods, Powder methods, Structure factor and determination of molecular parameter. Fourier series, Fourier refinement. Phase problem.

Electron diffraction: Introduction, Scattering intensity versus scattering angle, Wierl's equation, Radial distribution function, Refinement radial distribution function, Rotation sector methods.

Neutron diffraction: Introduction, Scattering of neutrons by solids and liquids. Difference between neutron and X-ray diffraction. [16 Hours]

UNIT-III

Material chemistry and Nano materials:

Solid state reactions: general principles experimental procedures, co-precipitations as a precursor to solid state reactions, Preparation of crystalline and amorphous solids.

Ceramics: General aspects of electronic and magnetic ceramics, structure of spinels and garnets, high temperature super conductor, layer compounds. A brief discussion of thermal, electrical, dielectric, magnetic and optical properties of ceramic materials.

Composites: general characteristics and classification of composite materials. Dispersion strengthened composite materials. Fibre - reinforced composites. Nanocrystalline phase, preparation procedures, special properties and their applications.

Speciality solid materials (Fashionating solids): Aspects of material, fast ion conductor, storage material, organic material, Langmuir's Blodgett films, Liquid crystals, intercalation compounds (Graphite, dichalcogenides, transition metals). [16 Hours]

UNIT-IV

Atomic spectra and atomic structure:

Review of hydrogen spectrum, hydrogen like spectra. Atomic spectra of alkali and alkali like elements. Atomic spectra of helium, atomic spectra of alkaline earth and alkaline earth like elements, prohibition of inter combination, Mosely lines, Multiplet structure, simple and compound doublets and triplets. Space quantization, Stern-Gerlach experiment, Normal Zeeman effect, Anomalous Zeeman effect, Paschen Back effect, Stark effect. Comparison between Stark and zeeman effect

[16 Hours]

Books Recommended:

1. Physical Chemistry by P. W. Atkins.
2. Introduction to kinetics of chemical chain reactions by Gimblett (TMH).
3. Chemical kinetics by Laidler.
4. X-ray diffraction by Clug and Alexander.
5. Elements of X-ray diffraction by Cullity.
6. Determination of molecular structure by P. J. Wheatley.
7. An Introduction to X-ray Cryatallography by M. M. Woolson.
8. Atomic structure and Atomic spectra by G. Herzberg.
9. Introduction to Atomic spectra by White.
10. Polymer science by Gowrikar.
11. Polymer chemistry by Flory.
12. Advanced polymer chemistry - A problem solving guide by Manas Chanda.
13. Physical Chemistry of macromolecules by D. D. Deshpande.

SCP 2.2: PHYSICAL CHEMISTRY PRACTICAL-II

(64 Hours)

PART-I

1. Determination of limiting equivalent conductance of a weak electrolyte.
2. Determination of Concentration of given solution by spectrophotometer (Cu^{2+} and NH_3).
3. Determination of optical rotation and rate constant by polarimeter.
4. Determination of standard electrode potential by potentiometry.
5. Determination of dissociation of constant of dibasic acid potentiometrically.

PART-II

1. Determination of rate constant and order of reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI.
2. Determination of distribution coefficient for benzene, benzoic acid and water system.
3. Construction of phase diagram for three component system.
4. Determine the equilibrium constant for the reaction $\text{KI} + \text{I}_2 = \text{KI}_3$ by distribution method.
5. Determination of molecular weight of a given solute by Beckmann thermometer.

Books Recommended:

1. Frindeleys Practical physical chemistry by B. P. Levitt.
2. Advanced practical physical chemistry by G. B. Yadhav.
3. Experiments in practical physical chemistry by Shomaker.
4. Systematic experimental physical chemistry by S.W. Rajbhoj and T K Chondeker.
5. Senior physical chemistry practicals by Khosla et. al.

OET 2.1: CHEMISTRY-I (Analytical Chemistry)

Treatment of quantitative results, Gravimetry, Titrimetry and Basic concepts of chromatography (64 Hours)

UNIT-I

Statistical Treatment of Analytical Data and Sampling: Limitations of analytical methods. Classification of errors-systematic errors-sources, effects and their reduction. Random errors-sources and distribution. Accuracy and precision. Measures of central tendency and variability. Reliability of results-confidence interval. Comparison of results-Student's t-test, comparing the two means and standard deviations F-test, t-test and paired t-test. Rejection of a result Q-test. Number of replicate determinations. Control charts. Correlation and regression-correlation coefficient, linear regression, errors in slope and intercept, error in the estimate of concentration. Detection limits, Sampling and sample handling-representative sample, sample storage, sample pretreatment and sample preparation. Hazards in sampling. Quality in analytical laboratories-quality control and quality assurance, accreditation system. [16 Hours]

UNIT-II

Gravimetric analysis: General principles, stoichiometry, calculation of results from gravimetric data. Properties of precipitates. Nucleation and crystal growth, factors influencing completion of precipitation. Co-precipitation and post-precipitation, purification and washing of precipitates. Precipitation from homogeneous solution, a few common gravimetric determinations-chloride as silver chloride, sulphate as barium sulphate, aluminium as the oxinate and nickel as dimethyl glyoximate.

Acid base titrations: Principles of titrimetric analysis, titration curves for strong acid-strong base, weak acid-strong base and weak base-strong acid titrations, poly protic acids, poly equivalent bases, determining the equivalence point-theory of acid base indicators, colour change range of indicator, selection of proper indicator.

Applications of acid-base titrations: Determination of nitrogen, sulphur, ammonium salts, nitrates, and nitrites, carbonates and bicarbonates, and organic functional groups like carboxylic acid, sulphonic acid, amine, ester, hydroxyl, carboxyl groups, air pollutants like SO₂.

Acid-base titrations in non-aqueous solvents: Role of solvent in Acid-base titrations, solvent systems, differentiating ability of a solvent, some selected solvents, titrants and standards, titration curves, effect of water, determining the equivalence point, typical applications-determination of carboxylic acids, phenols and amines. [16 Hours]

UNIT-III

Precipitation titrations: Titration curves, feasibility of precipitation titrations, factors affecting shape-titrant and analyte concentration, completeness of the reaction, titrants and standards, indicators for precipitation titrations involving silver nitrate, the Volhard, the Mohr and the Fajan's methods, typical applications.

Complexometric titrations: Complex formation reactions, stability of complexes, stepwise formation constants, chelating agents, EDTA-acidic properties, complexes with metal ions, equilibrium calculations involving EDTA, conditional formation constants, derivation of EDTA

titration curves, effect of other complexing agents, factors affecting the shape of titration curves-completeness of reaction, indicators for EDTA titrations-theory of common indicators, titration methods employing EDTA-direct, back and displacement titrations. Indirect determinations, titration of mixtures, selectivity, masking and demasking agents, typical applications of EDTA titrations-hardness of water, magnesium and aluminum in antacids, magnesium, manganese and zinc in a mixture, titrations involving unidentate ligands-titration of chloride with Hg^{2+} and cyanide with Ag^+ . [16 Hours]

UNIT-IV

Basic Concepts of Chromatography: General description, definitions, terms and parameters used in chromatography Classification of chromatographic methods. Criteria for selection of a stationary and mobile phase-nature of adsorbents, factors influencing the adsorbents, nature and types of mobile phases.

Elution chromatography: Theories, rate theory. Band broadening eddy diffusion, longitudinal diffusion and resistance to mass transfer. Column efficiency, plate theory and rate theory approach. Van Deemter's equation and its modern version. Inter relationship- capacity factor, selectivity factor and column resolution.

Thin layer Chromatography: Principle, methodology, determination of R_f value and its significance, variables that affect R_f value and applications. [16 Hours]

Books Recommended:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 Prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint. 2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Instrumental Methods of Chemical Analysis, Chatwal and Anand - 5th Edn.
7. Chromatography, E. Heftman (ed). 5th Edition, Part A. and Part B. Elsevier Science Publishers, 1992.
8. Chromatography Today, C. F. Poole & S. K. Poole, Elsevier Science Publishers (1991).
9. Analytical chemistry by Alka L. Gupta, A pragathi edition.
10. Separation methods by M. N. Sastri, Himalaya publisher.
11. Modern analytical chemistry, Harvey, Harcourt publishers.
12. An introduction to chromatography, theory and practical, V. K. Srivastav and K. K. Srivastav
13. Instrumental methods of chemical analysis, Gurudeep R Chatwal, Sharma K Anand. Himalaya publishers.
14. Chromatography by B. K. Sharma, GOEL publishers.
15. Basic concepts of Analytical chemistry, S. M. Khopkar, New Age International publications 3rd edition.

OEP 2.1: CHEMISTRY PRACTICAL-I (Analytical Chemistry) (64 Hours)

PART-I

1. Determination of total hardness of water.
2. Analysis of sodium carbonate and sodium bicarbonate in baking soda by acid-base titration.
3. Determination of acid content of vinegar.
4. Determination of magnesium and aluminum in antacid tablets by EDTA titrations.
5. Determination of chloride in solid samples by Mohr's method.
6. Estimation of Ni^{+2} as Ni-DMG.
7. Estimation of Al^{+3} as oxinate.

Books Recommended:

1. Fundamental of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch 8th edition, 2005, Saunders College Publishing, New York.
2. Analytical Chemistry, G.D. Christian, 5th ed., 2001 John Wiley & Sons, Inc, India.
3. Quantitative Analysis, R.A. Day and A.L. Underwood, 6th edition, 1993 prentice Hall, Inc. New Delhi.
4. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, 6th edition, Third Indian Reprint.2003 Pearson Education Pvt. Ltd., New Delhi.
5. Analytical Chemistry Principles, John H. Kennedy, 2nd edition, Saunders College Publishing, California, 1990.
6. Experiment on water pollution, D. I. Williams and D. Anglesia, Wayland, Publishers Ltd, England, 1978.
7. Chromatography by B. K. Sharma, GOEL publishers.
8. Laboratory manual of organic chemistry by Raj K. Bansal. Wiley eastern limited.

OET 2.2: CHEMISTRY-II (Physical Chemistry)

(64 Hours)

UNIT - I

Quantum Chemistry:

A brief review of black body radiation, Photoelectric effect, Compton effect, de-Broglie's hypothesis, Heisenberg's uncertainty principle., Concept of operator - Addition, Subtraction, Multiplication of operators, Commutative, Linear, Del, Hermitian operators and their properties , Hamiltonian operators, eigen values and Eigen function. Postulates of quantum mechanics Schrödinger wave equation - wave function and its interpretation, elementary application to a particle in one dimensional box, particle in a ring and hydrogen atom. One dimensional harmonic oscillator

Conditions for orthogonality and normalization of wave functions Kroneckers delta. Criteria for the formation of atomic and molecular orbitals: Paulies exclusion principle. Concept of σ , σ^* , π , π^* orbitals with characteristics. Hybrid orbitals. Comparison of M.O and V B. [16 Hours]

UNIT - II

Electrochemistry and Thermodynamics:

Activity and Activity co-efficient, Mean activity co-efficient, Debye-Huckle limiting law (qualitative aspect only) and assumptions. Ionic strength, thickness of ionic atmosphere. Basic concept of acids and bases, pH, pKa, pKw. Buffer action and capacity. Buffer solutions. Handerson Hassalback equation and its application in preparation of buffer. Importance of buffer in biological system.

Brief resume of concepts of laws of thermodynamics. Free energy, chemical potential and entropy. Gibb's-Helmholtz equation, Gibb's-Duhem and Maxwell's relation. Fugacity and its variation and determination of Duhem-Margulus Equation and its application to thermodynamics of ideal and non-ideal solutions. [16 Hours]

UNIT - III

Polymer Chemistry:

Review of polymers, Basic concepts and classification of polymers - Monomer, Repeat units, Linear, Branched, Cross Linked, Straight, Copolymers and Networks and interpenetrating networks(IPN). Degree of polymerization. Molecular weight distribution - Average molecular weight concepts, Number Average, Weight Average, Viscosity Average and Z - Average molecular weights. Determination of molecular weights, Osmotic pressure method, viscosity method, light scattering (Debye and Zimm plots), Ultra centrifugation method, Polydispersity and molecular weight distribution, Practical significance of polymer molecular weight, Glass transition temperature (Tg) and Melting point and relation between them. Commercial importance of polymers. Size of Polymer molecules. [16 Hours]

UNIT - IV

Chemical Dynamics-1:

A brief review of basic concepts and terminology in reaction kinetics. Methods of determining rate laws. Steady state approximation, Arrhenius equation. Collision state theory for bimolecular reaction rates, Transition state theory. Comparison between collision and transition state theories.

Lindemann and RRKM theories of unimolecular reaction rates. Concepts and significance of energy of activation.

Dynamics in solution: Ionic reactions, effect of ionic strength. Primary and secondary salt effects. Dynamics of Fast reactions, Relaxation methods, Flow methods (stopped flow and plugged flow), Flash photolysis methods. **[16 Hours]**

Books Recommended:

1. Molecular Quantum Chemistry P.W Atkins
2. Problems in Quantum Mechanics by G. L. Squires.
3. Introduction to Quantum Chemistry by A. K. Chandra, 4th Edn. TMH New Delhi.
4. Valence by C. A. Coulson.
5. Physical Chemistry by P. W. Atkins, ELBS London 1990.
6. Quantum Chemistry by Ira N. Levine, Prentiss Hall of India, New Delhi, India.
7. Quantum Chemistry by R. K. Prasad.
8. Electrochemistry by S. Glasstone.
9. Modern Electrochemistry by S. Bockris and A K N Reddy, Vol. 1 and 2, Butterworth London, 2006.
10. Thermodynamics by L. M. Koltz and R. M. Rosenberg.
11. An introduction to Chemical Thermodynamics by R. P. Rastogi and S. S. Mishra, Vikas publishing house Pvt limited, New Delhi.
12. Chemical Kinetics by K. J. Laidler, Pearson edition.
13. Polymer science by Gowrikar, New Age Pvt Limited publishers, Chennai.
14. Polymer chemistry by Flory.
15. Polymer chemistry by A. Tager.
16. Introduction to polymer chemistry Billmayer(Jr)

OEP 2.2: CHEMISTRY PRACTICAL – II (Physical Chemistry) **(64 Hours)**

PART-I

1. Determination of rate constant and energy of activation of a first order reaction.
2. Comparison of acid strengths.
3. Determining adsorption isotherm.
4. Determination of Molecular weight of polymer by viscometer.

PART-II

1. Determination of dissociation constant of a monobasic acid potentiometrically.
2. Determination of percentage composition of a given acid mixture conductometrically.
3. Determine the equivalent conductance of a strong electrolyte at several dilutions and hence verify the Onsager's equation.
4. Determination of amount of CuSO_4 present in the given solution using Spectrophotometer.
5. Conductometric titration of a weak acid with weak base and a strong acid with weak base.

Books Recommended:

1. Frindeleys practical physical chemistry by B. P. Levitt.
2. Advanced practical physical chemistry by G. B. Yadhav.
3. Experiments in practical physical chemistry by Shomaker.
4. Systematic experimental physical chemistry by S. W. Rajbhoj and T. K. Chondeker.
5. Senior physical chemistry practicals by Khosla et. al.
6. Experiments in physical chemistry by Daniel alberty and Williams's et.al.

SEMESTER-III

HCT 3.1: SPECTROSCOPY

(64 Hours)

UNIT-I

Electronic, Chiroptical and Vibrational Spectroscopy:

Introduction, energy considerations, experimental methods, Beer-Lambert's law. Theory and classification of electronic transitions. Terminology, substituent and solvent effects. Woodward-Fieser rules and their application in structural elucidation of organic compounds.

UV spectral study of alkenes, dienes, polyenes. Carbonyl and aromatic compounds. Steric effects, isobetic points, model compounds and charge transfer bands.

Vibrational Spectroscopy: Introduction and experimental methods. Units, notation and regions. Dispersive and FT-IR sampling techniques Complementarity of IR and Raman. Fundamental vibrations, Overtones, group frequencies, factors affecting group frequencies; Conjugation, Inductive, Resonance, steric effects. Mechanical coupling, Fermi resonance. Applications of IR In the study of H-bonding, stereoisomerism, tautomerism. Identification of the following organic compounds by IR; Alkenes,

Alkynes, Aromatic compounds, Aldehydes, Ketones, Alcohols, Thiols, Acids, Acid chlorides, Amides, Amines, Esters, Halides and Nitro compounds. **[16 Hours]**

UNIT – II

Proton Magnetic Resonance Spectroscopy:

Introduction- Magnetic properties of nucleus, Resonance condition, Field frequency Diagram, Precession of nuclei, Relaxation – CW and PFT methods. Instrumentation and sample handling, chemical shift- Mechanism of shielding and deshielding in alkanes, alkenes, alkyl halides, aromatic compounds, carbonyl compounds and annulenes. Chemical shifts of different types of organic compounds- Empirical rules.

Spin-spin coupling, geminal and vicinal coupling. Relative intensities, Karplus equation-curve, equivalence of protons-chemical and magnetic equivalence. Spin system- First order and second order patterns.

Long range coupling- Spin decoupling, CIDNP, NOE, Lanthanide shift reagents.

Protons attached to elements other than carbon exchange phenomena and temperature effect.

[16 Hours]

UNIT – III

Multi-Nuclear NMR and correlation spectroscopy:

¹³C-NMR Broad band and off resonance decoupling, methods of detection.

¹³C chemical shifts of different classes of organic compounds- Alkanes, alkyl halides, alkenes, alcohols, ethers, carbonyl compounds and aromatic compounds.

¹³C-H coupling DEPT. Introductory aspects of ¹⁵N, ¹⁹F, ³¹P-NMR. Correlation NMR spectroscopy.

Theory, pulse sequence. FT methods ¹H-¹H (Cosy) and ¹³C-H (Heterocopy) methods.

[16 Hours]

UNIT-IV

Mass Spectroscopy and Composite Problems:

Ionization and mass analysis:

Instrumentation, methods of ionization, EI, CI, DI, SI-methods.

Fragmentation: Principle, odd and even electron ions, molecular ion and base peak, nitrogen rule, meta stable ions, Isotopic effect in chloro and bromo compounds. Stevenson rule.

Fragmentation of:

i) Normal and branched alkanes, ii) Alkenes iii) benzene and its derivatives iv) Alcohols
v) Aldehydes vi) Ketones vii) Acids viii) Esters ix) Ethers x) Amines xi) Nitro compounds xii)
Halo compounds xiii) Peptides.

Mc Lafferty and Mc Lafferty+1 rearrangement, calculation of molecular formula.

Composite problems.

Applications of UV, IR, NMR, and MS methods and chemical reactions in structure elucidation
of organic compounds. [16 Hours]

Books Recommended:

1. Introduction to spectroscopy- By D. L. Paxia, G. M. Lampman and G. S. Kriz.
2. Spectroscopic identification of Organic compounds by R. M. Silverstein and F. X. Webster, 6th edn, Wiley and Sons, India Ltd (2006).
3. Organic spectroscopy- by William Kemp, 3rd edn. Palgrave Publishers (2002).
4. Organic Structural spectroscopy- by J. B. Lambert, H. F. Shurvell, D. A. Lightner and R. G. Cooks. Prentice Hall Publishers, Jersey (1998).
5. Organic spectroscopy- by D. W. Brown, A. J. Floyd and M. Sainsbury, John Wiley and sons.
6. Applications of Absorption Spectroscopy of Organic compounds-by J. R. Dyer, Prentice Hall Publishers, New Delhi (1969).
7. Interpretation of mass spectroscopy- by Mc Lafferty.
8. Organic spectroscopy- V. R. Dani, Tata McGraw Hill Ltd (1995).
9. Spectroscopic of Organic compounds- by P. S. Kalsi, 4th edn, New Delhi (2005).
10. Organic spectroscopy- by Jag Mohar (Narosa Publishing House) (2001).
11. Organic spectroscopy- by Yadav.

HCP 3.1: SYNTHESIS & SPECTRAL ANALYSIS

(64 Hours)

Synthesis / Spectral Analysis

Books Recommended:

1. Applications of computers in chemistry- Raman.
2. Computers and their applications to chemistry- Ramesh Kumar, Narosa Publishing House (2002).
3. Laboratory experiments in organic chemistry – Arun Sethi, New Age International Ltd. New Delhi (2006).
4. A Hand book of Organic chemistry – H. T. Clarke.
5. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

HCT 3.2 REACTION MECHANISMS

(64 Hours)

UNIT-I

Reactive Intermediates:

Carbocations: Formation, structure, stability and reactions of carbocations. Π -electron participation, non-classical carbocations, penta-coordinate carbonium ions.

Carbanions: Formation, stability and stereochemistry of carbanions. Carbanions and enolization, reactions and rearrangements of carbanions.

Free-radicals: Historical development, radical ions, detection of free radicals, geometry, stability and reactivity of free radicals.

Carbenes: Generations, structure and reactions of carbenes. Singlet and triplet carbenes, molecular rearrangements involving carbenes.

Enamines: Formation and reactions of enamines, Stork-enamine reaction.

Ylides: Phosphorous and sulfur ylides. Formation and synthetic applications. Nitrenes and arynes. [16 Hours]

UNIT-II

Reaction Mechanism-I:

Nucleophilic substitution at allylic and trigonal carbon atom.

Neighbouring group participation: Participation of σ , Π -bonds, intra molecular displacement by oxygen, neighbouring nitrogen, sulphur and halogen, aryl participation: the phenonium ion. Alkyl and cycloalkyl participation. Neighboring hydrogen. Trans annular rearrangement.

Neighboring group participation in addition and elimination reactions. [16 Hours]

UNIT-III

Reaction Mechanism-II:

Addition Reactions: Addition to conjugated polyenes.

Addition of nitrogen, sulfur and oxygen nucleophiles across carbonyl compounds, stereochemistry of C=O additions: Cram's rule. Hydride transfer reactions: Meerwein-Ponndorf reduction, Cannizzaro reaction.

Elimination Reactions:

Hoffmann- and Saytzeff like eliminations. Competition between substitution and elimination. Stereochemistry of elimination in non-cyclic systems. Eclipsing effect. Cyclic systems. Possibility of elimination by a Carbanion mechanism. Intramolecular (Cis) eliminations.

Mechanism and orientations in pyrolytic eliminations. Chugaev reaction, Cope reaction, Barton reaction, Hoffmann elimination. [16 Hours]

UNIT-IV

Named reactions and rearrangements: Mechanism and applications of the following reactions: Aldol condensation 2) Perkin reaction 3) Stobbe condensation 4) Mc Murry reaction 5) Fries rearrangement 6) Sandmeyer reaction 7) Schmidt rearrangement 8) Von-Richter reaction 9) Push-Pull reaction 10) Orton rearrangement 11) Kolbe reaction 12) Comberg- Bachmann reaction 13) Allylic rearrangements; unimolecular, bimolecular, free-radical mechanism and applications. [16 Hours]

Books recommended:

1. Organic chemistry- P. Y. Bruice, Pearson education Pvt. Ltd. New Delhi (2002).
2. Organic chemistry- R. T. Morrison and Boyd, Prentice Hall, New Delhi (1994).
3. Organic chemistry- Peter Sykes, Orient longman, UK.
4. Organic chemistry- F. A. Carry, Fourth Edn, Mc Graw Hill (2000).
5. Advanced Organic chemistry, Reactions, Mechanism and structure- J. March, 3rd edn, Wiley-Eastern Ltd, (2004).
6. Stereochemistry- Confirmations and mechanism- P.S. Kalsi, Wiley-Eastern Ltd, New Delhi (1992).
7. Organic chemistry- Vol-I and II- I. L. Finar, 6th edn, ELBS, London (2004).
8. Stereochemistry of Organic compounds- E. L. Eliel, et al., John Wiley and Sons Inc.
9. Stereochemistry Organic compounds- Principals and applications- D. Nasipuri, Wiley Eastern Ltd (1992).

HCP 3.2: MULTISTEP SYNTHESIS**(64 Hours)**

Multi-step preparation of organic compounds involving various reactions like addition, elimination, oxidation, hydrolysis etc., and purification of compounds by recrystallization and distillation.

Books recommended:

1. Laboratory experiments in organic chemistry – Arun sethi, New Age International Ltd. New Delhi (2006).
2. A Hand book of organic chemistry- H. T. Clarke.
3. Vogel's text book of practical organic chemistry, revised 5th edition, Addison Wesley, Longman Ltd, UK (1997).

SCT 3.1: NATURAL PRODUCTS

(64 Hours)

UNIT-I

Carbohydrates and Protein: Ring structure of mono saccharides. Anomeric effect, Hudson's rule, Chemistry of important derivatives of carbohydrates, ethers, acetals, ketals, deoxy sugars and amino sugars. Oligosaccharides-Structure and ring size determination with reference to maltose, sucrose, lactose and cellulose.

Polysaccharides- General methods of structural determination of polysaccharides. Structure of cellulose, starch and glycogen.

Amino acids, peptides, modern methods of synthesis of peptides. Blocking reagents in peptide synthesis. Structure of protein-primary, secondary and tertiary structures. End group analysis, sequence of amino acids in peptides. [16 Hours]

UNIT-II

Steroids and Steroid Hormones: Introduction to historical development and nomenclature of steroids, general methods of structure determination, basic rule, Barbier-Wieland degradation, Diels hydrocarbon.

Chemistry of cholesterol and ergosterols. Irradiation products of ergosterol.

Steroid hormone- Estrone, progesterone, testosterone, cortisone and rosterone. Diosgenin and its utility in hormone synthesis. Transformation in steroidal molecules, general study of cardiotoxic glucosides, saponin and steroidal alkaloids.

General biosynthetic studies on steroids. [16 Hours]

UNIT- III

Terpenes and Alkaloids:Introduction, classification of terpenes, Isoprene rule and general methods of determining the structure of terpenes. Chemistry of Camphor, β -santonin, abietic acid and Gibberelic acid (Gibberellin- A_3). Longifolene, Squalene, lanostrol and capsorubin. General biogenetic studies on mono, sesqui, di tri and tetra terpenoids.

Determination, classification and isolation of alkaloids. General methods of structural determination. Chemistry of Ephedrine, nicotine, cocaine, adrenalin, quinine, papaverine, morphine, yohimbine and ergonovine. [16 Hours]

UNIT- IV

Prostaglandins, Vitamins and Nucleic acids:

Introduction, nomenclature, structure and stereochemistry of PGE, synthesis of key intermediates.

Introduction, ascorbic acid, thiamine, riboflavin, vitamin A, biotin, vitamin-E, vitamin K and vitamin B₁₂. Biological importance of vitamins.

Composition of nucleic acids, nucleosides and nucleotides DNA, RNA, base pairing in DNA and conformation. Role of DNA and various types of RNA replications, transcription and translation, genetic code base sequencing in nucleic acid, recombinant DNA and coenzymes. [16 Hours]

Books Recommended:

1. Organic chemistry- Hendrickson, Cram and Hammonal.
2. Organic chemistry- T. W. G. Solomans.
3. Carbohydrates - N.Sharon
4. An introduction to the chemistry of carbohydrates- Gut and Honeyman.
5. Peptides and proteins- D. T. Elmore.
6. Steroids- L. F. Fieser and M. Fieser.
7. Organic Chemistrty- Jo Loman.
8. Medicinal Chemistry- Burger.
9. The terpenes Vol. I to III- J. Simonsen
10. The alkaloids- Manske and Holmes.
11. The nucleic acids Vol. I to III – Chargoff and Davidson.
12. Organic chemistry- Vol-I and II- I. L. Finar, 6th edn, ELBS, London (2004).

SCP 3.1: ISOLATION & CHARACTERIZATION OF NATURAL PRODUCTS

(64 Hours)

Isolation and Characterization of following Natural Products:

1. Caffeine from Tea leaves.
2. Piperine from Black pepper.
3. Lycopene from Tomato.
4. Caseine from Milk.
5. Nicotine from Tobacco.
6. Herperidines from Orange Peal.
7. Eugerol from Clove.
8. Azaleic from Caster oil.

Books Recommended:

1. Natural products, A laboratory Guide – R. Ikan, Academic Press, London (1969).
2. Laboratory experiments in organic chemistry- Arun Sethi, New Age International ltd. New Delhi (2006).
3. A Hand book of Organic chemistry – H. T. Clarke.
4. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

SCT 3.2 – HETEROCYCLIC CHEMISTRY

(64 Hours)

UNIT-I

Chemistry of three, four and seven membered heterocycles with one & two heteroatom.

Three membered: oxiranes, aziridines, Oxazirane and thiranes.

Four membered: oxetanes, azetidines, azetidinones and thietanes.

Seven membered: oxipines, azepines, diazepines and thiepinines. [16 Hours]

UNIT-II

Biologically important five and six membered heterocycles containing one or more than two hetero atoms and their derivatives.

- i) **Natural products related to indole:** Tryptophan, serotonin, lysergic acid diethylamide (LSD) and reserpine.
- ii) **Pyridine derivatives:** Nicotine, nicotinic acid, pyridoxine, pyridoxamine and pyridoxal.
- iii) **Thiamine and natural products related to pyrimidine and purine:** Thiamine, Cytosine, uracil, adenine and guanine. [16 Hours]

UNIT-III

General discussion, synthesis and reactions of the following heterocycles- Pyridine, Pyrazone, Pyrimidine, Pyridazone, Quinoline, Isoquinoline, Quinoxaline, Quinazoline, Cinnoline and Phthalazine. [16 Hours]

UNIT-IV

Medicinally Important Heterocycles:

Introduction, structure, synthesis and their biological activities of Reserpine, Morphine, codeine, thebaine, Papavarine, Yohombine, Strychnine, Brucine, Cinchonine, and Quinine. [16 Hours]

Books Recommended:

1. An introduction of the Chemistry of heterocyclic Compounds, R.M.Acheson, 4th Edn. John Wiley and sons.
2. Heterocyclic Chemistry, A.R.Katritzky and J.J.Logowskii.
3. Heterocyclic Chemistry, T.L.Gilchrist, 3rd Edn. Pearson Education, Delhi, (2005)
4. Modern heterocyclic Chemistry, Joules and Smith ELBS, Publication, UK.
5. Heterocyclic Chemistry, R.K.Bansal, 3rd Edn. New Age International Publishers (2002)
6. Heterocyclic Chemistry, 2nd Edn, J. A. Joule and G. F. Smith, ELBS Publication, Vab Nostrand Company Ltd, London UK (1979).
7. Introduction to Chemistry of Heterocyclic compounds- Acheson.
8. Chemistry of Heterocyclic compounds- G. M. Badger.

SCP 3.2: SYNTHESIS OF HETEROCYCLES

Synthesis of Heterocycles

Books Recommended:

1. Laboratory experiments in organic chemistry–Arun sethi, New Age International Ltd. New Delhi (2006).
2. A Hand book of organic chemistry- H. T. Clarke.

3. Vogel's text book of practical organic chemistry, revised 5th edition, Addison Wesley, Longman Ltd, UK (1997).

OET 3.1: CHEMISTRY –III (Inorganic Chemistry)

Bonding, Bioinorganic, Stereochemistry and Acid-base theory (64 Hours)

UNIT – I

Ionic bonding: Properties of ionic compounds, lattice energy, Born-Land's equation, Born-Haber cycle and its applications, Kapustinskii equation, Solvation energy, dissolution of ionic compounds in polar solvents and their energetics. The predictive power of thermochemical calculations of ionic compounds, covalent character in ionic compounds. Radius ratio and structure of ionic compounds and efficiency of packing of crystal lattices.

Covalent bonding: Valence bond theory, orbital overlap, molecular orbital theory, symmetry and overlap, molecular orbital diagrams of diatomic molecules (homo- and hetero- nuclear), triatomic molecules, linear (CO_2 , N_2O) and angular (NO_2), Walsh diagrams, Bent rules, some reactions of covalently bonded molecules, Resonance, hybridization, VSEPR theory, molecular geometries. [16 Hours]

UNIT – II

An over view of metals in biology: Introduction; the element content of living systems; biological chemistry of hydrogen; the economical use of resources—abundance and availability; biological need and behavior of inorganic elements.

Sodium and potassium channels and pumps: Introduction; transport across membranes; potassium and sodium channels; the sodium and potassium pump; active transport driven by Na^+ gradients, sodium/proton exchangers; other roles of intracellular K^+ .

Metal assimilation pathways: Introduction; metal assimilation in bacteria, plants, fungi and in mammals (iron, copper and zinc).

Storage and homeostasis of metal ions: Introduction; metal storage and homeostasis in bacteria, plants, fungi and in mammals (iron, copper and zinc). [16 Hours]

UNIT – III

Stereochemistry of Coordination Compounds: Coordination geometry, types of isomerism (geometrical & optical). Review of bonding theories; Molecular orbital theory/Ligand field theory (octahedral, tetrahedral and square planar complexes), MO theory applied to complexes with π -bonding. Evidences for metal-ligand orbital overlap, spectrochemical series and Jahn-Teller distortion in coordination compounds.

Magnetism: Types of magnetism; magnetic susceptibility; spin only moment; orbital contribution to spin only moment. [16 Hours]

UNIT – IV

Review of Acid-Base Concepts: Introduction, different definitions, types of reactions, solvent system and leveling effect. Generalized Acid-Base concepts (basicity of metal oxide, hydration and hydrolysis).

Measurement of Acid-Base strengths, Steric effect (back strain, front strain and Internal strain) Solvation effects with reference to liquid ammonia, anhydrous sulfuric acid, acetic acid and liquid sulfur dioxide. Hard-Soft Acids and Bases; classification, strength of hardness and softness; Irving William series; theoretical basis of hardness and softness. [16 Hours]

Books Recommended:

1. Advanced Inorganic chemistry - F.A.Cotton and Wilkinson, John-Wily and sons
2. Chemistry of the Elements – N.N.Greenwood and A. Eamshaw, Pergamon
3. Concise Inorganic Chemistry - J.D. LEE, ELBS
4. Inorganic Chemistry, Principles and Reactivity –J.E.Huheey, Harper and Row
5. Modern aspects of Inorganic Chemistry – H.J. Emuleus and A.G.Sharpe ELBS
6. Theoretical Inorganic Chemistry - M.C.Day, Jr. an J.Selbin East-West press
7. Concept and Model's in Inorganic Chemistry – Dougals, McDanial and Alexander John Wiley and sons.
8. Inorganic Qualitative Analysis - A.I.Vogel ELBS
9. Fundamentals of Analytical Chemistry - D.A.Skoog, D.M.West and F.T.Holler, Saunder college publishing
10. Inorganic Quantitative methods - Alexeev Mir publications
11. Principles of Inorganic Chemistry – Puri, Sharms and Kalia-Shobanlal-Nagin.
12. An Introduction to Inorganic Chemistry – Purcell and Kotz-Holt-Saunders
13. Coordination Chemistry-S.F.A. Kettle.
14. Comprehensive coordination Chemistry – G. Wilkinson, R.D. Gillars and J.A.Mcclevertry, Pergamon

OEP 3.1: CHEMISTRY PRACTICAL-III

(64 Hours)

Part-A

Semimicro qualitative inorganic analysis of a mixture.

Mixture containing three cations and three anions including one less common cations such Mo, Ti, Zr, Ce, V and Li and one interfering anion.

Part-B

- i) Determination total hardness of water.
- ii) Determination of nickel by complexometry (by back titrations)

Books Recommended:

1. Chemical Semi micro analysis- V.N.Alexeyev Mir Publishers (Mascow)
2. Vogel's Qualitative Inorganic analysis, Revised by G.Suchla Longarman group ltd.
3. Vogel's Text book of Quantitative Inorganic Analysis – J.Basett, R.C.Denney, G.H.Jeffery and J.Mendhaman, Longamans Green and Company Ltd.

OET 3.2: CHEMISTRY-IV (Organic Chemistry)

(64 Hours)

UNIT-I

Bonding and Aromaticity:

Hybridization, bond length, bond angle, bond energies, bond polarity and dipole moment aromaticity and Huckels rule-HMO theory, Non-benzenoid aromatics, Annulenes (10-18).

[16 Hours]

UNIT-II

Stereochemistry:

Elements of symmetry, symmetry operations E/Z, R/S nomenclature, Fischer, Sawhorse, Newmann projection, Enantiomers, Diastereomers and Epimers.

Prochirality: Homotopic, enantiotopic, diastereotopic groups.

[16 Hours]

UNIT-III

Organic Reactions:

Reactivity, classification of organic reactions, methods of identification kinetics, non kinetic methods. Isotopic labeling techniques, intermediates, cross over products and product proportions in different types of reactions. Named reactions. Classification, Aldol, Dieckmann, Claisen-Schmidt and similar anion addition reactions.

[16 Hours]

UNIT-IV

Heterocycles and Group Transformations:

Structure, synthesis, reactivity of the following heterocycles and their biologically important derivatives. pyrrole, furan, thiophene, pyridine, pyrimidine, Quinoline, isoquinoline & indole. Organic functional group inter conversions involving substitution, addition, eliminations, oxidation, reductions, esterification and hydrolytic reactions.

[16 Hours]

Books Recommended:

1. Organic Chemistry-P. Y. Bruice, Pearson education pvt. Ltd, New Delhi (2002).
2. Organic Chemistry- S. H. Pine, McGraw Hill, London (1987).
3. Organic Chemistry- R. T. Morrison, R. J. Boyd, Prentice Hall, New Delhi (1994).
4. Organic Chemistry-T. W. Graham Solman 4th edn, John Wiley & Sons (1988).
5. Organic Chemistry- Vol. I & II, I. L. Finar, 6th Edn. ELBS, London (2004).
6. Organic Chemistry- F. A. Carey, 4th edn, McGraw Hill (2000).
7. Advanced Organic Chemistry Reaction Mechanism and Structure- J. March, 4th edn. Wiley Eastern Ltd. (2004).
8. Stereochemistry- Conformation and Mechanism, P. S. Kalsi, Wiley-Eastern Ltd., New Delhi (1992).
9. Heterocyclic Chemistry- T. L. Gilchrist, Butterworth, London (1985).
10. Heterocyclic Chemistry- J. A. Joule & G. F. Smith, 2nd edn, Van Nostrand, London (1978).

OEP 3.2: CHEMISTRY PRACTICAL-IV (Organic Chemistry) **(64 Hours)**

Synthesis and Polarimetry:

1. Benzoic acid and Benzyl alcohol from Benzaldehyde (Cannizaro Reaction).
2. P-Nitroaniline from Acetanilide.
3. P-Bromoaniline fro Acetanilide.
4. Methyl Orange.
5. Benzil from Benzaldehyde.
6. Benzanilide from Benzophenone (Beckman Rearrangement).
7. Aniline from Benzene.
8. 2,4-Dinitrophenol from Chlorobenzene.
9. M-Nitroaniline from Nitrobenzene.
10. Benzoic acid from Toluene.
Quantitative estimation of sugar, mixture of sugars and determination of specific rotation of sugars

Books recommended:

1. Laboratory experiments in organic chemistry – Arun sethi, New Age International Ltd. New Delhi (2006).
2. A Hand book of organic chemistry- H. T. Clarke.
3. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

SEMESTER-IV

HCT 4.1: RECENT METHODS IN ORGANIC SYNTHESIS

(64 Hours)

UNIT-I

Retrosynthetic Analysis:

Disconnection approach- Terminology, synthesis, synthetic equivalent, functional group interactions, one group C-X and two group disconnections, applications of C-C disconnection in the synthesis of substituted 1,2-, 1,3- and 1,4-bifunctional compounds.

Retrosynthetic analysis and synthetic route for Alcohols, benzocaine, acetone cyanohydrins, p-methoxy acetophenone, 6-methyl Quinoline, pirindol. 6-methoxyindole-3-acetic acid. Applications to the synthesis of Javabione, taxol, Longifolene, Prelog-DJersai lactone.

[16 Hours]

UNIT-II

Newer Reagents and Reactions:

Tributyl tin hydride, Trimethyl Silyl iodide, Gilman's Reagent, Peterson Reaction, Woodward and Prevost hydroxylation, Organo-magnesium halides, Organo Zinc compounds, Aluminium isopropoxide, Organo Palladium compounds and Diazomethane.

[16 Hours]

UNIT -III

Oxidation and Reduction Reactions:

Oxidations: Oxidation of Organic compounds Using PCC, CrO₃, K₂Cr₂O₇, O₃, Oppenaur Oxidation, Wacker Oxidation, Alkoxy-sulphonium salts, Thallium (III) nitrate, Sharpless epoxidation and Hydroboration.

Reductions: Reduction of Organic Compounds using the following reagents. Borane, Alkylborane, Chiral hydride reagents, Hydrazine, Sodium cyanoborohydride, Trialkylborohydride, Clemmensen reduction and Rosenmund reduction.

[16 Hours]

UNIT-IV

Newer Reactions:

Mechanism and strategic applications of the following named reactions.

Suzuki Coupling, Prins Reaction, Mitsunobu Reaction, Robinson annulations, Pauson-Khand Reaction, Simon-Smith Reaction, Heck Reaction, Hoffmann-Löffler-Freytag Reaction, Junjappa-Ila aromatic and heteroaromatic annulations, Huisgen-1,3-dipolar cycloadditions, Claisen Rearrangement and Dieckmann Condensation.

[16 Hours]

Books recommended:

1. Principles of Organic Synthesis – R.O.C. Norman and J.M.Coxon, 3rd Edn. Nelson Thrones, UK (2003).
2. Synthetic Approaches in Organic Chemistry, Raj K. Bansal, Naroso Publishing House, New Delhi (1998).
3. Modern methods of Organic Synthesis, w. Carruthers 3rd Edn. Cambridge University Press, UK (1996).
4. Organic Reactions and their Mechanisms, P.S.Kalsi, 2nd Edn. New Age International Publishers (2002).
5. Modern Synthetic Methods by House.

HCP 4.1 SEPERATION & IDENTIFICATION

(64 Hours)

Separation and identification:

- i. TLC and Column Chromatography.
- ii. Application of computers in structure conformational analysis.
- iii. Preparation of derivatives.

Books Recommended:

1. Applications of computers in chemistry- Raman.
2. Computers and their applications to chemistry- Ramesh Kumar, Narosa Publishing House (2002).
3. Laboratory experiments in organic chemistry – Arun Sethi, New Age International ltd. New Delhi (2006).
4. A Hand book of Organic chemistry – H. T. Clarke.
5. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

HCT 4.2: SPECIAL TOPICS IN ORGANIC CHEMISTRY

(64 Hours)

UNIT-I

Photochemistry:

Activation of thermal and photochemical reactions. Light absorption and excitation, singlet and triplet states. Morse curves, Franck-Condon principle. De excitation processes, Jablonski diagram, photosensitization (donor, acceptor concept, resonance, collision and transfer). Chemical processes, quantum yield and quantum efficiencies. Variation in singlet and triplet states. Phenomena of optical pumping, Remote functionalization (Barton reaction).

Photochemistry of olefins: Cis-trans isomerisation, (2+2) cycloaddition and rearrangements. Reactions of conjugated olefins and di- π methane rearrangements.

Photochemistry of Ketones: Excited states of ketones, Norrish type -I and type -II cleavages. Pattero-Buchi reaction, α,β -unsaturated ketones, (2+2) addition, cis-trans isomerization. Rearrangements of cyclohexadienones.

Photochemistry of aromatic Compounds: Photorearrangement of benzene and its derivatives, cycloaddition of benzenes and substitutions of benzene derivatives.

Photochemical oxidation and reduction: Cycloadditions of (singlet) molecular oxygen, oxidative coupling, photoreduction by hydrogen abstraction. [16 Hours]

UNIT-II

Pericyclic reactions:

Definition of various terms, Pericyclic, electrocyclic, cycloaddition, sigmatropic, chelotropic and ene reaction. Con-rotatory, disrotatory, suprafacial, antarafacial, HOMO, LUMO etc.

Symmetry properties of molecular orbitals of ethylene, butadiene, hexatriene, vinyl radicals, anion, cation, pentadienyl radical, anion and cation. Conservation of orbital symmetry and the photochemical concerted processes. Formulation of selection rule by 1) orbital correlation diagrams 2) HOMO-LUMO method and 3) Huckel-Mobius aromaticity approach (all qualitative method only) for electrocyclic reactions of (butadiene-cyclobutene and hexatriene- cyclo hexadiene interconversions) Cycloadditions (2+2), (2+4) and examples of other higher systems.

Sigmatropic reactions: (1,3), (1,5), and (3,3) sigmatropic reactions, Cope and Claisen rearrangement reactions.(Several suitable examples are to be taken for each class of transformation). Chelotropic and ene reaction. Several examples in each class. [16 Hours]

UNIT-III

Molecular Rearrangements and reactions:

Clanician-Dennsted rearrangement, Cornforth rearrangement, Dimroth rearrangement, Meisenheimer rearrangement, Meyar-Schuster and Rupe rearrangement, Overman rearrangement, Payme rearrangement, Wittig- [1,2] and [2,3] rearrangement, Wolf rearrangement and Stevens rearrangement.

Corey - Nicolau microlactonization and De Mayo cycloaddition (2+2) photochemical.

[16 Hours]

UNIT-IV

Green chemistry:

Microwave synthesis: Introduction, reaction vessel, reaction medium, concept, specific effects, atom efficiency, percentage atom utilization, advantage and limitation. N-alkylation and alkylation of active methylene compounds. Condensation of active methylene compounds with aldehydes. Synthesis of Ibuprofen by BHC and BOOTS approach. Diels-Alder reaction, Leuckorts reductive amination of lactones. Oxidation of alcohols and sulphides. Supramolecules.

Modern Technology: Modern techniques in organic synthesis. Brief outline of microwave. Ultra sound clay catalyzed techniques and uses of ionic liquids and polymer supports in organic synthesis. Phase-transfer catalyst & Crown-ethers. Super critical fluid extractions.

[16 Hours]

Books Recommended:

1. Photochemistry, R. B. Cundal and A. Gilbert, Thomas Nelson and Sons Ltd. London, 1st edn. (1970).
2. Organic Photochemistry, J. M. Coxon and B. Halton, Cambridge Univ. Press, London 1st Edn. (1974).
3. Molecular reaction and Photochemistry, C. H. Depuy and O. S. Chapman, Prentice Hall, India, New Delhi, 1st Edn. (1972).
4. Orbital Symmetry, R. E. Lehr and A. P. Marchand, Academic Press, New York, 1st Edn. (1972).
5. Molecular Orbital theory for Organic Chemistry, A. Sreitweiser. Wiley and Sons, New York, 1st Edn. (1961).

HCP 4.2: ANALYSIS OF ELEMENTS & FUNCTIONAL GROUPS (64 Hours)

Semimicro analysis of nitrogen, halogen and sulphur.

Estimation of functional groups -OH, -NH₂, -NO₂, C-Methyl, Acetoxy and Active hydrogen.

Books Recommended:

1. Applications of computers in chemistry- Raman.
2. Computers and their applications to chemistry- Ramesh Kumar, Narosa Publishing House (2002).
3. Laboratory experiments in organic chemistry – Arun Sethi, New Age International Ltd. New Delhi (2006).
4. A Hand book of Organic chemistry – H. T. Clarke.
5. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

SCT 4.1: APPLIED ORGANIC CHEMISTRY

(64 Hours)

UNIT-I

Polymers:

Types of polymers, polymerization reactions, mechanism of polymerization reactions, cationic, anionic and free radical step growth polymerization. Initiation, propagation, termination and retardation processes. Ziegler-Natta catalyst and synthesis of stereoregular polymers.

Preparation and Significance: Classification of polymers based on physical properties, thermoplastic, thermosetting plastics, fibers, elastomers and their general applications.

Preparation of polymers based on different types of monomers. Industrial applications. Olefin polymers, diene polymers, Nylon, Crystal resin, Urea formaldehyde, phenol-formaldehyde and melamine resin. Epoxy resin, Ion-exchange resin, polycarbonates and its applications.

Rubbers: Natural and synthetic rubbers. Structural elucidation of natural rubber. Polymers degradation reactions. Thermal, oxidative and radiative process.

Synthesis and properties of Buna-S and butyl rubber.

Conducting polymers, Polyanilines.

[16 Hours]

UNIT-II

Dyes and Pigments:

Colour and Constitution (electronic concept). Classification of dyes. Methods of applying dyes to the fibres. A general study of the following dyes (Principle involved and synthesis of typical dyes).

Azo dyes: Orange – II, Mordant brown, Congo red, Methyl orange and Methyl red.

Triphenyl methane dyes: Malachite green, Rosaniline, Crystal violet and Phenolphthalein.

Cyanine dyes: Ethyl red, Cyanine blue and Quinaldine.

Sulphur dyes: Sulphur blue, Sulphur brown and Sulphur blue.

Reactive dyes and Optical brighteners: Tinopal and Blankophor ppp.

Pigments: Fast violet, Lake red and Orange R.

[16 Hours]

UNIT-III

Petrochemicals:

Petroleum refining, constituents of petroleum and their separation. Conversion process (Cracking, reforming, alkylation etc.) for precursors of petrochemicals. Brief description of the chemistry and applications of ethylene, propylene, butylenes, acetylene, benzene and some of their derivatives and conversion into useful products.

Synthetic fibres, rubbers and plastics.

Newer Reactions: Japp-Klingaman reaction, Meerwein arylation, Nef reaction, Raush asymmetric allylation, Sharpless asymmetric dihydroxylation, Ugi-multicomponent reaction and Williamson ether synthesis.

[16 Hours]

UNIT-IV

Insect Pheromones:

Introduction, Juvenile hormones, precocines, pyrethroids and antifeedant.

Regulation of insect behavior by pheromones. Use of pest control.

Synthesis of:

- i. Z-7,8-epoxy-2-methyl oxtadecane (Gypsy moth sex pheromone).
- ii. Faranal (Traie pheromone of pharash's ants).
- iii. Gradisol (Components of boll weevil pheromone).
- iv. Brevicommin (pheromone from Dendroctanus brevicomis).
- v. (+)-Disperlure (Gypsy moth sex pheromone).
- vi. 3,11-Dimethyl-2-nonacosanone (Pheromone of German cockroaches).
- vii. Bombykopl (Sex pheromone of silkworm moth).
- viii. Multistriatin (Elm bark beetle sex pheromone).

[16 Hours]

Books Recommended:

1. Polymer Science- Gowrikar.
2. Text book of Polymer Science- Billmeyer, Wiley Interscience.
3. A first Course in Polymer Science- Devid Seboler.
4. Synthetic dyes, Vol I- Venkataramana.
5. Industrial Chemistry- B. K. Sharma.
6. A text book of Petrochemicals- B. K. Bhaskara rao, Khanna Publishing, Delhi.
7. Chemicals controlling insect behavior- M. Beroza.
8. Insect Juvenile Hormones- J. J. Menn & M. Beroza.

SCP 4.1: SPECTROPHOTOMETRIC ANALYSIS

(64 Hours)

Spectrophotometric Analysis:

Quantitative estimation of ascorbic acid, cholesterol, carbohydrates, proteins, aminoacids, caffeine and uric acid.

Polarimetry:

Quantitative estimation of sugars, mixture of sugars and determination of specific rotation of sugars.

Books Recommended:

1. Applications of computers in chemistry- Raman.
2. Computers and their applications to chemistry- Ramesh Kumar, Narosa Publishing House (2002).
3. Laboratory experiments in organic chemistry – Arun Sethi, New Age International ltd. New Delhi (2006).
4. A Hand book of Organic chemistry – H. T. Clarke.
5. Vogel's text book of practical organic chemistry, revised 5th edn, Addison Wesley, Longman Ltd, UK (1997).

SCT 4.2 – MEDICINAL CHEMISTRY

(64 Hours)

UNIT-I

Introduction, History, Nomenclature and Literature of organic medicinal compounds. Factors influencing the metabolism, metabolic changes in drugs, pharmacokinetics and its applications. Relationship of chemical structure and biological activity with reference to oral contraceptives, Antidepressants and Anxiolytics, Antihypertensive, Vasodilators, Diuretics and Cardiac drugs.

[16 Hours]

UNIT- II

Modern theories of drug action, concept of receptors, computer aided drug design, qualitative and quantitative SAR.

Classification, synthesis and mode of action of each class of following drugs.

Sulfa Drugs: Sulfadiazines, Sulfamethazines, Sulfaguanidines, Sulfaisoxazoles and Sulfamerazines.

Analgesics: Narcotic and Non-Narcotic analgesics.

Narcotic: Opium alkaloids, Morphine, Metopon, Benzomorphan and Phenazocine.

Non-Narcotic: 4-Phenylpiperidines –Pethidine, Diisopropylamines, Methadone, Pyrazolones and Antipyrine.

Anti-fertility Drugs: Steroidal and non-steroidal compounds. Norethindrone. Mestranil, Norgestrol and non-steroidal anti-fertility drugs. [16 Hours]

UNIT – III: Synthesis and mode of action of the following drugs:

Antineoplastic Agents: Nitrogen mustards, Chlorobucil, Sarcocycin, Dopan and Cyclophosphamide. Pteridines: Amethopterin, Pyrimidines, 5-fluorouracil, Cis-platines and Anti-platines

Antibiotics: Structure, Synthesis, Stereochemistry and biological activities of the following antibiotics. Natural Penicillins, Semisynthetic penicillins, Chloramphenicol, streptomycin, Structural features and uses of common antibiotics Norfloxacin, Rifomycin and amoxicillin. [16 Hours]

UNIT IV

Biogenesis of Natural products:

- Carbohydrates- General pattern of carbohydrate biogenesis, biogenesis of glucose-6-phosphate, monosaccharides, disaccharides, photosynthetic and non photosynthetic pathways.
- Steroids- Biosynthesis of cholesterol, ergosterol, adrenosterol and steroidal sex hormones.
- Terpenoids – Biosynthesis of monoterpenes, sesqui terpenes and diterpenes.
- Lipids – Simple lipids and Phosphoglycerides.
- Alkaloids – Indole, Quinoline and Isoquinoline alkaloids. [16 Hours]

Books Recommended:

- Chemistry of Organic Medicinal Products – Wilson and Giswold.
- Pharmacological basis of Therapeutics – Goodman and Gillman.
- Principles of Medicinal Chemistry – Foya.
- Medicinal Chemistry Vol.I, II and III, A Burger, Wiley Interscience, New York (1988).
- Progress in Medicinal Chemistry Vol.1-8, Edited, G. P. Ellis and G. B. West, North Holland, New York (1974).

SCP 4.2: SYNTHESIS OF DRUGS

(64 Hours)

Synthesis of Drugs

Books recommended:

1. Laboratory experiments in organic chemistry – Arun sethi, New Age International Ltd. New Delhi (2006).
2. A Hand book of organic chemistry- H. T. Clarke.
3. Vogel's text book of practical organic chemistry, revised 5th edition, Addison Wesley, Longman Ltd, UK (1997).

HCMP 4.3: MAJOR PROJECT

The project work may include implant training in industries / short term work in the department / other department or institution/ R & D organization / Review of current literature / theoretical method computer applications. Experimental work may involve studies on synthesis / study of properties / characterization by physical methods / activity of reported / unreported research etc.

In case of students working outside the campus, the supervisor / staff member incharge visit to the work place during the period and may be eligible for TA- DA as per University rule.

Books Recommended:

1. Applications of computers in chemistry- Raman.
2. Computers and their applications to chemistry- Ramesh Kumar, Narosa Publishing House (2002).
3. Laboratory experiments in organic chemistry – Arun Sethi, New Age International ltd. New Delhi (2006).
4. A Hand book of Organic chemistry – H. T. Clarke.
5. Vogel's text book of practical organic chemistry, revised 5th edn. Addison Wesley, Longman Ltd, UK (1997).