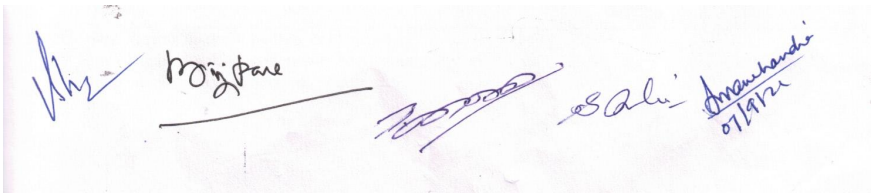
M. Sc. Chemistry

PROGRAM OBJECTIVES

1. To educate and prepare post graduate students from rural and urban area who will get employment in academic institutes, R & D and Quality control laboratories of Indian chemical/pharmaceutical industries as well as multinational and forensic laboratories.
2. To provide students with broad theoretical and applied background in all main branches of Chemistry.
3. To provide broad common frame work of syllabus to expose our young graduates to the recent and applied knowledge of interdisciplinary branches of chemistry involving medicinal, supra, hetero, analytical, industrial, pharmaceutical, polymer, Nano Science and technology.
4. To encourage students to conduct various academic activities like midterm tests, online tests, open book tests, tutorials, surprise test, oral, seminar, assignments and seminar presentation.
5. To give practical training to the students for qualitative and quantitative analysis instrumental techniques and synthetic procedures.

PROGRAM OUTCOMESS:

1. A graduate with a Master's degree in Chemistry will have in-depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods of chemistry.
2. The graduate will have the knowledge of a well-defined area within chemistry.
3. The graduate will have specific skills in planning and conducting advanced chemical experiments and applying structural-chemical characterization techniques.
4. Will have the skill in examining specific phenomena theoretically and/or experimentally.
5. The graduate will be able to contribute to the generation of new scientific insights or to the innovation of new applications of chemical research.



SEMESTER I

Paper-I

MCH-101: INORGANIC CHEMISTRY I **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Stereochemistry and bonding in Main group compounds,
- Metal-Ligand equilibrium in solution, determination of binary formation constant by potentiometry and spectrophotometry.
- Reaction mechanism of transition metal complex formation including structure and properties
- MOT and CFT theory of Metal-Ligand bonding in octahedral and tetrahedral complexes
- HSAB theory and their applications

OUTCOMES: On completion of this course, the students will be able to understand

- The VSEPR theory, dπ - pπ bond, Bent rule and able to predict shape of molecules from electron pairs, Walsh diagram, energetics of hybridisation.
- The stability of metal complexes by the use of formation constants and to calculate thermodynamic parameters potentiometry and spectrophotometry.
- The reaction mechanism of inert and labile complexes, trans effect, cross reactions and Marcus-Hush theory.
- VBT, MOT, CFT theory electronic structure, color and magnetic properties of co-ordination compounds.
- Classification of acids and bases as hard and soft, Lewis–acids and bases, reactivity approximation.

Unit-I

Stereochemistry and Bonding in Main Group Compounds:

VSEPR, Walsh diagram (triatomic and penta-atomic molecules), dπ-pπ bond, Bent rule and energetics of hybridization, some simple reactions of covalently bonded molecules.

Unit-II

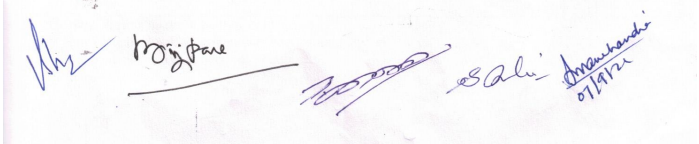
Metal-Ligand Equilibrium in Solution

Stepwise and overall formation constants and their interaction, trends in stepwise constant, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand. Chelate effect and its thermodynamic origin, determination of binary formation constants by potentiometry and spectrophotometry.

Unit-III

Reaction Mechanism of Transition Metal Complexes

Energy profile of a reaction, reactivity of metal complex, inert and labile complexes, kinetic application of valence bond and crystal field theories, kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and



indirect evidences in favor of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reactions in square planar complexes, the trans effect, mechanism of the substitution reaction. Redox reaction, electron transfer reactions, mechanism of one electron transfer reactions, outer sphere type reactions, cross reactions and Marcus-Hush theory, inner sphere type reactions.

Unit-IV

Metal-Ligand bonding

Limitations of Valence bond theory, Crystal field theory, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes, π-bonding and molecular orbital theory.

Unit-V

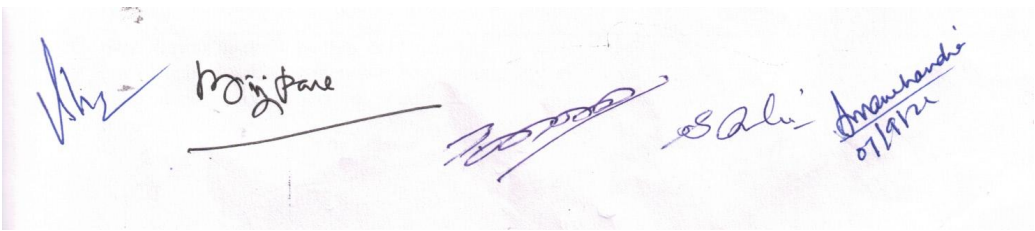
HSAB Theory

Classification of acids and bases as hard and soft; HSAB principle, theoretical basis of hardness and softness; Lewis-acid base reactivity approximation; donor and acceptor numbers, E and C equation; applications of HSAB concept.

At the end of the course, the learners should be able to: Identify the principles, structure and reactivity of selected coordination complexes

Books Suggested :

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes& Row.
3. Magnetiochemistry, R.1. Carlin, Springer Verlag.
4. Comprehensive Coordiantion Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. McCleverty,Pergamon.



Paper-II

MCH-102: ORGANIC CHEMISTRY I **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Huckel's rule, energy levels of π-molecular orbitals, Nature of bonding in crown ether, cryptands, and inclusion compounds.
- The stereochemistry of organic compound and of compounds having nitrogen, phosphorus and sulphur.
- The conformational analysis and reactive intermediates.
- The mechanisms of different types of reactions and their structure and reactivity
- Aliphatic nucleophilic substitution reactions: mechanism and reactivity, regioselectivity

OUTCOMES: On completion of this course, the students will be able to understand

- Delocalized bonding in organic molecule, concept of aromaticity, anti- aromaticity, PMO approach, bonds weaker than covalent bond.
- Optical isomerism, asymmetric synthesis, stereochemistry of nitrogen sulphur, phosphorus compounds.
- Conformational analysis and reactive intermediates.
- Types of reaction, mechanism and their thermodynamic and kinetic control, Curtin–Hammet principle, potential energy diagram, isotope effect
- Aliphatic nucleophilic substitution reactions:SN^1, SN^2, SN^i, SET factors affecting the mechanism phase transfer catalysis and ultrasound method

Unit-I

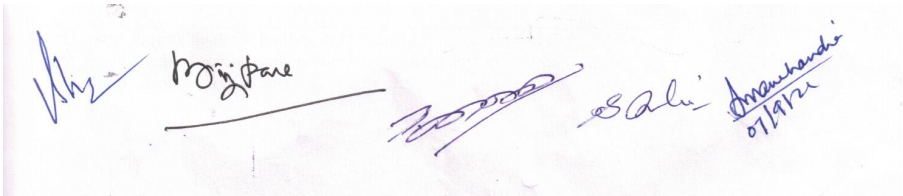
Nature of Bonding in Organic Molecules

Delocalized chemical bonding-conjugation, cross conjugation, resonance hyperconjugation, bonding in fullerences, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, energy. Level of π-molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, catenanes and rotaxanes.

Unit-II

Stereochemistry

Strain due to unavoidable crowding Elements of symmetry, chirality, molecules with more than one chiral center, threo and ertythro isomers, Sequence rule, R, S- nomenclature, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in the absence of chiral carbon (biphenyls, allenes and spirane chirallity due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.



Unit III

Conformational analysis and reactive intermediates

Conformational analysis of cycloalkanes, decalins, effect of conformation on reactivity, conformation of sugars. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. The Hammett equation and linear free energy relationship, substituents and reaction constants, Taft equation.

Unit-IV

Reaction Mechanism: Structure and Reactivity

Type of mechanisms, types of reactions, thermodynamic and kinetic requirements, kinetic and thermodynamic control, Effect of structure on reactivity: resonance and field effect, steric effects, Hammond's postulate, Curtir-Hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopes effects

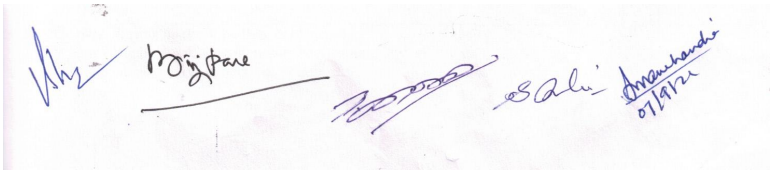
Unit-V

Aliphatic Nucleophilic Substitution

The SN^2, SN^1 mixed SN^1 and SN^2 and SET mechanism. The neighboring group mechanism, neighboring group participation by p and s bonds, anchimeric assistance. Classical and non classical carbocations, phenomium ions, norborynl systems, Common carbocation rearrangements: Pinacol-pinacolone, Wagner-Meerwein and Demjanov, The SNi mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophile, regioselectivity.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
5. Organic Reaction and Mechanism, P.S. Kalsi, New age international, New-Delhi.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professionsl.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Pericyclic Reactions, S.M. Mukherji, Macmillan, India
10. Stereochemistry, D. Nasipuri, New Age International.



Paper-III

MCH-103: PHYSICAL CHEMISTRY - I (5 credits)

OBJECTIVES: To impart the knowledge of

- Basics of quantum mechanics, Schrodinger equation and its application to solve model system.
- Approximation method, HMO theory, angular momentum.
- Nuclear stability and reactions, radioactivity, tracer techniques.
- Partial molar properties, concept of activity, fugacity and their determination methods**.**
- Distribution laws, Ensemble averaging, partition functions.

OUTCOMES: On completion of this course, the students will be able to understand

- Quantum mechanics and determine structure of atom, ion and magnitude of energies, tunneling effect, principle of causality.
- Approximation method, HMO theory, angular momentum and its applications to many electronic systems.
- Importance of subatomic particles, radioactive isotopes and their uses, tracer techniques and its applications.
- Debye Huckel theory for determination of activity coefficient and ionic strength applications of phase diagram to three component system.
- Bose-Einstein, Fermi-Dirac statistics, Ensemble averaging, partition functions and their applications.

Unit I

Introduction to Exact Quantum Mechanical Results

Schrödinger equation and the postulates of quantum mechanics, Discussion of solutions of the Schrödinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and hydrogen like wave function (shapes of orbitals), helium atom. Charge cloud representation of orbitals, Principle of casuality, Tunneling effect.

Unit-II

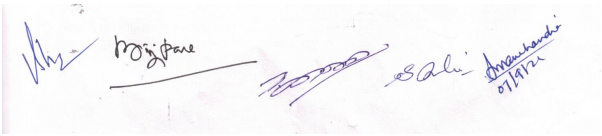
Approximate Methods

The variation theorem, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

Huckel theory of conjugated systems, bond and charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.

Ordinary angular momentum, generalized angular momentum, eigen fucntions for angular momentum, eigenvalues of angular momentum operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

Unit-III



Nuclear Chemistry

Introduction, characteristics of subatomic particles, Gluons, Quarks, Bosons, Nuclear stability, n/p ratio. nuclear energy and its future prospects, Mass defect, Packing fraction, Q value, Nuclear Models - Liquid drop Model, Shell Model, Collective Model, Fermi Gas Model. Nuclear reactions, Nuclear cross section, Nuclear fission, nuclear fusion and their significance, radioactivity, radioactive decay, radioactive isotopes and their uses, tracer techniques, Geiger Muller counter, Scintillation counter.

Unit-IV

Classical Thermodynamics

Free energy, chemical potential and entropies. Partial molar free energy, partial molar volume and partial molar heat content, their determination and significance.

Concept of fugacity and determination of fugacity. Non-ideal systems: Excess function for non-ideal solutions. Concept of activity and activity coefficient, determination of activity and activity coefficients;

Debye Huckel theory for activity coefficient of electrolytic solutions, ionic strength. Application of phase rule to three component systems; second order phase transitions.

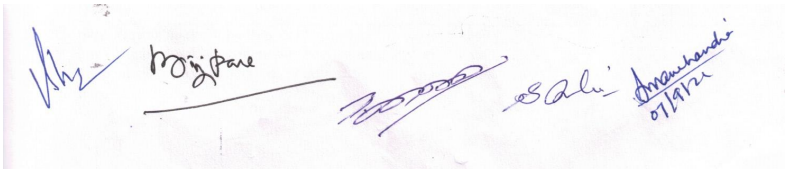
Unit-V

Statistical Thermodynamics

Concept of distribution, thermodynamic probability and most probable distribution. Ensemble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles, corresponding distribution laws (using Lagrange's method of undetermined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions, Calculation of thermodynamic properties in terms of partition. Applications of partition function. Fermi-Dirac Statistics. Bose-Einstein statistics

Books Suggested

1. Physical Chemistry: P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry: A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry,: Ira N. Levine, Prentice Hall.
4. Chemical Kinetics: K.J. Laidler, McGraw-Hill.
5. Principles of Physical Chemistry: Puri, Sharma ,Pathania Himalaya Publication
6. Basic Concepts of Nuclear Chemistry :Arnikar.
7. Basic Concepts of Nuclear Chemistry : Overman
8. Nuclear Physics and Chemistry: Harvey.
9. Source Book of Atomic Energy : Glasston
10. Introduction to Quantum Chemistry: R.K. Prasad, New Age Publication.
11. Physical Chemistry:T.Engel&Philip Reid. Pearson Education (2006)
12. Thermodynamics for Chemists :Glasston



Paper-IV

MCH-104: Group Theory & Spectroscopy I **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Concepts of symmetry and group theory in chemistry.
- Basic concepts and theories of microwave spectroscopy.
- Basic principle, modes of vibrations of Infrared spectroscopy and classical and quantum theories of Raman spectroscopy.
- Born-Oppenheimer approximation, Franck-Condon principle, electronic spectra of polyatomic molecules.
- The basics and instrumentation of NMR spectroscopy

OUTCOMES: On completion of this course, the students will be able to understand

- Mathematical treatment of group theory helps in predication of geometry, hybridization and spectral properties of molecules.
- Symmetry operations, point group examples, great orthogonality theorem and its uses, character tables and their applications in spectroscopy.
- The basic of Fourier transform spectroscopy, LASER, Synchrotron radiations and their applications, microwave oven, chemical analysis by microwave spectroscopy.
- Structure determination of compounds with the help of infrared and Raman spectroscopy and calculate different forms of energy of atoms and molecules.
- Rotational fine structure of electronic–vibration transitions of polyatomic molecules by electronic spectra.
- Nuclear spin, Larmor Precession, chemical shift, shielding-desheilding, CW and FT-NMR advantages.

Unit-I

Symmetry and Group theory in Chemistry

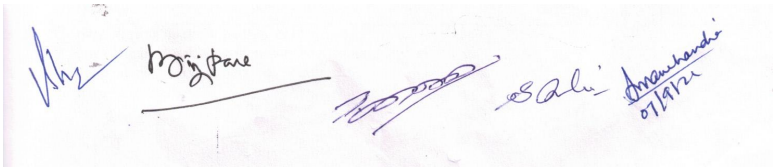
Symmetry elements and symmetry operations,definition of group, subgroup: Examples as H_2O, NH_3, BF_3,$[Ni(CN)_4]^{2-}$,PCl_5, H_2O_2, C_2H_4, Trans dichloro ethylene, C_6H_6, CO_2, H-Cl, allene etc.

Symmetry operations as matrices, conditions for a set of elements to be called a group, Conjugacy relation and classes. Point symmetry group,character of a representation. The great orthogonality theorem (without proof) and its importance, symbols for irreducible representations, character tables and their uses in spectroscopy. Derivation of character table for C_{2v} and C_{3v} point groups.

Unit-II

Microwave Spectroscopy

Characterisation of electromagnetic radiation, The Quantization of energy, Regions of the complete electromagnetic spectrum. Basic Elements of Practical Spectroscopy, Single to noise resolving power, The width and Intensity of spectral lines, Basic concept of Fourier Transform spectroscopy, Elementary idea of Stimulated Emisssion: LASERS, Synchrotron Radiations and their application.



Classification of molecules, Diatomic rigid rotator and non-rigid rotator model, allowed rotational energies, Population of energy levels, calculation of bond distance of carbon mono oxide, effect of isotopic substitution, Stark effect, Chemical Analysis by microwave spectroscopy, The microwave oven.

Unit-III

Infrared and Raman Spectroscopy

Energy of diatomic molecule, The simple harmonic oscillator, The Anhormonic Oscillator (Morse potential energy diagram), The diatomic vibrating Rotator, vibration-rotation spectroscopy. P.Q.R. branches, vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and intensities, The carbon dioxide, LASER.

Polarization of light and Raman Effect, Classical and quantum theories of Raman Effect. Pure rotational and vibration Raman spectra, selection rules, mutual exclusion principle, Structure determination from Raman and IR spectroscopy, Resonance Raman spectroscopy, Coherent Anti Stokes Raman spectroscopy (CARS).

Unit-IV

Electronic Spectroscopy

Energy levels of molecular orbitals, electronic spectra of diatomic molecules, The Born-Oppenheimer Approximation, Vibrational Coarse Structure: progressions, The Franck-Condon principle, Dissociation Energy and Dissociation Products, Rotational Fine structure of Electronic-vibration transitions, electronic spectra of polyatomic molecules, Change of shape on excitation, Chemical Analysis by Electronic Spectroscopy. The Re-emission of energy by an excited molecule.

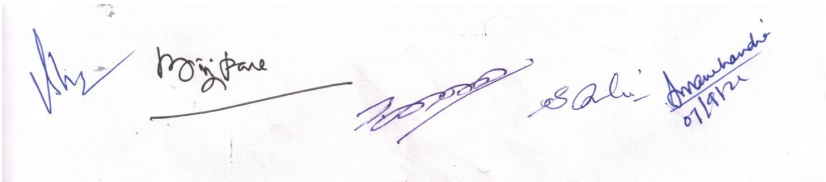
Unit-V

Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance, Population of Energy levels, The Larmor Precession, Relaxation Times, chemical shift and factors influencing chemical shift, shielding and deshielding, anisotropic effect, internal standards, spin-spin coupling, equivalent and non-equivalent protons, CW and FT-NMR, advantages of FT NMR, integration coupling (1st order analysis), basic ideas about instrument

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Wiley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. Physical Methods in Chemistry, R.S. Drago, Saunders College.
4. Chemical Applications of Group Theory, F.A. Cotton.
5. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
6. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
7. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBH, Oxford.
8. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
9. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, Harper & Row.



Paper-V

MCH-105 (a) : Mathematics and Statistics for Chemists (4 credits)

(For students without Mathematics in B.Sc.)

OBJECTIVES:

- To explain matrix algebra, its uses and properties.
- To explain vector algebra, dot, cross and triple products.
- To describe differentiation, integration and differential calculus in the physical sciences.
- To explain differential equations and its types with the applications.
- To study permutation and probability.
- To study statistical test and error analysis.

OUTCOMES: Upon successful completion, students should be able to:

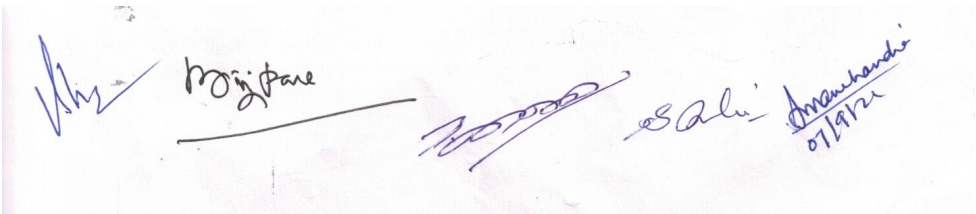
- Understand the matrix algebra, which is used for the manipulation of systems of equations, and for the construction of numerical methods of solution of the problems that give rise to theory of systems of linear equations in the physical sciences, in engineering, and in statistics.
- Understand the vector algebra, which is used for the formulation and solution of physical problems in three dimensions; in mechanics, fluid dynamics, electromagnetic theory, and engineering design. Some of the uses of vectors are in molecular dynamics, spectroscopy, and theoretical chemistry.
- Understand that how the value of a physical quantity is related to other physical quantities. In addition, they are able to understand how the value of the physical quantity changes on going from one state of the system to another, and in the rate of change with respect to time or with respect to some other physical quantity.
- Understand the probability theory which provides the theoretical models and analytical tools for the organization, interpretation, and analysis of statistical data.
- Understand the different types of Statistical test along with mean, mode, median with classification of errors.

Unit-I

Matrix algebra and Vector

A. Matrix algebra: addition and multiplication, inverse, adjoint and transpose of matrices, special matrices (symmetric, hermitian, skew hermitian, unit, diagonal etc) and their properties, matrix equations: homogeneous, non homogeneous, linear equations and conditions for the solution, linear dependence and independence of vectors, matrix eigen values and eigenvectors, diagonalization, determinants (examples from Huckel theory).

B. Vectors- dot, cross and triple products etc. the gradient, vector calculus, Gauss'theorem



Unit II

Differential calculus and differential equations

Functions, continuity and differentiability, rules for differentiation, applications of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell distribution etc), exact and inexact differentials with their applications to thermodynamic properties.

Variables-separable and exact first order differential equations, homogeneous, exact and linear equations, applications to chemical kinetics, secular equilibrium, quantum chemistry etc, solutions of differential equations by the power series method, solutions of harmonic oscillator, spherical harmonics, second order differential equations and their solutions.

Unit III

Integral calculus

Basic rules for integration, integration by parts, partial fraction and substitution, reduction formulae, applications of integral calculus, functions of several variables, partial differentiation, co-ordinate transformations e.g. Cartesian to spherical polar, curve sketching.

Unit IV

Permutation and probability

Permutations and combinations, probability and probability theorems, probability curves, average, root mean square and most probable errors, example from the kinetic theory of gases etc.

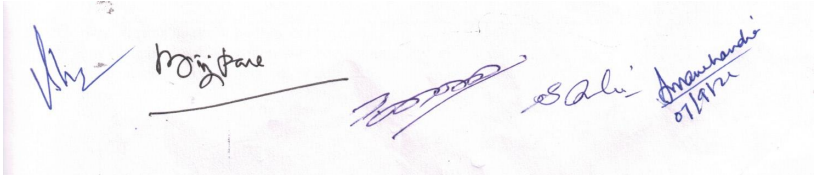
Unit V

Statistical tests and Error Analysis:

Accuracy, precision, mean, median, mode, significant figures and computation, mean deviation and standard deviation, classification of errors, Propagation of errors, Confidence limits, Tests of Significance, Rejection of results and Problems. Least square methods, regression coefficient, F-test, t-test and Chi-square test.

Book Suggested

1. The chemistry Mathematics Book, E.Steiner, Oxford University Press.
2. Mathematics for chemistry, Doggett and Suiclific, Logman.
3. Mathematical for Physical chemistry : F. Daniels, Mc. Graw Hill.
4. Chemical Mathematics D.M. Hirst, Longman.
5. Applied Mathematics for Physical Chemistry, J.R. Barante, Prentice Hall.
6. Mathematics for Chemists, Tebbutt, Wiley.



Paper-V

CH-105 (b) BIOLOGY FOR CHEMISTS **(4 credits)**

(For students without Biology in B.Sc.)

OBJECTIVES:

- To understand the principles of various fields of chemistry, analytical chemistry, biochemistry, genetics, metabolism and molecular biology.
- To develop as independent thinkers who are responsible for their own learning**.**
- To develop transferable quantitative skills.
- To apply modern instrumentation theory and practice to biochemical problem
- To make the students learn and understand the general concept of correlation between biology and chemistry.

OUTCOMES:

- The paper will develop individuals who have conceptual understanding of relation between biology and chemistry.
- Students will be imparted with basic knowledge about biology and will become aware about general life processes.
- The students will gain knowledge about different physiological and cytological aspects of body which will help them to understand the basis of drug development.
- (The study of the paper will help students to work in industries.

Unit-I

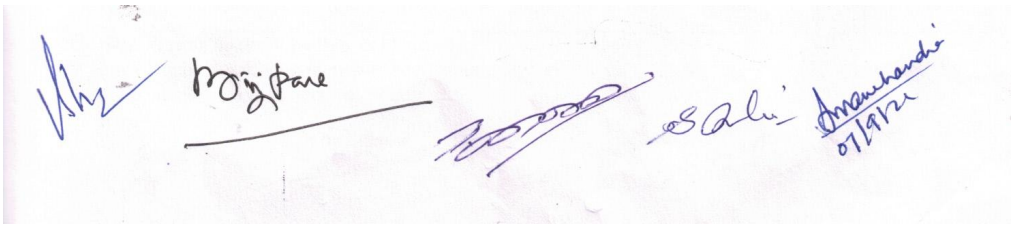
Cell Structure and Functions

Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Ove4rview and their functions, comparison of plant and animal cells. Overview of metabolic processes-catabolism and anabolism. ATP – the biological energy currency. Origin of life-unique properties of carbon chemical evolution and rise of living systems. Introduction to bio-molecules, building blocks of biomacromolecules.

Unit-II

Carbohydrates

Conformation of monosaccharides, structure and functions of important derivatives of mono-saccharides like glycosides, deoxy sugars, myoinositol, amino sugars. Nacetylmuramic acid, sialic acid disaccharides and polysaccharides. Structural polysaccharides cellulose and chitin. Storage polysaccharides-starch and glycogen. Structure and biological function of glucosaminoglycans of mucopolysaccharides. Carbohydrates of glycoporteins and glycolipids. Role of sugars in biological recognition. Blood group substances. Ascorbic acid.



Unit-III

Lipid

Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-compositiion and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism-boxidation of fatty acids.

Unit-IV

Amino-acids, Peptides and Proteins

Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing. Secondary structure of proteins. force responsible for holding of secondary structures. ahelix, -b-sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domina structure. Quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acids, sequence determination.

chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH).

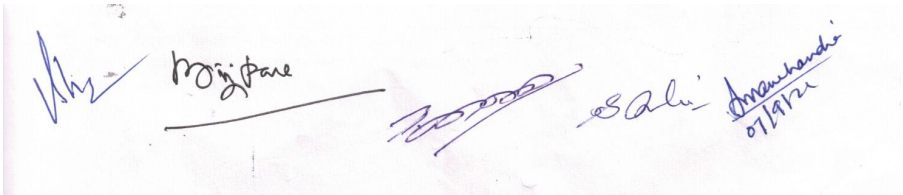
Unit-V

Nucleic Acids

Purine and pyrimidine bases of nucleic acids, base pairing via Hbounding. Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it. Chemical and enzymatic hydrolysis of nucleic acids. The chemical basis for heredity, an overview of replication of DNA, transcription, translation and genetic code. Chemical synthesis of mono and trinucleoside.

Book Suggested

1. Principles of Biochemistry, A.L. Lehninger, Worth Publishers.
2. Biochemistry, L. Stryer, W.H. Freeman.
3. Biochemistry, J. David Rawan, Neil Patterson.
4. Biochemistry, Voet and Voet, John Wiley.
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley.



PRACTICAL

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

SEMESTER I

Quantitative and quantitative Analysis	12
Preparation	12
Record	4
Viva Voce	5

Qualitative and Quantitative Analysis

a. Quantitative determinations of a three component mixture

b. Insoluble- Oxides, sulphates and halides.

c. Less common metal ions :Ti, Mo, W, Ti, Zr, Th, V, U (two metal ions in cationic/anionic forms).

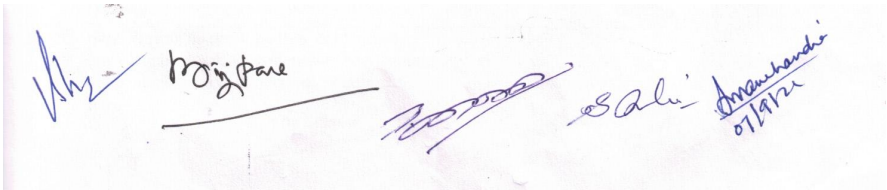
d. Quantitative separation and determination of the following pairs of metal ions using gravimetric and volumetric methods:

1. Cu^{2+} (gravimetrically) and Zn^{2+} (volumetrically),
2. Fe^{3+} (gravimetrically) and Ca^{2+} (volumetrically)
3. Cu^{2+} (gravimetrically) and Ni^{2+} (volumetrically)
4. Ni^{2+} (gravimetrically) and Zn^{2+} (volumetrically)
5. Cu^{2+} (gravimetrically) and Fe^{3+} (volumetrically)

Preparations

Preparation of selected inorganic compounds and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

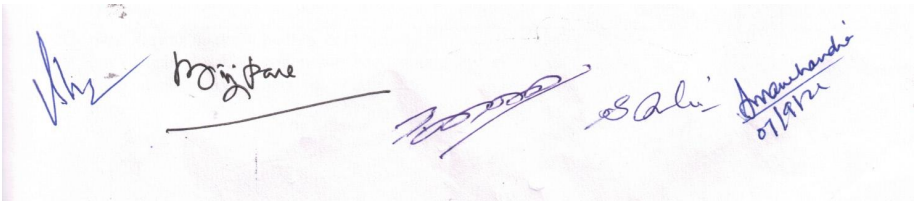
1. trans-potassium diaquabis(oxalato)chromate(III), trans-$K[Cr(ox)_2(H_2O)_2]$
2. cis-potassium diaquabis(oxalato)chromate(III), cis-$K[Cr(ox)_2(H_2O)_2]$
3. $Na[Cr(NH_3)_{2(}SCN)_4]$
4. $Ni(acac)_2$
5. $K_3[Fe(C_2O_4)_3]$
6. Prussian Blue, Turnbull's Blue.
7. Potassium tri-oxalato aluminate



ORGANIC CHEMISTRY
SEMESTER I
Organic Chemistry

Qualitative Analysis	16
Organic Synthesis	08
Record	4
Viva Voce	5

Qualitative Analysis
Separation, purification and identification of compounds of ternary mixture.
Organic Preparation
Acetylation: Acetylation of salicylic acid
Benzoylation of Glycine
Oxidation of benzil to benzilic acid
The Products may be Characterized by Spectral Techniques.



SEMESTER I

Physical Chemistry

Error Analysis and Statistical Data Analysis	8
Chemical Kinetics	9
Solution	8
Record	4
Viva Voce	5

Error Analysis and Statistical Data Analysis

1. Errors, types of errors, minimization of errors distribution curves precision, accuracy and combination; statistical treatment for error analysis, t test, null hypothesis, rejection criteria. F & Q test; linear regression analysis, curve fitting.
2. Calibration of volumetric apparatus, burette, pipette and standard flask.
3. Preparation of standard solutions (solid and liquid compounds) and their standardization
4. Equalization of strength of two acids by titrimetrically

Chemical Kinetics

Determination of the effect of (a) Change of temperature (activation parameters) (b) Change of concentration of reactant and catalyst and (c) Ionic strength of the media on the velocity constant of

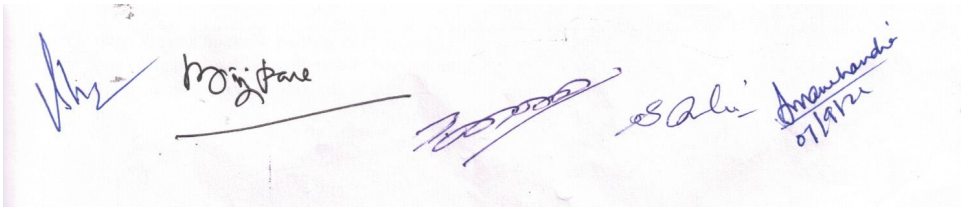
1. Acid catalyzed hydrolysis of an ester
2. Sodium-formate-I_2 reaction

Solution

1. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine- benzophenone system).
2. Determination of molecular weight of camphor by Rast method

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. curlin.



SEMESTER II

Paper-I

MCH-201: INORGANIC CHEMISTRY II **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Electronic spectral studies of transition metal complexes.
- Magnetic properties of transition of metal complexes.
- Bonding and structure of metal pi complexes.
- Structure and bonding in metal clusters.
- Rotatory dispersion and circular dichroism.

OUTCOMES: On completion of this course, the students will have the knowledge of

- Electronic spectral studies of d1-d9 systems in octahedral, tetrahedral and square planer complexes, Jahn-Teller effect, calculation of10Dq, B and β parameters.
- Guoy's method for determination of magnetic susceptibility, magnetic moments magnetic exchange coupling.
- Important reactions, bonding and structure elucidation of metal carbonyls, nitrosyls, dinitrogen.
- Wade's rule, sytx coding, total electron count and structure and bonding in metal clusters.
- Applications of optical rotatory dispersion and circular dichroism for the determination of absolute configuration and isomerism of complexes.

Unit-I

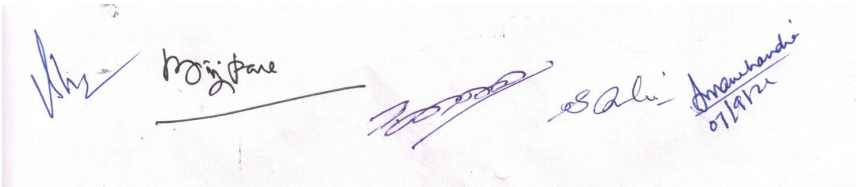
Electronic Spectral Studies of Transition Metal Complexes :

Spectroscopic ground states, Correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Electronic Spectral Studies for d^1 – d^9systemsin octahedral, tetrahedral and square planer complexes, Selection rule for electronic spectroscopy. Intensity of various type electronic transitions, Calculations of 10Dq, B and β parameters, effect of distortion on the d-orbital energy levels. Structural evidence from electronic spectrum, Jahn-Tellar effect, Spectrochemical and nephalauxetic series, charge transfer spectra

Unit-II

Magnetic Properties of Transition Metal Complexes

Origin of magnetism, types of magnetism, Curie law, Curie-Weiss Law, Magnetic properties of complexes-paramagnetism, quenching of orbital angular momentum by ligand fields, Magnetic properties of A, E & T ground terms in complexes, spin free- spin paired equilibria, Guoy's method for determination of magnetic susceptibility, calculation of magnetic moments, magnetic properties of free ions, orbital contribution, effect of ligand-field, Anomalous magnetic moments, magnetic exchange coupling and spin state cross over.



Unit-III

Metal π-Complexes

Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding structure and important reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand

Unit-IV

Metal Clusters

Structure and bonding in higher boranes, styx coding, Wade's rules, Carboranes, metalloboranes and metallo-carboranes compounds with metal metal multiple bonds. Metal Carbonyl clusters- Low Nuclearity Carbonyl clusters, High Nuclearity Carbonyl clusters, total electron count (TEC), Halide type Clusters, Chevrel phases, Naked clusters

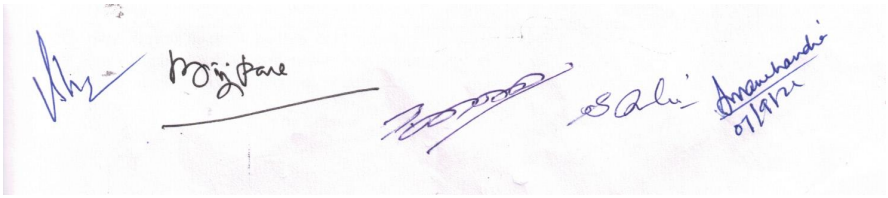
Unit-V

Optical Rotatory Dispersion and Circular Dichroism

Linearly and circularly polarized lights; optical rotatory power and circular birefringence, elipticity and circular dichroism; ORD and Cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings

Books Suggested :

1. Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes& Row.
3. Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.
4. Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.
5. Magnetiochemistry, R.1. Carlin, Springer Verlag.
6. Comprehensive Coordination Chemistry eds., G. Wilkinson, R.D. Gillars and J.A. Mc Cleverty, Pergamon.



Paper-II

MCH-202: ORGANIC CHEMISTRY II **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Aromatic electrophilic and nucleophilic substitution.
- Reaction conditions, products formation and mechanisms of free radical reactions.
- Mechanisms of addition reactions of Carbon-carbon double bonds.
- Mechanisms of addition reactions of Carbon–hetero multiple bonds
- Different types of organic reactions and reagents.

OUTCOMES: On completion of this course, the students will be able to understand

- Mechanistic aspects of Diazonium coupling, Vilsmeir, Gatterman-Koch, VonRichter, Sommelet–Hauser reaction and Smiles rearrangement.
- Types, mechanism, reactivity and rearrangement of free radical reactions, fenton's reagent, Elbs reaction.
- Mechanisms and stereochemistry of addition reactions of C=C bonds, Birch reduction, Hydroboration, Michael reaction.
- Mechanisms of LAH, $NaBH_4$, E1, E2, E1CB reactions.
- Synthesis, mechanism and applications of different types of organic reactions and reagents.

Unit-I

Aromatic Electrophilic Substitution

The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeirreactiion, Gatterman-Koch reaction

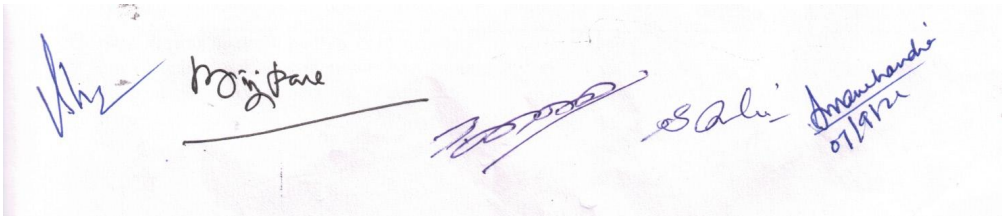
Aromatic Nucleophilc Substitution

The SNAr SN1, benzyne and SRN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richter. Sommelet-Hauser, and Smiles rearrangements.

Unit-II

Free Radical Reactions

Types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, autooxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction, Oxidation by peracids, Fenton's reagent, Elbs reaction.



Unit III

Addition to Carbon-Carbon double bonds

Mechanism and stereochemistry of addition reactions involving electrophiles, nucleophiles and free radicals, orientation and reactivity, cyanoethylation. Addition to conjugated systems. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings, Birch reduction. Hydroboration, Michael reaction, Sharpless asymmetric epoxidation.

Unit-IV

Addition to Carbon-Hetero Multiple bonds

Mechanism of reduction of LAH and $NaBH_4$of saturated and unsaturated carbonyl compounds, acids, esters and nitriles, chemoselectivity.

Addition of Grignard reagents, organozinc and organolithium reagents to saturated and unsaturated carbonyl compounds.

Elimination Reactions

The E2, E1 and E1 cB mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures, attacking base, the leaving group and the medium. Mechanism and orientation in pyrolytic elimination.

Unit-V

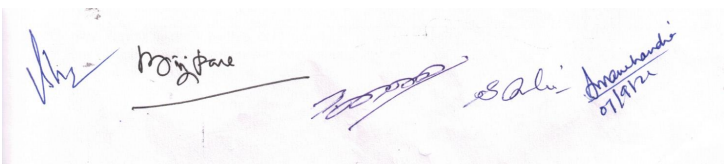
Organic Reactions and Reagents:

Reactions with mechanism and synthetic applications: Stork Enamine, Haller-Bauer, Houben-Hoesch, Shapiro, Stobbe, Wittig, Swern oxidation, Hoffman-Loffler-Freytag reactions, Di-Pi methane rearrangement, Dienone-phenol rearrangement.

Preparations of reagents and their synthetic applications: Lithium diisopropyl amide (LDA), Osmium tetra-oxide(OsO_4), Lead tetra acetate (LTA), Dicyclohexylcarbodiimide (DCC), 1,3-dithiane, Lithium dialkylcuprate, Pyridinium chlorochromate(PCC), Jone's and Collin reagents, Wilkinson's catalyst.

Book Suggested

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Structure and Mechanism in Organic Chemistry, C.K. Ingold, Comell University Press.
5. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice-Hall.
6. Modern Organic Reactions, H.O. House, Benjamin.
7. Principles of Organic Synthesis, R.O.C. Norman and J.M. Coxon, Blackie Academic & Professional.
8. Reaction Mechanism in Organic Chemistry, S.M. Mukherji and S.P. Singh, Macmillan.
9. Organic name reactions(A Unified approach), Goutam Brahmachari, Narosa Publishing House, New-Delhi.
10. Stereochemistry of Organic Compounds, D.Nasipuri, New Age International.
11. Stereochemisty of Organic Compounds, P.S. Kalsi, New Age International.
12. Some Modern Methods of Organic Synthesis. W. carruthers, Cambridge Univ. Press
13. Modern Methods of Organic Synthesis Normon-Coxan
14. Reaction Mechanism in Organic Chemistry, P.S. Kalsi, New age international, New- Delhi.



Paper-III

MCH-203: PHYSICAL CHEMISTRY II **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Rate laws of chemical reactions and kinetics, mechanism of chain reaction, enzyme catalysed reaction, fast reaction and unimolecular reactions.
- Surface tension, Gibb's adsorption isotherm, BET equation, thermodynamics and solublization of micelles
- Basics of polymers, classification and applications of polymers
- Phenomenological laws, Onsger reciprocity relation, pregoine principle
- Electrode reaction and processes in electrochemical systems, structure of electrified interface, Lippman equation, Butler-Volmer equation, Tafel plot

OUTCOMES: On completion of this course, the students will be able to understand

- Rate laws determination of chemical reactions and distinguishing the reaction of different order and their characteristics for optimizing the experimental conditions.
- Estimation of surface parameters by surface chemistry and applications of micelles
- Configuration and conformation of polymers and number, mass average molecular weight determination methods
- Importance and applications of non equilibrium thermodynamics
- Theories of electrochemical reactions and the application of electrochemistry in electro analytical fields.

Unit-I

Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, homogenous catalysis, Dyamic chain reactions (hydrogen-bromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical chain reactions (Hydrogen Bromine and hydrogen-Chlorine), kinetics of enzyme catalysed reactions,

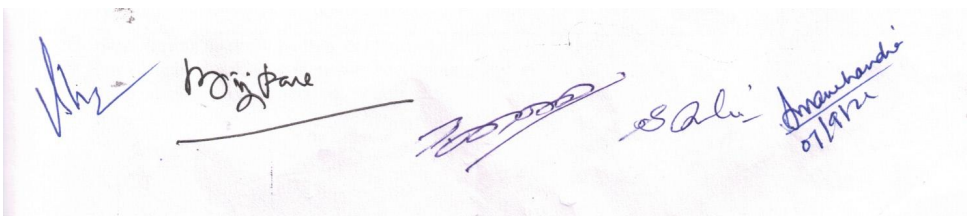
general features for fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis and the nuclear magnetic resonance method,

treatment of unimolecular reactions. dynamics of unimolecular reactions (Lindemann Hinshelwood and Rice-Ramsperger-Kassel- Marcus (RRKM) theories for unimolecular reactions).

Unit-II

Surface Chemistry and Micelles

Surface tension, surface energy, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).



Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles. Applications of micelles.

Unit-III

Polymer Chemistry

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-IV

Non-Equilibrium Theromodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non-equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

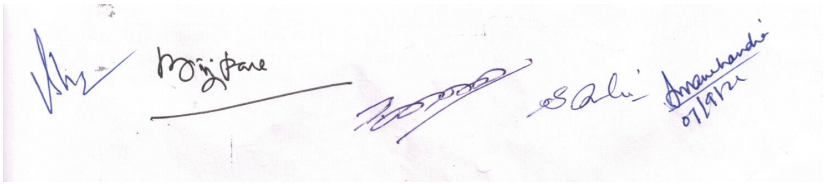
Unit-V

Electrochemistry

Electrochemistry of solutions. Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode, Thermodynamics of electrified interface equations, Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination, Structure of electrified interfaces, Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot, Quantum aspects of charge transfer at electrodes-solution interfaces, electrolyte solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, structure of double layer interfaces, Effect of light at semiconductor solution interface.

Books Suggested

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Coulson's Valence, R.Mc Ween y, ELBS.
5. Chemical Kinetics. K. J. Laidler, McGraw-Hill.
6. Kineties and Mechanism of Chemical Transformation J.Rajaraman and J. Kuriacose, Mc Millan.
7. Micelles, Theoretical and Applied Aspects, V. MOraoi, Plenum.
8. Modern Electrochemistry Vol. 1 and Vol II J.O.M. Bockris and A.K.N. Reddy, Planum.
9. Introduction to Polymer Science, V.R. Gowarikar, N.V. Vishwanathan and J.Sridhar, Wiley Eastern.



Paper-IV

MCH-204: Spectroscopy II and Diffraction Methods (5 credits)

OBJECTIVES: To impart the knowledge of

- Coupling constants, ^{13}C, ^{19}F, ^{31}P NMR studies, quadrupole nuclei, quadrupole moments and splitting.
- Zero field splitting Kramer's degeneracy, g-value, Mc Connell relationship.
- Concept of ESCA, Augar electron spectroscopy, EXAFS, SEXAFS.
- Laue, Bragg and Debye Scherrer method of X-ray structural analysis of crystals.
- Wierl equation, low energy Electron diffraction, scattering of neutrons by solid measurement techniques

OUTCOMES: On completion of this course, the students will be able to understand

- Spin-spin interaction, nuclear quadrupole resonance spectroscopy and its applications.
- Measurement and applications of electron spin resonance spectroscopy
- Surface characterization by ESCA, Auger electron spectroscopy, EXAFS, SEXAFS
- Basics and importance of X-ray diffraction technique, absolute configuration of molecules, structure analysis of crystal by X-ray diffraction method
- Elucidation of gas molecules and magnetically ordered unit cells by Electron and neutron diffraction techniques

Unit-I

Nuclear Magnetic Resonance Spectroscopy

Spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). spin decoupling, NMR studies of nuclei other than proton-13C, 19F and 31P.

Nuclear Quadrupole Resonance Spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting. Applications.

Unit-II

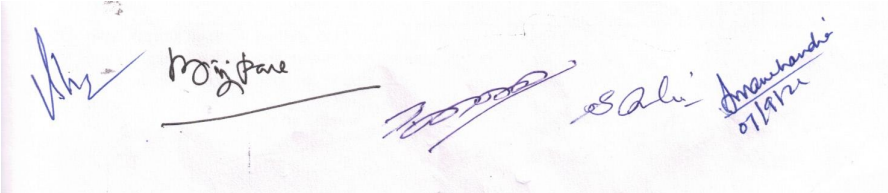
Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

Unit III

Surface Spectroscopies

Vibrational studies of surfaces, EELS, RAIRS, Raman Spectroscopy, Photoelectron Spectroscopy, Basic principles, photo-electric effect, ionization process, Koopman's theorem. Photoelectron spectra of simple molecules, ESCA, chemical information from ESCA. Auger electron spectroscopy, X-Ray Fluorescence, Structural Methods: EXAFS, SEXAFS,



Unit-IV

X-ray Diffraction

Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.

Unit-V

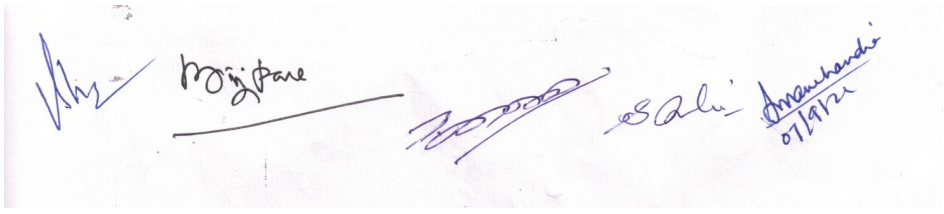
Electron Diffraction

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces.

Neutron Diffraction Scattering of neutrons by solids measurement techniques, Elucidation of structure of magnetically ordered unit cells.

Books suggested

1. Modern Spectroscopy, J.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and F.L. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R.V., Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.
5. Chemical Applications of Group Theory, F.A. Cotton.
6. Introduction to Molecular Spectroscopy, G.M. Barrow, Mc Graw Hill.
7. Basic Principles of Spectroscopy, R. Chang, Mc Graw Hill.
8. Theory and Application of UV Spectroscopy, H.H. Jaffe and M. Orchin, IBHOxford.
9. Introduction to Photoelectron Spectroscopy, P.K. Ghosh, John Wiley.
10. Introduction to Magnetic Resonance. A Carrington and A.D. Maclachalan, harper & Row.



Paper-V

MCH-205: COMPUTERS FOR CHEMISTS (4 credits)

OBJECTIVE:

- To make the students learn the working of computer.
- To develop competence of students in using computers to solve problems related to Chemistry.
- To demonstrate the applications of computer science in chemistry via programming.
- To make the students to use the software as a tool to understand chemistry, and solve chemistry based problems.
- To identify the applications of internet useful for chemistry.

OUTCOMES:

- To understand the basic concepts of computer and programming language.
- To understand the basic fundamentals of C programming language.
- To acquire the knowledge of C functions.
- To understand basic programs of C programming language in relation with chemistry.
- To understand the basics of internet and its applications for chemistry and utilize the chemistry softwares.

UNIT-I

Basic structure and functioning of computer, Memory I/O devices. Secondary storages, Computer languages, Operating systems with DOS as an example, Introduction to UNIX and WINDOWS.

Basics of Programming: Algorithms, Flowcharts, Introduction to Programming Languages, Assembler, Compiler, Interpreter, Features of HighLevel Programming Languages, Procedure Oriented Programming Language, History and Importance of C, Structure of C Program.

UNIT-II

Programming with C: Character Set, Identifiers, Keywords, Variables, Character Strings, Qualifiers, Typecasting, Constants, Operator and Expression, Operator Precedence and Associativity, Input-Output Statements.

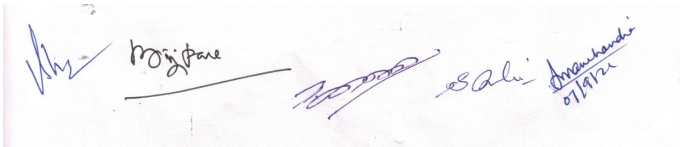
Control Statements: if, if-else, nested if, if-else ladder, switch Statements, Loops: for, while do-while, break and continue statement, Arrays, Strings.

UNIT-III

Functions: Why function? Structured Programming, Parameter Passing: call by value, call by reference, return values, recursion v/s iteration, scope extent, passing arrays and function to functions.

UNIT-IV

Developing of small computer codes involving simple formulae in Chemistry such as Van der Waals equation, Chemical kinetics (determination of Rate constant), Radioactive decay (Half Life and Average Life), Determination of Normality, Molarity and Molality of solutions, Evaluation of



Electronegativity of atom and Lattice Energy from experiment, determination of molecular weight and percentage of element organic compounds using data from experimental, metal representation of molecules in terms of elementary structural features such as bond lengths, bond angles, dihedral angles, etc.

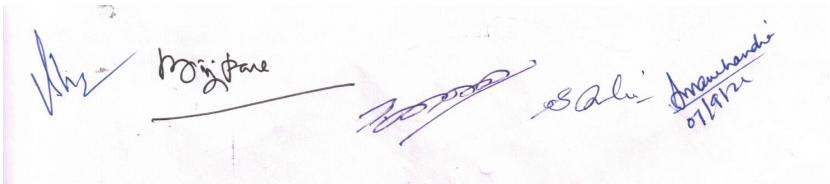
UNIT-V

Computer Software in Chemistry: Instrument Control, Instrument Maintenance and Calibration system, Graphical Display of Data and Molecular Structures, Chem Office, Chemdraw, Chemistry 4-D Draw Standard.

Introduction to Internet, Application of Internet for Chemistry, Search Engine, Net Protectors and E-mail version.

Reference Books

1. Computers and Their Applications to Chemistry by Ramesh Kumari, Narosa Publication
2. Let us C by Y. Kanetkar, BPB Publication
3. Programming in C by E. Balaguruswamy



PRACTICALS

SEMESTER II

Inorganic Chemistry

Chromatography	12
Preparation	12
Record	4
Viva Voce	5

Chromatography Separation of cations and anions by Column Chromatography : Ion exchange.

A. To determine the ion exchange capacity of cation exchangers
B. To determine the ion exchange capacity of anion exchangers
C. Ion – exchange chromatography; Separation & estimation of (Zn^{+2}/ Cd^{+2}) &(Zn^{+2} / Mg^{+2}) in mixtures using Amberlite IRA 400 anion exchanger
D. To determine the total cation concentration of given sample of water by ion exchange in ppm.

Preparations

Preparation of selected inorganic compounds and their studies by I.R. electronic spectra, Mossbauer, E.S.R. and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds.

1. $[Co(NH_3)_6]$ $[Co(NO_2)_6]$
2. $Hg[Co(SCN)_4]$
3. $[Co(Py)_2Cl_2]$
4. $[Ni(NH_3)_6]Cl_2$
5. $Ni(dmg)_2$
6. $[Cu(NH_3)_4]SO_4H2O$
7. $[Cr(NH_3)_6]Cl_3$
8. Reinecke's salt.

SEMESTER II

Organic Chemistry

Organic Synthesis	12
Quantitative Analysis	12
Record	4
Viva Voce	5

Organic Synthesis

Claisen Schmidt reaction:Dibenzal acetone from benzaldehyde.

Sandmeyer reactuion : p- Chlorotoluene from p-toluidine.

Acetoacetic ester Condensation : Synthesis of ethyl-n-butylacetoacetate by A.E.E. condensation.

Cannizzaro reaction : 4-Chlorobenzaldehyde as substrate.

Friedel Crafts reaction : b-Benzoyl propionic acid from succinic anhydride and benzene.

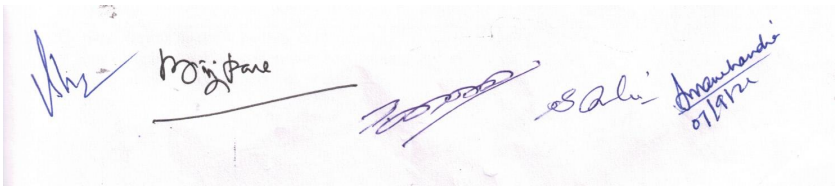
Aromatic electrophilic sustitutions : Synthesis of p-nitroaniline and p-bromoaniline.

The Products may be Characterized by Spectral Techniques.

Quantitative Analysis

Determination of iodine and Saponification values of an oil sample.

Determination of DO, COD and Hardness of water sample.



SEMESTER II

Physical Chemistry

Conductometry	12
Potentiometry/pH metry/ Polarimetry	13
Record	4
Viva Voce	5

Conductometry

1. To find out the strength of HCl solution by titrating against standard NaOH solution conductometrically
2. To find out the strength of HAc solution by titrating against standard NaOH solution conductometrically
3. To find out the strength of HCl andHAc in a mixture of both by titrating against standard NaOH solution conductometrically

Potentiometry/pH metry

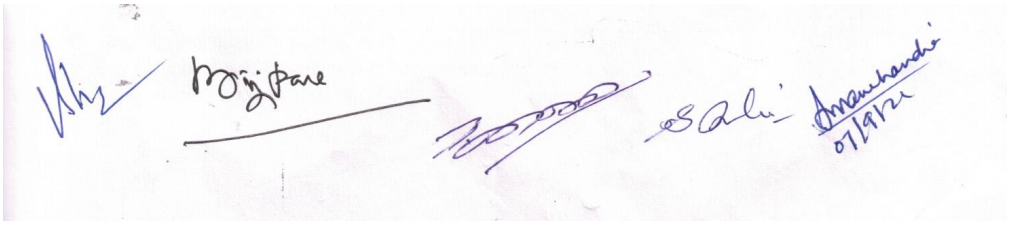
1. Estimation of halides (Cl^-,Br^- and I^-) single ionsand in a mixture potentiometrically.
2. Determination of the strength of strong and weak acids in a given mixture using pH meter.
3. Acid-base titration in a non-aqueous media using a pH meter.
4. Determination of activity and activity coefficient of electrolytes.
5. Determination of the dissociation constant of monobasic/polybasic acid by titrating against standard NaOH solution.

Polarimetry

1. Determination of rate constant for hydrolysis/inversion of sugar using a polarimeter.
2. Enzyme kinetics-inversion of sucrose.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. curlin.



SEMESTER III

Paper-I

MCH-301: APPLICATIONS OF SPECTROSCOPY- I (5 credits)

OBJECTIVES: To impart the knowledge of

- Electronic spectral studies of d^1-d^9 system in octahedral and tetrahedral complexes.
- Applications of group theory to infrared spectroscopy, symmetry and shapes of molecules.
- Measurement of chemical shift values, correlation proton bonded to carbon and other nuclei complexes spin-spin interaction between two and three ordered spectra.
- Carbon-13 nuclear resonance spectroscopy, FT technique, chemical shift of carbonyl, nitrosyl, oxime carbons
- Basic principle, spectral parameters and applications of Mossbauer techniques.

OUTCOMES: On completion of this course, the students will be able to understand

- Calculation of crystal field, inter electronic repulsion and bonding parameters by electronic spectroscopy.
- Symmetry aspects of molecular vibrations and mode of bonding in complexes, Resonance Raman spectroscopy and its applications.
- NMR shift reagent, nuclear overhauser effect (NOE), Karplus curve variation with coupling constant.
- Proton decoupling technique, off-resonance technique calculation of chemical shift of hydrocarbons and different types of carbons
- Mossbauer spectroscopic methods used for the characterization of organic compounds and Inorganic Compounds

Unit I

Electronic Spectroscopy

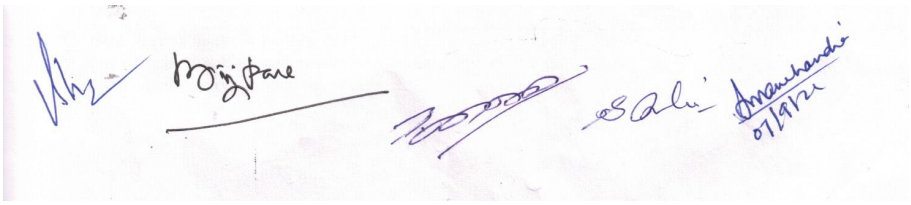
Electronic Spectral Studies for d^1 – d^9systems in octahedral, tetrahedral and square planer complexes, calculation of Crystal Field parameters, inter electronic repulsion parameter and bonding parameters.

Unit II

Vibrational Spectroscopy

Symmetry aspects of molecular vibrations of H_2O molecule. Application of Group theory to Infrared Spectroscopy: Introduction, selection rules, symmetry of vibrations and their IR activity, Group vibration concept and its limitations.

Symmetry and shapes of AB_2, AB_3, AB_4, AB_5 and AB_6, mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of Resonance Raman spectroscopy and its applications.



Unit III

Nuclear Magnetic Resonance Spectroscopy-I

Mechanism of measurement of chemical shift values and correlation for protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic) and other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides & mercapto), Chemical exchange, effect of deuteration, Complex spin spin interaction between two and three (I order spectra), Stereochemistry, hindered rotation, Karplus curve-variation of coupling constant with disordered angle. NMR shift reagents, solvent effects. nuclear over hauser effect (NOE).

Unit IV

Nuclear Magnetic Resonance Spectroscopy-II

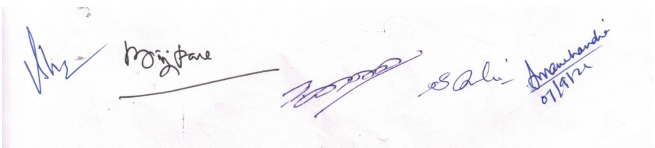
Carbon-13 NMR Spectroscopy, General considerations, instrumental difficulties, FT technique, advantages and disadvantages. Proton Noise Decoupling technique, off-resonance technique, Chemical shifts of solvents, factors affecting chemical shifts, analogy with ^{1}H NMR, calculations of chemical shift of hydrocarbons, effect of substituents on chemical shifts, different types of carbons (alkene, alkyne and allene), chemical shift of aromatic carbons and effect of substituent. Chemical shifts of carbonyl, nitrile, oxime carbons.

Unit V

Mössbauer Spectroscopy Basic principles, spectral parameters and spectrum display. Application of the technique to the studies of (1) bonding and structures of Fe^{+2} and Fe^{+3} compounds including those of intermediate spin, (2) Sn^{+2} and Sn^{+4} compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

Books Suggested:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral: Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassleradn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.



Paper-II

MCH-302: PHOTOCHEMISTRY AND PERICYCLIC REACTIONS (5 credits)

OBJECTIVES: To impart the knowledge of

- Photochemical excitation and Jablonski diagram, various phenomenon, photo reduction.
- Photochemistry of alkenes, butadienes and aromatic compounds.
- Photochemistry of carbonyl compounds and miscellaneous photochemical reactions.
- Pericyclic reactions: HOMO, LUMO, FMO, PMO and electrocyclic reactions.
- Pericyclic reactions: Cyclo addition and sigma tropic rearrangements

OUTCOMES: On completion of this course, the students will be able to understand

- The importance of photochemistry, determination of rate constant and life time of photochemical reactions.
- Photochemistry of Alkenes: cis-trans isomers, rearrangement of dienes, addition and substitution of aromatic compounds
- Photochemistry of carbonyl compounds, Barton reaction, singlet molecular oxygen reaction.
- Molecular orbital symmetry, Woodword-Hoffman rule, thermal and photochemical reactions of 4 and [4+2] systems.
- [2+2] and [4+2] cycloaddition reactions, suprafacial and antarafacial shifts of hydrogen, Claisen-Cope rearrangement.

Unit I

Interaction of electromagnetic radiation with matter(Dual nature of light and matter) types of excitations, singlet and triplet states, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

Determination of Reaction Mechanism

Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions, photoreduction.

Unit II

Photochemistry of Alkenes

Cis-trans isomerization, inter and intramolecular cyclisation reactions, Photochemistry of butadiene, Rearrangement of 1,4-(di-pi rearrangement) , 1,5- 1,6- and 1,7-dienes.

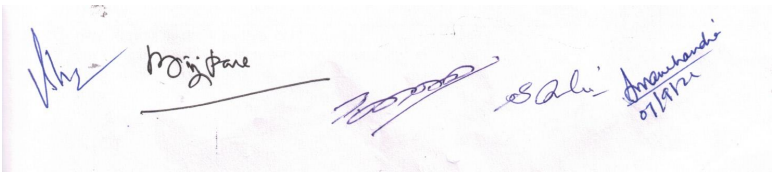
Photochemistry of Aromatic Compounds

Isomerisations, additions and substitutions.

Unit III

Photochemistry of Carbonyl Compounds

Reactions of carbonyl compounds-saturated, cyclic, acyclic and α, β- unsaturated compounds, Intermolecular cyloaddition reactions-dimerisations and oxetane formation.



Miscellaneous Photochemical Reactions

Barton reaction, Singlet molecular oxygen-structure, methods of generation and its reaction.

Unit IV

Pericyclic Reactions-I

Molecular orbital symmetry, HOMO and LUMO, Ground state and excited state electronic configurations of a conjugated diene, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system.

Electrocyclic reactions

Conrotatory and disrotatorymodes,Woodward-Hoffmann rules.

FMO and PMO approaches: Thermal and photochemical reactions of 4 and 4+2 systems (1,3-Butadiene and 1,3,5 – hexatriene), correlation diagrams.

Unit V

Pericyclic Reactions-II

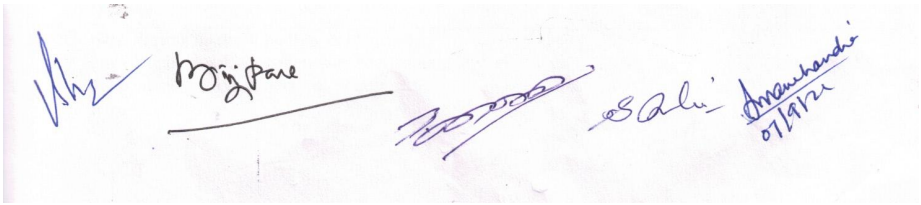
Cycloaddition Reactions

FMO approach, antarafacial and suprafacial additions, Molecular orbitals of ethylene, [2+2] and Diels-Alder [4+2] cycloadditions, endo and exo product, stereochemical rule, 1,3 dipolar cycloadditions.**Sigmatropic rearrangements**

Suprafacial and antarafacial shifts of H, 1,3-, 1,5- and 1,7- sigmatropic H shift, Claisen, and Cope rearrangements,Ene reaction.

Books Suggested

1. Fundamentals of photochemistry, K.K. Rothagi-Mukheriji, Wiley-Eastern.
2. Essentials of Molecular Photochemistry, A Gilbert and J. Baggott, Blackwell Scientific Publication.
3. Molecular Photochemistry, N.J. Turro, W.A. Benjamin.
4. Introductory Photochemistry, A. Cox and T. Camp, McGraw Hill.
5. Photochemistry, R.P. Kundall and A. Gilbert. Thomson Nelson.
6. Organic Photochemistry, J. Coxon and B.Halton, Cambridge University Press.



Paper-III

MCH 303 SOLID STATE CHEMISTRY **(5 credits)**

OBJECTIVES: To impart the knowledge of

- General principle, classifications and preparation of solids.
- Solid state reactions, crystal growth and properties of solids.
- Crystal defect, thermodynamics and properties of defects in solid
- The free electron, band theories of solids, the optical, magnetic and electrical properties of solids.
- Organic solids and types of liquid crystals, superconductors.

OUTCOMES: On completion of this course, the students will be able to understand

- Close packing, voids, structure of ionic crystals, spinels, perovskites.
- Kinetics and mechanism of solid state reactions, methods and theories of crystal growth.
- The importance and properties of defects in solid,colour centers, surface imperfections in solids.
- Electronic and band structure of solids, applications of optical , magnetic and electrical properties of solids.
- Electrically conducting solids, new materials, various theories of liquid crystals, LCD.

Unit I

The Structure of solids

The types of matter, classification of solids, close packing of atoms; Voids in closest packings; Radius ratio rule, Structure of ionic Crystals; Ionic Crystals with stoichiometry MX, Ionic Crystals with stoichiometry MX_2, spinel structure, inverse spinel, perovskite structure.

Unit II

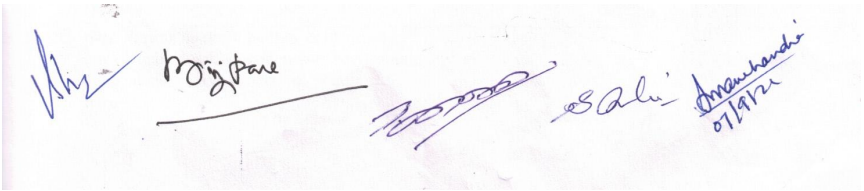
Solid State reactions and Crystal Growth

Classification of solid state reactions and their kinetics and mechanisms, thermal decomposition reaction, Nucleation, Reaction between two solids, Improving the reactivity of solids, Methods and theories of crystal growth, Zone refining method

Unit III

Crystal Defects and Non-Stoichiometry

Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects, Thermodynamics of Schottky and Frenkel defect formation, colourcentres, non-stoichiometry defects, Surface imperfections.



Unit IV

Electronic Properties and Band Theory

Metals insulators and semiconductors, electronic structure of solids, band theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, superconductors.

Optical properties-Application of optical and electron microscopy

Magnetic Properties-Classification of materials: Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.

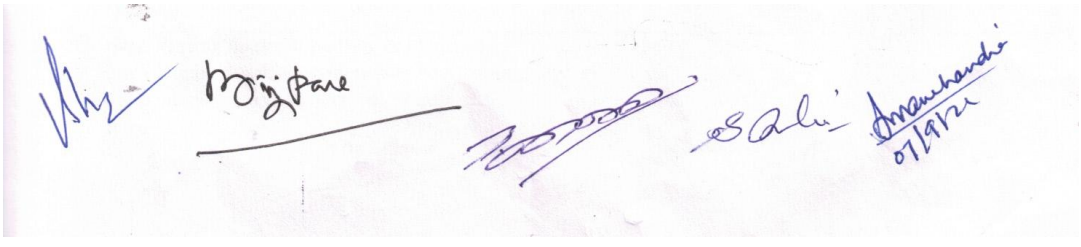
Unit V

Organic Solids and Liquid Crystals

Electrically conducting solids, organic charge transfer complex, organic metals, new superconductors. Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.

Books Suggested.

1. Solid state chemistry and its applications, A.R. West. Peenum.
2. Principles of the Solid State, H.V. Keer, Wiley Eastern.
3. Solid State Chemistry, N.B. Hannay.
4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.



ELECTIVE PAPERS

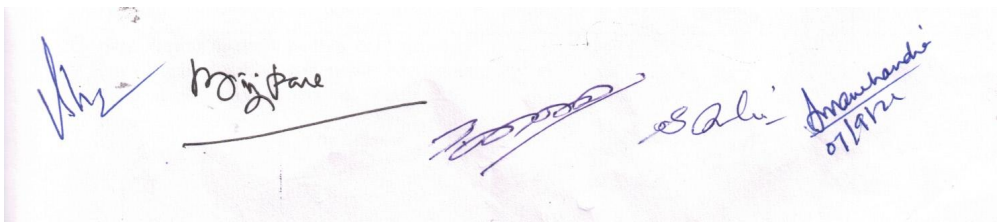
Out of the following select any two papers each of marks 50:

Discipline centric

1. OPT-1 MCH-304A Polymers
2. OPT-2 MCH-304B Heterocyclic Chemistry
3. OPT-3 MCH-304C Bioorganic Chemistry
4. OPT-4 MCH-304D Biophysical Chemistry
5. OPT-5 MCH-304E Bioinorganic Chemistry
6. OPT-6 MCH-304F Electrochemistry

Interdisciplinary

1. OPT-1 MCH-304G Environmental Chemistry



MCH-304 A POLYMERS **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Basic concepts and classifications of polymers, types of polymerization process.
- Number, weight and viscosity average molecular weights with various techniques.
- Processing of thermoplastic and thermosetting polymers with various techniques.
- Analysis, testing and characterization of polymers.
- Structure, properties and applications of polymers

OUTCOMES: On completion of this course, the students will be able to understand

- Importance of polymers, copolymerization, polymerization in homogeneous and heterogeneous system.
- Polydispersion-average molecular weight concept, practical significance of molecular weight, various molecular weight determination methods.
- Compounding, calendaring, casting, moulding, thermo forming of plastics, fibers, elastomers.
- Chemical, physical, thermal, mechanical testing of polymers, spectroscopic method of analysis of polymers.
- Functional polymers, biomedical polymers, borane, silicone, phosphorus, sulphur polymers, co-ordination, and metal chelate polymers.

Unit I

Basics

Importance of polymers, Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers, Classification of polymers, Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization, Polymerization conditions and polymer reactions, Polymerization in homogeneous and heterogeneous systems

UnitII

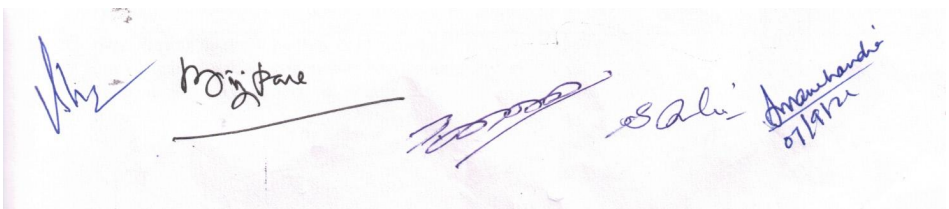
Polymer Characterization

Polydispersion-average molecular weight concept, Number, weight and viscosity average molecular weights, Polydispersity and molecular weight distribution, The practical significance of molecular weight, Measurement of molecular-weights, End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.

UnitIII

Analysis and testing of polymers

Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study, Microscopy, Thermal analysis and physical testing-tensile strength. fatigue, impact, tear resistance, Hardness and abrasion resistance.



UnitIV

Polymer Processing

Plastics, elastomers, fibers, Compounding, Processing techniques. Clendering, die casting, rotational casting, film casting, injection moulding, blow moulding, extrusion moulding, thermoforming, foaming, reinforcing and fire spining

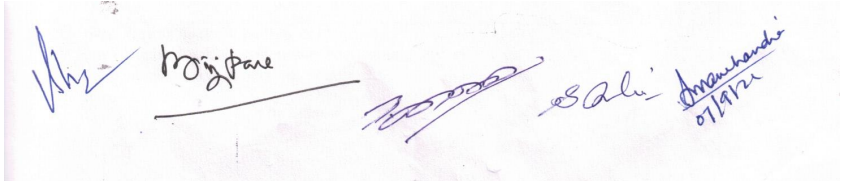
Unit V

Structure, Properties and Application of Polymers

Functional polymers: Fire retarding polymers and Electrically conducting polymers.
Biomedical polymers: Contact lens, dental polymers, artificial heart and kidney
Polymers based on boron-borazines, boranes and carboranes.
Polymers based on Silicon, silicone's polymetalloxanes, polymetallosiloxanes and silazanes.
Polymers based on Phosphorous-Phosphazenes, Polyphosphates
Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds.
Co-ordination and metal chelate polymers.

Books Suggested

1. Inorganic Chemistry, J.E. Huheey, Harper Row.
2. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.
3. Inorganic polymers- N.H. Ray.
4. Inorganic polymers, Graham and Stone.
5. Inorganic Rings and Cages : D.A. Armitage.
6. Textbook of Polymers Science, F.W. Billmeyer Jr. Wiley.
7. Contemporary Polymer Chemistry, H.R. Al cock and F.W. Lambe, Prentice Hall
8. Polymer Science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, Wiley-Eastern.
9. Inorganic polymers, J. E. Mark, H. R. Allcok and R. West.



MCH-304 B HETEROCYCLIC CHEMISTRY **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Nomenclature and aromaticity of heterocyclic compounds.
- Non-aromatic heterocyclic compounds and their synthesis by cyclisation and cyclo addition reaction.
- Three, four, five membered heterocycles and their applications.
- General introduction and classification of meso-ionic heterocycles.
- Heterocyclic compounds containing P, As, Sb and boron

OUTCOMES: On completion of this course, the students will able to understand.

- Nomenclature rules for heterocyclic compounds and their synthesis .
- Bond angle and torsional strain and conformation of heterocycles, principle and synthesis of heterocycles involving cyclisation and cyclo addition reactions.
- Synthesis reactions and medicinal applications of aziridines, benzopyrroles, imidazoles.
- General structure, synthesis, reactions and chemistry of meso- ionic heterocycles.
- Reactivity, synthesis and reactions of heterocyclic compounds containing P, As, Sb and boron.

Unit I

Nomenclature of Heterocycles

Replacement and systematic nomenclature (HantzsMCH-Widman system) for monocyclic fused and bridged heterocycles.

Aromatic Heterocycles

General chemical behaviour of aromatic heterocycles, classification (structural type), criteria of aromaticity (bond lengths, ring current and chemical shifts in ^{1}H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity and tautomerism in aromatic heterocycles.

Unit II

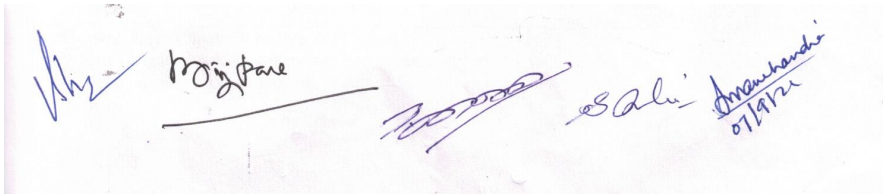
Non-aromatic Heterocycles

Strain-bond angle and torsional strains and their consequences in small ring heterocycles. Conformation of six-membered heterocycles with reference to molecular geometry, barrier to ring inversion, pyramidal inversion and 1,3-diaxial interaction. Stereo-electronic effects anomeric and related effects, Attractive interactions-hydrogen bonding and intermolecular nucleophilic electrophilic interactions. Heterocyclic synthesis-principles of heterocyclic synthesis involving cyclization reactions and cyclo addition reactions.

Unit III

Small Ring Heterocycles

Three-membered and four-membered heterocycles-synthesis and reactions of aziridines, oxiranes, thiranes, azetidines, oxetanes and thietanes.



Benzofused five membered heterocycles

Synthesis and reactions including medicinal applications of benzopyrroles, bezofurans and benzothiophenes.

Five membered heterocycles

Synthesis and reactions including medicinal applications of Imidazoles, oxazoles and thiazoles.

Unit IV

Meso-ionic Heterocycles

General introduction and classification of meso-ionic heterocycles , Chemistry of 1,3-oxazolium-4-olates, 1,3-oxathiolium-5-olates and 1,2-diazolium-4-aminides.

Six-Membered Heterocycles

Synthesis and reactions of coumarins and chromones. General structure and synthesis of anthocyanidins

Two or More Heteroatoms heterocycles: Synthesis and reactions of diazines, triazines.

Unit V

Seven-and Large-Membered Heterocycles:

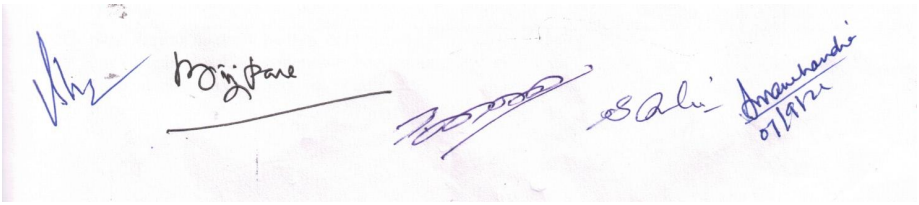
Synthesis and reactions of azepines, oxepines, thiepines, diazepines, and thiazepines.

Heterocyclic Systems Containing P, As, Sb and B

Heterocyclic rings containing phosphorus: Introduction, nomenclature, synthesis and reactions of 5-membered ring systems. Heterocyclic rings containing As and Sb : Introduction, synthesis and characteristics of 5- and 6-membered ring system. Heterocyclic rings containing B : Introduction, synthesis and reactivity of 5- and 6- membered ring system.

Books suggested

1. Heterocyclic Chemistry Vol. 1-3, R.R. Gupta, M. Kumar and V.Gupta, Springer Verlag.
2. The Chemistry of Heterocycles, T. Eicher and S. Hauptmann, Thieme.
3. Heterocyclic chemistry J.A. Joule, K. Mills and g.F. Smith, Chapman and Hall.
4. Heterocyclic Chemistry, T.L. Gilchrist, Longman ScietificTechinal.
5. Contemporary Hetrocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.
6. An Introduction to the Heterocyclic Compounds, R.M. Acheson, Johnwiely.
7. Comprehensive Heterocyclic Chemistry, A.R. Katrizky and C.W. Rees, eds. Pergamon Press.



MCH-304C BIOORGANIC CHEMISTRY **(5 credits)**

OBJECTIVEs: To impart the knowledge of

- Metabolism of carbohydrates and lipids and their synthesis.
- Biosynthesis of organic compounds: Aminoacids, Terpenoids, Carotenoids, Alkaloids.
- Nomenclature, classification and identification of enzymes.
- Enzyme models, Micelles synthesis, Biotechnological applications of enzymes.
- Classification of amino acids, proteins, Transcription and Translation mechanism.

OUTCOMES: On completion of this course, the students will able to understand

- Pentose phosphate pathway, Citric acid cycle: reaction, energetics and its significance, oxidation of fatty acids.
- Method of preparation of L-asaparagine, Mevolonate pathway, synthesis of ephedrine and quinine
- Michaelis-Menten: Lineweaver-Burk plot, Mechanism and Biological functions of enzyme.
- Biomimetic chemistry, Techniques and methods of immobilization of enzyme activity, clinical uses of enzymes and recombinant DNA technology.
- General structure of nucleic acids, RNA polymerase, promoters and their synthesis, mechanism and structure of ribosomes.

Unit I

Carbohydrate Metabolism: Glycolysis, Glycogenesis, ,glycogenolysis, Gluconeogenesis, metabolism of galactose, pentose phosphate pathway, Citric acid cycle: reactions, energetic and its significance.

Lipid Metabolism: Oxidation of fatty acids, alpha, Beta and omega oxidation.

Unit II

Biosynthesis of organic compounds

Amino acids: Shikimic acid route leading to chorismic acid to L-phenyl alanine and tryptophan, glutamate family: 2-oxoglutaric acid to L-proline, oxaloacetic acid to L-asparagine.

Terpenoids: Mevolonate pathway, acyclic (citronellal), monocyclic monoterpenoids (limonine, α-terpinene and α-terpineol), bicyclic monoterpene (α-pinene), sesquiterpene (cadinene) and squalene.

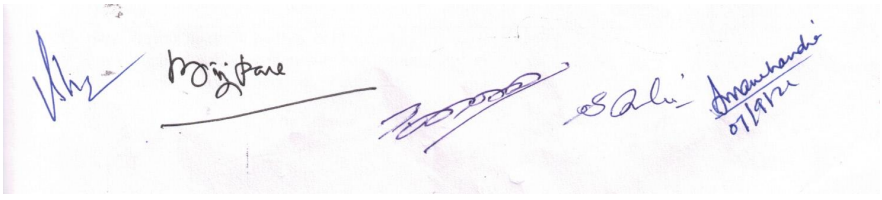
Carotenoids, cholesterol (from squalene) and flavonoids (quercetin and cyanidin)

Alkaloids: ephedrine (from phenyl alanine), quinine (from tryptophan)

Unit III

Enzymes

Enzymes: Introduction, Nomenclature and classification, Remarkable properties of enzymes, concept and identification of active site by use of inhibitors, reversible & irreversible inhibition, Michaelis-Menten and Lineweaver-Burk plot.



Kinds of Reactions Catalyzed by Enzymes:

B-cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

Mechanism of Enzyme action: Transition state theory, acid-base catalysis, covalent catalysis.

Co-Enzyme Chemistry:

Cofactors as derived from vitamins, coenzymes, prosthetic groups, apoenzymes, Structure and biological functions of coenzyme A.

Unit IV

Enzyme Models

Host guest chemistry, Chiral recognition and catalysis, molecular recognition, molecular asymmetry and pro chirality, Biomimetic chemistry, crown ethers, cryptates, cyclodextrins, cyclodextrin based enzymemodels, Calixarenes, ionophores, micelles synthetic enzyme or synzymes.

Biotechnological Application of enzymes:

Techniques and methods of immobilization of enzyme activity, application of immobilizedenzymes, clinical uses of enzymes and recombinant DNA technology.

Unit V

Proteins and nucleic acids

Classification, physical and chemical properties of amino acids, Structure of protein and stabilizing factors– primary, secondary, tertiary and quaternary structure of protein.

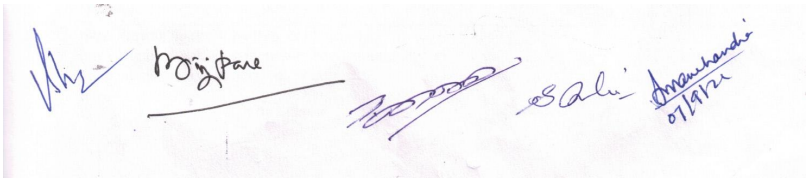
Structure of purines, pyrimidines, nucleosides and nucleotides. General structural plan of nucleic acids, features of DNA double helix.

Transcription – RNA polymerase, promoters, initiation elongation and termination of RNA synthesis, inhibitors of transcription, Reverse transcriptase. Genetic code – basic features, biological significance, degeneracy, wobble hypothesis.

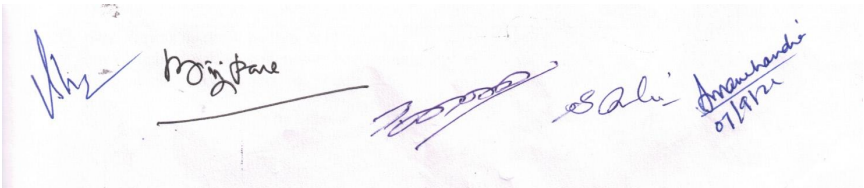
Translation – Mechanism, structure of ribosome, various steps involved in translation – initiation, elongation and termination, inhibitors of translation.

Book Suggested

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
5. Bioorganic Chemistry: A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, Springer Verlag.
6. Understanding Enzymes, Trevor Palmer, Prentice Hall.
7. Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.
8. Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.
9. Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.
10. Immobilized Enzymes : An Introduction and Applications in Biotechnology, Michael ID. Trevan, Hohn Wiley.
11. Enzymatic Reaction Mechanisms. C. Walsh. W.H. Freeman.



12. Enzyme Structure and Mechanism, A Fersht, W.H. Freeman
13. Biochemistry : The Chemical Reactions of Living Cells, D.E. Metzler, Academic Press.
14. Concepts in biotechnology by D. Balasubramananian& others\
15. Principals of biochemistry by Horton & others.
16. Bioorganic chemistry - A chemical approach to enzyme action by Herman Dugas and Christopher Penney.
17. Organic Chemistry, Volume 2: Stereochemistry And The Chemistry Natural Products, I. L. Finar, Pearson Education of India.
18. Principles and techniques of Biochemistry and Molecular Biology, Keith Wilson and John Walker, Cambridge University Press
19. Bioorganic, Bioinorganic and Supramolecular Chemistry, P. S. KAlsi, J. P. Kalsi, New Age International Publishers
20. Bioorganic Chemistry , G. R. Chatwal, Himalaya Publishing House



MCH-304D BIOPHYSICAL CHEMISTRY (5 credits)

OBJECTIVEs: To impart the knowledge of

- Biological cells and its constituents, various models of biomembranes ,standard free energy in biochemical reactions
- Biomimetic agents, non covalent interactions Artificial Photosynthesis intermolecular forces in a natural and synthetic polymers.
- Bioseparation processes, affinity chromatography, fluorescence spectroscopy.
- Electrochemistry of membrane transport phenomena, Ion selective electrode biosensor based on Tony married adenine Dinucleotide cofactor.
- Measurement of radioactivity , tracer techniques and use of isotopes in biology.

OUTCOMES: On completion of this course, the students will able to understand

- Active and passive transport, carrier mediated ion transport, mechanism of signal transduction, nerve conduction
- Acidic and basic properties of amino acids, application of membrane mimetic agents and enzyme model drug incapsulation, solar energy conversion in membrane mimetic system.
- Liquid-liquid extraction, membrane separation processes BLM, SLM and ELM
- Definition and classification of sensor, types of ion selective electrode, ethanol bio sensor based on conducting polymers.
- Some commonly used isotopes and their safety aspects, use of isotopes as a tracers in biological-sciences.

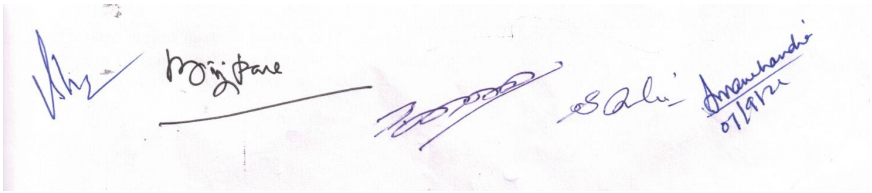
UNIT I

Biological cell and its constituents, Biomembrane, Various models of biomembrane, Fick's law, Active and Passive transport, Carrier mediated ion transport, Irreversible thermodynamic treatment to the membrane transport, Exergonic and Endergonic reactions, Mechanism of signal transduction, Nerve conduction, Standard free energy in biochemical reactions

UNIT II

Ions, ion solvation, acidity of solution, acidic and basic properties of amino acids, intermolecular forces in natural and synthetic polymers, Helix coil transition.

Non covalent interactions, Biomimetic agents, Surfactants, vesicles, Host-guest system, Drug-receptor interaction, Application of membrane mimetic agents, enzyme model, Drug encapsulation, Solar energy conversion in membrane mimetic system, Artificial photosynthesis.



UNIT III

Bioanalytical techniques

Bioseparation processes- centrifugation, ultra centrifugation, adsorption, Extraction-liquid liquid extraction, solvent extraction, reverse micelle extraction, membrane separation processes BLM, SLM and ELM etc.

Affinity chromatography, gel filtration and size exclusion chromatography, Flourescence spectroscopy.

UNIT IV

Bio electrochemistry

Electrochemistry of membrane transport, ion selective electrodes, Types of ions selective electrodes - Glass membrane ISE, Solid membrane ISE, liquid membrane ISE, Enzyme based ISE.

Definition and classification of sensors, Glucose biosensor, Cholesterol biosensor, Biosensor to determine the freshness of fish, Biosensors based on Nicotinamide Adenine Dinucleotide cofactor, Ethanol biosensor based on a conducting polymer.

UNIT V

Isotopes in biology

Radioactive decay, Interaction of Radioactivity with matter, measurement of radioactivity, liquid scintillation counting – use of stable isotopes in biology. Tracer techniques- use of isotopes as tracers in biological sciences, Some commonly used isotopes- safety aspects.

Suggested Books

1. Chemistry – An introduction to general, organic and biological chemistry, VII Edn ,Karen C Timberlake, Benjamin/ Cummings, 1999.

2. Biological Chemistry by James P Allen, Wiley-Blackwell, 2008.

3. Biochemistry: Rawn, J. David, N. Patterson Publishers, 1989.

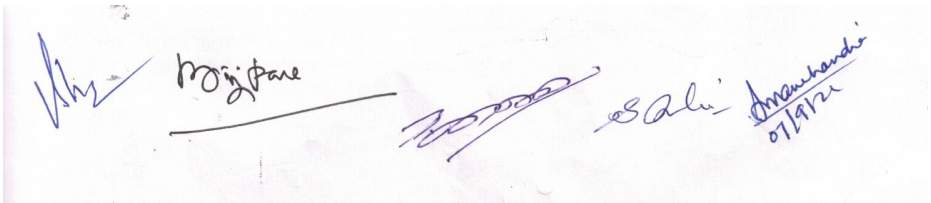
4. Introduction to Biophysical chemistry, R. Bruce Martin, McGraw-Hill, NY, 1964.

5. Physical Chemistry with applications to Biological systems, RamondChnag, Mc Millan publishing Co.inc, New York 1977.

6. Macromolecules: Structure and function, F. Wold, Prentice Hall, 1972.

7. Physical biochemistry; applications to biochemistry and molecular biology by Freifelder, David, San Francisco; WH Freeman and Company; 1976. 20

8. Environmental Biosensors, Edited by Vernon Somerset, ISBN 978-953-307-486-3, 356 pages, Publisher: In Tech, Chapters, published under CC BY-NC-SA 3.0 license DOI:10.5772/929, 2011



MCH-304E BIOINORGANIC CHEMISTRY (5 credits)

OBJECTIVES: To impart the knowledge of

- General survey of essential and trace metals and role of alkali and alkaline earth metals in biological systems.
- Role of Iron as oxygen carriers, storage and transport proteins.
- Biochemistry of Copper, Cobalt and Zinc as metalloenzymes and proteins.
- Role of Iron and Molybdenum in nitrogen fixation. Mechanism of photosynthesis with role of Magnesium and Manganese.
- Bioinorganic Chemistry of Toxic Metals and Radioisotopes. Role of Platinum, Gold and Lithium as pharmacological drugs

OUTCOME: On completion of this course, the students will be able to understand

- Recapitulation of Biological Roles of Metals & Ligands: Structural Information, Metal Activity, Specificity & Selectivity, Ionophores, active transport of cations across membranes by sodium pump and calcium pump
- Structure and functions of hemoglobin and myoglobin, Storage & Transport Proteins of Iron viz,. Ferritin, Transferrin and Siderophores, Cytochromes and their roles
- Structure and functions of B12 Coenzymes, Blue Copper Proteins, Non-blue copper proteins, Carboxypeptidase and Carbonic anhydrase enzymes
- *In vitro* and Biological nitrogen fixation, Structure of nitrogenase, Photosystem I and photosystem II
- Detoxification by Metal Chelation, Bioinorganic chemistry of Radio Pharmaceuticals

Unit I

Metal Ions in Biological Systems

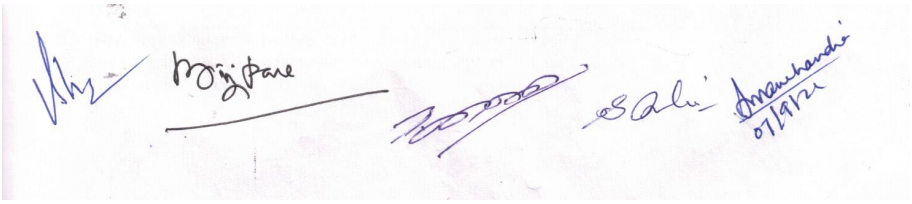
General survey of essential and trace metals, Disturbing factors in metabolic process and causes of diseases, Recapitulation of Biological Roles of Metals & Ligands: Structural Information, Metal Activity, Specificity & Selectivity, Biochemical Evolution of Metals in Biological System

Alkali and alkaline earth metals in biological systems: Ionophores, active transport of cations across membranes, sodium pump, Calcium pump, Calcium carriers, role of carriers in muscle contraction, blood clotting and hormones.

Unit II

Oxygen carriers: Porphyrins, metalloporphyrins, Hemoproteins, structure and functions of hemoglobin and myoglobin, synthetic oxygen carrier model systems, Storage & Transport Proteins of Iron viz,. Ferritin & Transferrin, Siderophores

Cytochromes and their roles, Iron-Sulfur Proteins



Unit III

Biochemistry of Cobalt: B12 Coenzymes and Model compounds, Adenosylcobalmin as a Coenzyme Methylcobalmin as cofactor

Biological Chemistry of Copper: Type I, II &III , Blue Copper Proteins (Plastocyanins Azurins & Blue Oxidases) , Non-blue copper proteins e.g. Tyrosinase, Galactose Oxidase, SOD etc.

Biological Chemistry of Zinc: Carboxypeptidase and Carbonic anhydrase enzymes

Unit IV

Nitrogen fixation: *In vitro* and Biological nitrogen fixation, Nitrogenase, model for nitrogenase, metal-N_2 complexes

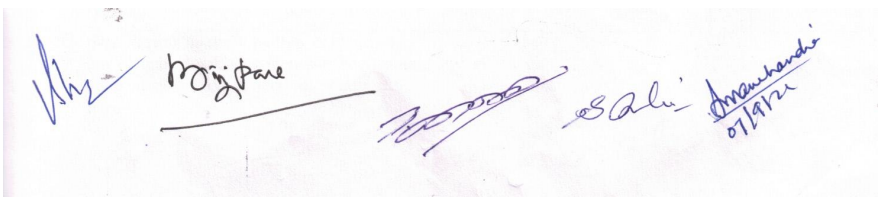
Photosynthesis,Role of chlorophyll, Photosystem I and photosystem II, Role of Mn

Unit V

Bioinorganic Chemistry of Toxic Metals- Detoxification by Metal Chelation-Drugs which add by binding at the metal sites of Metalloenzymes- Radiation risks and medical benefits- Natural and man made Radio isotopes- Bioinorganic chemistry of Radio Pharmaceuticals, Platinum Complexes in Cancer Therapy- Cisplatin and its mode of action, Gold containing Drugs as Antirheumatic Agents and their mode of action, LithiuminPschycopharmocological Drugs.

Book Suggested

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
2. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.



MCH-304F ELECTROCHEMISTRY **(5 credits)**

OBJECTIVEs: To impart the knowledge of

- Conversion and storage of electrochemical energy present status of energy, electrochemical energy storage.
- surface mechanism of corrosion and stability of metals and method for stabilizing surfaces by electrode
- protonic electrochemical mechanism of nervous system, kinetics of electrode processes.
- methods of determining kinetic parameters for the reversible and Irreversible waves, electrocatalysis.
- Theory, applications and diagnostic criteria of cyclic voltammetry, bulk electrolysis method and application of stripping analysis.

OUTCOMES: on completion of this course, the students will be able to understand

- Electrochemical generator fuel cells and their applications, properties of electrochemical energy storage charging and discharging of battery, classical batteries
- Thermodynamics and stability of metals, electrochemical method of passivation structure and mechanism of passivation
- Membrane potential enzyme as electrodes, overpotential, tafel equation, Butler volmer equation.
- Koutecks method, gellings method, chemical catalysis and electrochemical catalyst with special reference in Redox reactions.
- Cyclic voltammetry, theory and applications chronopotentiometry, electroorganic synthesis and its important applications

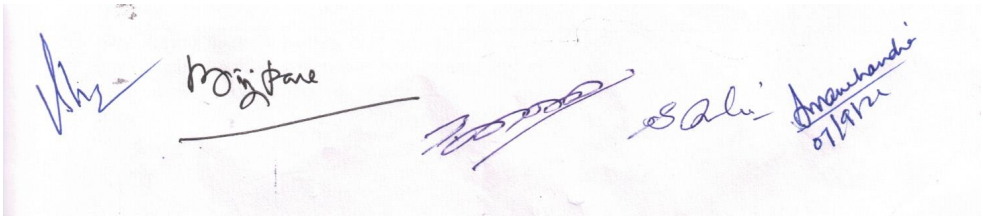
Unit I

Conversion and Storage of Electrochemical Energy Present status of energy consumption: Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs.

electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

Electrochemical Energy Storage :

Properties of Electrochemical energy storage : Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries : (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries : (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers : Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.



Unit II

Corrosion and Stability of Metals :

Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diagrams; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate : (i0 Weight Loss method, (ii) Electrochemical Method. **Inhibiting Corrosion :**

Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodicProtection, Organic inhibitors, The fuller Story Green inhibitors. **Passivation :** Structureof Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's
method for stabilizing surfaces.

Unit III

Bioelectrochemistry :

bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

Kinetic of Electrode Process :

Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current. **Irreversible Electrode processes :** Criteria of irreversibility, informatino from irreversible wave.

Unit IV

Methods of determining kinetic parameters for quasireversible and irreversible waves : Koutecky's methods, Meits Israel Method, Gellings method.

Electrocatalysis :

Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

Unit V

Potential Sweep Method :

Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cycli voltammetry. Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory ad applications.

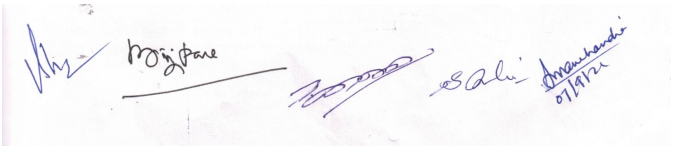
Bulk Electrolysis Methods :

Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis : anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.

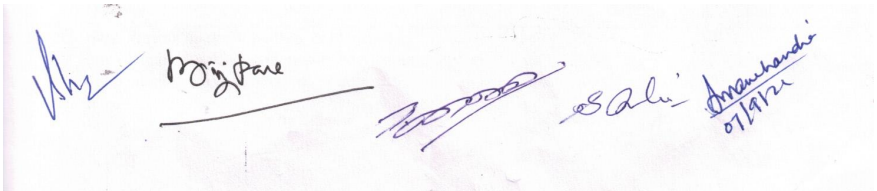
Books Suggested

1. Modern Electrochemistry Vol. I, IIa, Vol. IIB J'OM Bockris and A.K.N. Reddy, Plenum Publication, New York.

2. Polarographic Techniques by L. Meites, Interscience.



3. "Fuel Cells : Thjeir electrochemistry". McGraw Hill Book Company, New York.
4. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.
5. Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.
6. "Electroaalytical Chemistry by Basil H. Vessor & Galen W. ; Wiley Interscience.
7. Electroanalytical Chemistry by Basil H. Vessor & alen w. ; Wiley Interscience.
8. Topics in pure and Applied Chemistry, Ed. S. K. Rangrajan, SAEST Publication, Karaikudi (India)



MCH-304G ENVIRONMENTAL CHEMISTRY **(4 credits)**

OBJECTIVES: To impart the knowledge of

- Atmospheric layers, sources of trace atmospheric constituents.
- Air pollution and its control, Stratospheric ozone depletion, Green house effect, Urban air pollution.
- Aquatic chemistry and soil chemistry.
- Environmental toxicology: toxicity of heavy metals and organic compounds
- Goals and principles of green chemistry and importance of solvent free synthesis

OUTCOMES: on completion of this course, the students will be able to understand

- Atmospheric layers, Biogeochemical cycles of C, N, S, P, O sources of trace atmospheric constituents, tropospheric photochemistry.
- Aerosols–sources, acid rain control strategies, Discovery of Antarctic ozone hole and its control strategies, Global warming potentials, monitoring of CO and control strategies.
- Redox chemistry in water, determination of DO, COD, BOD, techniques of purification and disinfection of water.
- Bioaccumulations ,sources, causes, damaging effects and toxicity of heavy metals, polychlorinated biphenyls
- Emerging green technologies: microwave, sonochemistry, photochemistry and elactrochemistry.

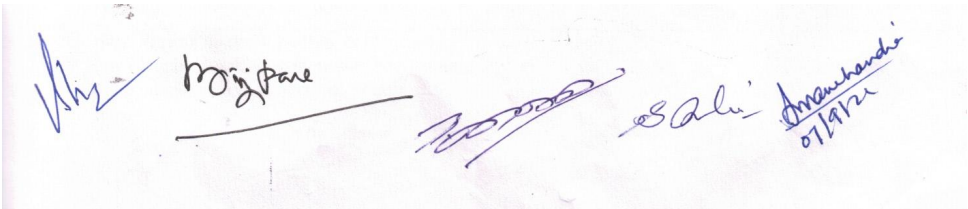
Unit-I

Atmosphere

Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate, Temperature inversion, Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Biogeochemical cycles of carbon, nitrogen, sulphur, phosphorus oxygen, Residence times.

Sources of trace atmospheric constituents: nitrogen oxides, sulphur dioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Tropospheric Photochemistry: Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2, Photochemical smog, meteorological conditions and chemistry of its formation.



Unit-II

Air Pollution

Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health, Acid rain precursors and their aqueous and gas phase atmospheric Oxidation reactions, Monitoring of SO_2 and NO_x, Acid rain control strategies.

Stratospheric Ozone Depletion: Mechanism of Ozone formation, Mechanism of catalytic Ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies. Green House Effect:Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.

Urban Air Pollution:Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.

Unit-III

Aquatic Chemistry and Soil Chemistry

Redox chemistry in natural waters, Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD, Aerobic and anaerobic reactions of organic sulphure and nitrogen compounds in water acid-base chemistry of fresh water and sea water, Aluminum, nitrate and fluoride in water, Sources of water pollution, Treatment of waste and sewage, Purification of drinking water, techniques of purification and disinfection.

Physicochemical and bacteriological sampling as analysis of soil quality, Soil Pollution Control. Industrial waste effluents and heavy metals, their interactions with soil components, Soil micro – organisms and their functions, degradation of different insecticides, fungicides and weedicides in soil, Different kinds of synthetic fertilizers (N, P & K) and their interactions with different components of soil.

Unit IV

Environmental Toxicology

Toxic heavy metals : Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

Toxic Organic Compound : Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.

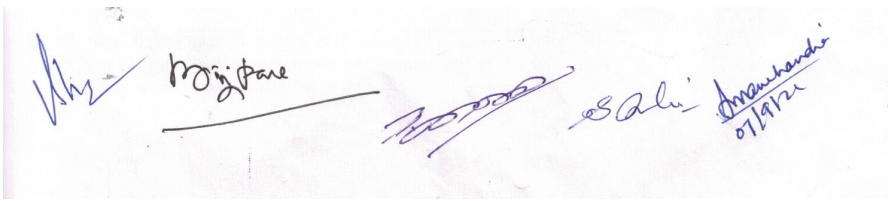
Polychlorinated biphenyls : Properties, use and environmental continuation and effects.

Polynuclear Aromatic Hydrocarbons : Source, structures and as pollutants.

Unit-V

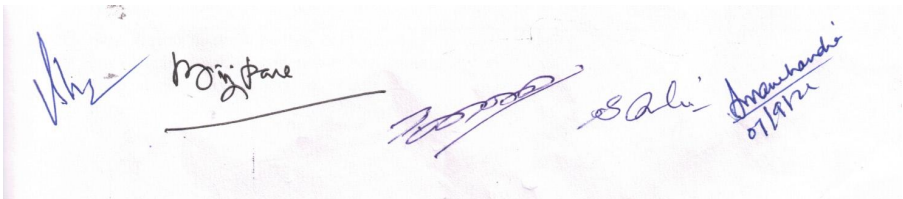
Green Chemistry

Principles and goals of green chemistry, Green chemicals, Green reagents, Green catalysts, Green solvents, Green organic synthesis in solid state, Emerging Green technologies like Microwave chemistry and sonochemistry, Photochemistry and electrochemistry, Green synthesis of Polycarbonates, Isocyanates and Urethanes, Green synthesis of Carbamyl pesticides.



Books Suggested

1. Environmental Chemistry, Sharma & Kaur, Krishna Publishers.
2. Environmental Chemistry, A.K. De, Wiley Eastern
3. Environmental Pollution Analysis, S.M. Khopkar, Wiley Eastern
4. Standard Method of Chemical Analysis, F.J. Welcher Vol. III, Van Nostrand Reinhold Co.
5. Environmental Toxicology, Ed. S. Landsberger and M. Creatchman, Gordon and Breach Science Publication.
6. Enviromental Chemistry, C. Baird, W.H. Freeman.
7. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
8. Chemistry of Atmospheres, R.P. Wayne, Oxford.
9. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
10. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
11. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.



Practical Syllabus

SEMESTER III

(Duration: 6-8 hrs in each branch)

Practical examination shall be conducted separately for each branch.

Inorganic Chemistry

Quantitative determinations of a three component mixture	15
Chromatographic Separations	10
Record	04
Viva Voice	05

Quantitative determinations of a three component mixture :

Quantitative analysis of tri-component mixture of metal ions using gravimetric and volumetric techniques.

(i) Mixed solution of Cu^{2+}, Ni^{2+} and Zn^{2+}

(ii) Mixed solution of Cu^{2+}, Ni^{2+} and Mg^{2+}

(iii) Mixed solution of Cu^{2+}, Ag^{+} and Fe^{2+}

(iv) Mixed solution of Ni^{2+}, Zn^{2+} and Fe^{2+}

Chromatographic Separations

Thin-layer chromatography-separation of nickel, manganese, cobalt and zinc. Determination of Rf values.

Separation of cations and anions by Paper Chromatography.

Cadmium and zinc

Zinc and magnesium.

SEMESTER III

Organic Chemistry

Multi-step Synthesis of Organic Compounds	16
Paper Chromatography	08
Record	04
Viva Voice	05

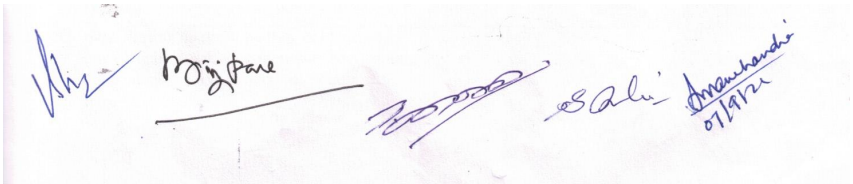
Multi-step Synthesis of Organic Compounds

The exercise should illustrate the use of organic reagents and may involve purification of the products by chromatographic techniques.

1. Beckmann rearrangement : Benzanilide from benzene Benzene -> Benzophenone ->Benzphenone oxime -> Benzanilide
2. Benzilic acid rearrangement :Benzilic acid from benzoin Benzoin ->Benzil ->Benzilic acid
3. Synthesis of heterocyclic compounds Skraupsynthesis : Preparation of quinoline from aniline
4. Fisher Indole synthesis : Preparation of 2-phenylindole from phenylhydrazine.

Thin layer and Paper Chromatography

Separation and identification of the sugars / amino acids present in the given mixture by TLC and Paper chromatography and determination of RF values



Practical

(Duration: 6-8 hrs in each branch)

Physical Chemistry

Spectroscopy	12
Conductometry/ Equilibrium and Dissociation Constants	12
Record	04
Viva Voice	05

Conductometry

1. Determination of solubility and solubility product of sparingly soluble salts (e.g. PbSO4, BaSO4) conductometrically.
2. Determination of the dissociation constant of acetic acid.
3. A commercial sample of vinegar is suspected of having H_2SO_4. Show conductometricly, if it is so and estimate the impurity of mineral acid if present.

Spectroscopy

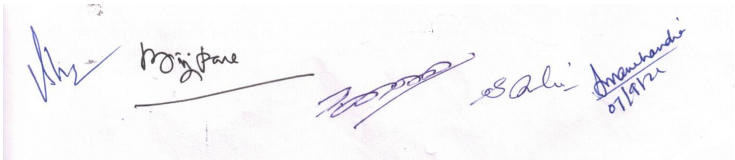
1. Determination of PKa of an indicator (e.g. methyl red) in (a) aqueous and (b) micellar media.
2. To verify Beers law for solution of $K_2Cr_2O_7$ and $KMnO_4$ using spectrophotometer and determine the concentrations in their solutions of unknown concentration.
3. To determine the composition of a binary mixture containing say $K_2Cr_2O_7$ or $KMnO_4$ spectrophotometrically.
4. Determination of stoichiometry and stability constant of Ferricisothicoyanation complex ion in solution.

Equilibrium and Dissociation Constants

1. To determine the equilibrium constant of the esterification reaction between acetic acid and ethanol.
2. To determine the equilibrium constant of the keto-enol tautomerism of ethylacetoacetate.
3. To determine the dissociation constant of picric acid by studying its distribution between benzene and water.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.



SEMESTER IV

Paper-I

MCH-401 APPLICATION OF SPECTROSCOPY II **(5 credits)**

OBJECTIVE: **To** impart the knowledge of

- Basics,principle and applications of Ultraviolet and visible spectroscopy .
- Detailed study of Infrared spectroscopy and their applications.
- Nuclear resonance of paramagnetic substances in solutions
- Applications of various two-dimensional nuclear magnetic resonance spectroscopy in structure determination
- Introduction, principle and applications of Mass spectrometry .

OUTCOME: on completion of this course, the student will have

- The basic concepts and theories of Ultraviolet and visible spectroscopy, Woodward-Fieser rule, calculate UV λmax value of compounds.
- Characteristic vibrational frequencies and spectral analysis of organic compounds, combination bands, Fermi resonance.
- Mechanism of relaxation and factors affecting it. Nuclear resonance of paramagnetic substances in solutions, some applications of NMR including biochemical systems.
- 2D NMR COSY, NOESY, HMQC, HETCOR, HMBC and DEPT techniques
- Principle, theory, instrumentation, fragmentation process of mass spectrometry and their role in structural elucidation of organic compounds

Unit-I

Ultraviolet and Visible spectroscopy

Various electronic transitions (185-800 nm) Beer-Lambert law, chromophores, auxochromes, intensity and wavelength shifts, types of bands, effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, α, β-unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heteroaromatic compounds. Steric effect in biphenyls, olefins.Applications of UV-visible spectroscopy.

Unit-II

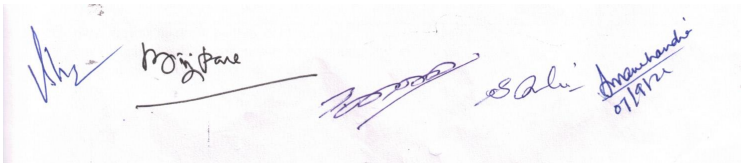
Infrared Spectroscopy

Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines, Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.

Unit – III

Nuclear Magnetic Resonance of Paramagnetic Substances in Solution

The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on ^{195}Pt and ^{119}Sn NMR.



Unit-IV

Two dimension NMR spectroscopy

Principle and pulse technique, DEPT with 3 different angles, ^{1}H-^{1}H COSY, ^{1}H-^{13}C COSY, NOESY, HMBC and HMQC techniques, interpretation of 2D spectra and examples

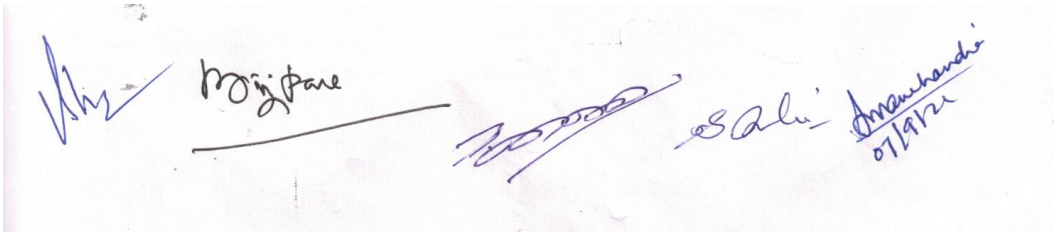
Unit-V

Mass Spectrometry

Introduction ion production E1, C1 FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak, metastable peak. Me Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry. Structure elucidation of simple molecules using UV – Visible, IR, NMR and mass spectral techniques.

Suggested Readings:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.
2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.
4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.
5. Transition Metal Chemistry ed. R.L. Carlin vol. 3 dekker.
6. Inorganic Electronic Spectroscopy, A.P.B. Lever, Elsevier.
7. NMR, NQR, EPR and Mossbauer Spectroscopy in Inorganic Chemistry, .V. Parish, Ellis Haywood.
8. Practical NMR Spectroscopy, M.L. Martin. J.J. Deepish and G.J. Martin, Heyden.
9. Spectrometric Identification of Organic Compounds, R.M. Silverstein, G.C. Bassleradn T.C. Morrill, John Wiley.
10. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.
11. Application of Spectroscopy of Organic Compounds, J.R. Dyer Prentice Hall.
12. Spectroscopic Methods in Organic Chemistry D.H. Williams, I. Fleming, Tata McGraw-Hill.
13. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.
14. Introduction to NMR spectroscopy, R.J. Abraham, J. Fisher and P. Loftus, Wiley.



Paper-II

MCH-402: ORGANOTRANSITION METAL CHEMISTRY (5 credits)

OBJECTIVE: To impart the knowledge of

- Introduction ,classification and various aspects of organometallic compounds.
- Types, synthesis and stability of aryl and alkyl transition metal complexes
- Important reactions and properties of transition metal pi complexes.
- Fluxional behavior of organometallic compounds
- Different types of organotransition metal complexes catalyzed reactions and their applications

Outcome: on completion of this course, the students should have

- The oxidative addition and reductive elimination, insertion reactions, β- hydride elimination
- Route of synthesis and structure and bonding aspects of aryl and alkyl transition metal complexes, Fischer type and Schrock type carbene and carbyne complexes
- Preparation, nature of bonding and structural features of transition metal **π**–complexes
- Dynamic equilibria and fluxionality of organometallic compounds
- Zeigler-Natta polymerization, Wilkinson's catalyst, Wacker's process, oxo process etc.

Unit I

Introduction

Classification of organometallic compounds by bond types viz. covalent, ionic, electron deficient and cluster compounds. Compound based on haptacity and polarity of M-C bond, Nomenclature and general characters, 18 Electron rule

Important reaction types: Oxidative addition and reduction, elimination, insertion (migratory) reactions, β- hydride elimination, nucleophilic attack

Unit II

Alkyls and Aryls of Transition Metals

Types, routes of synthesis, stability and decomposition pathways, organocopper compounds in organic synthesis.

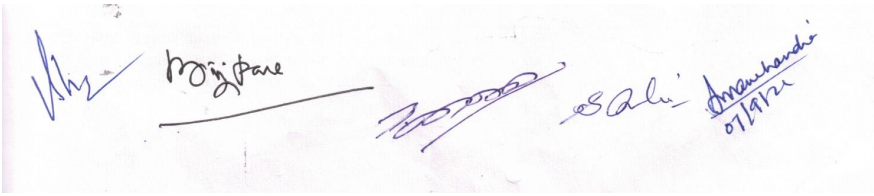
Compounds of Transition Metal-Carbon Multiple Bonds

Transition metal- carbine complexes: Fischer type and Schrock type carbene complexes, their synthesis, reactions and structures & bonding; Transition metal-carbyne complexes: their synthesis, reactions and structural features

Unit III

Transition Metal π–Complexes

Transition metal π–complexes with unsaturated molecules, alkenes, alkynes, allyl, diene, dienyl(metallocene), arene, cyclooctatrienyl, cyclooctatetraene complexes, preparation, properties and



nature of bonding and structural features, important reactions related to nucleophilic and electrophilic attack on ligands and to organic synthesis.

Unit IV

Fluxional Organometallic Compounds

Fluxionality & dynamic equilibria in compounds such as acyclic alkenes, σ-bonded and π–bonded cyclic alkenes, rotation of ligands on metals, ligand scrambling on metals.

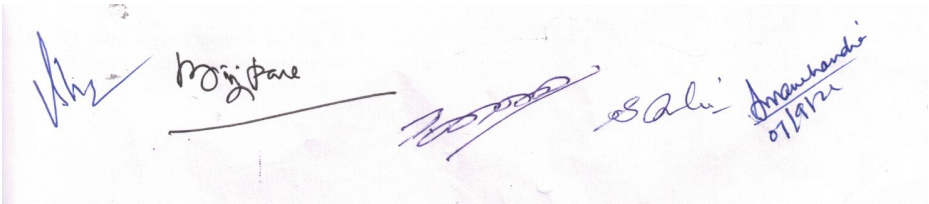
Unit V

Applications of Transition metal Organometallics as Catalysts

Zeigler-Natta polymerization, homogeneous catalytic hydrogenation, alkene hydrogenation-Wilkinson Catalyst, Alkene Metathesis, Oxidation of olefins-Wacker's process, Carbonylation-Monsanto acetic acid Synthesis, hydroformylation of olefins – the oxo process.

Book Suggested

1. Principles and Application of Organotransition Metal Chemistry, J.P. Collman, L.S. Hegsdus, J.R. Norton and R.G. Finke, University Science Books.
2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree. John Wiley.
3. Metallo-organic Chemistry, A.J. Pearson, Wiley.
4. Organometallic Chemistry, R.C. Mehrotra and A. Singh New Age International.



Paper-III

MCH 403 ORGANIC SYNTHESIS (5 credits)

OBJECTIVES: To impart the knowledge of

- Introduction of disconnection approach, chemo, region and stereo selectivity.
- Concepts and importance of one and two-group C-C bond disconnections.
- Oxidation and reduction reactions of organic compounds.
- Principle, preparation, properties and applications of organometallic reagents
- Introduction and synthesis of terpenoids, alkaloids and flavonoids.

OUTCOMES: On completion of this course, the students will have the knowledge of

- Basics concepts, importance and synthesis of disconnection approach.
- Formation and uses of one and two-group C-C bond disconnections approach.
- Different oxidation, reduction reaction processes.
- Synthesis with mechanistic details of organometallic reagents.
- General methods of structure elucidation and spectroscopic identification of terpenoids, alkaloids and flavonoids

Unit-I

Disconnection Approach

An introduction to synthons and synthetic equivalents. Disconnection approach, functional group inter-conversions, the importance of the order of events in organic synthesis, one group C-X and two group C-X disconnections, chemoselectivity, reversal of polarity, cyclisation reaction, amine synthesis. Protection of groups, chemo, region and stereo selectivity.

Unit-II

One Group C-C Disconnections

Alcohols, Alkyl halides, ethers and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic Nitro compounds in organic synthesis.

Two Group C-C Disconnections

Regioselectivity and stereospecific of Diels-Alder Reaction, 1,3-difunctionalised compounds, a-b-unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds. Michael addition, Mannich and Robinson annelation.

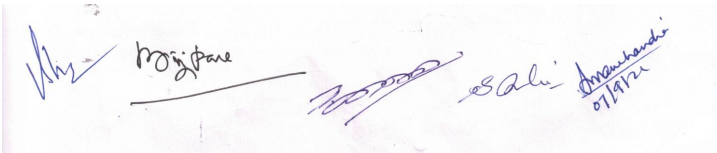
Unit-III

Oxidation

Introduction, Different oxidative processes. Hydrocarbons-alkenes, aromatic rings, saturated C-H groups (activated and unactivated) Alcohols, diols, aldehyde's, ketones, ketals and carboxylic acids. Amines, hydrazines, and sulphides. Oxidations with ruthenium tetraoxide, iodobenzene diacetate and thallium. (III) Nitrate.

Reduction

Introduction, Different reductive processes. Alkanes, alkenes, alkynes, and aromatic rings. Carbonyl compounds-aldehydes, ketones, acids and their derivatives. Epoxides. Nitro, nitroso, azo and oxime groups. Expoxide, Nitro, Nitroso, azo and oxime groups. Hydrogenolysis.



Unit-IV

Organometallic Reagents

Principle, preparations, properties and applications of the following in organic synthesis with mechanistic details. Group I and II metal organic compounds Li, Mg, Hg, Cd, Zn and Ce Compounds.

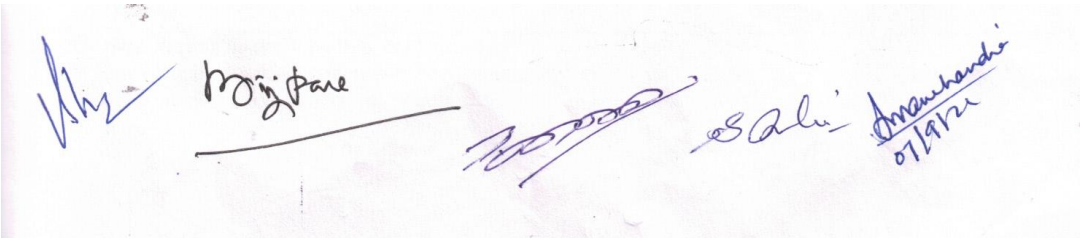
Unit-V

Synthesis of some complex molecules:

General methods of Struture elucidation and spectroscopic identification of terpenoids, alkaloids, flavonoids by taking the examples of Citral, Camphor, Progesterone, Androsterone, Papaverine, Tropic acid , Quercetin.

Books Suggested:

1. Designing Organic Synthesis, S. Warren. Wiley.
2. Organic Synthesis-Concept, Methods and Starting Materials, J. Fuhrhop.
3. Some Modern Methods of Organic Synthesis. W. carruthers, Cambridge Univ. Press.
4. Modern Synthetic Reactions H.O. House, W.A Benjamin.
5. Advanced Organic Chemistry : Reactions, Mechanisms and Structure, J. March. Wiley.
6. Principles, of Organic Chemistry Part B. F.a. Carey and R.J. Sundberg, Plenum Press.



ELECTIVE PAPERS

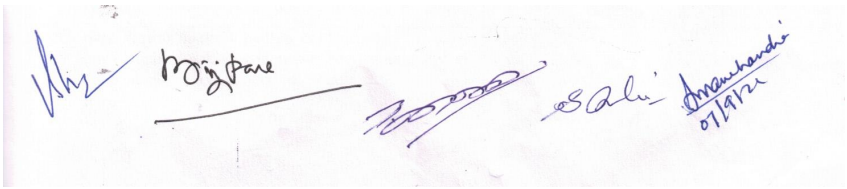
Out of the following select any two papers each of marks 50:

ELECTIVE PAPERS

OPT-1	MCH-404A	Natural Product Chemistry
OPT-2	MCH-404B	Analytical Chemistry
OPT-3	MCH-404C	Medicinal Chemistry
OPT-4	MCH-404D	Material Chemistry
OPT-5	MCH-404E	Supramolecular and Nano Chemistry
OPT-6	MCH-404F	Chemistry of Textile Printing

Interdisciplinary

OPT-1	MCH-405G	Instrumental Methods of Analysis



MCH-404A NATURAL PRODUCT CHEMISTRY (5 credits)

OBJECTIVES: To impart the knowledge of

- Classification, nomenclature, occurrence, isolation and synthesis of terpenoids and Carotenoid.
- Definition, nomenclature, occurrence, isolation, physiological action and synthesis of alkaloids
- Basic skeleton, nomenclature, occurrence, isolation and synthesis of steroids
- Nomenclature, occurrence, isolation and synthesis of plant pigments and prophyrins.
- Occurrence, nomenclature, isolation, reactions and synthesis of prostaglandin, pyrethroids and rotenones

OUTCOMES

- Biosynthesis, stereochemistry and structure determination of terpenoids and Carotenoids.
- Classification based on nitrogen containing heterocyclic rings, role of alkaloids in plants, general method of structure elucidation of alkaloids
- Diel's hydrocarbon and stereochemistry, biosynthesis and structure determination of steroids.
- Biosynthesis of flavonoids, acetate pathway, structure and synthesis of haemoglobin and chlorophyll.
- Biogenesis and physiological effects, synthesis of PGE2 and PGF2A, pyrethroids and rotenones

Unit I

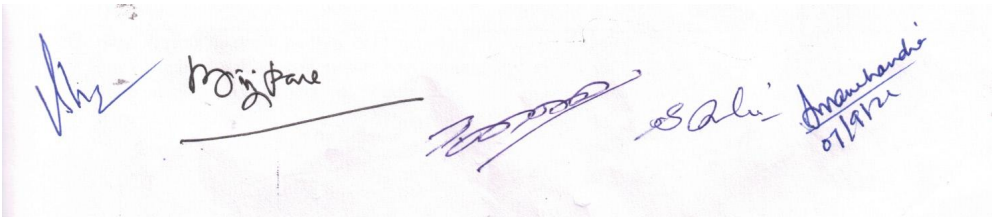
Terpenoids and Carotenoids

Calcifications, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules :Citral, Geraniol α-Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and β-Carotene.

Unit-II

Alkaloids

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.



Unit-III

Steroids

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.

Unit-IV

Plant Pigments

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin-7-arabinoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway.

Prophyrins: Structure and synthesis of Haemoglobin and Chlorophyll.

Unit-V

Prostaglandin

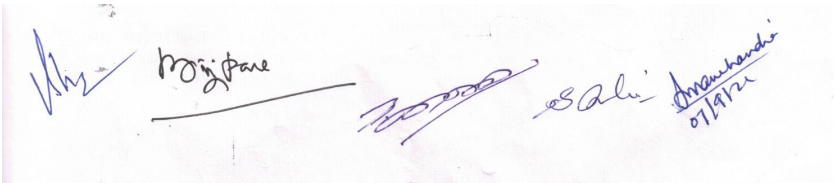
Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a.

Pyrethroids and Rotenones

Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).

Books Suggested:

1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthropeadn J.B. Harbome, Longman, Esses.
2. Organic Chemistry : Vol. 2 1L. Finar, ELBS
3. Stereoselective Synthesis : A Practical Approach, M. Norgradi, VCH.
4. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston. harwood Academic Publishers.
6. Introduction to Flavonoids, B.A. Bohm. Harwood Academic Publishers.
7. New Trends in Natural Product chemistry, Ataaur Rahman and M.L. Choudhary, Harwood Academic Publishers.
8. Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.



MCH-404B ANALYTICAL CHEMISTRY (5 credits)

OBJECTIVE: To impart the knowledge of

- Importance of analytical methods, laboratory operations and practices.
- Techniques and applications of food analysis.
- Water pollution law and standards, water pollution and its control measurement techniques.
- Analysis of soil and fuel, body fluids and drugs.
- Clinical chemistry and drug analysis.

OUTCOMES: On completion of this course, the students will have the knowledge of

- The role of analytical chemistry, classification of analytical methods, errors, evaluation and use of statistics
- Role of chemistry in food analysis micro examination of food for aadulterants, extraction purification of food sample by HPLC, GC-MS.
- Redox chemistry in water, determination of DO, COD, BOD, techniques of purification and disinfection of water
- Chemical analysis of soil, proximate and ultimate analysis of coal, octane and cetane number, flash-fire point, water gas and producer gas
- Principle of radio immune-assay (RIA) and its applications, narcotics and dangerous drug

Unit I

Introduction

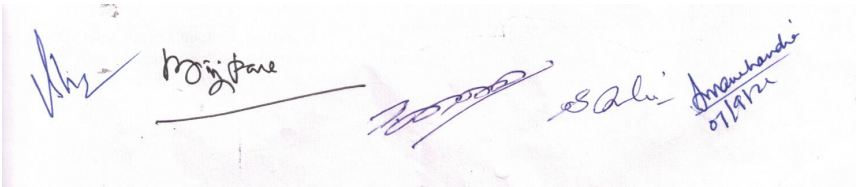
Role of analytical chemistry, Classification of analytical methods classical and instrumental, Types of instrumental analysis. Selecting an analytical method, Neatness and cleanliness, laboratory operations and practices, Analytical balance, Techniques of weighing, errors, Volumetric glassware cleaning and calibration of glassware, Sample Volumetric glassware cleaning and Calibration of glassware, Sample preparation-dissolution and decompositions, Gravimetric techniques, Selecting and handling or reagents, Laboratory notebooks, Safety in the analytical laboratory.

Errors and Evaluation Definition of terms in mean and median, Precision-standard deviation, relative standard deviation, Accuracy-absolute error, relative error, Types of error in experimental data determinate (systematic), indeterminate (or random) and gross, Sources of error and the effects upon the analytical results, Methods for reporting analytical data, Statistical evaluation of data-indeterminate errors, The uses of statistics.

Unit II

Food analysis

Moisture, ash, crude protein, fat crude fiber, carbohydrates, calcium, potassium, sodium and phosphate, Food adulteration-common adulterants in food, contamination of foods stuffs, Microscopic examination of foods for adulterants, Pesticide analysis in food products. Extraction and purification of sample, HPLC, Gas chromatography for organophosphates, Thin-layer chromatography for identification of chlorinated pesticides in food products.



Unit III

Analysis of Water Pollution

Origin of Waste water, types, water pollutants and their effects, Sources of water pollution-domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. COURSE COURSE OBJECTIVES of analysis-parameter for analysis-color, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy metal pollution-public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems, Measurements of DO, BOD, and COD, Pesticides as water pollutants and analysis, Water pollution laws and standards.

Unit IV

Analysis of soil and Fuel, Body Fluids and Drugs

(a)Analysis of Soil, moisture pH total nitrogen, phosphorus, silica, lime, magnesia, manganese, sulphur and alkali salts.

(b)Fuel analysis: liquid and gas. Ultimate and proximate analysis-heating values-grading of coal, Liquid fuels-flash point, aniline point, octane number and carbon residue, Gaseous fuels-produced gas and water gas-calorific value

Unit V

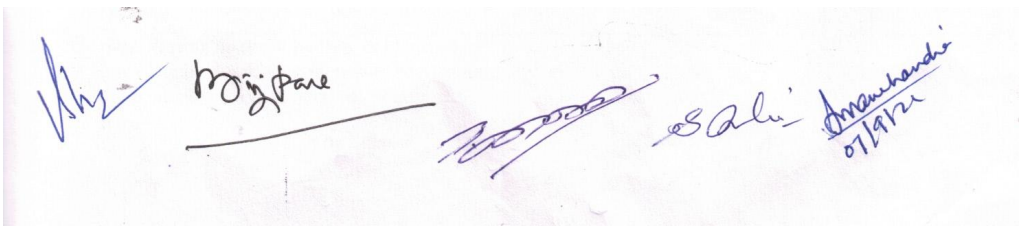
Analysis of Body Fluids and Drugs

(a) **Clinical Chemistry** : Composition of blood-collection and preservation of samples. Clinical analysis. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid, albumin, globulins, barbiturates, acid and alkaline phosphates. Immunoassay : principles of radio immunoassay (RIA) and applications. The blood gas analysis trace elements n the body

(b) **Drug analysis** : Narcotics and dangerous drug. Classification of drugs. Screening by gas and thin-layer chromatography and spectrophotometeric measurements.

Books Suggested:

1. Analytical Chemistry, G.D. Christian, J.Wicy.
2. Fundamentals o analytical Chemistry. D.A. Skoog. D.M. West and F.J. Hooler, W.B. Saunders.
3. Analytical Chemistry-Principles. J.H. Kennedy. W.B. Saunders.
4. Analytical Chemistry-Principles and Techniques. LG. Hargis. Prentice Hall.
5. Principles of Instrumental analysis D.A. Skoog and J.L. Loary, W.B. Saunders.
6. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders.
7. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
8. Environmental Solution, S.M. Khopkar, Wiley Eastern.
9. Basic Concepts of Analysis Chemistry, S.M. Khopkar, Wiley Eastern.
10. Handbook of Instrumental Techniques for Analytical Chemistry, F. Settle, Prentice Hall



MCH-404C MEDICINAL CHEMISTRY **(5 credits)**

OBJECTIVES: To impart the knowledge of

- Drug designing, development and SAR and QSAR studies.
- Introduction and elementary treatment of pharmaco dynamics
- The structure, synthesis and mode of action of antibiotic drugs
- SAR and mode of action of antibacterial and antimalarial drugs.
- Synthesis, structure and mode of action of ant-inflammatory and non-steroidal drugs.

OUTCOMES: on completion of this course, the students will be able to understand

- The General aspects of drug, drug designing and their SAR and QSAR studies.
- Significance of drug metabolism in medicinal chemistry.
- Structure and biological activity and the role of antibiotics in everyday life.
- Chemotherapy of malaria, Synthesis and mode of actions of antibiotics, anti malarials.
- Classification with structure, synthesis, SAR and mode of action of anti-inflammatory and non-steroidal drugs

Unit I

Structure and activity

Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Concept of lead compound. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free-Wilson analysis and Hansch analysis.

Unit II

Pharmacodynamics

Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

Unit III

Antibiotics: Structure, Synthesis, SAR and mode of action of:

Penicillins, Cephalosporins, Streptomycin, Chloramphenicol, Tetracyclines

Unit IV

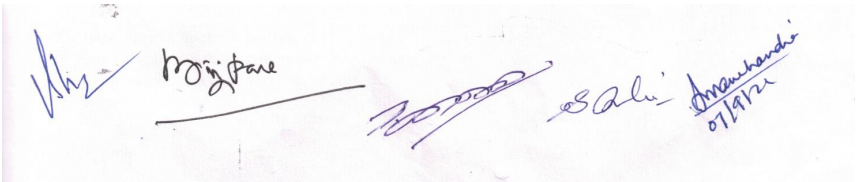
Antibacterials and antimalarials

Synthesis and mode of action of Ciprofloxacin, Norfloxacin, Acyclovir.

Polyenes: Structure and synthesis of β- carotene, SAR and mode of action of polyenes with reference to amphotericin B.

Antimalarials

Chemotherapy of malaria. Synthesis, SAR and mode of action of: Chloroquine, Chloroguanide or proguanil and Mefloquine.



UnitV

Non-steroidal Anti-inflammatory Drugs

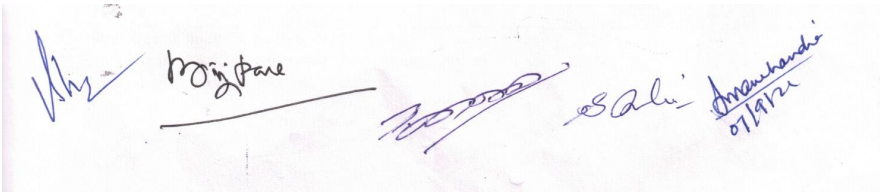
Classification with Structures, Synthesis, SAR and mode of action ofDiclofenac Sodium, Ibuprofen and Nefopam

Antihistaminic and antiasthmatic agents

Classification with Structures, Synthesis, SAR and mode of action ofTerfenadine, Cinnarizine, Salbutamol and Beclomethasone dipropionate.

Books Suggested

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.
2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.
3. An Introduction to Drug Design, S.S. Pandya and J.R. Dimmock, New Age Internaitonal.
4. Burger's Medicianl Chemistry and Drug Discovery, Vol-I (Chapter 9 and Chapter 14), Ed. M.E.Wolff, JohnWiley.
5. Goodman and Gilman's Pharmacoloical Basis of Therapeutics, Mc GRaw-Hill.
6. The Organic Chemistry of Drug Design and Drug Action, R.B. Silverman, Academic Press.
7. Strategies for Organic Drug synthesis and Design, D.Lednicer, John Wiley.
8. Principles of Medicinal Chemistry W.O.Foye
9. Medicinal Chemistry; The Role of organic chemist in Drug Research, S.M. Roberts and B.J. Pricer.



MCH-404D MATERIAL CHEMISTRY (5 credits)

OBJECTIVES: To impart the knowledge of

- Structure, properties and applications of multiphase materials and Glasses, Ceramics, Composites and Nanomaterials
- Preparation properties and applications of Thin Films and Langmuir-Blodgett Films. Types and properties of Liquid Crystals
- Molecular shape, structure and configuration of polymeric materials. Types of Ionic Conductors and their mechanism
- Properties and applications of High T_c Materials
- Materials of solid state devices and structure of Organic Solids, Fullerenes, Molecular Devices

OUTCOME: on completion of this course, the students will be able to understand

-
- properties of ferrous and non-ferrous alloys and their applications, characterizations, properties and applications of Ceramic structures, Refractories and Microscopic composites
- MOCVD, sol-gel etc. photolithography, Mesmorphic behaviour, thermotropic liquid crystals, positional order. Dielectric susceptibility and dielectric constants and description of ordering in liquid crystals.
- Applications of conducting and ferro-electric polymers, phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.
- Preparation and characterization of 1-2-3 and 2-1-4 materials, optical phonon modes, Various parameters like superconducting state; heat capacity; coherence length etc.
- Rectifiers, transistors, low-dimentional quantum structures; optical properties. Fullerenes-doped, fullerenes as superconductors, materials for second and third harmonic generation.

Unit I

A. Multiphase materials

Ferrous alloys; Fe-C phase transformations in ferrous alloys; stainless steels, non ferrous alloys, properties of ferrous and non-ferrous alloys and their applications.

B. Glasses, Ceramics, Composites and Nanomaterials

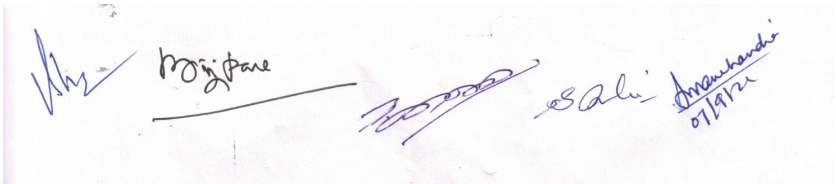
Glassy state, glass formers and glass modifiers, applications. Ceramic structures, mechanical properties, clay products. Refractories, characterizations, properties and applications.

Microscopic composites; dispersion-strengthened and particle-reinforced, firbre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties, applications.

Unit II

A. Thin Films and Langmuir-Blodgett Films

Preparation techniques; evaporation/sputtering, chemical processes, MOCVD, sol-gel etc. Languir-Blodgett (LB) film, growth techniques, photolithography, properties and applications of thin and LB films.



B Liquid Crystals

Mesmorphicbehaviour, thermotropic liquid crystals, positional order, bond orientational order, nematic and smectic mesophases; smectic-nematic transition and clearing temperature-homeotropic, planer and schlieren textures, twisted nematics, chiral nematics, molecular arrangement in smectic A and smectic C phases, optical properties of liquid crystals. Dielectric susceptibility and dielectric constants. Lyotropic phases and their description of ordering in liquid crystals.

Unit III

A. Polymeric Materials

Molecuar shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric polymers.

B. Ionic Conductors

Types of ionic conductgors, mechanism of ionic conduction, interstitial jumps (Frenkil); vacancy mechanism, diffusion superionic conductors; phase transitions and mechanism of conduction in superionic conductors, examples and applications of ionic conductors.

Unit IV

High T_c Materials

Defect perovskites, high T_c superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials, normal state properties; anisotropy; temperature dependence of electrical resistance; optical phonon modes, superconducting state; heat capacity; coherence length, elastic constants, position lifetimes, microwave absorption-pairing and multigap structure in high T_c materials, applications of high T_c materials.

UnitV

A. Materials of Solid State Devices

Rectifiers, transistors, capacitors-IV-V compounds, low-dimentional quantum structures; optical properties.

B. Organic Solids, Fullerenes, Molecular Devices

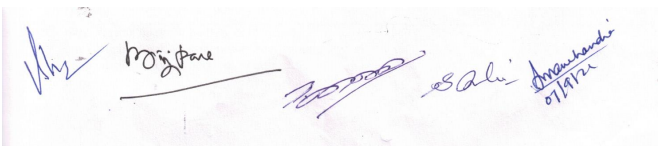
Conducting organics, organic superconductors, magnetism in organic materials.Fullerenes-doped, fullerenes as superconductors

Moleuclar rectifiers and transistors, artificial phytosynthetic devices, optical storage memory and switches-sensors.

Nonlinear optical materials; nonlinear optical effects, second and third order-molecular hyperpolarisability an second order electric susceptibility – materials for second and third harmonic generation.

Book Suggested

1. Solid State Physics, N.W.Ashcroft and N.D.Mermin, Saunders College.
2. Materials Science and Engineering, An Introduction, W.D.Callister, Wiley.
3. Principles of the Solid State, H.V. Keer, Wiley Eastern.
4. Materials Sciences, J.C.Anderson, K.D.Leaver, J.M.Alexander and R.D. Rawlings, ELBS
5. Thermotropic liquid Crystals, Edl, G.W. Gray, John Wiley.
6. Handbook of Liquid Crystals, Kelker and Hatz, Chemie Verlag.



MCH-404E: SUPRAMOLECULAR AND NANO CHEMISTRY (5 credits)

OBJECTIVES: To impart the knowledge of

- Preparation procedures, special properties and applications of multiphase materials, glasses , ceramic, composites and Nano materials
- Preparation technique, conducting properties and thermal behavior of thin films Langmuie-blodgett films and liquid crystals
- Molecular shape structure types applications of polymeric materials and ionic conductor.
- Defect pervoskites, preparation, characterization and applications of high T_C materials.

OUTCOMES: on completion of this course, the students will be able to understand

- Optical, electrical, and thermal properties of solid state materials, organic solids fullerenes and molecular devices
- Ferrous alloys, glass modifiers, refractories, nanocrystalline phase, macroscopic composites and their applications.
- Growth technique and photolithography of Langmuir-blodgett films, thermotropic and lyotropic behaviour of liquid crystals
- Mechanical, thermal and electrical conducting properties of Polymers and ionic conductors
- Superconducting state, microwave absorption- pairing and multi gap structure in high T_C materials
- Quantum state of solid materials ,optical properties of organic solids, fullerenes as superconductors, molecular devices, switches- sensors, nonlinear optical materials.

Unit I

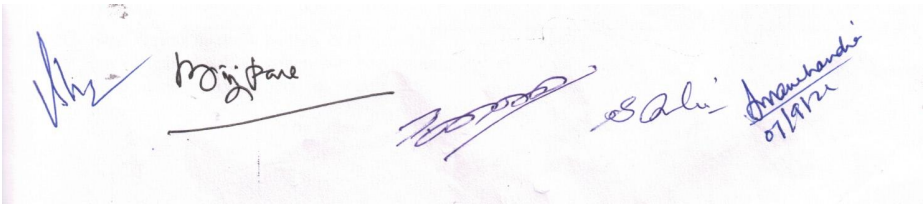
Concepts and Language

Properties of covalent bonds-bond length, inter-bond angles, force constant, bond and molecular dipole moments. Molecular and bond polarizability, bond dissociation enthalpy, entropy. intermolecular forces, hydrophobic effects. Electrostatic, induction, dispersion and resonance energy, magnetic interactions, magnitude of interaction energy, forces between macroscopic bodies, medium effects. Hydrogen bond.

Unit II

Molecular recognition

molecular receptors ,design and synthesis of receptors and coreceptor molecules Multiple recogn Molecular devices ition, Principle of molecular association and organizations, utilization of H bonds to creat supramolecular structures and crystal engineering, Novel liquid crystals, Fullerenes, Dendrimers, Cation and anion binding hosts, binding of neutral molecules and organic molecules.Transport processes and carrier design, Ion Channels



Unit III

Molecular devices and sensors

Principle and types- Electronic Photonic and Ionic devicesChemical sensors ,Glass membrane sensors, Polymer membrane chemical sensors(Ca^{2+}, K^{+} , F^{-} NO_3^{-} Ion sensors) Biosensors Glucose and cholesterol biosensor, Biosensor to determine the freshness of fish Implantable electrodes.

Unit IV

Nanotechnology

Concept and future prospects elementary idea of miniaturized total analysis system (μTAS) Preparation of nanomaterials and their characteristic differences over bulk material.Principle of electron microscopy, Dynamic light Scattering, Atomic force microscopy and charactrisation of nanomaterials.

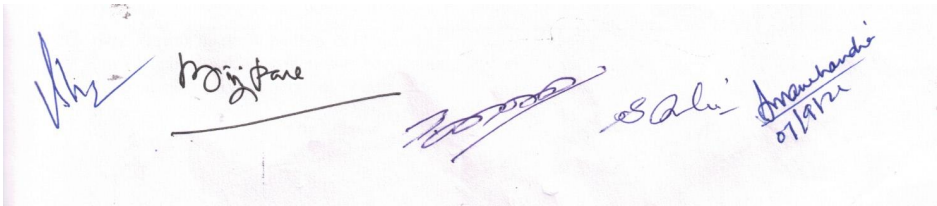
Unit V

Smart Materials and Nanomedicine

Calixarenes, Catenanes, Rotaxanes, Drug Encapsulation ,functional drug carriers, Smart materials, smart instruments, surgical robots, Tissue Regeneration Scaffolds, Imaging devices

Books Suggested

1. Material Science and Engineering – An Introduction, William D. Callister, Jr., John Wiley & Sons
2. Materials Science & Engineering – A First Course, V. Raghavan, Prentice Hall
3. Nanostructured Materials and Nanotechnology, edited by Hari Singh Nalwa, Academic Press
4. Self Assembled Nanostructures, Jin Zhang, Zhong-lin Wang, Jun Liu, Shaowei Chen & Gang-Yu-Liu, Kluwer Academic/Plenum
5. Nanotechnology: A Gentle Introduction To The Next Big Idea, Ratner and Ratner
6. Membrane mimetic chemistry: characterizations and applications of micelles, microemulsions, monolayers, bilayers, vesicles, host-guest systems, and polyions ,Fendler
7. Advances in Nanoscience & Nanotechnology, Ashutosh Sharma, Jayesh Bellare, Archana Sharma
8. Principles of Nanotechnology: Molecular-Based Study of Condensed Matter in ... ,G. Ali Mansoori



MCH-404F CHEMISTRY OF TEXTILE PRINTING (5 credits)

OBJECTIVES: To impart the knowledge of

- Classification, characteristics of textile fibres, Formation and arrangement of Crystalline and Amorphous region in fiber and their influence.
- chemical constitution, properties, methods of application and suitability of various dyes to different fibers and their blends
- Textile Testing and Quality Control
- New developments in textiles, Role of computer in designing and different methods of printing
- Need and rationale of small-scale industry

OUTCOME: on completion of this course, the students will be able to understand

- Fiber Structure, physical and chemical properties of Man-made fibers, Formation and arrangement of ultra-fine fibers, photo adoptive fibers, intelligent fibers, nano fibers and medical fibers.
- Theory of dyeing -Affinity of a dye, role of water, electrolytes, heat. Classification of dye-stuff and its properties
- Drape meter crease resistance and crease recovery, abrasion testing of abrasion resistance. Flammability and factors affecting flame resistance.
- Industrial textiles, different styles of printing and their fixation methods.
- Procedures for registration of small-scale industry. Assessment of demand and supply in potential areas of growth, Concept of Eco or green design, recycling materials and their visual aspects.

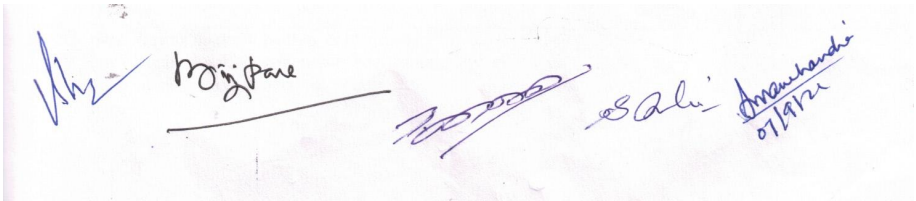
UNIT I

Introduction to Textiles, Textile fibers and their classification, essential and desirable properties of textile fibers, Characteristics of Fibre, Fiber Structure, physical and chemical properties of Man-made fibers, Formation and arrangement of Crystalline and Amorphous region in fiber and their influence on various properties of fibres. Study of new fibers- Lycra, lyocel, ultra fine fibers, , photo adoptive fibers, intelligent fibers, nano fibers and medical fibers. Manufacturing processes - Bonded fabrics , felt fabrics, laminated fabrics.

UNIT II

Nomenclature of Dyes, Colour and Dyes, colouring and Dyeing. Chromophores and Auxochromes. Colour theory, introduction about chemical constitution, properties, methods of application and suitability of various dyes to different fibers and their blends.

Theory of dyeing -Affinity of a dye, role of water, electrolytes, heat. Dye auxiliary - Carriers or swelling agents, leveling agents, anionic and cationic leveling agents. Classification of dye-stuff and its properties- (a) Natural dyes- Vegetable and Mineral dyes (b)Synthetic dyes - Acid dyes, direct dyes, reactive dyes,Vat dyes, Sulphur dyes, Azoic dyes.



UNIT III

Textile Testing and Quality Control - Selection of textile material for research based on textile testing methods. Random Sampling procedure for determination of properties of fibers, yarn and fabric. Measurement of air permeability of fabrics, fabric drape. Drape meter crease resistance and crease recovery, abrasion testing of abrasion resistance. Different Color fastness tests. Fabric Testing: Pilling of fabric, pilling tester assessment of pilling. Flammability some definitions and terms used relating to flammability, flame proof material, factors affecting flame resistance.

UNIT IV

New developments in textiles- Industrial textiles- Geo textiles ,medical, nano textiles, smart textiles, Protective Clothing ,Automotive Textile.Fundamentals of Computer and application of C A T D (Computer Aided Textile Designing)

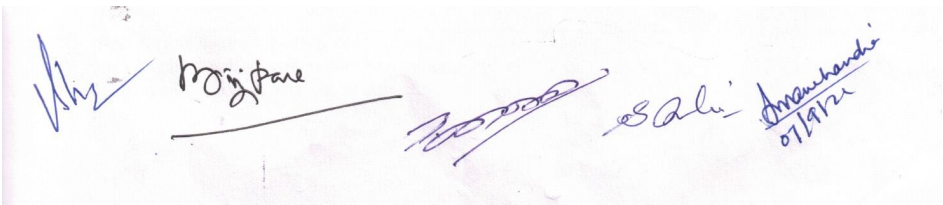
Chemical treatment of cloth before printing, General principle of printing, Methods of printing, block printing, digital printing, discharge printing, pigment printing, resist printing, Styles of printing and their fixation methods.

UNIT V

Small scale industry: Definition; Characteristics; Need and rationale: Objectives: Scope; role of SSI in Economic Development. Advantages of SSI, Steps to start in SSI, Impact of Liberalization, Privatization, Globalization on S.S.I. , How to start a small scale industry, Procedures for registration of small scale industry , List of items reserved for exclusive manufacture in small scale industry, Assessment of demand and supply in potential areas of growth , Understanding business opportunity , Considerations in product selection, Data collection for setting up small ventures. Environmental aspects of fabrics, dyes, chemicals and packaging, Indian and International textiles, Eco Labels, standards, quality control, strategy, information systems, Eco or green design, ,Concept of recycling materials and their visual aspects.

Suggested Books

1. J. E. Booth- Principle of Textile Testing – Meanness Butterwroths, London.
2. GrowerandHamley – Handbook of Textile Testing and quality control,
3. wilegJohn H. Skihtle – Textile Testing – Chemical Publishing Co. Inc. Brooklyn,
4. Gerry Cookline, Garments-Technology for Fashion Designers, Man Milan Co.
5. Fiber to fabric, Begnard P. Corbman, McGrawHillInternatinaleditins.
6. K.I. Floyd and H.M. Taylor- Industrial Application of Textiles,Textile Institute, Manchester.
7. R.Marks and A. T. C. Robinson -Principles of weaving-.
8. D.B. Ajronkar- Knitting technology
9. Shenai V. A. -History of Textile Design,Principles and practice of dyeing.
10. Watson- Textile design and colour, universal publishing corporation.



MCH-404G INSTRUMENTAL METHODS OF ANALYSIS (4 credits)

OBJECTIVES: To impart the knowledge of

- Principle, instrumentation and applications of atomic absorption and atomic emission spectroscopy and flame photometry.
- General principles, instrumentation and application of polarography , cyclic voltammetry coulorometry ,amperometry and thermal methods in analytical chemistry.
- Basic principle and types of liquid- liquid extraction and theory of column efficiency in chromatography.
- Theory , principle , classification and applications of chromatography techniques.
- Basic principle, theory and applications of AFM, SEM, TEM microscopic techniques. , nanoscale lithography, Nano sensors and their types.

OUTCOMES: on completion of this course, the students will be able to understand

- Interferences in AAS and Flame photometry, qualitative and quantitative analysis of AAS and Flame photometry.
- Ilkovic equation, half wave potential, types of polarography and cyclic voltammetry , applications of thermal methods in analytical chemistry
- Accelerated and microwave assisted extraction and solid phase extraction, retention time and retardation factor.
- Ion exchange chromatography, HPLC, LC-MS GC-MS IC-MS, HP-TLC, ICP-MS spectroscopy.
- Characterization of Nanomaterials by XRD, AFM, SEM, TEM microscopic techniques.

Unit I

Spectrochemical Methods

Spectrophotometry: Principles of absorption, instrumentation, single beam, double beam, determination of pKa value of an indicator, detectors, applications

Atomic Absorption Spectroscopy: Principles, Instrumentation, monochromator, detector, Sensitivity and detection limits, Interferences in AAS and their elimination.

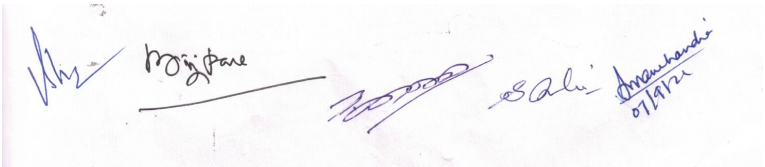
Atomic Emission Spectroscopy: Principles, Sources for excitation, Instrumentation, Qualitative and quantitative Analysis.

Flame Photometry: Principles, Interferences, Evaluation methods in Flame Photometry

Unit II

Electroanalytical Methods and Thermal methods

General principles of polarography, derivation of Ilkovic equation, consequences of the Ilkovic equation, half -wave potential, equations for reversible cathodic, anodic, and cathodic-anodic waves, analysis of reversible polarographic wave, factors affecting the half- wave potential, Cyclic voltammetry, Linear-scan voltammetry, Pulse voltammetric methods, Voltammetry with ultra micro electrodes, stripping methods, Amperometry, Amperostatic Coulometry, Coulometrc titrations and controlled- potential electrolysis.



Principles and instrumentation of TG and DTA, Complementary nature of TG and DTA, Differential scanning calorimeter (DSC), Applications of thermal methods in analytical chemistry

Unit III

Separation Techniques

Principles of analytical separations, liquid –liqidextraction : Distribution coefficient, distribution ratio, solvent extraction of metals, multiple batch extractions, countercurrent distribution., multiple extractions, Aceelerated and microwave assisted extraction, Solid Phase extraction. Principles of Chromatographic separations, Theory of column efficiency in chromatography, Retention time (Rt) and Retardation factor (R_f), Resolution.

Unit IV

Chromatography

Classification of chromatographic separations, Techniques and applications of chromatographic methods: Adsorption and partition chromatography, paper chromatography, Thin-Layer Chromatography, Column Chromatography, High Pressure Liquid Chromatography (HPLC), Gas Chromatography, Ion-Exchange Chromatography, Size Exclusion, Affinity and chiral columns, Counter- Current distribution and Electrophoresis and other hyphenated Techniques like LC-MS, GC-MS, IC-MS, HP-TLC, and ICP-MS Spectroscopy

Unit V

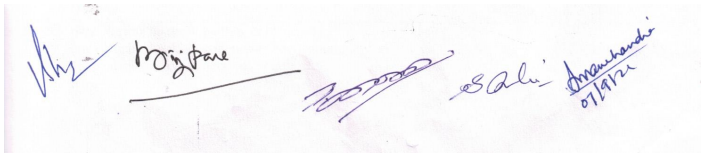
Electron Microscopy

Theory and applications of Scanning Probe microscopy: Scanning Tunneling Microscopy(STM), Atomic Force Microscopy(AFM), Scanning Electron Microscopy(SEM), Transmission Electron Microscopy (TEM).

Characterization of nanomaterials by XRD, SEM, Energy dispersive X-ray Analysis, TEM, AFM techniques. Nanoscale Lithography and its types, Nano sensors and their types, zeta sizer

Suggested Reading

1. D. A. Skoog , D. M. West and F.J.Holler, Fundamentals of Analytical Chemistry, 2nd Ed., Saunders College Publishing, 1991.
2. R.A.Day and A.L.Underwood, Quantitative Analysis, 6th Ed., Prentice-Hall of India Pvt.Ltd., 1993.
3. Analytical Chemistry - G. D. Christian.
4. Analytical Chemistry - Principles – J. K. Kennedy and W. B. Saunders.
5. Instrumental Methods of Chemical Analysis – B. K. Sharma.
6. Specrometric identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley.
7. Introduction to NMR Spectroscopy, R. J. Abraham, J. Fisher and P. Loftus, Wiley.
8. Application of Spectroscopy of Organic Compounds, J. R. Dyer, Prentice Hall.
9. Spectroscopy Methods in Organic Chemistry, D. H. Williams, I. Fleming, Tata McGraw-Hill.
10. Spectroscopy of Organic Compounds, P. S. Kalsi, New Age International Ltd.
11. Modern Spectroscopy, J.M.Hollas,John Wiley
12. Physical Methods in Chemistry ,R.S.Drego , Saunders Collge



Practical Syllabus
SEMESTER IV
(Duration: 6-8 hrs in each branch)
Practical examination shall be conducted separately for each branch.
Inorganic Chemistry

Preparation	12	
Instrumentation		12
Record	04	
Viva Voice	05	

Preparation
Preparation of selected inorganic compounds and their study by IR, electronic spectra, and magnetic susceptibility measurements. Handling of air and moisture sensitive compounds involving vacuum lines. Selection can be made from the following :
1. Sodium tetrathionate $Na_2S_4O_6$.
2. cis-$[Co(trien)(NO_2)_2]Cl.H_2O$
3. Metal complex of dimethyl sulfoxide : $CuCl_2.2DMSO$ J.Chem. Educ., 1982, 59, 57.
4.Synthesis of metal acethylacetonate :Inorg. Synths, 1957, 5, 130, 1963, 1, 183.
5 tris(acetylacetonato)manganese(III), $[Mn(acac)_3]$;
6. Bis(acetylacetonato) complexes of Cu(II), Co(II), and OV(IV)
7. Cis and Trans $[Co(en)_2CI_2]^+$.
8. Cu_2HgI_4

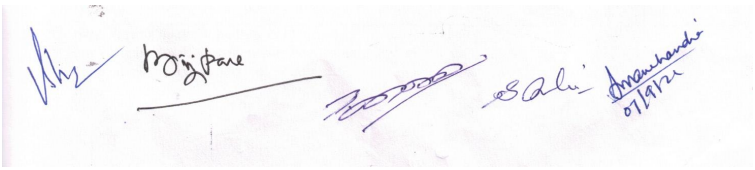
Spectrophotometric Determinations
a. Nickel by extractive spectrophotometric method.
b. Copper-Ethylene diamine complex : Slope-ratio method.
d. Determination of Keq of M – L systems such as Fe (III) – Salicylic acid or Fe(III) – β – resorcilic acid by Job's &Mole ratio method.

Flame Photometric Determinations
a. Sodium and potassium when present together.
b. Lithium/calcium/barium/strontium.
c. Cadmium and magnesium in tap water.

Potentiometric Titrations:
1. FAS Vs $K_2Cr_2O_7$
2. FAS Vs. $KMnO_4$
3. Determination of phosphoric acid in cola beverages by pH titration.

Conductometry.
1. Verification of Debye Huckle theory of ionic conductance for strong electrolytes KCl, $BaCl_2$, K_2SO_4, $K_3[Fe(CN)_6]$
2. Conductometric Titrations: (a) NaOH Vs. HCl (b) NaOH Vs. Boric acid

Analysis of Electronic Spectra of transition metal complexes at least for one system [dn (Oh) or (Td)] and calculation of Crystal Field parameters, interelectronic repulsion parameter and bonding parameter.



SEMESTER IV

Organic Chemistry

Extraction of Organic Compounds from Natural Sources 12

Spectrophotometric Determinations or Estimations 12

Record 04

Viva Voice 05

Extraction of Organic Compounds from Natural Sources

1. Isolation of caffeine from tea leaves.
2. Isolation of casein from milk
3. Isolation of lactose from milk
4. Isolation of nicotine dipicrate from tobacco.
5. Isolation of piperine from black pepper.
6. Isolation of lycopene from tomatoes.
7. Isolation of b-carotene from carrots.
8. Isolation of (+) limonine from citrus rind.

Spectroscopy

Identification of organic compounds by the analysis of their spectral data (UV, IR, PMR, CMR & MS)

Spectrophotometric (UV/VIS) Estimations

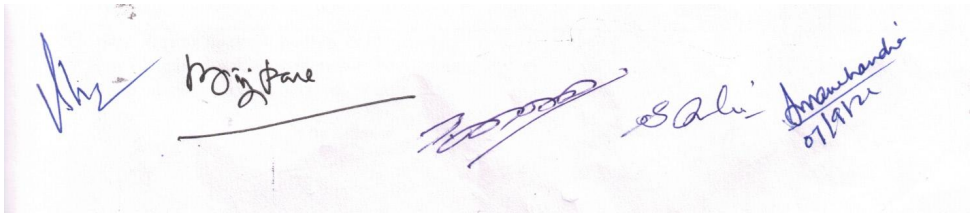
1. Aminoacids 2. Proteins 3. Carbohydrates

Or

Determination of the percentage or number of hydroxyl groups in an organic compound by acetylation method.

Estimation of amines/phenols using bromate bromide solution/or acetylation method.

Estimation of glucose by Fehling solution



SEMESTER IV

Physical Chemistry

Thermodynamics/Instrumentation	12
Chemical Kinetics	12
Record	04
Viva Voice	05

Thermodynamics

1. Determination of partial molar volume of solute (e.g.KCl) in a binary mixture.
2. Determination of partial molar volume of ethanol in a binary mixture.
3. Determination of the temperature dependence of the solubility of a compound in two solvents having similar intromolecular in tetractions (benzoic acid in water and in DMSO water mixture and calculate the partial molar heat of solution.

Chemical Kinetics

1. Determination of energy and enthalpy of activation in the reaction of KMnO4 and benzyl alcohol in acid medium.
2. Determination of the velocity constant for the oxidation of iodide ions by hydrogen peroxide study the kinetics as an iodine clock reactions.
3. Kinetics of an enzyme catalyzed reaction.

Potentiometry

1. Estimation of halides (Cl^-,Br^- and I^-) in a binary and ternary mixture potentiometrically.
2. To find out the composition of zinc ferrocyanide precipitate on adding zinc sulphate to acidified potassium ferrocyanide solution potentiometrically.

Books Suggested

1. Vogel's Textbook of Quantitative Analysis, revised, J. Bassett, R.C. Denney, G.H. Jeffery and J. Mendham, ELBS.
2. Synthesis and Characterization of Inorganic Compounds, W.L. Jolly. Prentice Hall.
3. Experiments and Techniques in Organic Chemistry, D.P. Pasto, C. Johnson and M. Miller, Prentice Hall.
4. Macroscale and Microscale Organic Experiments, K.L. Williamson, D.C. Health.
5. Systematic Qualitative Organic Analysis, H. Middleton, Adward Arnold.
6. Handbook of Organic Analysis-qualitative and Quantitative. H. Clark, Adward Arnold.
7. Vogel's Textbook of Practical Organic Chemistry, A.R. Tatchell, John Wiley.
8. Practical Physical Chemistry, A.M. James and F.E. Prichard, Longman.
9. Findley's Practical Physical chemistry, B.P. Levitt, Longman.
10. Experimental Physical Chemistry, R.C. Das and B. Behera, Tata McGraw Hill.
11. Inorganic Experimens, J. Derek Woolings, VCH.
12. Microscale Inorganic Chemistry, Z. Szafran, R.M, Pike and M.M. Singh, Wiley.
13. Practical Inorganic Chemistry, G. Marr and B. W. Rockett, Van Nostrad.
14. The systematic Identification of Organic Compounds, R.L. Shriner and D.Y. curlin.