Analytical Chemistry
CHE-401

Unit-I

Statistical tests and Error Analysis:

Accuracy, precision, classification n of errors, significant figures and computation, mean deviation and standard deviation, Least square methods, regression coefficient , F-test, t-test and Chi-test. Sampling and Sample Treatment Factors involved in effective sampling, good samples; Representative and homogeneous, samples of mixtures.

Unit –II

Spectrochemical:

Spectrophotometry: Quantities principles of absorption, instrumentation, sing le beam, double beam, determination of pka value of an indicator, detectors, applications.

Atomic spectroscopy: Principles of emissions, atomic emission spectroscopy an d flame emission

Unit –III

Electro analytical Methods:

Theory of electro gravimetric analysis, electrode reactions, over potential, Cyclic voltammetry, Linear-scan voltammetry, Pulse voltammetry methods, stripping methods.

Coulometer: Coulometric titrations and controlled- potential electrolysis.

Unit - IV

Chromatography Techniques :

Classification of chromatographic separations. Theory of chromatography. Applications of chromatographic methods: A desorption and partition chromatography. Ion exchange chromatography , LC, HPLC and GC, Column matrices, Detectors. Affinity and chiral columns(all type of chromatography)

Unit – V

Separation Techniques :

Principles of analytical separations, liquid –liquid extraction : Distribution coefficient, distribution ratio, solvent extraction of metals, analytical separations, multiple batch extractions, countercurrent distribution., multiple extractions.

Thermal Methods :

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

Books Suggested:

Gary D.Christian, Analytical Chemistry, John-WH.A.Willard, L.L.Merrit, and J.A.Dean, Instrumental Methods of Analysis , Van Nostrand, New York, 1D.A.Skoog & D.M.West Principles of Instrumental Analysis. Holt Rinahart Winston, New York, 1988.

K A Robinsons Chemical Analysis, Harper Collins Publishers, NewYork.

SSA.J. Bard and L. R. Faulkner, Electrochemical Methods: Fundamentals and Applications, John Wiley & Sons: New York.

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Chemistry of Natural Products
CHE-402

Unit – I

Structure determination, stereochemistry, biosynthesis and synthesis of some common terpenopids Citral, α-Terpeneol, Farnesol, Zingiberence, Santonin, Phytol and Abietic acid.

Unit –II

Alkaloids:

Structure, stereochemistry, synthesis and biosynthesis of some common alkaloids Ephedrine, Nicotine, Atropine, (+) Conin Quinine and Morphine.

Unit –III

[a] Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of: Cholesterol, Bile acids. Harmon's: Androgen , Testosterone, Estrogen, Progesterone, Aldosterone, Biosynthesis of Steroids.

[B] Prostaglandins

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

Unit -IV

Plant Pigments:

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolinn Quercetin, Myrcetin, Vitexin, Diadzein, Aureusin, Cyanidn, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid path way. Porphyries, Structure and synthesis of Hemoglobin and Chlorophyll.

Unit –V

Pyrethroids and Rotenone's:

Synthesis and reactions of Pyrethroids and Rotenone's.

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

Suggested Books:

Organic Chemistry : Vol. 1 and 2, I. L. Finar, ELBS

Organic Chemistry of Natural Products Vol. I and Vol. II, Gurdeep R. Chatwal, Himalaya Publishing House

Stereo selective Synthesis: A P recital Approach, M. Norgradi, VCH.

Rodd's Chemistry of Carbon compounds, Ed. S. Coffey, Elsevier.

Introduction to Flavonoids, B. A. Bohm. Harwood Academic Publishers.

New Trends in Natural Product chemistry, Ataaur Rahman and M.L. Chodhary , Harwood Academic Publishers.

Insecticides of Natural Origin, Sukh Dev, Harwood Academic Publishers.

BIOCHEMISTRY

CHE-403A[optional]

UNIT-I:

Metal Ions in Biological Systems :
Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump.
Bioenergetics and ATP Cycle.
DNA polymerization, glucose storage, metal complexes in transmission of energy; chlorophyll's,photosystem I and photosystem II in cleavage of water.

Transport and Storage of Dioxin Heme proteins and oxygen uptake structure and function of hemoglobin's, myoglobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt andcopper.

UNIT-II:

Electron Transfer in Biology

Structure and function of metal of proteins in electron transport processes cytochrome's and ion-sulphure proteins, synthetic models. **Nitrogen fixation** Biological nitrogen fixation, and its mechanism, nitrogenize, Chemical nitrogen fixation.

UNIT-III:

Enzymes
Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, reversible and irreversible inhibition.
Mechanism of Enzyme Action Transition-state theory, orientation and Steric effect, acid-basecatalysis, covalent catalysis, strain or distortion..

Kinds of Reactions Catalyzed by Enzymes Nucleophiles displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions,.

UNIT-IV:

Co-Enzyme Chemistry

Cofactors as derived from vitamins, coenzymes, prosthetic groups, Apo enzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors., cryptates. Cyclodextrins, cyclodextrion-based enzymemodels, micelles synthetic enzymes or synzymes.

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Biotechnological Applications of Enzymes

large-scale production and purification of enzymes, techniques and methods of immobilization of enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from corn starch, enzymes astargets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.

UNIT-V:

Biological Cell and its Constituents

Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coilstransition.

Biopolymer Interactions

Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of binding processes in biological systems. Hydrogen ion titration curves.

Cell Membrane and Transport of Ions

Structure and functions of cell membrane, ion transport through cell membrane, irreversible thermodynamic treatment of membrane transport. Nerve conduction.

Suggested Readings:

Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.
Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.
Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.
Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.
Bioorganic Chemistry : A chemical Approach to Enzyme Action, Hermann Dugas and C. Penny, SpringerVerlag.

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SOLID STATE CHEMISTRY

CHE403B[optional]

UNIT-I

Solid State Reactions:

General principles, experimental procedure, co-precipitation as a precursor to solid state reactions, kinetics of solid state reactions.

UNIT-II

Crystal Defects and Non-Stoichiometry:

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

UNIT-III

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, super conductors. 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-IV

Organic Solids:
Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.

UNIT-V

Liquid Crystals:

Types of liquid crystals: Nematic, Smectic, Ferroelectric, Ant ferroelectric, Various theories of LC, Liquidcrystal display, New materials.

Suggested Readings:

Solid state chemistry and its applications, A.R. West. Peenum.
Principles of the Solid State, H.V. Keer, Wiley Eastern.
Solid State Chemistry, N.B. Hannay.

Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern

Understanding Enzymes, Trevor Palmer, Prentice Hall.

Enzyme Chemistry : Impact and applications, Ed. Collin J suckling, chemistry.

Enzyme Mechanisms Ed. M.I. Page and A Williams, Royal Society of Chemistry.

Fundamentals of Enzymology, N.C. Price and L. Stevens. Oxford University Press.

ELECTROCHEMISTRY

CHE-404 C[optional]

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 aircell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

1. 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 stores : 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) Diaphragms; 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, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

Passivation :

Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.

UNIT-III

Bioelectrochemistry :

bioelectronics, 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, Over potential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current.

Irreversible Electrode processes : Criteria of irreversibility, information from irreversible wave.

UNIT-IV

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

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

UNIT-V

Potential Sweep Method :

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

Bulk Electrolysis Methods :

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

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SUGGESTIED READINGS:

Polarographic Techniques by L. Meites, Interscience.

"Fuel Cells : Thjeir electrochemistry". McGraw Hill Book Company, New York.

Modern Polarographic Methods by A.M. Bond, Marcell Dekker.

Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.

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