

8. Classics in total synthesis, Nicolaou E.J., Chemie Verlag, 1996
9. The logic of chemical synthesis, Corey E.J. and Cheng X.M., John Wiley & Sons, 1989.
10. Reagents in Organic chemistry, Fieser and Fieser
11. Handbook of reagents in organic synthesis, P Wipf, John Wiley & Sons.
12. Protecting group in Organic synthesis, Greene T, Wuts P.G.M., John Wiley & Sons, 1989.
13. Modern methods of Organic synthesis, Carruther W., Cambridge University Press.
14. Organic synthesis: The science behind art, Smith W.A., Bochkor A.F., Caple, R., RSC, 1998
15. Supramolecular Chemistry – An Introduction, Vögtle F and Alfter F, J. Wiley & Sons: Chichester, 1993
16. Supramolecular Chemistry – Concepts and Perspectives, J-M Lehn, Wiley-VCH, 1995.

CHY B03: HETEROCYCLIC CHEMISTRY- I

UNIT – I

Nomenclature of Heterocycles

Replacement and systematic nomenclature (Hantzsch-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 ^1H NMR-spectra. Empirical resonance energy, delocalization energy and Dewar resonance energy, diamagnetic susceptibility exaltations). Heteroaromatic reactivity.

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.

UNIT – III

Small Ring Heterocycles- Three-membered and Four-membered Heterocycles:

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synthesis and reactions of aziridines, oxiranes, thiiranes, oxaziridines, azetidines, oxetanes, thietanes and azetidinones.

UNIT - IV

Five membered Heterocycles with Two Heteroatoms

Synthesis and reactions of 1,2- & 1,3- diazoles, oxazoles and thiazoles

Benzo-fused five-membered Heterocycles

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

CHYB04: NATURAL PRODUCTS

UNIT - I

Prophyrins

Structure, reactions and synthesis of Haemoglobin and Chlorophyll.

Prostaglandins

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE₂ and PGF_{2α}.

UNIT - II

Pyrethroids

Introduction, structure elucidation and synthesis of pyrethroids, namely pyrethrins and cinerins. Structure-activity relationships and synthesis of various synthetic pyrethroids.

Rotenoids

Introduction, isolation, stereochemistry and classification. Synthesis of Rotenone.

Plant Hormones

Introduction, occurrence, isolation and physiological effects of Auxins, Gibberellins (Synthesis of GA₃), Cytokinins and Abscisic acid.

UNIT - III

Vitamins

Introduction, synthesis, biological functions and deficiency syndromes of Vitamin B (Thiamine), C, E and K.

Insect Hormones

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Introduction to BH, JH and MH, chemistry of JH, structure elucidation and synthesis, structural analogs. JH mimics – some structures, chemistry of Juvabione.

UNIT – IV

Biosynthesis

Biosynthetic pathways for terpenoids, alkaloids, steroids, pigments and hormones with emphasis to the compounds in the course.

SUGGESTED BOOKS AND REFERENCES

1. Natural Products : Chemistry and Biological Significance, J. Mann, R.S. Davidson, J.B. Hobbs, D.V. Banthorpe and J.B. Harborne, Longman, Essex.
2. Organic Chemistry : Vol. 2 I L. Finar, ELBS
3. Stereoselective Synthesis : A Practical Approach, M. Norgradi, VCH.
4. Chemistry of Natural Products : S. V. Bhat, B. A. Nagasampagi and M. Sivakumar, Narosa Publishing House.
5. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston. Harwood Academic Publishers.

CHY B05: ORGANIC SYNTHESIS - II

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.

Protecting groups: Principle of protection of alcohol, amine, carbonyl and carboxyl groups. Simple practice exercises.

UNIT II

One Group and Two Group C-C disconnections: One group C-C disconnections involving alcohols and carbonyl compounds, regioselectivity, Alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

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

UNIT III

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Computer-aided Synthesis Planning: General concepts, Heindrickson's SYNGEN approach, Barone's MARSEIL/SOS and LHASA systems.

Stereogenic centres and planning of synthesis: Stereogenic skeletal bond forming reactions, asymmetric synthesis, synthesis of a racemate and resolution, incorporation of chiral building blocks.

UNIT IV

Ring Synthesis: Introduction to ring synthesis of saturated heterocycles. General strategy and stereoselectivity. 3-membered rings: cyclisations and insertion reactions. Rerarrangements in synthesis. 4-membered rings: photocycloadditions and use of ketenes. 5-membered rings: from 1,4- and 1,6-dicarbonyl compounds. Pericyclic rearrangements and special methods. 6-membered rings: carbonyl condensations, Diels-Alder reactions and reduction of aromatic compounds.

SUGGESTED BOOKS AND REFERENCES

1. Organic synthesis, Smith M.B., McGraw Hill, 2002.
2. Organic synthesis: The disconnection approach. Warren S. John Wiley & Sons. 2004
3. Designing organic synthesis – The synthon approach, Warren S., Wiley, 1978 (Re-printed 2002).
4. Organic Synthesis – Concepts, Methods and Starting Materials, J. Fuhrhop and G. Li, Wiley-VCH, 2003.
5. Modern methods of Organic synthesis, Carruther W., Cambridge University Press, 2004.
6. Modern Synthetic Reactions, H.O. House, W. A. Benjamin, 1972.

CHY B06: HETEROCYCLIC CHEMISTRY- II

UNIT-I

Five membered Heterocycles with more than two Heteroatoms

Syntheses and reactions of triazoles, tetrazoles, oxadiazoles and thiadiazoles

Meso-ionic Heterocycles

General classification, chemistry of some important meso-ionic heterocycles of type-A and B and their applications.

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UNIT-II

Six-Membered Heterocycles with one Heteroatom

Synthesis and reactions of pyrylium salts, pyrones coumarins and chromones.

Six membered Heterocycles with two or more Heteroatoms: Synthesis and reactions of diazines, triazines, and tetrazines.

UNIT-III

Thiazines- 1,4-Benzothiazines and Phenothiazines.

Diazepines- 1,4 or 1,5-Benzodiazepines.

Thiazepines- 1,4 or 1,5-benzothiazepines.

UNIT-VI

Heterocyclic Systems Containing P and B

Heterocyclic rings containing Phosphorus: Introduction. nomenclature. synthesis and characteristics of 5- and 6-membered ring systems phospholes and phosphonines (with or without nitrogen atom). **Heterocyclic rings containing boron:** Introduction, synthesis reactivity and spectral characteristics of 5- and 6- membered ring systems- borole, borobenzene and borazine.

SUGGESTED BOOKS AND REFERENCES

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 Scientific Technical.
5. Contemporary Heterocyclic Chemistry, G.R. Newkome and W.W. Paudler, Wiley-Inter Science.

Comprehensive Heterocyclic Chemistry, A.R. Katritzky and C.W. Rees, eds. Pergamon Press.

CHY C01: ELECTROANALYTICAL TECHNIQUES

UNIT - I

A.Errors Precision and Accuracy

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.

B.Chromatography and Applications

Thin layer chromatography (TLC), Adsorption (column) chromatography, High-performance liquid chromatography (HPLC) and Gas chromatography.

UNIT – II

A.Conductometry:

Important laws, definitions, relations, effect of dilution on conductivity, measurement of conductivity , types of conductometric titrations, its applications and limitations.

B.Potentiometry :

Principle, instrumentation, types of potentiometric titrations and its applications, pH measurements, determination of pH, ion selective electrodes, instrumentation and applications.

UNIT – III

Coulometry:

Introductions, principle, experimental details of coulometry at constant current and constant potential, titrational applications.

UNIT – IV

Atomic Absorption Spectroscopy

Introduction, principle, grotrian diagram, instrumentation, application, detection limit, sensivity and disadvangates.

SUGGESTED BOOKS AND REFRENCES

1. Principles of instrumental analysis D.A. Skoog and J.L. Loary. W.B. Saunders, CBS
2. Principles of Instrumental Analysis D.A. Skoog W.B. Saunders, CBS
3. Handbook of Instrumental Techniques for Analytical Chemistry F. Settle, Prentice Hall.

CHY C02: ELECTROCHEMISTRY - I

UNIT – I

Electro-chemical Energy Storage:

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Properties of Electrochemical energy storers: measure of battery performance, Charging and discharging of batteries, 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

Bioelectrochemistry:

Membrane potential, simplistic and modern theory, Electrical conductance in biological organisms, electrochemical mechanism of nervous systems, enzymes as electrodes, Biosensors, Bioelectrocatalysis.

UNIT – III

Corrosion and Passivity:

Electrochemical mechanism of corrosion of metals, thermodynamics and stability of metals, potential - pH (or Pourbaix) Diagrams, uses and abuses, corrosion current and corrosion potential - Evans diagrams.

Measurement of corrosion rate: weight loss method & Electrochemical method.

Inhibition of Corrosion (i) by addition of substrates to the electrolyte environment (ii) By charging 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 – IV

Kinetics of Electrode Process:

Essentials of electrode reaction, current density, overpotential, Tafel equation, Butler Volmer equation. Standard rate constant (K^0) and Transfer coefficient (α), exchange current density. criteria of irreversibility information from irreversible wave.

Koutecky's method, Meits Israel and Gelling's method for determining kinetic parameters for quasireversible and irreversible waves.

SUGGESTED BOOKS AND REFERENCES

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1. Modern, Electrochemistry, Vol. I, II A, Vol. II B, J' OM Bockris and A.K. N. Reddy, Plenum Publication, New York.
2. Polarographic Techniques by L. Meites, Intersciences. New York
3. Modern Polarographic Methods by A. M. Bond, Marcell Dekker.
4. Polarography and allied techniques by K. Zutshi, New Age International Publication, New Delhi

CHY C03: CHEMICAL KINETICS

UNIT - I

(a)**Oscillatory Reactions:** Autocatalysis and oscillatory reactions, Oscillatory reactions from the new point of thermodynamics. Kinetics and mechanism of Belousov-Zhabotinski (B-Z) reaction.

(b)**Enzymes and Inhibitors:** Enzyme catalyzed models of 1:2 type enzyme-substrate systems.

Kinetics of one enzyme-Two substrate systems and their experimental characteristics. Enzyme inhibitors and their experimental characteristics. Kinetics of enzyme inhibited reactions.

UNIT - II

Dynamics of Gas-Surface Reactions :

Adsorption/desorption kinetics and transition state theory, Dissociative adsorption and precursor state. Mechanism of Langimur's adsorption of the oxidation of carbon monoxide to carbon dioxide. True and apparent activation energies. Industrial importance of heterogeneous catalysis.

UNIT - III

Transition State:

A brief aspect of statistical mechanics and transition state theory, application in calculation of the second order rate constant for reactions with collision for (i) atom + atom (2) atom + molecule (3) molecule (for both linear and non-linear molecules) + molecule reactions. Static solvent effects and thermodynamic formulations. Adiabatic electron transfer reactions, energy surfaces.

UNIT - IV

Metal-ion Catalysis: Kinetics and Mechanism of following Reactions

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- (i) When reaction rate is independent of one of the reactants in presence of metal ion catalyst
- (ii) When reaction rate is retarded by one of the products in presence of metal ion catalyst.
- (iii) When metal ion catalysis indicates an intermediate species.
- (iv) Cyclodextrines are acting as catalyst mode of catalysis. Analysis of one full case study of B-cyclodextrine, catalysed reaction, Hydroformylation reaction.

SUGGESTED BOOKS AND REFERENCES

1. Progress in Inorganic chemistry, Vol. 30, 1967.
2. R. Lumry and R.W. Raymond, Electron transfer Reactions, Interscience.
3. N.L. Bender, Mechanism of Homogeneous catalysis from protein to protein, Wiley.
4. A.G. Sykes, Kinetics of Inorganic reactions, Pergamon.
5. S.W. Benson, Mechanism of Inorganic Reactions, Academic Press.
6. Physical chemistry Vol. 2, Ed. Prof. Ya Grasimov, Mir Publisher.
7. Basolo and Pearson, Inorganic Reaction Mechanism, Wiley
8. H. Taube, Electron transfer Reactions, Oxford Press.

CHY C04: CHEMICAL ANALYSIS

UNIT I

Water Analysis

Sources of water pollution domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. 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. (Measurement

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of DO, BOD and COD) Pesticides as water pollutants and analysis. Water pollution laws and standards.

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 food 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

Soil and Fuel Analysis :

(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-producer gas and water gas-calorific value.

UNIT IV

Body Fluids and Drug Analysis :

Composition of blood collection and preservation of samples. Serum electrolytes, blood glucose, blood urea nitrogen, uric acid albumin, globulins acid and alkaline phosphatases, Immunoassay : Principle of radio immunoassay (RIA) and applications. The blood gas analysis trace elements in the body.

Narcotics and dangerous drugs classification of drugs. Screening by gas and thin layer chromatography and spectrophotometric measurements.

SUGGESTED BOOKS AND REFERENCES

1. Analytical Chemistry, G.D. Christian, J. Wicy
2. Fundamentals of 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.

W.B. Saunders

4. Analytical Chemistry - Principles and Techniques. L.G. Hargis, Prentice Hall.
5. Quantitative Analysis, R.A. Day, Jr. and A.L. Underwood, Prentice Hall.
6. Environmental Solution, S.M. Khopkar, Wiley Eastern.
7. Basic Concepts of analysis Chemistry, S.M. Khopkar, Wiley Eastern.

CHY C05: ELECTROCHEMISTRY - II

UNIT I

Fuel Cells:

Electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells. Hydrogen Air Cell, Hydrocarbon air cell, alkaline fuel cell, Phosphoric acid fuel cell, direct NaOH fuel cells, applications of fuel cells.

UNIT II

Electrocatalysis :

Chemical catalysis and Electrocatalysis, cathodic and anodic electro catalysis; electrocatalysis of mixed oxides of titanium doped with rare earth oxides (Ebonex); Electrolysis in simple redox reactions; Electrocatalysis of carbon nanotubes and bimetallic (alloys) Nano- structured materials.

UNIT III

Voltammetry :

General Principle and applications, linear sweep voltammetry (LSV), cyclic voltammetry (CV), square wave voltammetry, stripping voltammetry, cathodic adsorptive stripping voltammetry (CAAdSV), anodic adsorptive stripping voltammetry (AAAdSV) applications of stripping analysis.

UNIT IV

Electro-organic Synthesis:

Types of electro organic reactions, constant current and constant potential electrolysis, cell design, effect of variable, nature of medium, nature of electrode materials, over-voltage, effect of redox couple, application to sewage waste water treatment, electro-chemical incineration of human waste in combined space. Electro-organic synthesis of novel drugs.

SUGGESTED BOOKS AND REFERENCES

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1. Electrochemical methods by Allen J. Bard and Larry R. Faulkner, John Wiley. Publication.
2. Electrochemistry by Carl H. Hamann, Andrew Hammett and Wolf Vielstich.
3. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.
4. Electroanalytical chemistry by Basil H. Vessor & Galen W. Wiley Interscience.
5. Topics in pure and applied chemistry Ed. S.K. Rangrajan SAEST publications, Karaikudi, (India)
6. Techniques of Electro-organic synthesis Part I, II and III by N.L. Weinberg John Wiley Publication.
7. Organic Electrochemistry by M.M. Baizer Marcel Dekker.
8. Principles and applications of Electrochemistry By: D.R. Crow (Stanley Thrones (Pub.) Ltd.

CHY C06: CHEMICAL KINETICS - II

UNIT I

(a) Micelles Catalysis and Inhibition: Micelles and their classification, Kinetics and mechanism of micelle catalyzed reactions (1st Order and second order) Various type of micelle catalyzed reactions. Micelle inhibited reactions.

(b) Kinetics and Mechanism of Substitution Reaction: Classification of ligand substitution mechanism, anation and base catalyzed Kinetics of anation reactions. Aquation and acid catalyzed Kinetics of aquation reactions (octahedral complexes).

UNIT - II

Radiation Chemistry-I

Radiation chemistry and Photochemistry. Radiation chemistry of water and aqueous solutions. Hydrogen atom and hydroxyl radical-oxidizing and reducing conditions. Kinetics and mechanism of photochemical and photosensitized reactions (one example in each case).

Stern-volmer equation and its application. Hole-concept in the presence of semiconductor photocatalysts. Kinetics and mechanism of electron transfer reaction in the presence of visible light. Kinetics of exchange reactions (mathematical analysis).

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UNIT - III

Induced Phenomena:

- (i) Metal ion catalyzed reactions, induced reactions, difference between the..... Kinetics of Induced reactions and their characteristics. Induction factor and its mechanistic significance. Mechanism of (i) Fe (II) induced oxidation of iodide by Cr (VI)
- (ii) As (III) induced oxidation of Mn (II) by chromate in acid solutions.
- (iii) Kinetics and mechanism of induced reactions in metal complexes (octahedral complexes of cobalt (III) only).

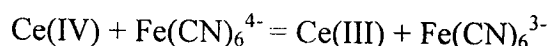
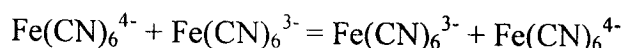
UNIT - IV

Electron Transfer Reactions in Metal Complexes:

Kinetics and mechanism of 1:1, 1:2 and 1:3 metal-substrate complexes as intermediates. Inner-sphere and outer-sphere reactions. Henry Taube's classical reaction. its kinetics and mechanism, experimental analysis by chromatographic and spectroscopic techniques.

Pattern of reaction via adjacent and remote attacks, linkage isomerism. Mechanism of inner sphere and outer sphere mode of electron transfer reactions.

Marcus - Cross-relation in outer-sphere reactions, (no mathematical derivation) in following reactions -



Bridged outer-sphere electron transfer mechanism.

SUGGESTED BOOKS AND REFERENCES

1. Progress ion inorganic chemistry, Vol. 30, 1967.
2. R. Lumry and R. W. Raymond, Electron Transfer Reactions, Interscience.
3. N. L. Bender, Mechanism of Homogeneous catalysis from protein to protein, Wiley.
4. A.G. Sykes, Kinetics of Inorganic Reactions, Pergamon.
5. Physical chemistry Vol. 2, Ed. Prof. Ya Grasimov, Mir Publisher.

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6. S.W. Benson, Mechanism of Inorganic Reactions, Academic Press.
7. Basolo and Pearson, Inorganic Reaction Mechanism, Wiley.
8. H. Taube, Electron Transfer Reactions, Oxford Press.

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