

Acharya Nagarjuna University
M.Sc. FINAL YEAR CHEMISTRY (ANALYTICAL CHEMISTRY SPECIALIZATION)
Effective for the students admitted from the year 2010 - 2011
SEMESTER III

Paper –I PRINCIPLES AND TECHNIQUES IN CLASSICAL ANALYSIS (C3.1(A)-10)

UNIT-I

THEORY AND PRINCIPLES OF TITRIMETRIC ANALYSIS.:

ACID - BASE TITRATIONS: Titrimetric procedures involved in the neutralisation of acids and bases; Acid base indicators-indicator action-preparation of indicator solutions-mixed and universal indicators.,

REDOX TITRATIONS: Theoretical principles - red ox indicators-Indicator action.,

Analytical chemistry of some selected oxidants/reductants, selection of suitable indicators for various oxidant/reductant titration systems.

Oxidants: Mn(III), Mn(VII), Ce(IV), Cr(VI), V(V), Ti(III), Iodimetry and iodometry,

Reductants: Cr(II), V(II), Ti(III), Sn(II),

Use of Karl-Fisher reagent in the estimation of moisture content.,

UNIT - II

TITRATION IN NON-AQUEOUS SOLVENTS: Choice of solvents for non-aqueous titrations. End point detection- Applications of non-aqueous titrations using glacial acetic acid as titre.

COMPLEXOMETRIC TITRATIONS: Theoretical principles involved in complexometric titrations - role of indicators, EDTA titrations, Silver cyanide titration, Direct titration, back titration, substitution titration, total hardness of water, fluoride ion as demasking agent- analysis of nickel alloy.

PRECIPITATION TITRATIONS: Theoretical principles involved in argentometric titrations-use of normal and adsorption indicators -Indicator action.,

UNIT-III

GRAVIMETRIC ANALYSIS : Precipitation methods: Nucleation and crystal growth, completeness of precipitation, effect of excess precipitant, pH, complex formation on completeness of precipitation, purity of the precipitate, precipitation from the homogeneous solutions.

Analytical Applications of organic precipitants in gravimetric analysis- Structural requirements of an organic precipitant- -Specificity, selectivity, sensitivity, masking .

Complexing precipitants like DMG, Oxine, Salicylaldoxime, α -Benzoinoxime.

Ion association precipitants: Benzidine, Sodium tetra phenyl boron, arsonium salts.

UNIT-IV

CATALYSED AND INDUCED REACTIONS AND KINETIC METHODS OF ANALYSIS.:

Kinetic aspects of the analytical use of chemical reactions-Kinetics of chemical reactions- Kinetic effects in oxidation reduction reactions

Application of kinetic methods: catalytic reactions-enzyme reactions-uncatalysed reactions- determination of components, determination of the rate with change of concentration, ,

Types of kinetic methods: single point method, Differential method, Integral method,

Rate determination by complex decomposition, by steady state condition, Kinetics of enzyme catalysed reactions- Factor effecting- activators, inhibitors, hydrogen ion concentration, temperature- Principles of the analytical use of enzyme reactants-Determination of enzymes.

SUGGESTED BOOKS.:

1. I.M. Kolthoff-Volumetric analysis V.A. Strenger Vols I to III,
2. A.I. Vogel - A text Book of quantitative Inorganic analysis - ELBS,
3. H.P. Walton- Principles and methods of chemical analysis-Prentice Hall,
4. Laitnen-Chemical Analysis,
5. C.W. Wilson and D.W. Wilson-Comprehensive analytical Chemistry,
6. R.A. Day Jr and A.L. Underwood-Quantitative analysis-Prentice Hall,
7. K.B. Yarstimiskii-Kinetic Methods of Analysis,
8. D.A. Skoog, D.M. West and F.J. Holler--Fundamentals of Analytical Chemistry .

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SEMESTER III

PAPER II- APPLIED INORGANIC ANALYSIS (C3.2(A)-10)

UNIT-I

Analysis of Limestone: moisture, loss on ignition, insoluble matter (silica), determination of combined oxides (R_2O_3), calcium, magnesium, carbon dioxide.

Analysis of haematite, - moisture, volatile matter, silica, iron, oxide iron,

Analysis of pyrolusite- moisture, volatile matter, silica, manganese, combined oxides

Analysis of clay materials: moisture, volatile matter, silica, R_2O_3, Fe_2O_3 ,

UNIT II

Analysis of phosphate rock- moisture, loss on ignition, SiO_2 , alumina, Fe_2O_3 , total CaO, magnesium.

Analysis of feldspar- silica, sodium, potassium, sulphate,

Analysis of monozite- oxides of cerium, thorium, calcium, magnesium, iron, aluminium, sulphur, silica

UNIT-III

Analysis of ferrous alloys:

Analysis of Steels- types of steels- digestion methods for different types of steels- determination of contents of carbon, silicon, sulphur, phosphorus, manganese, nickel, magnesium, vanadium, molybdenum, nickel, aluminium, chromium and tungsten in steel samples.

Analysis of non-ferrous alloys:

Brass, bronze and solder: Compositions of different alloys- digestion procedures of alloys- Procedures for the determination of contents like tin, copper, lead, zinc and iron, aluminium, manganese, antimony,

UNIT - IV

Analysis of Complex materials:

Analysis of cement- loss on ignition, insoluble residue, total silica, sesquioxides, lime, magnesia, ferric oxide,

sulphuric anhydride.

Analysis of glasses - Determination of silica, sulphur, barium, arsenic, antimony, total R_2O_3 , calcium,

magnesium, total alkalis, aluminium, chloride, fluoride

Colouring agents in glasses- chromium, cobalt, copper, total iron, manganese, nickel, titanium, lead, barium, sodium,

potassium, cerium, zirconium, arsenic,

SUGGESTED BOOKS:,

1. F.J. Welcher- Standard methods of analysis,
2. I.M. Kolthoff- Volumetric analysis V.A. Strenger Vols I to III,
3. A.I. Vogel - A text Book of quantitative Inorganic analysis - ELBS,
4. H.P. Walton- Principles and methods of chemical analysis- Prentice Hall,
5. Laitnen & Harris - Chemical Analysis,
6. C.W. Wilson and D.W. Wilson- Comprehensive analytical Chemistry,
7. F.D. Snell & F.M. Biffen- Commercial methods of analysis- D.B. Tarapuravala & sons,
8. Manual of procedures for Chemical and instrumental analysis of Ores, Minerals and Ore Dressing Products-

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SEMESTER III

PAPER -III ANALYSIS of APPLIED INDUSTRIAL PRODUCTS (C3.3(A)- 10)

UNIT-I

Analysis of soaps: moisture and volatile matter, combined alkali, total fatty matter, free alkali, total fatty acid,

sodium silicate and chlorides.

Analysis of paints : Vehicle and pigments, Barium Sulphate, total lead, lead chromate, iron pigments, zinc

chromate

UNIT- II

Analysis of oils: saponification value, iodine value, acid value, ester value, bromine value, acetyl value

Analysis of industrial solvents like benzene, acetone, methanol and acetic acid.

Determination of methoxyl and N-methyl groups.

UNIT-III

Analysis of fertilizers: urea, NPK fertilizer, super phosphate,

Analysis of DDT, BHC, endrin, endosulfone, malathion, parathion.,

Analysis of starch, sugars, cellulose and paper,

UNIT -IV

Gas analysis: carbon dioxide, carbon monoxide, oxygen, hydrogen, saturated hydrocarbon, unsaturated hydrocarbons,

nitrogen, octane number, cetane number

Analysis of Fuel gases like: water gas, producer gas, kerosene (oil) gas.

Ultimate analysis : carbon, hydrogen, nitrogen, oxygen, phosphorus and sulfur.,

SUGGESTED BOOKS:

- 1.F.J.Welcher-Standard methods of analysis,
- 2.A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,
- 3.H.H.Willard and H.Deal- Advanced quantitative analysis- Van Nostrand Co,
- 4.F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,
- 5.J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on analytical chemistry and its applications -- Inter Science- Vol I to VII.,
- 6.G.Z.Weig - Analytical methods for pesticides, plant growth regulators and food additives - Vols I to VII,
- 7.Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
- 8.Manual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L.Sharma, Kalyani Publishers, New Delhi

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SEMESTER III
PAPER –IV OPTICAL METHODS OF ANALYSIS AND OTHER TECHNIQUES
(C3.4(A)-10)

UNIT – I :-

Infrared Spectroscopy :- Theory – Molecular Vibrations – Instrumentation- Limitations – Structure determination – Quantitative Analysis – Base line techniques.

Raman Spectroscopy :- Theory – Properties of Raman lines – Differences between Raman & IR Spectra – Rayleigh Scattering – Mechanism of Raman effect – Instrumentation – Applications.

UNIT – II :

Nephelometry & Turbidimetry :- Theory – Instrumentation – Difference between Nephelometry & Turbidimetric titrations – Applications.

Fluorimetry & Phosphorimetry :- Theory – Fluorescence & Phosphorescence – factors effecting Fluorescence & Concentration – Limitations – Comparison of Fluorimetry & Phosphorimetry – Applications.

UNIT – III :-

Emission Spectroscopy :- Principle – Theory – Instrumentation – Types responsible for Line Spectra –

Merits & Demerits – Applications.

Flame Photometry: Principle–Theory– Instrumentation–Experimental Procedures– Errors in Flame Photometry – Applications.

Atomic Absorption Spectroscopy :- Principle – Theory – Limitations – Relation between Atomic absorption & Flame emission – Instrumentation Estimation of cation & anions – Applications.

Inductively Coupled Spectrometer :- Principles – Instrumentation – Advantages over Atomic Absorption Spectroscopy – Applications with specific examples like Chromium, Molybdenum, Zirconium and Aluminium.

UNIT – IV :-

Thermal analysis techniques: - Thermogravimetric Analysis – Types of Thermal balances – Differential Thermal Analysis – Differential scanning calorimetry- Thermometric Titrations.

Radio Chemical Methods :- Objectives, introduction, principles and theoretical aspects, technique/ method, gas counter, scintillation counter, errors and correction, liquid scintillation counting, sample preparation, applications

SUGGESTED BOOKS:;

1. B.K.Sharma -- Instrumental methods of chemical analysis, Goel Publishers,
2. G.Chatwal and S.Anand -- Instrumental methods of chemical analysis,,
3. A.I.Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS,
4. H.H.Willard, L.L Merrit and J.A Dean -- Instrumental Methods of Analysis.,
5. Peacock -- Instrumental Methods of Analysis,
6. J.W.Robinson- Under graduate Instrumental Analysis,
7. G.W Eving- Instrumental Methods of Chemical Analysis.,

- 8.D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry ,
- 9.H.Kaur-- Instrumental methods of chemical analysis,Pragathi Prakasan,
- 10.D.A.Skoog,F.J.Holler and Nieman-- Instrumental Methods of Analysis.,

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SEMESTER IV
PAPER -I ADVANCED METHODS OF ANALYSIS (C4.1(A-10))

UNIT-I

MASS SPECTROMETRY:

Principle-theory-instrumentation-interpretation of spectra of metal compounds-identification of compounds of metal compounds from fragmentation pattern. Quantitative analysis of metal chelates-alkaline earth metal derivatives, metal chelates derived from 8-hydroxyquinoline, Schiff's bases-Salicylaldehyde-nitrogen rule, thermodynamic studies-molecular structure Analytical aspects of the mass spectrometry.

UNIT-II

X-RAY SPECTROSCOPY :

Principles-theory, X-ray diffraction -instrumentation -X-ray fluorescence- applications-identification of substances by the powder diffraction method-applications.,

UNIT-III

ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY (EPR):,

Principle-theory-instrumentation -hyperfine interactions-determination of 'g' value-ender and eldor applications-study of free radicals-structural determination-reaction velocities and mechanisms-study of inorganic compounds-study of catalysis-determination of oxidation state of metal determination of manganese-determination of vanadium.,

UNIT-IV

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY (NMR):

Principles-theory-instrumentation-differences between NMR and EPR-chemical shift-spin-spin coupling effect of chemical exchange on spin-spin interactions-spin decoupling-limitations of NMR-cause of chemical shift and shielding-applications-qualitative and quantitative analysis-kinetic studies.,

SUGGESTED BOOKS:,

1. Becky -- Ionization mass spectrometry,
2. Physical methods of Analytical Chemistry Vol I - III,
- 3 J. Roilly and W.N. Ray -- Physical Chemical Methods,
4. Advances in Analytical Chemistry and Instrumentation. Vol I - IV,
5. T.H. Gow - Guide to modern methods of instrumental analysis,
6. A.I. Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS,
7. P. Delahay -- New instrumental methods in Analytical Chemistry,
8. H.H. Willard, L.L. Merrit and J.A. Dean -- Instrumental Methods of Analysis.,
9. Banwell- Fundamentals of molecular spectroscopy,
10. D.M. Williams and I. Fleming - Spectroscopic methods of Inorganic Chemistry,
11. J. Charalambous - Mass spectrometry of metal compounds,
12. J.W. Robinson- Under graduate Instrumental Analysis,
13. D.A. Skoog, F.J. Holler and Neman-- Instrumental Methods of Analysis.,

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SEMESTER IV

PAPER-II ANALYSIS OF DRUGS, FOODS, DAIRY PRODUCTS & BIOCHEMICAL ANALYSIS (C4.2(A)-10)

UNIT I

Analysis of the following drugs and pharmaceuticals preparations:

(Knowledge of molecular formula, structure and analysis)

Analysis of analgesics and antipyretics like aspirin and paracetamol

Analysis of antimalarials like chloroquine .

Analysis of drugs in the treatment of infections and infestations : Amoxicillin., chloramphenicol, metronidazole,

penicillin, tetracycline.

Anti tuberculous drug- isoniazid.

UNIT II

Analysis of the following drugs and pharmaceuticals preparations:

(Knowledge of molecular formula, structure and analysis)

Analysis of antihistamine drugs and sedatives like: allegra, zyrtec(citirizine), alprazolam, trazodone, lorazepam.

Analysis of anti epileptic and anti convulsant drugs like phenobarbital and phenacemide.

Analysis of drugs used in case of cardiovascular drugs:atenolol, norvasc(amlodipine),

Analysis of lipitor(atorvastatin) a drug for the prevention of production of cholesterol.

Analysis of diuretics like: furosemide (Lasix), triamterene

Analysis of prevacid(lansoprazole) a drug used for the prevention of production of acids in stomach.

UNIT III

Analysis of Milk and milk products:

Acidity, total solids, fat, total nitrogen, proteins, lactose, phosphate activity, casein, chloride

Analysis of food materials- Preservatives: Sodium carbonate, sodium benzoate sorbic acid

Flavoring agents - Vanilla , diacetyl, isoamyl acetate, limonene, ethylpropionate , allyl hexanoate and

Adulterants in rice and wheat, wheat flour, sago, coconut oil, coffee powder, tea powder, milk.

UNIT IV

Clinical analysis of blood:Composition of blood,clinical analysis,trace elements in the body.Estimation of blood

cholesterol, glucose, enzymes, RBC & WBC , Blood gas analyser.

SUGGESTED BOOKS :

1.F.J.Welcher-Standard methods of analysis,

2.A.I.Vogel-A text book of quantitative Inorganic analysis-ELBS,

3.F.D.Snell & F.M.Biffen-Commercial methods of analysis-D.B.Taraporavala & sons,

4.J.J.Elving and I.M.Kolthoff- Chemical analysis - A series of monographs on

analytical chemistry and its applications -- Inter Science- Vol I to VII.,

5.Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers

6.Quantitative analysis of drugs in pharmaceutical formulations by P.D.Sethi

CBS Publishers and Distributors, New Delhi

7.G.Ingram- Methods of organic elemental micro analysis- Chapman and Hall.,

8.H.Wincciam and Bobbles (Henry J)- Instrumental methods of analysis of food additives.,

- 9.H.Edward-The Chemical analysis of foods;practical treatise on the examination of food stuffs and the detection of adulterants,
- 10.The quantitative analysis of drugs- D.C.Garratt-Chapman & Hall.,
- 11.A text book of pharmaceutical analysis by K.A.Connors-Wiley-International.,
- 12.Comprehensive medicinal chemistry-Ed Corwin Hansch Vol 5,Pergamon Press.,

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SEMESTER IV
PAPER-III ENVIRONMENTAL CHEMISTRY AND ANALYSIS (C4.3(A)-

10)

UNIT-I

Significance of basic segments of Environment-Nomenclature in the study of Environmental Chemistry.,

SOIL CHEMISTRY & POLLUTION STUDIES:Principles of weathering-effect of temperature, water, air, plants and animals on weathering., Soil formation/development-factors affecting soil development-physical properties of soil; soil colloids-ion exchange properties.,Soil fertility, productivity- Soil nutrients-micro and macro.,

UNIT II

STUDY OF WATER POLLUTION AND MONITORING AND TREATMENT METHODS OF WATER POLLUTANTS:

Hydrosphere-water resources-hydrological cycle-unique properties of water- water quality parameters.,

Pollution from Domestic water ,industrial,agricultural,solid waste, shipping, radio active waste & thermal pollution , Effect of specific pollutants like mercury, lead, arsenic, selenium, nitrates, oil.,

Effects of soaps,detergents,pesticides,hydrocarbon with regard to water pollution.,

Techniques of water treatment-Primary, secondary and tertiary methods-use of coagulants-flash distillation-solar stills, ion exchange reverse osmosis, electro dialysis.,

UNIT -III

STUDY OF AIR POLLUTION AND MONITORING AND TREATMENT METHODS IN CASE OF AIR POLLUTION:

Atmospheric sources and emission of air pollutants-carbon monoxide-sulphur ,oxides-oxides of nitrogen,organic pollutants and photo chemical smog-particulates-acid rain and radioactive substances.

Continuous monitoring of air pollutants-Principles,Monitoring instruments,monitoring of sulphur dioxide,hydrogen sulphide,oxides of nitrogen, oxides of carbon, hydrocarbons, ozone and suspended particulate matter and radio active substances.

UNIT-IV

ENVIRONMENTAL CHEMICAL ANALYSIS:

Analysis of soil: Sampling,determination of moisture,total nitrogen, phosphorus, silicon, lime, humus, nitrogen, alkali salts.,

Analysis of water samples : Dissolved oxygen,Chemical oxygen demand ,Biological oxygen demand,Phosphates,nitrogen compounds.analysis of metallic constituents,

Analysis of Air samples: carbon mono oxide,carbon dioxide,sulphur dioxide,hydrogen sulfide,oxides of nitrogen,ammonia,ozone,hydrocarbons and aromatic hydrocarbons.,

SUGGESTED BOOKS:.

- 1.Environmental Chemistry by A.K.De, Wiley Eastern Limited, New Delhi
- 2.A Text Book of Environmental Chemistry by O.D.Tyagia and M.Mehra-Anmol Publications,
- 3.Environmental Pollution Control and Engineering by C.S.Rao , Wiley Eastern Limited,
- 4.Environmental Chemistry by P.S.Sindhu,-New Age International Publishers
- 5.A Text Book of Environmental Chemistry and Pollution Control by S.S.Dara ,S.Chand & Co
- 6.Environmental Pollution Analysis by S.M.Khopkar, Wiley Eastern Limited, New Delhi
- 7.Analytical Agricultural Chemistry by S.L.Chopra & J.S.Kanwar -- Kalyani Publishers
- 8.Manual of soil, plant, water and fertilizer analysis, R.M.Upadhyay and N.L Sharma, Kalyani Publishers, New Delhi
- 9.Environmental Chemistry by B.K.Sharma- Goel Publishing House, Meerut.
- 10.Soil Chemical Analysis by M.L.Jackson,Prentice-Hall India Pvt Ltd, New Delhi

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SEMESTER IV
PAPER-IV SEPARATION TECHNIQUES AND ELECTRO ANALYTICAL TECHNIQUES
(C4.4(A)-10)

UNIT-I

SEPARATION TECHNIQUES IN CHEMICAL ANALYSIS:

SOLVENT EXTRACTION :

Introduction, principle, techniques, factors affecting solvent extraction, quantitative treatment of solvent extraction equilibria-chelate and ion association systems-synergism.,

ION EXCHANGE :

Introduction, action of ion exchange resins, separation of inorganic mixtures, applications.,

UNIT - II

CHROMATOGRAPHY:

Introduction-Column, paper chromatography-Thin layer chromatography and HPLC and Gas chromatography :

Introduction, equipment. Gas liquid chromatography. Exclusion chromatography.-Applications

UNIT III

Electrogravimetry : -

Theory of electro analysis-Polarisation-Over voltage-Principles involved in electrogravimetric analysis-current - voltage curves - separation of metals by electrolysis - constant current - controlled potential electrolysis.

Coulometry : -

Coulometry at controlled potential - separation of Nickel and Cobalt - coulometres - types of coulometric analysis - constant current coulometry of coulometric titrations.

UNIT - IV :

Voltametry, Polarography and Amperometric titrations: -

Voltametry - Principle of Polarography - dropping mercury electrode; working; factors effecting the limiting current; residual current, migration current - diffusion current - kinetic current - polarographic maximum - Half wave potential - Organic Polarography, Rapid Scan polarography - cyclic voltametry - qualitative and quantitative polarographic analysis - Amperometric titrations - its advantages and disadvantages - Bi Amperometric titrations - Chrono potentiometry

SUGGESTED BOOKS:;

1. B.K.Sharma -- Instrumental methods of chemical analysis, Goel Publishers,
2. G.Chatwal and S.Anand -- Instrumental methods of chemical analysis,.,
3. J.J.Lingane- Electroanalytical Chemistry- Inter Science,
4. A.I.Vogel -- A text Book of Quantitative Inorganic Analysis-ELBS,
5. H.H.Willard, L.L Merrit and J.A Dean -- Instrumental Methods of Analysis.,
6. Peace-Instrumental Methods of Analysis,
7. J.W.Robbinson- Under graduate Instrumental Analysis,
8. R.A.Day and A.L.Underwood- Quantitative Analysis,
9. G.W Eving- Instrumental Methods of Chemical Analysis.,
10. D.A.Skoog, D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry ,
11. H.Kaur-- Instrumental methods of chemical analysis, Pragathi Prakasan,
12. D.A.Skoog, F.J.Holler and Neman-- Instrumental Methods of Analysis.,
14. G.H.Morrison and H.Frieser- Solvent extraction in Analytical Chemistry,
17. Chemical Separation methods- J.A Dean, D.Vannoststrand Company, New York

18. Physical and Chemical Methods of Separation by E.W.Berg, MC Graw Hill Book Company, New York

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III & IV SEMESTER
PRACTICALS FOR THE EXAMINATIONS TO BE CONDUCTED AT THE END OF IV SEMESTER

Practical I Classical Methods of Analysis

1. Analysis of iron ore
2. Analysis of pyrolusite
3. Analysis of brass / synthetic mixture copper and nickel
4. Analysis of synthetic mixture of iron and zinc
5. Analysis of solder
6. Analysis of cement
7. Analysis of total hardness in waters
8. Analysis of chloride in water samples
9. Analysis of dissolved oxygen in water samples
10. Analysis of phosphate and nitrate and ammonia in fertilizers
11. Estimation of total iron with different procedures using various reductants
12. Analysis of zinc in zinc containing alloy using EDTA
13. Analysis of nickel by EDTA
14. Estimation of glucose
15. Analysis of oil for the determination of saponification value, acid value and iodine value

Practical II Instrumental methods of analysis

1. Determination of alkalinity in industrial or environmental samples using pH metric procedures
2. Assay of commercial acids by pH metric titrations using suitable base
3. Conductometric titrations with individual acids and mixtures of acids
4. Potentiometric titration of Fe(II) with Cr(VI)
5. Estimation of mixture of Mn(VII) and V(V) with Fe(II) using potentiometric techniques.
6. Mixture analysis of Ce(IV) and V(V) with Fe(II) by a potentiometric method.
7. Estimation of potassium thiocyanate with silver nitrate by potentiometric method
8. Estimation of chloride and iodide in a mixture by potentiometric method
9. Determination of Fe(III) colorimetrically using potassium thiocyanate
10. Estimation of amount of manganese by colorimetric procedure
11. Estimation of phosphate by using ammonium molybdate and hydrazine sulphate
12. Simultaneous determination of manganese and chromium in mixture
13. Estimation of nitrate from environmental samples
14. Estimation of phosphate in environmental samples
15. Flame photometric estimations of sodium, potassium and lithium

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SEMESTER III

PAPER-I ADVANCES IN INORGANIC CHEMISTRY

(C3.1(In)-10)

UNIT- I

Molecular orbital theory -experimental evidence for covalence in coordinate bond of metal complexes- sigma and pi bonding orbitals in octahedral complexes -energy level diagrams - Measurement of pi - bonding effects- influence of pi -overlap on delta- Qualitative treatment of square planar and tetrahedral complexes on M.O.theory., Concept of resonance
Coordination polymers: linear, two dimensional and three dimensional polymers, Chelate effects- Macro cyclic complexes of alkali: metals, crown ethers and cryptate forming ligands.,

UNIT II

INORGANIC REACTION MECHANISMS:

Homogeneous catalytic hydrogenation-metal ion catalysis of organic reactions- hydrolysis, transamination, aldol condensation, decarboxylation, carboxylation.,
Synthetic oxygen carriers.,

Reactions of coordinated ligands-Template reactions, photo chemistry of complex ions- photo chemical decomposition of Co(III) and Cr(III) complexes- photolysis of metal tri oxalates- photo absorption and isomerisation in complexes- photo oxidation in solution.,

ORGANOMETALLIC CHEMISTRY:

Acetylene and olefin complexes of transition metals- preparation, properties and reactions- structure and bonding.,

Metallocenes- Synthesis and reactions of ferrocene- structure and bonding. Some examples of arene complexes,

Carbonylate anions - carbonyl hydrides- structure and bonding in metal carbonyls.,

UNIT III

NOVEL INORGANIC COMPOUNDS

Acyclic & cyclic systems from the periodic table - Inorganic homo- & heterocycles saturated and unsaturated ring systems. p electron precise and rich rings. synthesis, structure and reactivity.

Metallacycles -Chemistry of individual rings. Cages & clusters of Elements, structural variety. properties and implications of borides, carbides, silicides, nitrides, phosphides, oxides and sulphides of transition elements, multiple bonds and cluster variety of transition metals. Higher boranes, carboranes and metalloboranes. Inorganic polymers, definition, variety and merits., P, Si, S, N, & O based polymers. Polyphosphazenes, polythiazenes, poly siloxanes and poly silanes.

UNIT-IV

Catalysis by organometallic compounds-oxidative addition, insertion/migration reactions, hydroformylation, olefin isomerisation and polymerisation reaction- catalysis reaction of synthetic gas- synthetic gasoline-Ziegler - Natta catalysis in polymerization.,
Dinitrogen complexes Nitrogen fixation.

SUGGESTED BOOKS:

1.J.L.Huheey: Inorganic Chemistry-Principles, structure and reactions-Harper,

- 2.F.A.Cotton and G.W.Wilkinson : Advanced Inorganic Chemistry-Wiley Eastern,
3.F.Basolo and R.G.Pearson : Mechanism of Inorganic Reactions-Wiley-Eastern,
4.D.Banerjea : Coordination Chemistry - Tata Mcgraw-Hill, New Delhi.

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SEMESTER III
PAPER-II PHYSICAL INORGANIC CHEMISTRY (C3.2(In)-10)

UNIT-I

INORGANIC ENERGITICS: General Principles of thermochemistry- thermodynamics- enthalpy, entropy and free energy concepts-interpretation of entropy- temperature dependence of entropy and enthalpy-trends in entropies. Equilibrium-effect of temperature on equilibrium.Lattice energies-Born-Mayer equation-Born Haber Cycle-applications.Bond energies-Hydration-structural treatment-enthalpy and entropy of hydration.Solution of electrolytes- electro chemical cells-emf and its relation to free energy and equilibrium constants. Thermodynamic approach to the use of high temperature techniques in inorganic synthesis.,

UNIT - II

SOLID STATE CHEMISTRY:;

Structure and bonding in metals-V.B. and band theories-interstitial compounds-Hume-Rothery rules-semiconductors-photo and thermal semi conductors; ,solid-solid reactions.,

Types of close packing - hcp and ccp. packing efficiency, radius ratios; structure types -NaCl, ZnS. Na₂O, CdCl₂, wurtzite, nickel arsenide, CsCl, CdI₂, rutile and Cs₂O, perovskite ABO₃, K₂NiF₄, spinels. Preparative methods: Solid state reaction, precipitative reactions, sol-gel route, precursor method, Ion exchange reactions, intercalation / deintercalation reactions. glasses and thin film preparation. Thermal analysis, microscopy as tools of characterization. Electrical properties: Development of free electron theory to band theory of solids - metals and their properties; semiconductors - extrinsic and intrinsic, Hall effect; Insulators - Dielectric, Ferroelectric, Pyroelectric and Peizelectric properties and the relationship between them. New Materials - Zeolites, Fullerenes. Defects - colour centers - reactivity.

UNIT-III

ACIDS AND BASES :Arrhenius, Bronsted lowry, Lewis Luxflood, solvent systems,Usanovich concepts-generalized acid- base concept-HSAB theory-symbiosis-measures of acid-base strengths- trends in acidities-Bond energies and bond lengths in acid-base compounds.,

NON-AQUEOUS SOLVENT CHEMISTRY:Classification of solvents-reactions in liquid ammonia-solution of metal in ammonia-reactions of solvated electron-sulphurdioxide and acetic acid as non aqueous solvents-molten solids as non aqueous systems.,

Nonaqueous solvents: General properties and classification of solvents. Self-ionization and leveling effect. Reactions in nonaqueous solvents: Solute-solvent interaction. Reactions in liquid NH₃. Solutions of metals in liquid ammonia. Reactions in anhydrous sulphuric acid, liquid SO₂, liquid HF, liquid halogens and interhalogens, and liquid dinitrogen tetroxide. Titrations in nonaqueous solvents.

UNIT- IV

INORGANIC POLYMERS, INORGANIC CHAINS-heterocatenation-intercalation chemistry-inorganic rings-borazines-phosphozenes-cyclo and linear phosphozines- homocyclic and heterocyclic inorganic ring systems-cages-boron cage compounds-boranes-and carboranes-metal clusters-binuclear and trinuclear clusters-bonding.,

SUGGESTED TEXT BOOKS:;

- 1.J.L.Huheey:Inorganic Chemistry-Principles ,structure and reactions-Harper
- 2.W.E.Addison: Structural Principles of Inorganic Compounds-Longmans,
- 3.R.S.Drago : Physical Methods in Inorganic Chemistry-Reinhold,
- 4.K.B.Harvey and G.B.Porter: Physical Inorganic Chemistry- Addison-Weslay.,
- 5.J.B.Ander and A.J.Sonnessa : Principles of Chemistry-Macmillan,
- 6.A.Barnard : Theoretical Basis of Inorganic Chemistry- Tata-McgrawHill.,
7. H.Sisler, “Chemistry of Nonaqueous Solvent.
- 8.N.B.Hannay, “Solid State Chemistry”, Prentice Hall.

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SEMESTER III

PAPER-III INSTRUMENTAL METHODS IN INORGANIC ANALYSIS (C
3.3(In)-10)

UNIT – I

Radio Chemical Methods : -Objectives, introduction, principles and theoretical aspects, technique/ method, gas counter, scintillation counter, errors and correction, liquid scintillation counting, sample preparation, applications

Thermal analysis techniques: - Thermogravimetric Analysis – Types of Thermal balances – Differential Thermal Analysis – Differential scanning calorimetry- Thermometric Titrations.

UNIT – II

Infrared Spectroscopy :- Theory – Molecular Vibrations – Instrumentation – Limitations – Structure determination – Quantitative Analysis – Base line techniques.

Raman Spectroscopy : - Theory – Properties of Raman lines – Differences between Raman & IR Spectra – Rayleigh Scattering – Mechanism of Raman effect – Instrumentation – Applications.

UNIT – III

Nephelometry & Turbidimetry : - Theory – Instrumentation – Differences between Nephelometry & Turbidimetric titrations – Applications.

Fluorimetry & Phosphorimetry : - Theory – Fluorescence & Phosphorescence – factors effecting Fluorescence & Concentration – Limitations – Comparison of Fluorimetry & Phosphorimetry – Applications.

UNIT – IV

Flame Photometry : - Principle – Theory – Instrumentation – Experimental Procedures – Errors in Flame Photometry – Applications.

Atomic Absorption Spectroscopy : - Principle – Theory – Limitations – Relation between Atomic Absorption & Flame emission – Instrumentation- Estimation of cation & anions – Applications.

Inductively Coupled Spectrometer : - Principles – Instrumentation – Advantages over Atomic Absorption Spectroscopy – Applications with specific examples like Chromium, Molybdenum, Zirconium and Aluminium.

SUGGESTED BOOKS ;,

1. A.I.Vogel : A text book of quantitative Inorganic Analysis-3rd Edition-ELBS,
- 2.J.W.Robbins- : Under-graduate Instrumental Analysis,
- 3.R.A.Day and A.L.Underwood : Quantitative Analysis-,

- 4.G.W.Eving : Instrumentation Methods of Chemical Analysis-McGraw-Hill.,
- 5.Willard ,Merrit and Dean :Instrumental Methods of Analysis - D.Van Nostrand ,
- 6.J.A.Barnard and R.Chayan : Modern Methods of Chemical Analysis,
- 7.G.H.Morrison and H.Frieser : Solvent Extraction in Analytical Chemistry-John Wiley.,
8. S.M.Khopkar : Basic Concepts of Analytical Chemistry- ,
9. H.A.Laintenen and W.E.Harris : Chemical Analysis.,
- 10.B.K.Sharma -- Instrumental methods of chemical analysis,Goel Publishers,
- 11.G.Chatwal and S.Anand --Instrumental methods of chemical analysis.,
- 12.J.J.Lingane- Electroanalytical Chemistry- Inter Science,
- 13.Peace,Instrumental Methods of Analysis,
- 14.D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry ,
- 15.H.Kaur-- Instrumental methods of chemical analysis,Pragathi Prakasan,
- 16.D.A.Skoog,F.J.Holler and Nieman-- Instrumental Methods of Analysis.,

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SEMESTER III

PAPER-IV BIO-INORGANIC CHEMISTRY (C3.4(In)-10)

UNIT-I

Introduction,role of essential and non essential elements in living systems,
 Importance of elements with particular reference to : calcium,sodium and potassium,
 Metalloporphyrines-structures & functions of the following:chlorophyll and its activity-role of Mg in
 photosynthesis;

Haemoglobin:Structure and mechanism of transportation of oxygen-mioglobin
 Other biological dioxygen carriers like: Hemerythrin, and hemocyanine

UNIT - II

Enzymes -Importance and introduction :Enzyme related proteins of cobalt(II),copper,
 molybdenum ,

Vitamin B₁₂ &B₁₂ -coenzymes,

Enzymes - Structure and function:-red ox reactions-oxidation of ascorbic acid by Cu(II) enzymes-
 peroxydases and

catalases-cytochromes.,

UNIT-III

Reduction of nitrogen by nitrogenase,

Carboxylation and decarboxylation reactions-phosphorylation -exchange of functional groups -
 blocking of functional groups -transportation and storage of metal ions by complex formation,

UNIT-IV

Metal ion toxicity-metal ion detoxification-nitrogen fixation in vitro and vivo-bio chemistry of
 metals-ADP and ATP-Inorganic Chemistry of biological systems- antibiotics and related
 complexes.,

SUGGESTED BOOKS :

- 1.J.E.Huheey, E.A.Keiter and R.L.Keiter, Inorganic Chemistry-,
- 2.D.Banerjea-Fundamental principles of Inorganic Chemistry -S.Chand &.,
- 3.D.Banerjea -Coordination Chemistry -Tata McGraw Hill,New Delhi,

4. Gurudeepraj- Advanced Inorganic Chemistry -Vol 2, Goel Publishing House, Meerut,
5. E.I. Ochiai - Bio-Inorganic Chemistry-An Introduction-Allyn & Bacon, London,
6. K.Hussain Reddy—Bioinorganic Chemistry—New Age International Publs
7. Bertini, Gray, Lippard & Valentine -- Bioinorganic Chemistry-Viva-Low priced
8. Lippard & Berg—Principles of Bioinorganic Chemistry- Panima Publs Co
9. A review of physiological chemistry by H.A.Harper, V.W.Rodwell and P.A.Mayes-
Lange Medical Publications, California.
10. A.Bhagi and G.R.Chatwal- Bioinorganic Chemistry- Himalaya Publishing House, New Delhi

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SEMESTER IV

Paper I – PHOTOINORGANIC CHEMISTRY (C4.1(In)-10)

UNIT-I

BASICS OF PHOTOCHEMISTRY : Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times- measurements of the times. Flash photolysis, stopped flow techniques. Energy dissipation by radiative and non radiative processes, absorption spectra, Frank-Condon principle, photo chemical stages- primary and secondary processes.

PROPERTIES OF EXCITED STATES : structure, dipole moment, acid-base strengths, reactivity. Photochemical kinetics- calculation of rates of radiative processes. Bio molecular deactivation- quenching

UNIT II

EXCITED STATES OF METAL COMPLEXES: comparison with organic compounds, electronically excited states of metal complexes, charge-transfer spectra, charge transfer excitations, methods for obtaining charge – transfer spectra .

METAL COMPLEX SENSITIZERS: Metal complex sensitizer, electron relay, metal colloid systems, semiconductor supported metal or oxide systems, water photolysis, nitrogen fixation and carbon dioxide reduction.

UNIT III

LIGAND FIELD PHOTOCHEMISTRY : Photo substitution, photo oxidation and photo reduction, lability and selectivity, zero vibrational levels of ground state and excited state, energy content of excited state, zero – zero spectroscopic energy, development of equations for redox potentials of the excited states – Energy transfer under conditions of weak interaction and strong interaction – exciplex formation, conditions for the excited states to be useful as redox reactants, excited electron transfer, metal complexes as attractive candidates.

UNIT IV

REDOX REACTIONS BY EXCITED METAL COMPLEXES: (2,2'- bipyridine and 1,10-phenanthroline complexes). Illustration of reducing and oxidising character of Ruthenium²⁺

(bipyridal complex , comparison with $\text{Fe}(\text{bipy})_3$, role of spin – orbit coupling – life time of these complexes. Application of redox processes of electronically excited states for catalytic purposes , transformation of low energy reactants into high energy products, chemical energy into light.

SUGGESTED BOOKS:

1. Concepts of inorganic photochemistry – A.W.Adamson and P.D.Fleischauer, Wiley
2. Inorganic photo Chemistry – J.Chem. Educ., Vol 60 No 10, 1983
3. Progress in Inorganic Chemistry, Vol 30, ed. S.J.Lippard, Wiley
4. Coordination Chem. Revs , 1981, Vol 39, 121, 131 ; 1975 ,15-321, 1990 , 97, 313
5. Photo chemistry of coordination compounds , V.Balzari and V.Carassiti, Academic Press,
6. Elements of Inorganic Chemistry, G.J.Feraudi, Wiley

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SEMESTER IV

PAPER– II PHYSICAL METHODS IN STRUCTURAL STUDIES (C4.2(In)-10)

(Basic principles and simple applications)

UNIT-I

ELECTRONIC ABSORPTION SPECTROSCOPY - requirement for transitions-nomenclature and assignment of transitions-intensity of transitions-application to inorganic systems-charge transfer spectra-study of molecular addition compounds by UV visible spectroscopy-composition and structure of inorganic complexes.
IR AND RAMAN SPECTROSCOPY: Theory -difference between IR and Raman spectra-basic instrumentation and general experimental techniques-typical applications in inorganic chemistry for structure elucidation. , group frequencies of organic, inorganic and organometallic systems, factors affecting the group frequencies, study of hydrogen bonding effects, vibrational spectra of ionic, coordination and metal carbonyl compounds.

UNIT-II

NMR SPECTROSCOPY Principle-basic instrumentation-chemical shifts-spin-spin coupling-typical applications in structure determination of inorganic compounds and complexes. spin 1/2 nuclei, ^1H , ^{13}C , ^{19}F and ^{31}P , Zeeman splitting, Boltzmann distribution, effect of magnetic field strength on sensitivity and resolution, ^1H -NMR, chemical shift d, anisotropic effects, chemical and magnetic equivalence, coupling constants J, Karplus relationship of J on dihedral angle, first order splitting patterns and structure correlation, second order effects on the spectrum, AB, AMX, AA'BB' spin systems, simplification of second order spectra, high field NMR, double irradiation, selective decoupling, chemical shift reagents. Significance of coalescence temperature. - Introduction to ^{31}P and ^{19}F NMR.

ESR SPECTROSCOPY :Principle-basic instrumentation-presentation of spectra -hyper fine splitting-illustrations for structural and reaction mechanistic studies in inorganic chemistry.,ESR spectra of organic free radicals and ion radicals, transition metal complexes, application of spin traps.

UNIT-III

MASS SPECTROMETRY:,Principle-theory-instrumentation-interpretation of spectra of metal compounds-, ionization methods, isotope abundance, molecular ions, fragmentation processes of

organic molecules and deduction of structural information, high resolution MS, introduction to soft ionization techniques and illustrative examples in macromolecular and supra molecular chemistry. **MAGNETIC METHODS:** Paramagnetism-diamagnetism-Gouy's method and Faraday's method of magnetic susceptibility measurements-applications for structural studies of inorganic compounds., **X-RAY DIFFRACTION METHODS:** Crystal structure of simple inorganic compounds.,

UNIT-IV

NEUTRON AND ELECTRON DIFFRACTION STUDIES: An outline of their application, to the study of crystalline solids. Dipole moments-polarization and dipole moments-determination of dipole moments-structural information from dipole moments. Photo electron spectroscopy(CSCA)-principle-some examples of its application in structural analysis.,

ELECTRONIC SPECTROSCOPY: Electronic levels and types of electronic transitions in organic, inorganic and organometallic systems, solvent effects, effect of extended conjugation, Woodward-Fieser rules for calculation of absorption maximum, stereochemistry and electronic absorption.

SUGGESTED TEXT BOOKS:;

- 1.J.L.Huheey:Inorganic Chemistry-Principles ,structure and reactions-Harper
- 2.W.E.Addison: Structural Principles of Inorganic Compounds-Longmans,
- 3.R.S.Drago : Physical Methods in Inorganic Chemistry-Reinhold,
- 4.K.B.Harvey and G.B.Porter: Physical Inorganic Chemistry- Addison-Wesley.,
- 5.J.B.Ander and A.J.Sonnessa : Principles of Chemistry-Macmillan,
- 6.A.Barnard : Theoretical Basis of Inorganic Chemistry- Tata-McgrawHill.,
- 7.R. M. Silverstein, G. C. Bassler and T. C. Morrill :
Spectrometric Identification of Organic Compounds, Wiley: 5.

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SEMESTER IV

PAPER- III INSTRUMENTAL METHODS IN INORGANIC ANALYSIS AND SEPARATION METHODS (C4.3(In)-10)

UNIT – I :

Electrogravimetry : Theory of electro analysis – Polarisation – Over voltage – Principles involved in electro gravimetric analysis – current – voltage curves – separation of metals by electrolysis – constant current – controlled potential electrolysis.

Coulometry : Coulometry at controlled potential – separation of Nickel and Cobalt – coulometres –types of coulometric analysis – constant current coulometry - coulometric titrations.

UNIT – II :

Voltametry, Polarography and Amperometric titrations : -

Voltametry – Principle of Polarography – dropping mercury electrode; working; factors effecting the limiting current; residual current, migration current – diffusion current – kinetic current – polarographic maximum – Half wave potential – Organic Polarography,

Rapid Scan polarography –cyclic voltametry – qualitative and quantitative polarographic analysis – Amperometric titrations – its advantages and disadvantages – BiAmperometric titrations – Chrono potentiometry

UNIT – III :

SEPARATION METHODS:;

SOLVENT EXTRACTION:General considerations-distribution ratio-percent extraction effectiveness of extraction-classification of metal extraction systems-factors which effect chelate formation-process of extraction-quantitative treatment.

TECHNIQUES OF EXTRACTION:;

Choice of solvent-batch extraction-continuous extraction-back washing and stripping-treatment of emulsions.,

ION EXCHANGE METHODS IN CHEMICAL ANALYSIS:Chemical structure of ion exchange resins,ion-exchange equilibria,selectivity,ion exchange capacity-application of ion-exchangers.,

UNIT – IV :

CHROMATOGRAPHIC TECHNIQUES:

(Principles-elementary theory and simple applications)

General introduction- Column chromatography-chromatographic techniques and nomenclature - adsorption chromatography-partition chromatography-paper chromatography-thin layer

chromatography-ion exchange chromatography

Gas chromatography-Gas liquid chromatography(GLC)

High Pressure Liquid Chromatography (HPLC)

SUGGESTED BOOKS :,

1. A.I.Vogel : A text book of quantitative Inorganic Analysis-3rd Edition-ELBS,
- 2.J.W.Robbinson- : Under-graduate Instrumental Analysis,
- 3.G.W.Eving : Instrumentation Methods of Chemical Analysis-McGraw-Hill.,
- 4.Willard ,Merrit and Dean :Instrumental Methods of Analysis - D.Van Nostrand,
- 5.J.A.Barnard and R.Chayan : Modern Methods of Chemical Analysis,
- 6.G.H.Morrison and H.Frieser:Solvent Extraction in Analytical Chemistry-John Wiley.,
- 7.B.K.Sharma -- Instrumental methods of chemical analysis,Goel Publishers,
- 8.G.Chatwal and S.Anand --Instrumental methods of chemical analysis.,
- 9.J.J.Lingane- Electroanalytical Chemistry- Inter Science,
- 10.D.A.Skoog,D.M.West and F.J.Holler--Fundamentals of Analytical Chemistry ,
- 11.H.Kaur-- Instrumental methods of chemical analysis,Pragathi Prakasan,
- 12.D.A.Skoog,F.J.Holler and Nieman-- Instrumental Methods of Analysis.,

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SEMESTER IV

PAPER– IV ENVIRONMENTAL CHEMISTRY (C4.4(In)-10)

UNIT-I

Significance of basic segments of environment-Nomenclature in the study of environmental chemistry.,

Soil chemistry & pollution studies:Principles of weathering-effect of temperature, water, air, plants and animals on weathering., Soil formation/development-factors affecting soil development-physical properties of soil; soil colloids-ion exchange properties.,Soil fertility, productivity- Soil micro and macro nutrients.

UNIT-II

AIR POLLUTION:

General classification of atmospheric regions and significance-Chemical reactions taking place in atmosphere-Structure and properties-study of temperature inversion phenomenon.-Depletion of stratospheric ozone and its effect on environment.

Atmospheric sources and emission of air pollutants with special reference to particulate and radioactive substances.,

Analysis of carbon mono oxide-sulphur dioxide-hydrogen sulphide,hydrocarbons,aromatic hydrocarbons.

UNIT-III

HYDROSPHERE AND WATER POLLUTION ANALYSIS

Hydrosphere-water resources-hydrological cycle-unique properties of water- water quality parameters-domestic water pollution-industrial,agricultural,solid waste,thermal, shipping water pollution and radio active waste pollution.

Effect of specific pollutants like mercury, lead, arsenic, selenium, nitrates, oil.,Effects of soaps,detergents,pesticides,hydrocarbon with regard to water pollution., Determination of D.O. ,COD,BOD,phosphates,nitrogen compounds.,

UNIT-IV

MONITORING AND TREATMENT METHODS IN CASE OF AIR POLLUTION, WATER POLLUTION & CONTROL:

Continuous monitoring of air pollutants and control -Principles,Monitoring instruments,monitoring of sulphur dioxide, hydrogen sulphide,oxides of nitrogen, oxides of carbon, hydrocarbons, ozone, suspended particulate matter and radioactive substances.,

Techniques of water treatment-Primary,secondary and tertiary methods-use of coagulants-flash distillation-solar stills,ion exchange,reverse osmosis,electroanalysis,electro dialysis.,

SUGGESTED BOOKS:;

- 1.Standard methods of examination of water and waste water.,
- 2.H.D.Forth and L.M.Turk-Fundamentals of Soil Science: Wiley-Eastern P. Ltd.,,
- 3.J.Drever-The Geochemistry of Natural Waters-Prentice Hall Inc.
- 4.N.F.Voznaya-Chemistry of water and microbiology-Mir Publishers.,
- 5.F.I.Belan-Water Treatment-Mir Publishers,
- 6.J.A.Daji-Text Book of Soil Science-Media Promoters and Publishers,
- 7.AK.De-Environmental Chemistry-Wiley Eastern Ltd.,,
- 8.B.K.Sharma-Environmental Chemistry-Pragathi Prakasan,
- 9.L.M.Thomson,F.R.Troch-Soils and Soil fertility- TataMcGraw Hill,
- 10.V.V.Metelev,A.I.Kanaev and N.G.Dzasokhova-Water Toxicology-AmorinPublish co,
- 11.N.C.Brady and Beckmann-Nature and Properties of Soils-Eurasia Publishing Co,
- 12.S.S.Dara- A Text Book of Environmental Chemistry and Pollution Control,
- 13.O.D.Thyagi and M.Mehra-A text Book of Environmental Chemistry-Anamol
- 14.S.M.Khopkar –Environmental Pollution Analysis
- 15.Soil Chemical Analysis by M.L.Jsackson,Prentice-Hall India Pvt Ltd, New Delhi

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III & IV SEMESTERS

PRACTICALS FOR THE EXAMINATIONS TO BE CONDUCTED AT THE END OF IV SEMESTER

Practical I Classical Methods of Analysis

- 1.Analysis of iron ore
- 2.Analysis of pyrolusite
- 3.Analysis of brass / synthetic mixture copper and nickel
- 4.Analysis of synthetic mixture of iron and zinc
- 5.Analysis of solder
- 6.Analysis of cement
- 7.Analysis of total hardness in waters
- 8.Analysis of chloride in water samples
- 9.Analysis of dissolved oxygen in water samples

10. Analysis of phosphate and nitrate and ammonia in fertilizers
11. Estimation of total iron with different procedures using various reductants
12. Analysis of zinc in zinc containing alloy using EDTA
13. Analysis of nickel by EDTA
14. Preparation -I
15. Preparation -II
16. Preparation -III
17. Preparation -IV
18. Preparation -V

Practical II Instrumental methods of analysis

1. Determination of alkalinity in industrial or environmental samples using pH metric procedures
2. Assay of commercial acids by pH metric titrations using suitable base
3. Conductometric titrations with individual acids and mixtures of acids
4. Potentiometric titration of Fe(II) with Cr(VI)
5. Estimation of mixture of Mn(VII) and V(V) with Fe(II) using potentiometric techniques.
6. Mixture analysis of Ce(IV) and V(V) with Fe(II) by a potentiometric method.
7. Estimation of potassium thiocyanate with silver nitrate by potentiometric method
8. Estimation of chloride and iodide in a mixture by potentiometric method
9. Determination of Fe(III) colorimetrically using potassium thiocyanate
10. Estimation of amount of manganese by colorimetric procedure
11. Estimation of phosphate by using ammonium molybdate and hydrazine sulphate
12. Simultaneous determination of manganese and chromium in mixture
13. Estimation of nitrate from environmental samples
14. Estimation of phosphate in environmental samples
15. Flame photometric estimations of sodium, potassium and lithium

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SEMESTER III

PAPER – I : ORGANIC SPECTROSCOPY –I. (C3.1(O)-10)

UNIT –I

- (a) Ultraviolet spectroscopy : Mechanics of measurement – Energy transitions – Simple chromophores – UV absorption of Alkenes – polyenes unsaturated cyclic systems – Carbonyl compounds
 α,β - unsaturated carbonyl systems - Woodward – Fieser rules – aromatic systems – solvent effects – geometrical isomerism – acid and base effects – typical examples – calculation of λ_{\max} values using WF-rules.
- (b) Optical rotatory dispersion : Theory of optical rotatory dispersion – Cotton effect – The octant rule – application in structural studies.

UNIT –II

- (c) Infrared spectroscopy : Mechanics of measurement – Fundamental modes of vibrations –

Stretching and bending vibrations – hydrogen bonding – finger print region and its importance –

Typical group frequencies for – CH, -OH, -NH, -CC, -CO and aromatic systems -
Application in structural determination – Examples – simple problems

UNIT –III

- (a) NMR spectroscopy : Magnetic properties of Nuclei theory of Nuclear resonance Fourier transformation and its importance in NMR spectrometry. The chemical shift its importance and measurement calculation of chemical shift integration and J values from the spectral data problems related to calculation of chemical shift integration and J values Factors effecting chemical shift such as electro negativity and anisotropy – Shielding and deshielding mechanisms in acetylene carbonyl and Benzene anisotropy – spin-spin Interactions related to first order and higher order spectra – AB – A2 – AB2. ABX – ABC – AMX interactions – temperature dependence spectra – double irradiation and its importance in the interpretation of Proton Spectra – Hydrogen bonding – Geometrical and optical isomerism interpretation of NMR spectrum of a given compound leading to identification –typical examples of PMR spectroscopy.

UNIT-IV

- (a) Problems involving individual spectral methods – UV, IR and PMR
(b) Problems involving combined any two of UV, IR and PMR
(c) Problems involving all the three of UV, IR and PMR.

TEXT BOOKS:

1. Spectrometric identification of organic compounds by R.N. Silverstein & G.C. Bassier (John Willey)
2. Spectroscopic methods in Organic Chemistry by Williams and Fleming (Mcgraw Hill)
3. “Organic Photochemistry” by R.O.Kan (Mc Graw Hill)
4. “ Advanced organic Chemistry Reaction Mechanisms and Structure” by J March (Mc Graw Hill & Kogshusha)
5. “ Carbon-13 NMR Spectroscopy” by J.B.Stothers.

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SEMESTER III

PAPER-II: ORGANIC SYNTHESIS, MECHANISMS AND NANO CHEMISTRY (C3.2(O)-10)

UNIT-I:

i) Methods for determining Reaction mechanisms by kinetic and non-kinetic studies.

Kinetics of reaction, Energy profile diagram, Intermediate versus transition state, Reaction rate and rate limiting step. Identification of products, testing possible intermediates, trapping of intermediates, Cross over experiments, Isotopic labeling.

ii) Free radicals and their reactions

Introduction, formation, detection and stability of radicals. Some radical reactions, Addition of halogens, Hydrogen halides. Substitution reactions-Halogenation, Aromatic substitution, Sandmeyer reaction, Autooxidation, Decomposition of dialkyl and diacyl peroxides.

UNIT-II: Oxidations

Introduction: Different Oxidative processes.

Hydrocarbon: alkenes, aromatic rings saturated C-H groups (activated and unactivated), Alcohols, diols, aldehydes, Ketones, Carboxylic acids, Amines, hydrazines, sulphides. Oxidations with ruthenium tetroxide iodobenzene diacetate and Tl(III) nitrate, Lead tetra acetate, SeO_2 , MnO_2 , Ag_2CO_3 , oppenauer oxidation, peracids.

Oxidation of C=C perhydroxylation using KMnO_4 , OsO_4 , peracids.

UNIT –III: Reductions

Introduction: Reductive process Hydrocarbons: Alkanes, alkenes, alkynes, and aromatic rings

Carbonyl compounds – aldehydes, ketones, acids and their derivatives. Nitro, nitroso, azo and oxime group Hydrogenolysis. Catalytic hydrogenations, Reduction by dissolving metals, Reduction with metal and acid. Reduction with metal in liquid ammonia (Birch reduction).

Reduction by hydride transfer reagents Aluminium alkoxide, LiAlH_4 , NaBH_4 , Diisobutyl aluminium hydrides – Sodium cyano borohydride, trialkyl borohydrides – Reduction with diimide.

UNIT-IV: Nanochemistry

Nanochemistry: Introduction, carbon nanotubes: structure of single and multi wall carbon nanotubes, synthesis-solid and gaseous carbon source-based production techniques, synthesis with controlled orientation. Growth mechanism of carbon nanotubes-catalyst free growth, catalyst activated growth, properties-general, adsorption, electronic & optical, Mechanical and reactivity. Applications.

SUGGESTED BOOKS:

1. Mechanism and structure in Organic Chemistry “ E.S.Gould Henry – Holt and Co, Newyork
2. Advances in Organic Reaction mechanism and structure J. March (McGrew Hill)
3. A Guide Book to Mechanism in Organic Chemistry” by P.Sykes
4. Synthetic approaches in organic chemistry by R.K.Bansal(Narosa Publications)
5. Some modern methods of synthesis by Carruthers (Cambridge).
6. G.A.Ozin, A.C. Arsenault *Nano chemistry*, RSC.
7. Diwan, Bharadwaj, *Nanocomposites*, Pentagon.
8. V.S.Muralidharan A.Subramania, *Nanoscience and Technology*, Ane Books.

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SEMESTER III

PAPER – III : ALKALOIDS AND PHENOTHIAZINES (C3.3(O)-10)

UNIT-I

Alkaloids:

- (1) Definition, nomenclature and physiological action – occurrence – isolation – general methods of structural elucidation – degradation – classification based on nitrogen heterocyclic ring –role of alkaloids in plants.
- (2) Cinchona alkaloids : Cinchonine, quinine, stereochemistry of cinchonine and quinine

- (3) Isoquinoline alkaloids: Aporphines: Glaucine and dicentrine phthalide isoquinolines: Hydrastine and narcotine Protoberberines: Berberine and canadine
Benzylisoquinoline: Coclawrine.

UNIT-II

ISOQUINOLINE & MORPHINE GROUP ALKALOIDS:

- (1) Ipecac alkaloids: Emetine, Stereochemistry of emetine.
- (2) Morphine alkaloids: Morphine Thebaine Codeine – Stereochemistry of morphine alkaloids – some rearrangements of morphine alkaloids
- (3) Biogenesis of alkaloids

UNIT-III

- (1) Indole alkaloids : Reserpine, strychnine, brucine, physostigmine, lysergic acid, isolysergic acid, ergotamine and Ibogamine
- (2) Structure, stereochemistry, synthesis and biosynthesis of Ephedrine, Conine and nicotine.

UNIT-IV

Phenothiazines:

- (1) Classification , general methods of synthesis of phenothiazines – pharmacological properties of phenothiazines
- (2) Dimethylamine series: Promazine and promethazine
- (3) Piperazine series: Prochlorperazine and trifluoperazine
- (4) Piperidine series: Thiorazine and mesoridiane

TEXT BOOKS:

1. Alkaloids by K. W. Bentley Vols I & II.
2. Text Book of Organic Chemistry I.L. Finar Vol. II
3. An introduction of alkaloids by G. A. Swain,

Books for further Study:

1. Chemistry and physiology of alkaloids by Manske Vol. I & II, VII
2. Medicinal Chemistry by A. Burger
3. Isoquinoline Alkaloids by M. Shamma
4. Heterocyclic Chemistry by J. A. Joule et al, Chapman – Hall
5. An introduction to heterocyclic compounds by R. M. Acheson, John – Wiley
6. Non-Antibiotics – A new class of unrecognized antimicrobics by AN Chakraborty et al, National Institute of Science Communication, (CSIR), New Delhi, India, 1988
7. Principles of Medicinal Chemistry by William O. Foye, Lea & Febiger, Philadelphia/London, 1989

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SEMESTER III

PAPER-IV: CHEMISTRY OF NATURAL PRODUCTS (C3.4(O)-10)

UNIT-I

Terpenoids: Classification , sources , isolation, synthesis and stereochemistry with special reference to zingiberene, santonin, eudesmol, abietic acid., Biosynthesis of terpenoids

Flavonoids: Classification, sources, isolation, chemistry and synthesis with special reference to quercetin and kampferol

UNIT-II

Steroid Hormones: Chemistry & synthesis of equilenine, oestrone, progesterone, androsterone, testosterone, cortisone.

Non steroid hormones: Chemistry & synthesis of thyroxin, epinephrine and oxytocin

UNIT-III

Fat Soluble Vitamins: Chemistry, Synthesis & biosynthesis of vitamin A₁, vitamin E ($\alpha, \beta, \gamma, \delta$ -tocopherols) and vitamin K

Water soluble Vitamins: Chemistry, Synthesis and biosynthesis of B₁ and C

Chemistry of biomolecules

a) Enzymes : classification , kinetics and mechanism of enzyme action

b) Coenzymes and cofactors: NAD FAD folic acid citric acid cycle.

c) Prostaglandins with special reference to PGE and PGF

UNIT-IV

Naturally occurring insecticides: Introduction, general properties, sources, isolation, synthesis and stereochemistry of

Pyrethrin I and II; Jasmolin I & II; Jasmolone and Cinerelone.

Structure activity relationship (SAR) studies and bio synthesis of pyrethrins

Rotenoids – Chemistry and synthesis of rotenone

Isobutylamines: Chemistry and synthesis anacyclin, spilanthol

Minor insecticides of plant origin: pachyrrhizin and custard-apple.

TEXT BOOKS:;

1. The Chemistry of Natural Products Vol. II Mono and Sesqui-Terpenes" by P. De Mayo (John Wiley Inc)

2. The Higher Terpenoids Vol. III by P. De Mayo.,

3. Steroids by Fieser and Fieser.;

4. The Vitamins by S.F. Dykes.,

5. The Natural Pigments by K.W. Bentley;

6. Biological Chemistry by Holum,

7. Organic Chemistry Vol. II by I.L. Finar,

8. Naturally occurring insecticides by M. Jacobson and D.G. Crosby, Marcel- Decker Inc, New York

9. General Organic and Biochemistry by F.A. Bettelheim and Jerry March, Saunders

College, Publishing ,

Further Study:

1. The terpenoids by Simonsen;

2. The steroids by Shoppee,

3. Chemistry of Carbon compounds by Rodd.

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SEMESTER IV
PAPER – I: ORGANIC SPECTROSCOPY –II (C4.1(O)-10)

UNIT-I

- (a) CMR spectroscopy – noise decoupled and offresonance spectra of simple Compounds – typical examples: of CMR spectroscopy – simple problems

UNIT-II

- (a) Mass spectrometry : Introduction – determination of Molecular weight and formulae – Behavior of organic compounds in Mass spectrometer – fragmentation of typical organic compounds – stability of fragments – rearrangements – metastable peaks – Mass spectra of representative compounds and related problems.

UNIT-III

- (a) 2D NMR spectroscopy – Definitions and importance of COSY DEPT HOMCOR HETCOR INADEQUATE INDOR INEPT NOESY HOM2DJ HET2DJ DQFCOSY – COSY of menthol DEPT of ethanol – study of simple organic compounds.

UNIT-IV

- (a) Spectral characters and Structural elucidation of the following natural and synthetic compounds involving all the spectral data
- 1) 4',8-disubstituted Flavone
 - 2) 4,4'-disubstituted chalcone
 - 3) apigenin
 - 4) Kaempferol
 - 5) lawsone
 - 6) nicotine
 - 7) Di-substituted phenanthrene
 - 8) Di-substituted naphthalene
 - 9) camphor
 - 10) Zingiberene
 - 11) Equilenine
 - 12) Progesterone

TEXT BOOKS:

1. Spectrometric identification of organic compounds by R.N. Silverstein & G.C. Bassier (John Willey)
2. Spectroscopic methods in Organic Chemistry by Williams and Fleming (McGraw Hill).
3. Organic photochemistry by R.O. Kan (Mc Graw Hill)
4. Advanced organic Chemistry Reaction Mechanisms and Structure by J March (Mc Graw Hill & Kogshusha)
5. Carbon-13 NMR Spectroscopy by J.B. Stothers.

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SEMESTER IV

PAPER – II: ORGANIC SYNTHESIS, MECHANISMS AND GREEN CHEMISTRY
(C4.2(O)-10)

UNIT-I: Formation of C-C single & double bonds and Diels–Alder & related reactions

Formation of C-C single bonds – enamines and related reactions – Formation of C-C double bonds – Wittig reaction of Phosphorus ylides – stereoselective synthesis of tri and tetra substituted alkenes. Diels–Alder and related reactions – diene-dienophile, intra molecular Diels –Alder reactions, Stereochemistry and mechanism Retro Diels – Alder reaction – 1,3-dipolar reactions.

UNIT-II: Synthetic applications of organoboranes and Organic synthesis by Disconnection approach.

Synthetic applications of organoboranes – protonolysis, oxidation, carbonylation Reaction of alkenylborane – enantioselective synthesis of secondary alcohols from alkenes – organolithium compounds.

An introduction of synthons and synthetic equivalents, disconnection approach, functional group interconversions. One group, two group disconnections in simple molecules. Alcohols, Olefins, aryl ketones, α,β -Unsaturated compounds – 1,3 dicarbonyl compounds.

UNIT-III: Green Chemistry and Photochemistry

Green Chemistry: Introduction, Principles, examples of green reactions-synthesis of Ibuprofen, Clean Fischer-Indole synthesis comparison of the above with conventional methods. Introduction to Microwave organic synthesis, Applications: solvents (water and organic solvents), solvent free reactions (solid state reactions), multistep V/s single pot synthesis.

Photochemistry: Photochemistry of olefins–conjugated olefins–Aromatic compounds–isomerisation–additions. Photochemistry of carbonyl compounds – Norrish type I and II reactions – Paterno – Buchi Reaction. Photo reduction, Photochemical rearrangements – Photo Fries rearrangement, Di- π -methane rearrangement.

UNIT-IV: Pericyclic reactions

Pericyclic reactions: Definition, classification, MO theory, Electronic configuration in ground and first excited states of aliphatic conjugated polyene system (upto 4 double bonds).

Electrocyclic Reactions: Mechanism, stereochemistry, PMO, FMO, correlation diagram, Woodward Hoffman rules.

Cycloaddition Reactions: FMO and correlation diagram methods-(2+2) and (4+2) cycloaddition reactions, stereochemistry. Woodward Hoffman rules.

Sigmatropic Rearrangement: classification, Mechanism by FMO method, Woodward Hoffman rules. Cope, Claisen and Aza-cope rearrangements. Fluxional molecules.

SUGGESTED BOOKS:

1. Some Modern methods of synthesis By Caruthers (Cambridge)
2. Organic synthesis by Robert & Ireland (Printce Hall of India)
3. Designing Organic Synthesis B Stuart Warron, John Wiley & Sons
4. “Pericyclic reactions a mechanistic study” S.M.Mukheji
5. Synthetic approaches in Organic Chemistry “ R.K.Bansal Narosa Publications
6. Advances in Organic Chemistry – Reaction mechanism and structure” by J. March (Mc Graw Hill)
7. ‘Organic Photo chemistry and Pericyclic reactions’ M.G.Arora Anmol Publications Pvt. Ltd.
8. Fundamentals of photochemistry by K.K.Rohatgi–Mukharjee Now Age international publishers.

- Anastas, P.T.; Warner, J. C., *Green Chemistry, Theory and Practice*, Oxford University Press, Oxford, 2000. ISBN: 0 19 850698 8 (Paperback).
- Green chemistry, *V.K.Ahluwalia*, Ane books.
- P.T. Anastas and J.C.Warner *Green chemistry*, Oxford.

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SEMESTER IV
PAPER – III: ANITIBIOTICS AND DRUGS (C4.3(O)-10)

UNIT-I

Antibiotics:

- Cell wall biosynthesis, inhibitors, β -lactam rings, antibiotics inhibiting protein synthesis, synthesis of penicillin-G, penicillin-V, ampicillin, amoxicillin, chloramphenicol and cephalosporin
- Streptomycin, tetracyclins, terramycin, aureomycin, gramidin.

UNIT-II

Drugs and Medicinal chemistry:

- Chemotherapy : Methodology for structure – activity relationship determination.
- Drugs: Structure synthesis & Activity of the following :
Anticancer Agents: Taxol, Vinblastine, Vincristine, Camptothecin

UNIT-III

Chemotherapy of Brain: Introduction – neurotransmitters

CNS stimulants : Strychnine (CNS activity only) Picrotoxin nikethemide caffeine Nicotine CNS depressants

General anesthetics, mode of action of Sedatives & Hypnotics.

UNIT-IV

- Antimalarials: Paludrin – quinacrin – chloroquin – camoquin – pamaquin – sontoquine.
- Antiamoebic agents : Chiniofon – Resotren – Iodochlorohydroxyquin.
- Sulpha drugs: Sulphanilamide – Dihydrocurprine – Prontosil
- Antiseptics: Diphenyl – Chlorophene-2,4,4-trichloro-2'-hydroxydiphenyl ether – aminocetine hydrochloride.
- Antifungal agents: 1,8 dihyrosxyanthranol – griseofulvin.

TEXT BOOKS:

- Introduction to Medicinal Chemistry – Wiley VCH
- Text Book of Organic Medicinal and Pharmaceutical Chemistry, Wilson and Gisvild, (ed Robert F. Dorge)
- An introduction to drug design by SS Pandeya
- Buger's Medicinal Chemistry and drug discovery Vol.I by (Ed) ME Wolff – John – Wileyby A. Burger
- The Organic Chemistry of drug design and drug action by RB Silverman, Academic press
- Principles of Medicinal Chemistry by William O. Foye, Lea & Febiger, Philadelphia/London, 1989.

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SEMESTER IV

PAPER- IV: TECHNIQUES FOR MODERN INDUSTRIAL APPLICATIONS. (C4.4(O)-10)

UNIT-I : Classical Methods of purification

- 1. Recrystallization:** Basic principles, choice of solvent, seeding, filtration and centrifugation and drying. Industrial applications. Concepts of fractional crystallization.
- 2. Distillation: Basic principles.** Distillation types- continuous distillation, batch distillation, fractional distillation, vacuum distillation and steam distillation. Industrial applications.
- 3. Solvent extraction:** Basic principles. Different types of extraction. Selection of solvents. Avoiding emulsion formation. Basic concepts on Soxhlet extraction. Industrial applications.

UNIT-II : Adsorption and Partition Chromatography

- 1. Introduction to chromatography.** Different types of Chromatography. Adsorption chromatography-adsorbents, solvents, solutes, apparatus. Column Chromatography-stationary phase, Mobile phase, packing of column, advantages and disadvantages.
- 2. Thin Layer chromatography:** Basic Principles. Common stationary phases, Methods of preparing TLC plates, Selection of mobile phase, Development of TLC plates, Visualization methods, R_f value. Application of TLC in monitoring organic reactions. identification and quantitative analysis.
- 3. Paper chromatography:** Basic Principles. Ascending and descending types. Selection of mobile phase, Development of chromatograms, Visualization methods. Application of paper chromatography in the identification of sugars and amino acids. One and two dimensional paper chromatography.

UNIT-III: Gas Chromatography and High Performance Liquid Chromatography

- Gas chromatography:** Basic Principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative analysis of organic compounds.
- High Performance liquid chromatography(HPLC):** Basic Principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. detectors; RT values. Applications in the separation, identification and quantitative estimation of organic compounds. Concepts on HPLC method development.

UNIT-IV : Ion Exchange Chromatography and Electrophoresis

- 1. Ion exchange chromatography:** Basic Principles. Preparation of cross linked polystyrene resins. Different types of cation and anion exchange resins. Application in the purification of carboxylic acids and amines.

2. Electrophoresis: Basic Principles. Capillary electrophoresis. Instrumentation, applications, zone-electrophoresis, gel-electrophoresis.

SUGGESTED BOOKS:

1. Principles of Instrumental Analysis by D. A. Skoog, F. J. Holler and T. A. Nieman, Harcourt College Pub.
2. Separation Techniques by M. N. Sastri, Himalaya Publishing House (HPH), Mumbai.
3. Bio Physical Chemistry by A. Upadhyay, K. Upadhyay and N. Nath,(HPH) , Mumbai.
4. A Hand Book of Instrumental Techniques for Analytical Chemistry- Ed-F. A. Settle, Prearson Edⁿ, Delhi.
5. Introduction to Organic Laboratory Techniques-D. L. Pavia, G. M. Lampman,G. S. Kriz and R. G. Engel, Saunders College Pub (NY).
6. Instrumental methods of Chemical Analysis by B. K. Sharma, Goel Publish House, Meerut.
7. Instrumental methods of Chemical Analysis by H. Kaur, Pragati Prakasan, Meerut.
8. Protein Purification-Principles and practice, III Edⁿ- R. K. Scopes, Narosa Publishing House , Delhi.

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III & IV SEMESTERS

PRACTICALS FOR THE EXAMINATIONS TO BE CONDUCTED AT THE END OF IV SEMESTER

PRACTICAL-I

1. Synthesis and purification of Organic Compounds involving two or more stages.
(The student must be given training in at least six syntheses / preparations)

For University Practical Examination: Duration: 6 hours Marks 80

TEXT BOOKS:

1. Practical Organic Chemistry A.I.Vogel (Longmans)
2. Text Book of practical organic Chemistry F.G.Mann & B.C. Sanders.
3. A Manual of Practical Organic Chemistry Day Sitaramam & Govindachari
4. Organic Experiments L.F.Fieser.
5. Practical Organic Chemistry H.T.Openshaw
6. Systematic Identification of Organic Compounds, P.L.Shriner, R.C.Fuson & D.Y.Curtin.
7. Identification of Organic Compounds N.D.Cheronis & J.B.Entrilkin
8. Advanced Organic Synthesis by R.S.Monson Academic Press

PRACTICAL – II

Note: Both mixture analysis and other determinations are compulsory for University examinations

Part 1. Two component mixture analysis

(The student must be given training in at least six mixtures with different functional groups)

and

Part 2. The following determinations /analysis / methods:

- i) Determination of functional groups: NO₂, OMe, OCOCH₃, CO, N and un-saturation semi-micro scale; Carbohydrates: Glucose, Sucrose,
- ii) Analysis of Fats and Oils: Saponification and Iodine number
- iii) Physical methods chromatography (Column paper and TLC)
- iv) Spectral methods: U.V. and I.R.

For University Practical Examination: Duration: 6 hours Marks 80

Note: University examinations will be conducted one from above two parts