Semester IV
M 4 CHE 01- CT 11
Special Methods of Analysis

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

(a)**Thermo Gravimetry Analysis (TGA) and Derivative.** Thermogravimetry (DTG): Principle, instrumentation and application, factor affecting TG curves,

(b) **Differential Thermal Analysis (DTA):** Principle, instrumentation and application, factor affecting TA curves

(c) **Differential Scanning Calorimeter (DSC):** Principle, instrumentation and application, factor affecting DC curves, comparison with DTA.

UNIT-II

(a) **D.C. Polarography:** Basic principle, types of currents, experimental technique, Illovic equation (no derivation) and application of polarography

(b) Principle, technique and application of

(i) Voltametric and cyclic voltametery

(ii) Amperometry

(iii) Anodic stripping voltametery

UNIT-III

(a) **High Performance Liquid Chromatography (HPLC):** Introductory knowledge of adsorption basic principle, instrumentation and applications of HPLC, comparison with gas liquid chromatography

(b) **Gas Liquid Chromatography:** Principle, instrumentation and applications

(c) **Gel Permeation or Size Exclusion Chromatography:** Introduction, theory and application

UNIT-IV

(a) **Ion Exchange:** Introduction, types-cationic, anionic, chelating and liquid ion exchangers, preparation, action and properties of exchangers and applications of ion exchangers

(b) Solvent Extraction, ion association complexes

(c) **Gel Electrophoresis:** Introduction, Factors affecting ionic migration, detection of separated components and applications of Gel electrophoresis.

UNIT-V

(a) **Radioactive Technique:** Tracer technique, neutron activation analysis, counting technique such Geiger-Muller, ionization and proportional counters

(b) **Light Scattering Techniques:** Principle, instrumentation and applications of nephelometery and Raman spectroscopy.

Books recommended:

1. Ion exchange separations in Analytical Chemistry. O.Samuelson, John Wiley

2. Exchangers amd Solvent Extractions, J.A.Marinsky and Y.Parcus, Marcel Dekker

3. Polagraphic Techniques, I.Metes, Interscience

4. Gel Chromatography, Tibor Kremmer and Laszol Boross, Wiley.

Semester IV
M 4 CHE 02-CT 12
Photochemistry and Supramolecules

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Basic of Photochemistry: Photochemical laws, quantum yield, electronic excitation and molecular orbital view of excitation, excited states and fate of excited molecules (modified Jablonski diagram).

Photochemistry of alkenes: Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1, 4-and1, 5-dienes.

UNIT-II

Photochemistry of carbonyl compounds: Intramolecular reactions of carbonyl compounds - saturated, cyclic and acyclic, β, γ- unsaturated and α,β-unsaturated compounds, cyclohexadienones, intermolecular cycloaddition reactions- dimerisations and oxetane formation.

Photochemistry of aromatic compounds: Isomerisations, additions and substitutions.

Unit III

Miscellaneous Photochemical Reactions: Photo-Fries reactions of anilides. Photo Fries rearrangement, Barton reaction, Hoffmann-Loeffler-Freytag reaction, Singlet molecular oxygen reactions, Photochemical formation of smog, Photo degradation of polymers, Photochemistry of vision.

UNIT-IV

Supramolecular Chemistry: Concepts: Definition and development, nature of supramolecular interactions, Cation binding hosts: Crown ethers, cryptands and spherands - synthesis and properties, binding of anions: biological anion receptors and organometallic receptors, Templates and selfassembly-tennis balls and soft balls, catenanes and rotaxanes, Supramolecular chemistry

of Fullerene, fullerene as guests, fullerene as hosts and fullerene as superconducting intercalation compounds, supramolecular photochemistry.

UNIT-V

Nanochemistry

Introduction, Synthesis of nanomaterials: Chemical methods. Dendrimers. Nanostructured materials: Carbon Nanotubes (CNTs) : Single walled carbon nanotubes (SWNTs), Multiwalled carbon nanotubes (MWNTs), Graphenes. Characterization techniques for Nanomaterials: Optical Microscopy: Scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning tunnel microscopy (STM).

Books Recommended:

1. Photochemistry, J.G.Cavert and J.N.Pitts, Wiley

2. Molecular Photochemistry, N.J.Turro, Benjamin

3. Fundamentals of Photochemistry, K.K. Rohatgi Mukherji, New Age

4. Photochemistry, R.P. Wayne, Butterworth

5. Analytical Chemistry of Macrocyclic and Supramolecular compounds, S.M. Khopkar

6. Supramolecular Chemistry, J.M. Lehn VCH

7. Supramolecular Chemistry, J.W Stead and J.I. Atwood, John Wiley. G. Timp, Ed. Nanotechnology: Springer-Verlag: N.Y. (1999)

8. Nanochemistry, G.B. Sergeev, Elsevier (2006)

9. Supramolecular and Bioinorganic Chemistry, Rekha Dashora and A. K. Goswami, Pragati Prakashan.

SEMESTER IV
M 4 CHE 03- ET 03 A
Organometallic Chemistry

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Introduction

Classification and Nomenclature and general Characteristics of Organometallic Compounds

UNIT-II

Organometallic Compounds of transition metals- Introduction and nature of bonding, α bonded Organometallics, π bonded Organometallics

UNIT-III

Fluxional organometallic compounds: Classification of fluxional organometallic Compounds, Some simple example of non-rigid molecule in different coordination geometries.

UNIT-IV

Synthetic and catalytic aspects of Organometallic Chemistry: General Introduction, Transition metal organometallics as catalytic and synthetic reagents

UNIT-V

Biological application and environmental aspect of organometallic compounds: Organometallics in medicine, Organometallics in Industry, Environmental aspects of Organometallic Compounds.

Books Recommended:

1. Principle and Applications of Organotransition Metal Chemsitry, J.P. Coliman, L.S Hegsdus, J.R. Norton and R.G. Finke, University Science Books.

2. The Organometallic Chemistry of the Transition Metals, R.H. Crabtree, John Wiley.

3. Metallo-Organic Chemistry, A.J. Pearson, Wiley

4. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books

5. Bioinorganic Chemistry, I. Bertini, H.B. Gray, S.J. Lipparad and J.S Valentine, University, Science Books

6. Inorganic Biochemistry Volume I and II. Ed G.L. Eichhorn, Elsevier

7. Progress in Inorganic Chemistry, Volume 18 and 38 Ed. J.J. Lipparad, Wiley

SEMESTER-IV
M 4 CHE 04- ET 04 A
Inorganic polymers

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Inorganic polymers: Introduction, Classification, Preparation, General Characteristics of Inorganic Polymers.

UNIT II

Silicon Polymers: General preparation, properties and application of silazanes, polysilazanes, organo-siloxy and poly-carbosilanes

UNIT III

Phosphorus nitrogen polymers: Synthesis and important properties of organometallic polyphosphazenes, Liquid crystalline high refractive index polyphosphazenes, poly carbophosphazenes, polynitrophosphazenes

UNIT IV

Metal chelate polymers and Ferrocenes: Synthetic methods, linking of ligands with metal ions, Reactions with chelates containing fluxional groups, Synthesis of Ferrocenes containing polyamides and polyurea polymers

UNIT V

Applications of Phosphorous, Nitrogen, Silicon and Ferrocene as well as other metal chelate polymers in industry such as advanced elastomers and biomedical materials.

SEMESTER-IV
M 4 CHE 03- ET 03 B
Medicinal Chemistry

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT I

Drug Design: Development of new drugs, procedures followed in drug design, concepts of lead compound and lead modification, concepts of prodrugs and soft drugs, structure-activity relationship (SAR), factors affecting bioactivity, resonance, inductive effect, isosterism, bio-isosterism, spatial considerations. Theories of drug activity- occupancy theory, rate theory, induced fit theory. Elementary idea of Quantitative structure activity relationship, Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Free-Wilson analysis, Hansch analysis, LD-50, ED-50 (Mathematical derivations of equations excluded).

UNIT II

Pharmacokinetics: Introduction to drug absorption, disposition, elimination using pharmacokinetics, important pharmacokinetic parameters in defining drug disposition and in therapeutics. Mention of uses of pharmacokinetics in drug development process.

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

UNIT III

Antineoplastic Agents: Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer. Mention of carcinolytic antibiotics and mitotic inhibitors.

Synthesis of mechlorethamine, cyclophosphamide, melphalan, uracil, mustards, and 6-mercaptopurine. Recent development in cancer chemotherapy. Hormone and natural products.

Cardiovascular Drugs: Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol.

UNIT IV

Local Antiinfective Drugs: Introduction and general mode of action. Synthesis of sulphonamides, furazolidone, nalidixic acid, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, ethionamide, ethambutal, flucanazole, econozole, griseofulvin, chloroquin and primaquin. Antibiotics Cell wall biosynthesis, inhibitors, (3-lactam rings, antibiotics inhibiting protein synthesis. Synthesis of penicillin G, penicillin V, ampicillin, amoxycillin, chloramphenicol, cephalosporin, tetracyclin and streptomycin.

UNIT V

Psychoactive Drugs (The Chemotherapy of Mind): Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, anti-anxiety drugs, benzodiazipines, buspirone, neurochemistry of mental diseases. Antipsychotic drugs - the neuroleptics, antidepressants, butyrophenones, serendipity and drug development, stereochemical aspects of psychotropic drugs. Synthesis of diazepam, oxazepam, chlorazepam, alprazolam, phenytoin, ethosuximde, trimethadione, barbiturates, thiopental sodium, glutethimide

Books Recommended:

1. Introduction to Medicinal Chemistry, A Gringuage, Wiley-VCH.

2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F. Dorge.

3. An Introduction to Drug Design, S. S. Pandeya and J. R. Dimmock, New Age International.

4. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter-9 and Ch-14), Ed. M. E. Wolff, John Wiley.

5. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.

6. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press.

7. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley.

SEMESTER
M 4 CHE 04- ET 04 B
Chemistry of Natural Products

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

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

UNIT-II

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

UNIT-III

Plant pigments: Occurrence, nomenclature and general methods of structure determination, isolation and synthesis of Apigenin, Luteolin, Quercetin, Myrcetin, Quercetin-3-glucoside, Vitexin, Diadzein, Butein, Aureusin, Cyanidin-7, arabinoside, Cyanidin and Hirsutidin.

Biosynthesis of flavonoids: acetate pathway and shikimic acid pathway.

Porphyrins: Structure and synthesis of hemoglobin and chlorophyll.

UNIT-IV

Steroids: Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, isolation, structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progestrone, Aldosterone, biosynthesis of steroids.

UNIT-V

Prostaglandins: Occurrence, nomenclature, classification, biogenesis and physiological effects, synthesis of PGE_2 and $PGF_{2\alpha}$

Pyrethroids and Rotenones: Synthesis and reactions of pyrethrodis and rotenones.

Books Recommended-

1. New Trends in Natural Products Chemistry, Atta-ur-Rahman and M.I. Choudhary.

2. Chemistry of Natural Products, S.N. Bhat

3. Organic Chemistry Vol.-II, I.L. Finar

SEMESTER-IV
M 4 CHE 03- ET 03 C
Advanced Photochemistry and Radiation Chemistry

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT-I

Photochemistry: Molecular photochemistry: An overview: Transitions between states (Chemical, classical and quantum dynamics, vibronic states). Potential energy surfaces; transitions between potential energy surfaces, The Franck-Condon Principle and radiative transitions. A classical model of radiative transitions. The absorption and emission of light - state mixing, spin-orbit coupling and spin forbidden radiative transitions, absorption complexes, delayed fluorescence and phosphorescence.

UNIT-II

Photophysical radiation less transitions: Wave mechanical interpretation of radiationless transitions between state factors that influence the rate of vibrational relaxation. Energy transfer: Theory of radiation less energy transfer, energy transfer by electron exchange: An overlap or collision mechanism. The role of energetic in energy transfer mechanism. Diffusion controlled quenching. The Perrin formulation. Triplet- triplet, triplet-singlet, singlet-triplet energy transfer. Multiphoton energy transfer processes, reversible energy transfer.

UNIT-III

Radiation Chemistry: An overview, G-value. The mechanism of interaction of high energy radiation with matter, Photoelectric effect, Compton effect, Pair production, total absorption co-efficient, excitation and ionization, Stopping power and linear energy transfer.

UNIT-IV

Radiation dosimetry: Radiation dose and its measurement, standard free air chamber method, chemical dosimeter (Frick's Dosimeter). Short lived intermediates (ions, excited molecules, free radicals: Various mechanisms of their formation and energy transfer processes).

UNIT-V

Flash photolysis: Principle and its applications. Radiolysis of water and aqueous solutions. Radiolysis of molecules of biological interest (carbohydrates, amino acids, peptides, and nucleic acids).

Books Recommended:

1. Turro, N. J. Modern Molecular Photochemistry Univ. Science Books (1991).

2. Gilbert, A. & Baggot, J. Essentials of Molecular Photochemistry Blackwell Scientific (1990)

3. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry 8th Ed., Oxford University Press (2006).

4. McQuarrie, D. A. & Simon, J. D. Physical Chemistry: A Molecular Approach 3rd Ed., Univ. Science Books (2001).

SEMESTER-IV
M 4 CHE 04- ET 04 C
Solid State Chemistry

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT I

General principles and experimental procedures to study solid state reactions

Difference between reactions in solution, gaseous and solid state phase

UNIT II

Crystal Defects-perfect and imperfect crystals, intrinsic and extrinsic defect, point defects, line and plane defects, Thermodynamics of Schottky and Frenkel defect formation, color centers.

UNIT III

Electronic Properties and Band Theory of metals, insulators and semiconductors, band theory of solids (qualitative treatments), band structure of metals, insulators and semiconductors, p-n junctions

UNIT IV

Superconductors, magnetic properties, persistent current and BCS theory of Superconductors,

Optical properties- photoconduction

UNIT V

Magnetic Properties: Classification of materials, Magnetic domains, hysteresius loop.

Electrically conducting organic solids, organic charge transfer complex, new superconductors

Books Recommended:

1. Solid State Chemistry and its Applications, A. R. West, Plenum.

2. Principles of the Solid State, H. V. Keer, Wiley Eastern.

3. Solid State Chemistry, N. B. Hannay.

4. Solid State Chemistry, D. K. Chakrabarty, New Age International

SEMESTER-IV
M 4 CHE 03- ET 03 D
Analytical Techniques

Time: 3 Hrs. **80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT- I

Food analysis: Reason for analysis of food, analysis of moisture in food materials, analysis of ash, crude fibers, fats, proteins and carbohydrates in food. analysis of calcium and sodium, adult erants and contaminants in food, microscopic examination of food, extraction, purification and estimation of pesticides samples in food by HPLC, TLC for chlorinated pesticides in food products, gel chromatic analysis of food products for orgnophosforos

UNIT-II

Cement: Introduction raw material for cement, Portland cement, weathering of cement and concrete, other types of cement, chemical admixture of concrete, analysis of constituents of cement by various methodology

UNIT-III

Analysis of polymers: Introduction, types of polymers and their uses, chemical analysis of polymers spectroscopic methods for polymer analysis X-ray diffraction analysis, microscopy, thermal analysis of polymers, physical testing of polymers

UNIT-IV

Electrogravimetric analysis: Principles involving electrogravimetric analysis, current voltage relationship during electrolysis, effect of experimental variables, anodic deposition, instrumentations electrolysis at constant current principle and instrumentation, estimation of copper and cobalt by constant current electrolysis, electrolysis at constant potential, principle instruments and application determination copper lead and tin in brass sample by control potential method, electrolysis using mercury electrode principle and application.

UNIT-V

Voltametry: Principle and application of voltametric analysis, Amperometric analysi

SEMESTER-IV
M 4 CHE 04- ET 04 D
Applied Analytical Methods

Time: 3 Hrs. **M.M. 80 marks (External)**
20 marks (Internal)
Credits = 4

UNIT- I

Soil analysis: Introduction, type of soils, analysis of moisture, determination of pH, total nitrogen, phosphorous, silica, magnesium, manganese, lime, sulphur and salts in soil. Quantitative estimation

UNIT-II

Analysis of water pollutants: Water pollution, water pollutants, origin and source of water pollutions effect of water pollutants, Analysis of water, colour turbidity, TDS, total solids, conductivity, acidity/ alkalinity and hardness, Chloride, sulphate and fluoride in water, analysis of silica phosphate and heavy metals pollutants in water. Determination of DO, BOD, COD

Separation and estimation of herbicides as water pollutants, water quality standards, drinking water standards

UNIT-III

Fuel analysis

Fuels types and classifications, solid, liquid and gaseous fuels, producer gas, natural gas, calorific value of fuel, analysis of coal, proximate analysis, ultimate analysis, grading of coal, aniline point, flash point and free point, octane number and its significance

UNIT-IV

Clinical analysis:

Composition of blood, collection and preservation of samples immunoassay principal of radioimmunoassay (RIA) and its applications serum electrolytes, test for carbohydrates, blood glucose blood urea uric acid blood urea nitrogen total serum proteins, serum albumin, non-protein nitrogen (serum creatinine), serum phosphate, alkaline phosphatase, bilirubin, serum cholesterol, trace elements in body

UNIT-V

Drug analysis: Introduction, sources of drugs, dangerous drug, narcotics, classification of drugs, assay of drugs, drug screening by gas chromatography, thin layer chromatography of drugs, analysis of drugs by spectrophotometric methods

Books recommended:

1. Analytical Chemistry by Gurdeep R. Chatwal, Himalaya Publishing House

2. Analytical chemistry, 6^{th} edition by Gary D. Christian, Wiley student Edition.

3. Analytical Chemistry by S.M. Khopkar, New Age International.

SEMESTER-IV

M 4 CHE 05 CP 06
(Core Practical -6)

Time 8h

80 marks (External)
20 marks (Internal)
Credits 4;

1. Extraction of organic compounds from natural sources (Minimum-5)

I. Isolation of caffeine from tea leaves.

II. Isolation of casein from milk (the students are required to try some typical colour reactions of proteins).

III. Isolation of lactose from milk (purity of sugar should be checked by TLC and PC and R_f value reported).

IV. Isolation of nicotine dipicrate from tobacco.

V. Isolation of piperine from black pepper.

VI. Isolation of lycopene from tomato.

2. Polymer synthesis (Minimum-5*)*

I. Preparation of Urea formaldehyde

II. Preparation of Phenol formaldehyde

resins

III. Preparation of Thiol rubber

IV. Preparation of Condensation polymer

V. Preparation of Epoxy resin

VI. Preparation of Polymerisation of acrylonitrile

VII. Preparation of Solution polymerization of vinyl acetate

VIII. Preparation of free radical polymer

3. Coal Analysis

I. Moisture contents/Volatile matter-C-Coal Analysis

II. Ash contents

III. Fixed carbon

SEMESTER-IV
M 4 CHE 06- EP 02 A
(Inorganic Chemistry)

Time 8h

80 marks (External)
20 marks (Internal)
Credits 4

1. Quantitative analysis by Spectrophotometry (minimum-4)

I. Iron/Manganese/Chromium/Vanadium in steel sample by spectrophotometric method

II. Nickel/Molybdenum/Tungsten/Vanadium/Uranium by extractive spectrophotometric method.

III. Fluoride/Nitrite/Phosphate.

IV. Barium/Sulphate by turbidimetric method

2. Quantitative analysis I (one)

I. Volumetric determination of three components (ternary) mixture from synthetic mixture, Ores and minerals, Alloys like German Silver, Cement etc.

II. Simultaneous estimation of Cr(III) and Fe(III) by EDTA titration, Ca^{+2} and Zn^{+2} , Pb^{+2} and Mg^{+2}

3. Solvent extraction (any one)

I. Uranyl nitrate from thorium nitrates with the help of tributyl phosphate II. Separation of metal from a mixture

III. Study of the solvent extraction of Hg and Al with 8-hydroxyquinoline.

4. Atomic absorption Spectroscopy (any one)

I. Determination of components of Soil, Cement and industrial wastes etc.

5. Study of thermal properties (two)
I. Interpretation of TGA, DTA, DSC etc. curves

SEMESTER-IV

M 4 CHE 06- EP 02 B

Time 8 h **(Organic Chemistry)**

80 marks (External)
20 marks (Internal)
Credits 4

1. **Quantitative Analysis**

I. To estimate the percentage of Nitrogen in the given organic sample by Kjeldahl's method.

II. To estimate Halogen in the given sample by Alkaline Reduction method (Modified Stepenow method).

III. To estimate the percentage of Sulfur in the given organic sample by Messenger's method.

2. Synthesis of Organic Compounds

I. Fisher- Indole Synthesis-

Preparation of 2-phenylindole or 2-methylindole or 1, 2, 3, 4-tetrahydro carbazole

II. Enzymatic Reduction-

Reduction of ethyl acetoacetate using Baker's yeast to yield enantiomeric excess of S(+) ethyl-3-hydroxy butanoate and to determine its optical purity.

III. Synthesis using microwaves- Benzoic acid, Chalcones, Coumarin, synthesis of simple heterocyclic compound

IV. Synthesis using phase transfer catalyst-Alkylation of diethyl malonate or ethyl acetoacetate with alky halides.

V. Diels Alder reaction

VI. Ultrasound assisted reaction- Esterification, saponification

3. Miscellanous experiments

I. Estimation of glycine (Sorensons method)

II. Estimation of formaldehyde

III. Estimation of cane sugar

SEMESTER-IV

M 4 CHE 06- EP 02 C

Time 8h **(Physical Chemistry)**

80 marks (External)
20 marks (Internal)
Credits 4

1. Surface Tension

I. Determination of atomic Parachor value of Hydrogen, Carbon and Oxygen

II. To study surface tension-concentration relationship for solutions (Gibb's equation)

III. Compare different commercial available detergents by surface tension study.

2. Spectrophotometry

I. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture by the MLRA method.

II. Determine the dissociation constant of an indicator spectrophotometrically.

III. Study the kinetics of reaction between acetone and iodine in presence of acid.

IV. Record the U.V. spectrum of a given compound (acetone) in cyclohexane

A. Assign the transitions by recording spectra in solvents of different polarities (H_2O, CH_3OH, $CHCl_3$, CH_3CN and 1, 4-dioxane). Comment on the energy of hydrogen bonding.

B. Calculate the energy involved in the electronic transition in different units, i.e.cm^{-1}, Joules/mol, cal/mol. & eV.

C. Calculate the oscillator strength/ transition probability.

3. Phase equilibrium

I. Determination of congruent composition and temperature of a binary system (e.g. diphenylamine-benzophenone system).

II. Determination of glass transition temperature of a given salt (e.g $CaCl_2$) conductometrically.

SEMESTER-IV

M 4 CHE 06- EP 02 D

Time 8h **(Analytical Chemistry)**

80 marks (External)
20 marks (Internal)
Credits 4

1. Determination of Ca, Mo, Zn, Cu, phosphate and silica contents of soil samples

2. Analysis of sludge obtained from Zinc Smelter

3. Analysis of cement

4. Determination of water in mixture by Karl-Fisher method

5. Colorimetric estimation of fluoride, Fe in drinking waters

6. Analysis of aspirin, sulpha drugs and vitamin C

7. Potentiometric estimation of Ni, Zn, etc.

8. Analysis of Lime, Brass and gun metal

9. Estimation of soluble salts in soils by conductometric method

10. Separation and identification of most common acidic and basic drugs by TLC

Books recommended:

1. Instrumental Methods of analysis, 7^{th} edition, CBS Publishers and distributors

2. Instrumental Methods of chemical analysis, 3^{rd} edition by Galen W. Ewing, International student edition.

3. Principles and practice of Analytical chemistry by F.W. Fifield and D. kealey, Blackwell Publishing.

Skill Based Course- 1

Title of the course - Green methods in chemistry

Tools of Green chemistry, twelve principles of Green chemistry, with examples.

The following Real world Cases in Green Chemistry should be discussed:

1. A green synthesis of ibuprofen which creates less waste and fewer byproducts (Atom economy)

2. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO_2 for precision cleaning and dry cleaning of garments.

3. Environmentally safe antifoulant

4. CO_2 as an environmentally friendly blowing agent for the polystyrene foam sheet packaging market.

5. Using a catalyst to improve the delignifying (bleaching) activity of hydrogen peroxide.

6. A new generation of environmentally advanced preservative: getting the chromium and arsenic out of pressure treated wood.

7. Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

8. Development of a fully recyclable carpet: cradle to cradle carpeting.

List of experiments (minimum 10)

1. Preparation of acetanilide

2. Synthesis of dibenzalpropanone

3. Bromination of *trans*-stilbene

4. Diels-Alder reaction between furan and maleic acid

5. Benzil-Benzilic acid rearrangement

6. Thiamine hydrochloride catalyzed synthesis of benzoin

7. Clay catalyzed solid state synthesis of 7-hydroxy-4-methylcoumarin

8. Nitration of phenol

9. Bromination of acetanilide

10. Photoreduction of benzophenone to benzopinacol

11. Preparation of benzopinacolone

12. Rearrangement of diazoaminobenzene to *p*-aminoazobenzene

13. Preparation of 1, 1-bis-2-naphthol

14. Synthesis of adipic acid

15. Synthesis of dihydropyrimidinone

16. Microwave-assisted ammonium formate-mediated Knoevenagel reaction

17. Preparation of Manganese (III) acetylacetonate, $Mn(acac)_3$ or $Mn(C_5H_7O_2)_3$

18. Preparation of Iron (III) acetylacetonate, $Fe(acac)_3$ or $Fe\ (C_5H_7O_2)_3$

19. Synthesis of tetrabutylammonium tribromide (TBATB)

20. Preparation of ionic liquid, [pmlm]Br

21. Preparation of 2- phenylbenzothiazoles catalyzed by ionic liquid, [pmlm]Br

Reference Books:

1. Green Chemistry Experiments A Monograph, R. K. Sharma, Indu Tucker and Mihir K. Chaudhuri, Tucker Prakashan, New Delhi.

2. Manahan S.E. (2005) Environmental Chemistry, CRC Press

3. Miller, G.T. (2006) Environmental Science 11^{th} edition. Brooks/cole

4. Mishra A. (2005) Environmental Studies. Selective and Scientific Books, New

5. Green chemistry: Fundamentals and Applications, Suresh C. Ameta and Rakshit Ameta, Apple Academic Press

Skill Based Course- 2

Title of the course - Basic analytical chemistry

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concepts of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

List of experiments (minimum 10):

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titration, Chelation, Chelating agents, use of indicators.

a. Determination of pH of soil samples.

b. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

a. Determination of pH, acidity and alkalinity of a water sample.

b. Determination of dissolved oygen (DO) of a water sample.

Analysis of food products: Nutritional value of foods, idea about food processing and food preservation and adulteration.

a. Identification of adulterants in some common food items like coffee powder, asafetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion(Fe^{+3} and Al^{+3})

b. To compare paint samples by TLC method.

Ion exchange: Column, ion-exchange chromatography etc.

Determination of ion exchange capacity of anion/cation resin (using batch procedure if use of column is not feasible)

Analysis of cosmetics: Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.

b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Suggested Applications (Any one):

a. To study the use of phenolphthalein in trap cases.

b. To analyze arson accelerants

c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations:

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin/Dietary Tablets

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in soft Drink.

References books:

1. Willard, H.H. *Instrumental Methods of Analysis*, CBS publishers.
2. Skoog & Leery. *Instrumental Methods of Analysis*, Sanders College publications, New York.

3. Skoog, D.A.; West, D.M. & Holler, F.J. *Fundamentals of Analytical Chemistry* 6th *Ed.* Saunders College Publishing, Fort worth (1992).

4. Harris, D.C. *Quantitative Chemicals* Analysis, W.H. Freeman.

5. Dean, J.A. *Analytical Chemistry*, Notebook, McGraw Hill

6. Day, R. A. & Underwood, A.L. *Quantitative Analysis*, Prentice Hall of India.

7. Freifelder, D. Physical Biochemistry 2nd *Ed*., W.H. Freeman and Co., N.Y. USA (1982).

8. Cooper, T.G. *The Tools of Biochemistry*, John Wiley and Sons, N.Y. USA. 16 (19770.

9. Vogel, A.I. Vogel's *Qualitative Inorganic Analysis* 7th *Ed*., Prentice Hall.

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Skill Based Course- 3

Title of the course - Basics in pharmaceutical chemistry

Drugs and Pharmaceuticals:

Drug discovery, Design and development; Basic retrosynthetic approach. Synthesis of the representative drugs of the following classes; analgesic agents, antipyrectic agents, anti-inflammatory agents(aspirin, paracetamol, ibruprofen); antibiotics (chloramphenicol); antibacterial and antifungal agents (sulphonamide; sulphanethoxazol, sulphacetamide, trimethoprin); antiviral agent (acyclovir), central nervous system agent (Phenobarbital, diazepam), cardiovascular (glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT-Zidovudine).

Fermentation

Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) antibiotics; penicillin, Cephalosporin, chloromycetin and streptomycin, (iii) Lysin, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

List of experiments (minimum 2 from each group I/II/III/IV, maximum 10):

I. To carry out the identification tests with the following pharamaceutical aids:

1. Ammounium Chloride (expectorant diuretic)

2. Boric acid (anti-infective)

3. Calamine (mild astringent)

4. Magnesium Sulfate (Cathartic)

5. Zinc Oxide (astringent soothing)

6. Potassium Permanganate (protective)

7. Iodine

II. To carry out the quantitative analysis of following agents- (assay)

(as per I.P.)

1. Aspirin

2. Paracetamol

3. Isoniaziol

4. Borax

5. Ascorbic acid

III. To determine the % purity of following drugs through spectroscopy

1. Aspirin (colorimetry)

2. Paracetamol (calibration curve method)

3. Ibuprofen

IV. To synthesize following medicinal compounds:

1. Aspirin

2. Sulphonamides

3. Acetaminophen

References:

Pharmacopoea of India 2007