

SEMESTER-VI - Electives
ELECTIVE Paper – VII-(A) : ANALYTICAL METHODS
IN CHEMISTRY

✓
45hrs (3h / w)

UNIT-I

Quantitative analysis:

10h

- a) Importance in various fields of science, steps involved in chemical analysis. Principles of volumetric analysis ∴ Theories of acid-base, redox, complexometric, iodometric and precipitation titrations - choice of indicators for these titrations.
- b) Principles of gravimetric analysis: precipitation, coagulation, peptization, coprecipitation, post precipitation, digestion, filtration and washing of precipitate, drying and ignition.

UNIT-II

Treatment of analytical data:

7h

Types of errors, significant figures and its importance, accuracy - methods of expressing accuracy, error analysis and minimization of errors, precision - methods of expressing precision, standard deviation and confidence limit.

UNIT-III

SEPARATION TECHNIQUES IN CHEMICAL ANALYSIS:

8h

SOLVENT EXTRACTION : Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism., Application - Determination of Iron (III)

ION EXCHANGE : Introduction, action of ion exchange resins, separation of inorganic mixtures, applications, Solvent extraction: Principle and process,

UNIT – IV

10h

Chromatography: Classification of chromatography methods, principles of differential migration adsorption phenomenon, Nature of adsorbents, solvent systems, R_f values, factors effecting R_f values.

Paper Chromatography: Principles, R_f values, experimental procedures, choice of paper and solvent systems, developments of chromatogram - ascending, descending and radial. Two dimensional chromatography, applications.

UNIT -V

10h

Thin layer Chromatography (TLC): Advantages. Principles, factors effecting R_f values. Experimental procedures. Adsorbents and solvents. Preparation of plates. Development of the chromatogram. Detection of the spots. Applications.

Column Chromatography: Principles, experimental procedures, Stationary and mobile Phases, Separation technique. Applications

HPLC : Basic principles and applications.

List of Reference Books

1. Analytical Chemistry by Skoog and Miller
2. A textbook of qualitative inorganic analysis by A.I. Vogel
3. Nanochemistry by Geoffrey Ozin and Andre Arsenault
4. Stereochemistry by D. Nasipuri
5. Organic Chemistry by Clayden

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LABORATORY COURSE – VI
Practical Paper – VII-(A) (at the end of semester VI) 30hrs (2 h / W)

50M

1. Identification of aminoacids by paper chromatography.
2. Determination of Zn using EDTA
3. Determination of Mg using EDTA

Q. Answer
(BOS)

CLUSTER ELECTIVES: Cluster Elective – I
Analytical and Physical
SEMESTER-VI
PAPER – VIII-A-1: POLYMER CHEMISTRY

45 hrs (3 h / w)

UNIT-I

12h

Introduction of polymers:

Basic definitions, degree of polymerization ,classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers , Fibers and Resins, Linear ,Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical, ionic and Zeigler – Natta polymerization.

UNIT-II

10h

Techniques of Polymerization : Bulk polymerization , solution polymerization , suspension and Emulsion polymerization.

Molecular weights of polymers: Number average and weight average molecular weights
Determination of molecular weight of polymers by Viscometry , Osmometry and light scattering methods.

UNIT-III

6h

Kinetics of Free radical polymerization, Glass Transition temperature(T_g) and Determination of T_g:

Free volume theory, WLF equation, factors affecting glass transition temperature (T_g).

UNIT-IV

9h

Polymer additives:

Introduction to plastic additives – fillers, Plasticizers and Softeners , Lubricants and Flow Promoters, Anti aging additives , Flame Retardants , Colourants , Blowing agents , Cross linking agents ,Photo stabilizers , Nucleating agents.

UNIT-V

8h

Polymers and their applications:

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Polyacrylonitrile, Terelene , Nylon6.6 silicones.

Reference Books:

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction*, Marcel Dekker, Inc. New York, 1981.
2. Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers*. Interscience Publishers, NewYork, 1967.

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SEMESTER-VI

PAPER – VIII-A-2: INSTRUMENTAL METHODS OF ANALYSIS

45 hrs (3 h / w)

UNIT – I

Introduction to spectroscopic methods of analysis:

4 h

Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental methods. Consideration of electromagnetic radiation.

UNIT – II

Molecular spectroscopy:

8h

Infrared spectroscopy:

Interactions with molecules: absorption and scattering. Means of excitation (light sources), separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat, differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

UNIT – III

10h

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoacoustic, fluorescent tags).

UNIT – IV

Separation techniques

Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis. 46 *Immunoassays and DNA techniques*

8h

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations, Detection and interpretation (how this is linked to excitation).

8h

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UNIT – V

Elemental analysis:

10h

Mass spectrometry (electrical discharges).

Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence. Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spin coupling, Applications.

4h

Electroanalytical Methods: Potentiometry & Voltammetry

4h

Radiochemical Methods

4h

X-ray analysis and electron spectroscopy (surface analysis)

Reference books:

1. Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis*, Cengage Learning India Ed.
2. Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A. *Instrumental Methods of Analysis*, 7th Ed. Wadsworth Publishing Company Ltd., Belmont, California, USA, 1988.
3. P.W. Atkins: *Physical Chemistry*.
4. G.W. Castellan: *Physical Chemistry*.
5. C.N. Banwell: *Fundamentals of Molecular Spectroscopy*.
6. Brian Smith: *Infrared Spectral Interpretations: A Systematic Approach*.
7. W.J. Moore: *Physical Chemistry*

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SEMESTER-VI

PAPER – VIII-A-3 : ANALYSIS OF DRUGS, FOODS , DAIRY PRODUCTS & BIO-CHEMICAL ANALYSIS

45 hrs (3 h / w)

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 :Amoxycillin., chloramphenicol, metronidazole, penicillin, tetracycline, cephalexin(cefalexin).

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, ambien(zolpidem), diazepam,

UNIT - III

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 - IV

Analysis of Milk and milk products: Acidity, total solids, fat, total nitrogen, protein, lactose, phosphate activity, casein, chloride. Analysis of food materials-

Preservatives: Sodium carbonate, sodium benzoate, sorbic acid. Coloring matters, - Brilliant blue FCF, fast green FCF, tartrazine, erythrosine, sunset yellow FCF.

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 - V

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.

REFERENCE 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.Tarapuravala & 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.,

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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.,

I. LABORATORY COURSE – VIII

Practical Paper – VIII-A-1: (at the end of semester VI)

30 hrs (2 h / W)

1. Preparation of Aspirin
2. Preparation of Paracetamol
3. Preparation of Acetanilide
4. Preparation of Barbutiric Acid
5. Preparation of Phenyl Azo β -naphthol

II. LABORATORY COURSE – VIII

Practical Paper – VIII-A-2 (at the end of semester VI)

30 hrs (2 h / W)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Acetylation of 1^o amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil-Benzilic acid rearrangement
4. Electrophilic aromatic substitution reaction: Nitration of phenol
5. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
6. Green oxidation reaction: Synthesis of adipic acid
7. Green procedure for Diels Alder reaction between furan and maleic anhydride

List of Reference Books

1. Green Chemistry Theory and Practice. P.T. Anatas and J.C. Warner
2. Green Chemistry V.K. Ahluwalia Narosa, New Delhi.
3. Real world cases in Green Chemistry M.C. Cann and M.E. Connelly
4. Green Chemistry: Introductory Text M.Lancaster: Royal Society of Chemistry (London)
5. Green Chemistry: Introductory Text, M.Lancaster
6. Principles and practice of heterogeneous catalysis, Thomas J.M., Thomas M.J., John Wiley
7. Green Chemistry: Environmental friendly alternatives R S Sanghli and M.M. Srivastava, Narosa Publications

VII-A-3 Practical:- Project Work

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