MANGALORE UNIVERSITY

Department of Industrial Chemistry

ICH 451: ANALYTICAL CHEMISTRY

Course Outcomes:

- Students get to learn how measure errors occur during estimations
- Chromatographic techniques namely, gas chromatography, liquid chromatography, ion exchange chromatography, TLC and paper chromatography.
- Electroanalytical techniques with advance instrumental technique such as surface probe microscopy, thermal analysis and X-ray diffraction analysis.

UNIT I **14 hrs**

Preparation of samples for analysis, nature of errors, statistical treatment of errors, the t- and F-tests, significant figures, rejection of data. Precipitation phenomena: Precipitation from homogeneous solutions, organic precipitants in inorganic analysis. Solvent extraction of metal ions, nature of extractant, distribution law, partition coefficients, types of extractions and applications. Theories of redox indicators, titration curves, feasibility of redox titrations. Chelometric titrations-titration curves with EDTA, feasibility of EDTA titrations, indicators for chelometric titrations, selective masking and demasking techniques, industrial applications of masking.

UNIT II **14 hrs**

Chromatographic Techniques: Principles, classifications and theory of chromatographic separations.

Gas Chromatography: Principles, columns, detectors-TCD, FID, ECD and column efficiency, capacity factors, resolution. Practical aspects of GC-Hypernated techniques. **Liquid Chromatography** HPLC: Principles, equipment, columns, detectors, choice of column, materials GC, GCMS and LCMS.

Ion exchange chromatography: Structures of resins, selectivity, capacity of resins, ion exchange equilibria, applications-removal of interfering ions, concentration and recovery of traces, anion and cation separations and application for the separation of lanthanides and actinides. Techniques of column chromatography and size exclusion chromatography.

Thin layer chromatography, efficiency of TL plates, selection of stationary and mobile phases. Qualitative and quantitative analysis

Paper chromatography: Theory and principle. Techniques: one, two- dimensional and circular paper chromatography. Mechanism of separation, structure of cellulose and types of paper. Methodology- Factors affecting R_f values. Advantages and applications.

UNIT-III

14 hrs

Electroanalytical Techniques

Introduction, theory, principle, methodology, instrumentation and application of the following tecniques: Conductometry, Potentiometry, Coulometry, Voltammetry.

Light -Scattering methods: Nephelometry & turbidimetry theory, effects of concentration, particle size & wavelength on scattering, instrumentation & application.

Fluorometry and phosphorimetry: Introduction, fluorescence and phosphorescence, factors affecting fluorescence and phosphorescence, internal conversion, intersystem crossing (radiationless processes) quenching. theory, relationship between intensity of fluorescence and concentration, instrumentation– basic differences in the measurement of fluorescence and phosphorescence, spectrofluorometers, advantages, limitations and precautions.

UNIT IV Advanced instrumental techniques: **14 hrs**

Spectrophotometry, Atomic spectroscopy

Surface probe microscopy: Atomic force microscopy, Scanning tunnelling microscopy, Field emission scanning electron microscopy, Transmission electron microscopy.

Thermal Analysis- TG, DTA and DSC- Principles and applications.

X-ray diffraction techniques- Powder and single crystal XRD, principle, techniques and applications.

References:

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3. G.D. Christian, Analytical Chemistry, John Wiley, 1986.
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6. H.H. Wlliard, L.L. Merrit and J.J. Dean, Instrumental methods of analysis, 1988.
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10. B.K. Sharma, Chromatogarphy, Krishna Prakashan media, 1997.
11. Bier, Milan E D, Electrophoresis: Theory methods and applications, Academic 1967.
12. A K Tareen and Kutty, Crystallpgraphy, University Press, 2002.
13. F.C. Ladd Mark & Palmer, R.A.: Structure Determination by X-ray Crystallography, 2003.
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