INSTRUMENTATION METHODS FOR CHEMICAL ANALYSIS

(Professional Elective-II)

COURSE CODE:15CH1125

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COURSE OUTCOMES:

At the end of the course the student shall be able to

CO 1 Classify the instrumental techniques and interpret the signals.

CO 2 Select the spectroscopy instruments and analyze the given sample.

CO 3 Distinguish the Atomic Absorption Spectrometry and Infrared spectrometry.

CO 4 Select the chromatographic instrumentation and test a given sample for project work.

CO 5 Classify the chromatographic methods; identify the column efficiency and resolution.

UNIT-I (10 LECTURES)

AN INTRODUCTION TO INSTRUMENTAL METHODS:

Terms Associated With Chemical Analysis, Classification Of Instrumental Techniques, A Review Of The Important Considerations In Analytical Methods, Basic Functions of Instrumentation, Important Considerations in Evaluating an Instrumental Method.

MEASUREMENTS, SIGNALS AND DATA:

Introduction, Signal-to-Noise Ratio, Sensitivity and Detection Methods, Source of Noise, Hardware Techniques for Signal-to-Noise Enhancement, Software Techniques for Signal-to-Noise Enhancement, Evaluation of Results, Accuracy and Instrument Calibration, Chemometrics.

UNIT-II (10 LECTURES)

AN INTRODUCTION TO ABSORPTION AND EMISSION SPECTROSCOPY:

The Nature of Electromagnetic Radiation, The Electromagnetic Spectrum, Atomic Energy Levels, Molecular Electronic Energy Levels, Vibrational Energy Levels, Raman Effect, Lasers, Nuclear Spin Behaviour, Electron Spin Behaviour.

ULTRAVIOLET AND VISIBLE SPECTROMETRY-INSTRUMENTATION:

Radiation Sources, Wave Length Selection, Cells and Sampling Devices, Detectors, Instruments for Absorption Photometry.

ULTRAVIOLET AND VISIBLE ABSORPTION METHODS:

Fundamental Laws of Photometry, Spectrophotometric Accuracy, Photometric Precision, Quantitative Methodology, Differential or Expanded-Scale Spectroscopy.

UNIT-III (10 LECTURES)

FLAME EMISSION AND ATOMIC ABSORPTION SPECTROSCOPY:

Introduction, Instrumentation for Flame Spectrometric Methods, Flame Emission Spectrometry, Atomic Absorption Spectrometry, Interference Associated with Flame and Furnaces, Applications, Comparison of FES and AAS.

INFRARED SPECTROMETRY:

Correlation of Infrared Spectra with Molecular Structure, Instrumentation, Sample Handling.

UNIT-IV (10 LECTURES)

MASS SPECTROMETRY:

Sample Flow in a Mass Spectrometer, Inlet Sample System, Ionization Methods in Mass Spectrometry, Mass Analyzers, Ion-Collection System, Vacuum System, Isotope- Ratio Spectrometry, Correlation of Mass Spectra With Molecular Structure.

GAS CHROMATOGRAPHY:

Gas Chromatographs, Derivative Formation, Gas Chromatographic Columns, Liquid Phases and Column Selection, Detectors for Gas

Chromatography.

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY:

HPLC Instrumentation, Mobile-Phase Delivery System, Sample Introduction, Separation Columns, Detectors.

X RAY DIFFRACTION:

General Principles, Braggs equation, Laue photographic method, Rotating crystal method, Oscillating crystal method, Powder method, Interpretation of the Diffraction pattern, Applications of XRD.

UNIT-V (10 LECTURES)

CHROMATOGRAPHY: GENERAL PRINCIPLES:

Classification of Chromatographic Methods, Chromatographic Behaviour of Solutes, Column Efficiency and Resolution, Column Processes and Band Broadening, Time of Analysis and Resolution, Quantitative Determinations.

TEXT BOOKS:

1. Willard,H.H, Merritt,L.L, Dean,J.A, and Settle, F.A, "Instrumental methods of analysis" CBS Publishers & Distributors, 7 Ed, 1986.

REFERENCES:

1. Srivastava. A.K. and. Jain, P.C, "Instrumental Approach to Chemical Analysis", 4th Edition , S Chand and Company Ltd, New Delhi, 2012.
2. Chatwal. G.R., Anand, Sham K., "Instrumental Methods of Chemical Analysis" 5th Edition, Himalaya Publishing House, 2005.