

UNIVERSITY OF MADRAS
B.Sc. DEGREE COURSE IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2020-2021

BCY-DSE3A

ELECTIVE-III(A): ANALYTICAL CHEMISTRY

Learning Outcome

Learning terminology; Separation techniques; Principles and instrumentation of chromatographic, gravimetric, thermal, spectroscopic and electroanalytical techniques.

Semester	Subject Title	Total Hours	Credit
VI	Analytical Chemistry	75	5

UNIT-I **(10hrs)**

Data Analysis - Theory of errors - idea of significant figures and its importance with examples - Precision - accuracy - methods of expressing accuracy - error analysis - minimizing errors methods of expressing precision - average deviation - standard deviation and confidence limit.

Purification of solid compounds - extraction - use of immiscible solvents - soxhlet extraction Purification of liquids - experimental techniques distillation - fractional distillation - vacuum distillation - steam distillation –tests for purity.

UNIT-II **(20hrs)**

Principles of gravimetric analysis - characteristics of precipitating agents- choice of precipitants and conditions of precipitation –specific and selective precipitants - DMG, cupferron, salicylaldehyde, ethylenediamine- use of sequestering agents - co-precipitation - post precipitation - peptisation- differences- reduction of error - precipitation from homogeneous solutions - calculations in gravimetric methods - use of gravimetric factor.

Thermal analytical methods - Principle involved in thermogravimetric analysis and differential gravimetric analysis - discussion of various components with Block diagram - characteristics of TGA and DTA - factors affecting TGA and DTA curves- thermometric titrations.

Chromatography Techniques - Principles - adsorption, partition and ion exchange chromatography , column chromatography - adsorbents - preparation of column - elution, recovery of substance and applications. TLC - choice of adsorbent and solvent - preparation of chromatogram (R_f value) and applications - Paper chromatography - Solvents used - factors affecting R_f value- separation of amino acid mixtures.

UNIT-III **(15hrs)**

Definition of spectrum - electromagnetic radiation - quantisation of different forms of energies of molecules - translational, vibrational, rotational, vibrational and electronic energies.

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UV - Visible spectroscopy - absorption laws –theory- electronic spectra - types of electronic transitions - chromophores and auxochromes –absorption bands and intensity - factors governing absorption maxima and intensity - instrumentation

IR spectroscopy - vibrations of diatomic molecules- harmonic and anharmonic oscillators, zero point energy, force constant, condition for a molecule to be IR active, selection rules - instrumentation

UNIT-IV **(15 hrs)**

NMR spectroscopy - principle - equivalent and non-equivalent protons - shielded and deshielded protons, chemical shift - TMS, delta tau scales, spin-spin coupling- analysis of spectrum of ethanol - instrumentation

Mass spectrometry:

Basic principles of mass spectrum Instrumentation and Block diagram molecular ion peak, base peak, isotopic peak, fragmentation - Nitrogen rule - determination of molecular formulae - fragmentation and mass spectrum of simple organic compounds - alcohols and carbonyl compounds- McLafferty rearrangement.

UNIT-V **(15 hrs)**

Polarography - principle - concentration polarization - dropping mercury electrode - advantages and disadvantages - migration and diffusion currents - Ilkovic equation (derivation not required) and significance - experimental assembly –electrodes - capillary - current voltage curve - oxygen wave - influence of temperature and agitation on diffusion layer - polarography as an analytical tool in quantitative and qualitative analysis . Amperometry- basic principles and uses

References

1. Gopalan R., Rengarajan K., and Subramanian P.S., Elements of Analytical Chemistry, 3rd ed. Reprint, Sultan Chand & Sons, 2013.
2. Skoog DA, West DM, James Holler F and Stanley R, Fundamentals of Analytical Chemistry, 9th ed., 2013
3. Khopkar S.M., Analytical Chemistry, New Age International.
4. Analytical Methods: Interpretation, Identification, Quantification, R Gopalan and K S Viswanathan, Universities Press Private Limited, Chennai, 2018
5. Analytical Chemistry, G L David Krupadanam; D Vijaya Prasad; K Varaprasad Rao; K L N Reddy; C Sudhakar, Universities Press Private Limited, Chennai, 2001