Name of the Programme: M.Sc. Part-II (Analytical Chemistry)

Course Code: CHA-600 **Title of the course:** Practical Course in Analytical Chemistry - III

Number of Credits: 4

Effective from AY: 2023-24

Prerequisites for the course:	Should have studied Analytical chemistry practical course at M.Sc. Part-I.	
Course Objectives:	1. To study various experimental techniques for analysis. 2. To learn data analysis, handling and interpretation of spectra.	
Content	*This course consists of 10 units of experiments in various areas of Analytical chemistry. Minimum 20 experiments which include at least 02 experiments from each unit shall be conducted.*	No of hours 120
	Unit 1: Analysis of Pharmaceutical Tablets/Samples (Titrimetry) i. Estimation of Paracetamol by titrimetry. ii. Estimation of streptomycin in tablet sample by Maltol method. iii. Estimation of iron using Zimmermann-Reinhardt reagent by titrating against $KMnO_4$.	12
	Unit 2: Ion exchange Chromatography and Solvent Extraction Method i. Determination of capacity of a cation exchange resin. ii. Concentration and determination of copper (II) ions from a brine solution using a chelating ion exchange resin and AES/AAS iii. Separation of organic mixture (acidic + basic + neutral) by extraction.	12
	Unit 3: Planar and Column Chromatography i. Thin layer chromatography analysis of commercially available analgesic/antipyretic/antihistamine etc and to identify the active ingredients. ii. Purification and determination of amount of paracetamol from commercial tablet by column chromatography. iii. Separation of a mixture of benzoin and benzil on silica gel column.	12
	Unit 4: Spectrophotometric Method i. Determination of pk value of methyl red indicator.	12

	ii. Determination of stoichiometry and stability constant of ferric salicylic acid complex by Job's method and mole ratio method. iii. Determination of the Fe ion as Fe-oxine complex.	
	Unit 5: HPLC Analysis i. Analysis of a mixture (benzene and toluene or nitrobenzene and toluene) by normal/reverse phase-HPLC. ii. HPLC analysis of an analgesic (e.g. Ibuprofen)/or any other drug with method development and validation. iii. Quantitative analysis of Paracetamol tablet by HPLC iv. Determination of plate height/number of theoretical plates by HPLC using Acetophenone as a reference material. v. Study of HPLC method development by using linear/stepwise gradient elution for binary system. vi. Determination of caffeine content in Tea or Coffee	12
	Unit 6: Electrochemical Method i. pH-metric determination of the acid-base dissociation constant and isoelectric point of amino acid. ii. Determination of moisture content in tablet powder by Karl Fischer titration. iii. Analysis of mixture of carbonate/bicarbonate present in water sample using pH metry or Potentiometry.	12
	Unit 7: Gas Chromatographic Analysis i. GC analysis of a given sample mixture (e.g. perfumes, cosmetics). ii. GC analysis of non-volatile analyte by derivatization. iii. Quantitative analysis of a mixture of chloroform and carbon tetrachloride. iv. Gas chromatographic analysis for a mixture of gases like O_2, N_2 and CO_2. v. Determination of alcoholic content in Beer or wine	12
	Unit 8: Analysis of Ores/Minerals/Industrial Material i. Analysis of Iron Ore or Bauxite (from Goa). ii. Analysis of cement or plaster of Paris. iii. Analysis of limestone or dolomite.	12

	Unit 9: Other Instrumental Techniques i. Electrophoretic techniques for the separation of nucleic acids or proteins ii. Study the dissolution rate of commercial tablets. iii. Determination of optical rotation of Chiral compounds using polarimeter (e.g. Amino acids, drugs, natural products, lactic acid, tartaric acid etc) iv. Determination of sulphate ion content by turbidimetry. v. Determination of turbidity in water sample. vi. TG/DTA analysis of sample or mixture (e.g. $MgCO_3$-MgO). vii. Determination of molar composition of Toluene-Anisole mixture by qNMR.	12
	Unit 10: Demonstration/Interpretation Exercises i. Demonstration/Interpretation of LC-MS spectra. ii. Demonstration/Interpretation of NMR spectra of Ethyl cinnamate/Vanilin. iii. Assessment of TG-DTA plot. iv. Statistical Evaluation of Data including Linear Regression Analysis. v. Analysis of materials using Microscopic Techniques. vi. Demonstration of XRD and interpretation of diffraction pattern.	12
Pedagogy:	Prelab exercises / assignments / presentations / lab hand-out or a combination of some of these. Sessions shall be interactive in nature to enable peer group learning.	
References / Readings	1. J. H. Kennedy, Analytical Chemistry Principles, 2nd Ed., Saunders College Publishing, 1990. 2. G. D. Christian, Analytical chemistry, 5thEd., John Willey and Sons, 1994 3. J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis, 6thEd., Pearson Education Asia 2009. 4. A. J. Elias, Collection of interesting chemistry experiments, University press, 2002. 5. R.A. Day & A.L. Underwood, Quantitative Analysis, 6thEd., Prentice Hall, 2001. 6. J. Kenkel, Analytical Chemistry for Technicians, 3rdEd., Lewis publishers, 2002.	

Course Outcomes:	1. Students will be able to use different techniques for qualitative and quantitative estimation. 2. Students will be able to interpret spectra and use statistical methods to analyse data. 3. Students will be able to use different techniques for mixture separation. 4. Students will be able to analyse pharmaceutical samples.