

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2023-2024

Title of the Course	ANALYTICAL INSTRUMENTATION TECHNIQUES PRACTICAL						
Paper No.	Core XII						
Category	Core	Year	II	Credits	4	Course Code	524C4C
		Semester	IV				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	-	1	4		5		
Prerequisites							
Objectives of the course	<p>To design chromatographic methods for identification of species. To analyze different constituents through instrumental methods of analysis. To evaluate different contaminants in materials using turbidimetry and conductivity measurements. To design experiments for analysis of inorganic and organic materials. To analyze constituents in materials using emission and absorption techniques.</p>						
Course Outline	<p>UNIT-I:</p> <ol style="list-style-type: none"> Determination of the equivalent conductance of a weak acid at different concentrations and verifying Ostwald dilution law. Calculation of the dissociation constant of the acid. Determination of the equivalent conductance of a strong electrolyte at different concentrations and examining the validity of the Onsager's theory as limiting law at high dilutions. Conductometric titration of a mixture of HCl and CH₃COOH Vs NaOH. Conductometric titration of NH₄Cl Vs NaOH. Conductometric titration of CH₃COONa Vs HCl. Potentiometric titration of a mixture of HCl and CH₃COOH Vs NaOH Determination of pK_a of weak acid by EMF method. Potentiometric titration of FAS Vs K₂Cr₂O₇ Potentiometric titration of KI Vs KMnO₄. Potentiometric titration of a mixture of Chloride and Iodide Vs AgNO₃. Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode. Study of the inversion of cane sugar in the presence of acid by Polarimetric method. 						
	<p>UNIT-II:</p> <ol style="list-style-type: none"> Estimation of Fe, Cu and Ni by colorimetric method. Estimation of Na and K by flame photometric method. Determination of spectrophotometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the complex formation. Determination of the amount (mol/L) of ferricyanide present in the given solution using cyclic voltammetry. Determination of the diffusion coefficient of ferricyanide using cyclic voltammetry. Determination of the standard redox potential of ferri-ferrocyanide redox couple using cyclic voltammetry. Estimation of the amount of sulphate present in the given solution using Nephelometric turbidimeter. 						

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2023-2024

	<ol style="list-style-type: none"> 8. Estimation of the amount of nitrate present in the given solution using spectrophotometric method. 9. Heavy metal analysis in textiles and textile dyes by AAS 10. Determination of caffeine in soft drinks by HPLC 11. Analysis of water quality through COD, DO, BOD measurements. 12. Assay of Riboflavin and Iron in tablet formulations by spectrophotometry 13. Estimation of chromium in steel sample by spectrophotometry 14. Determination of Stern-Volmer constant of Iodine quenching by fluorimetry 15. Determination of ascorbic acid in real samples using Differential Pulse Voltammetry and comparing with specifications 16. Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography 17. Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry. 18. Estimation of Fe(II) by 1,10 phenanthroline using spectrophotometry
	<p>UNIT-III: Interpretation and identification of the given spectra of various organic compounds arrived at from the following instruments</p> <ol style="list-style-type: none"> 1. UV-Visible 2. IR 3. Raman 4. NMR 5. ESR 6. Mass etc.,
<p>Extended Professional Component (is a part of internal component only, Not to be included in the external examination question paper)</p>	<p>Questions related to the above topics, from various competitive examinations UPSC / TRB / NET/ UGC-CSIR / GATE /TNPSC others to be solved (To be discussed during the Tutorial hours)</p>
<p>Skills acquired from this course</p>	<p>Knowledge, Problem solving, Analytical ability, Professional Competency, Professional Communication and Transferable skills.</p>
<p>Recommended Text</p>	<ol style="list-style-type: none"> 1. B. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, 2. Viva Books, New Delhi, 2009. 3. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996. 4. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996. 5. Renu Gupta, Practical Physical Chemistry, New Age International (P) Ltd., New Delhi, 2018. 6. H. Kaur, Instrumental methods of chemical analysis, Pragati Prakashan, 2003. 7. G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, Vogel's

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2023-2024

	<p>Textbook of Quantitative Chemical Analysis, Longman Scientific and Technical, 1989.</p> <p>8. S.M. Khopkar, Basic concepts of analytical Chemistry, 3rd Edn, New age International Ltd, 2011.</p>
Reference Books	<ol style="list-style-type: none"> 1. J. N. Gurtu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 2011. 2. J. B. Yadav, Advanced Practical Physical Chemistry, Goel Publishing House, 2001. 3. G.W. Garland, J.W. Nibler, D.P. Shoemaker, Experiments in Physical Chemistry, 8th edition, McGraw Hill, 2009. 4. J. N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987. 4. V.D. Athawale and Parul Mathur, Experimental Physical Chemistry, New Age International (P) Ltd., New Delhi, 2008. 5. Shailendra K. Sinha, Physical Chemistry-A laboratory manual, Narosa Publishing House Pvt. Ltd., 2014. 6. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry an Introduction, Saunders College Publishers, 2000. 7. D.A. Skoog, E.J. Holler, Stanley. J. Croch, Principles of Instrumental Analysis, Cengage Learning, 6th edition, 2019. 8. J. Mendham, R. C. Denney, J. D. Barnes and M. Thomas, Vogel's Text book of Quantitative Chemical Analysis, Pearson Education Pvt. Ltd., 2004. 9. J. G. Dick, Analytical Chemistry, Sir George Williams University, McGraw-Hill Book Company, New York, 1973. 10. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Seattle, Instrumental methods of analysis, 5th Ed., Harcourt Asia Pvt. Ltd., India, 2001. 11. Gary D. Christian, Analytical Chemistry -, 6th ed. John Wiley and sons. Inc, New York, 1994.
Website and e-learning source	<ol style="list-style-type: none"> 1. https://bit.ly/3QESF7t 2. https://bit.ly/3QANOnX
Course Learning Outcomes (for Mapping with POs and PSOs)	
<p>Students will be able:</p> <p>CO1: To recall the principles associated with various inorganic organic and physical chemistry experiments</p> <p>CO2: To scientifically plan and perform all the experiments</p> <p>CO3: To observe and record systematically the readings in all the experiments</p> <p>CO4: To calculate and process the experimentally measured values and compare with graphical data.</p> <p>CO5: To interpret the experimental data scientifically to improve students efficiency for societal developments.</p>	

UNIVERSITY OF MADRAS
M.Sc. DEGREE PROGRAMME IN CHEMISTRY
SYLLABUS WITH EFFECT FROM 2023-2024

CO-PO Mapping (Course Articulation Matrix)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	S	S	S	S	M	S	S	S	S	M
CO 2	M	S	S	S	S	M	S	S	S	S
CO 3	S	S	M	S	S	S	S	M	S	S
CO 4	M	S	S	S	S	M	S	S	S	S
CO 5	M	S	M	S	S	M	S	M	S	S

3 – Strong, 2 – Medium, 1 - Low

Level of Correlation between PSO's and CO's

CO /PO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted percentage of Course Contribution to Pos	3.0	3.0	3.0	3.0	3.0

3 – Strong, 2 – Medium, 1 - Low