University of Kerala

Discipline	CHEMISTRY				
Course Code	**UK3DSECHE202**				
Course Title	**ANALYTICAL CHEMISTRY -I**				
Type of Course	**DSE**				
Semester	3				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	4 hours	-		4
Pre-requisites	1. General Chemistry 2. Equilibrium Principles				
Course Summary	This course provides students with the knowledge and skills necessary to understand the principles and practices of analytical chemistry, including the scope, function, and analytical perspective of the field. Students will learn about various analytical techniques, methods for sample preparation and analysis.				

Detailed Syllabus:

Module	Unit	Content ANALYTICAL CHEMISTRY -I	Hrs 60
I	**INTRODUCTION TO ANALYTICAL CHEMISTRY**		**9**
	1.1	Scope, function, The Analytical Perspective, Analytical Problems and their solutions, Trends in Analytical Methods and Procedures, Introduction to the terms used in analytical chemistry	3
	1.2	Qualitative and Quantitative Analysis, Sampling	2
	1.3	The analytical process: Steps in the analytical process	1
	1.4	Validation of a method, Use of literature, Analyze Versus Determine	3
II	**BASIC TOOLS OF ANALYTICAL CHEMISTRY**		**9**
	2.1	The Laboratory Notebook, Laboratory Basic Equipments & Measurements: Volumetric Glassware (Volumetric flasks, Pipets, Syringe pipets, Burets & Use of volumetric Glassware,) The Analytical Balance	2
	2.2	Units for Expressing Concentration**:** Molarity and Formality, Normality, Molality, Weight, Volume, and Weight-to-Volume Ratios, Converting Between Concentration Units, p-Functions	3
	2.3	Stoichiometric calculations, Selection of glassware, Preparation of standard acid & base solutions	2

	2.4	Other apparatus: Blood samplers, Desiccators, furnaces & ovens, hoods, wash bottles, Centrifuges & filters,	2
III	**LANGUAGE OF ANALYTICAL CHEMISTRY**		**9**
	3.1	Analysis, Determination, Measurement, Techniques, Methods, Procedures and Protocols, Classifying Analytical Techniques, Use of Literature	2
	3.2	Selecting an Analytical Method: Accuracy, Precision, Sensitivity, Selectivity, Robustness and Ruggedness, Scale of Operation, Equipment, Time, and Cost, Making the Final Choice	3
	3.3	Developing the Procedure & Standardizing Analytical Methods: Compensating for Interferences, Calibration and Standardization, Sampling, Validation, Analytical signals, Calibrating the signals, and Sensitivity determination.	3
	3.4	Protocols, The Importance of Analytical Methodology	1
IV	**CHEMICAL EQUILIBRIUM AND SEMIMICRO QUALITATIVE INORGANIC ANALYSIS**		**18**
	4.1	Reversible Reactions and Chemical Equilibria, Thermodynamics and Equilibrium Chemistry, Le-Chatelier's Principle, the law of mass action, Factors affecting chemical reactions in solutions	4
	4.2	Solubility product, Common Ion Effect, Fractional precipitation, Effect of acids, temperature and solvent on the solubility of a precipitate	4
	4.3	Introduction to semimicro qualitative inorganic analysis, The study of reactions of cations and anions on the semi-micro scale	3
	4.4	Preliminary tests, systematic analysis and Confirmatory tests for anions on the semi micro scale, Modifications of separation procedures in the presence of interfering anions	3
	4.5	Preparation of solution for cation testing, separation and identification of cations into groups (I, II A, II B, III A, III B, IV & V) on the semi micro scale	4
V	**Open Ended Module: Learning through problem-solving, seminars, open discussions, assignment discussions, Quizzes, Open book exams etc.**		**30**
	1	Select an analytical method used in a specific industry (e.g., pharmaceuticals, environmental monitoring). Discuss the process of validation and standardization for this method, including the use of literature, compensating for interferences, and calibration techniques.	
	2	Identify, categorize, and describe the uses of apparatus and equipment commonly found in an analytical chemistry laboratory. Provide detailed explanations of the principles behind the operation of each instrument, as well as their applications in qualitative and quantitative analysis.	
	3	Perform stoichiometric calculations and demonstrate the selection and proper use of volumetric glassware, including volumetric flasks, pipettes, syringe pipettes, and burettes. Practice the preparation of standard acid and base solutions and conduct titrations to determine concentration.	
	4	Discuss the importance of proper instrument maintenance, calibration, and troubleshooting to ensure accurate and reproducible measurements.	

	5	Examine the theory and procedures involved in semi-micro qualitative inorganic analysis.	
	6	Discuss the systematic approach to testing for anions and cations, including preliminary tests, confirmatory tests, and separation techniques	
	7	Highlight the challenges and considerations in identifying and eliminating interfering groups.	

References

1. G. H. Jeffery, J. Bassett, J. Mendham, R. C. Denney, *Vogel's Textbook of Quantitative Inorganic Analysis*, Longman, Fifth Edition, 1989.
2. D. A. Skoog, D. M. West and F. J. Holler, *Fundamentals of Analytical Chemistry*, Saunders College Publishing, 7th edition, 1996.
3. D. J. Holme and H. Perk, *Analytical Biochemistry*, 3rd edition, Prentice Hall, 1998.
4. Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug, *Analytical Chemistry* –, Wiley, 7th edition, 2013.
5. D. A. Skoog and D. M. West, *Principles of Instrumental Analysis*, Saunders College Publishing, 5th edition, 1998.
6. G. Svehla, *Vogel's Textbook of Macro and Semimicro Qualitative Inorganic Analysis*, Longman, 5th edition, 1979.

Course Outcomes

No.	Upon completion of the course the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the scope, function, and analytical perspective of analytical chemistry, the steps involved in the analytical process, gain proficiency in validating analytical methods	U	1,3
CO-2	Learn units for expressing concentration, perform conversions between concentration units, and stoichiometric calculations and prepare standard acid and base solutions.	Ap, R	1,3
CO-3	Learn to select analytical methods, develop procedures and standardize analytical methods.	E	1,2
CO-4	Learn about the common ion effect and its impact on equilibrium, systematic analysis techniques on a semi-micro scale for cations and anions,	An	1,2

CO-5	Applies the knowledge in basics of Anlaytical chemistry and semimicro qualitative analysis in problem solving	Ap	1,2,3,5

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Name of the Course: ANALYTICAL CHEMISTRY 1

Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/ PSO	Cognitive Level	Knowledge Category	Lecture (L)/ Tutorial (T)	Practical (P)
1	CO-1	1,3	U	F, C	L	
2	CO-2	1,3	Ap, R	C, P	L	
3	CO-3	1,2	E	C, P	L	
4	CO-4	1,2	An	C, P	L	
5	CO-5	1,2,3,5	Ap	M	L	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs:

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	-	3	-	-	-	1	2	-	-	-	-
CO 2	3	-	2	-	-	-	2	2	-	-	-	-
CO 3	2	2	-	-	-	-	3	2	-	-	-	-
CO 4	2	2	-	-	-	-	2	2	-	-	-	-
CO 5	3	2	2	-	3	-	3	2	2	-	-	-

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	√			√
CO 2	√			√
CO 3	√	√		√
CO 4	√			√
CO 5	√	√	√	