



UNIVERSITI TEKNOLOGI MARA

CHM231: ANALYTICAL CHEMISTRY

Course Name (English)	ANALYTICAL CHEMISTRY APPROVED
Course Code	CHM231
MQF Credit	3
Course Description	This course is an introduction to quantitative and qualitative chemical analysis inclusive of the theoretical and practical aspect including the treatment of data using the statistical analysis. The emphasis is on the preparation of standard solution, dilution, cleaning calibrating glassware, the various types of volumetric analysis, gravimetric analysis and chromatography. The outcomes shall be assessed through paper examination, tests, presentation, laboratory skills as well as written laboratory reports.
Transferable Skills	Demonstrate analytical skill using scientific apparatus and basic instruments.
Teaching Methodologies	Lectures, Lab Work, Presentation, Collaborative Learning
CLO	CLO1 Analyze the samples quantitatively and qualitatively using conventional analysis methods which includes volumetry, gravimetry and basic chromatography and evaluate data using the statistical analysis. (PLO7) CLO2 Perform scientific investigation in chemical related practices using volumetric analysis, gravimetric analysis and basic chromatography analysis. (PLO3) CLO3 Demonstrate good information management and life-long learning skill in presenting the finding from scientific investigation using conventional analysis methods. (PLO9)
Pre-Requisite Courses	No course recommendations
Topics	
1. Introduction to analytical chemistry 1.1) Definition of chemical analysis (qualitative versus quantitative analysis) 1.2) Analyte and interferent 1.3) General steps in analytical process - Selection of method (wet versus instrumental) - Sampling and sample preservation - Sample preparation (homogenizing, drying, dissolution, dry ashing wet digestion)	
2. Basic tools in analytical chemistry. 2.1) Correct techniques in using apparatus (analytical balances, oven, furnace, desiccators) 2.2) Correct techniques in using and calibrating volumetric glass wares (burette, pipettes, volumetric flasks) 2.3) Classification of the purity of chemical reagents (Industrial/Technical, Analytical /Reagent ACS grade, Primary standard grade) 2.4) Expressing quantities and concentration units - Moles and millimoles - Molarity, Normality and Molality -% concentration (% w/w, v/v, w/v), ppm, ppb for liquid and solid	
3. Errors and statistical evaluation of experiment data 3.1) Classifying experimental errors -Determinate or systematic error (examples and sources of the error) - Indeterminate or random error (examples and sources of the error) - Methods to overcome the errors 3.2) Definition and application of statistical terms - Precision and accuracy - Error, absolute error and relative error - Mean, median, deviation, standard deviation and relative standard deviation - population and sample, population mean and sample mean 3.3) Methods for reporting analytical data - Q- test - Confidence limit (CL) and confidence interval (CI)	

4. Titrimetric analysis

- 4.1) Introduction to volumetric analysis - Primary and secondary standards. - Standard solutions, standardization - Titration, titre, titrant, end point, equivalence point.
4.2) Acid-base titration. - Types of acid base titrations. -Titration (pH) curves and acid-base indicators. - Calculation of percent content involving direct and back titration.
4.3) Precipitation titration. - Mohr, Volhard and Fajan methods.
4.4) Redox titration - Standard oxidising agents (KMnO₄, K₂Cr₂O₇, Iodine). - Principle and quantitative analysis of iodometric and iodimetric titration. - Chemical Oxygen Demand (COD) and its calculation.

5. Gravimetric analysis

- 5.1) Principles and process in gravimetric analysis
5.2) Types and properties of precipitates and precipitating reagents
5.3) Factors affecting precipitation
5.4) Determination of % content using gravimetric analysis

6. Chromatography

- 6.1) Principle of chromatography: Stationary and mobile phase, planar and column Chromatography
6.2) Principles and techniques of separations - Paper Chromatography - Thin Layer Chromatography (TLC)
- Column chromatography

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Practical	Laboratory written report -10% Observation of Practical skill -10%	20%	CLO2
	Presentation	Video Presentation	20%	CLO3
	Test	Chapter 1,2 and 3	20%	CLO1

Reading List	Recommended Text	• Skoog, D. A., West, D. M., Holler, F. J., Crouch, S. R., & Winters, C. 2021, <i>Fundamentals of analytical chemistry</i> , Brooks/Cole Pacific Grove
	Reference Book Resources	<ul style="list-style-type: none"> • Gary D. Christian, Purnendu K. Dasgupta, Kevin A. Schug 2014, <i>Analytical Chemistry</i>, 7 Ed., Wiley Hoboken, New Jersey • Daniel C. Harris 2020, <i>Quantitative Chemical Analysis</i>, 10 Ed., WH Freeman • Patil, C. S 2017, <i>Fundamentals of Analytical Chemistry</i>, Oxford Book Company Jaipur • Skoog, D. A., West, D. M., Holler, F. J., & Crouch, S. R 2014, <i>Fundamentals of Analytical Chemistry</i>, Brooks/Cole, Cengage learning. Belmont
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	