UNIVERSITI TEKNOLOGI MARA

CHM260: BASIC INSTRUMENTAL ANALYSIS

Course Name (English)	BASIC INSTRUMENTAL ANALYSIS APPROVED
Course Code	CHM260
MQF Credit	3
Course Description	This course is an introduction to the theory, application and basic instrumentation for chromatography (Gas Chromatography and High Performance Liquid Chromatography) and spectroscopy. Molecular absorption spectroscopy discussed includes Ultraviolet, Visible and Infrared. The types of atomic spectroscopy covered are Flame Atomic Absorption Spectroscopy (AAS) and Flame Atomic Emission Spectroscopy (AES).
Transferable Skills	Demonstrate analytical skills using scientific instrument and apparatus.
Teaching Methodologies	Lectures, Lab Work
CLO	CLO1 Relate theories and formulas to solve spectroscopic and chromatographic problems CLO2 Explain principles, instrumentations, qualitative and quantitative concepts in spectroscopy and chromatography CLO3 Report functions of spectroscopic and chromatographic components CLO4 Perform experiments in spectroscopy and chromatography
Pre-Requisite Courses	No course recommendations

Topics
1. An Introduction to Spectroscopic Methods of Analysis 1.1) Properties of electromagnetic radiation 1.2) The electromagnetic spectrum 1.3) Spectroscopic measurements 1.4) Radiation absorption, transmittance, absorbance 1.5) Beer's Law, theory and application, limitations to the applicability of Beer's Law 1.6) Absorption spectra, atomic absorption, molecular absorption 1.7) Emission of electromagnetic radiation, line spectrum, band spectrum, continuum spectrum
2. Molecular Absorption Spectroscopy; Theory, Instrumentation and Application 2.1) Components of Instruments for Optical Spectroscopy 2.2) Optical Materials 2.3) Radiation Sources 2.4) Wavelength Selectors 2.5) Radiation Detectors and Transducers 2.6) Sample Containers 2.7) Instruments for Optical Absorption Measurements 2.8) Ultraviolet/Visible Spectrophotometers 2.9) Infrared Spectrophotometers 2.10) Ultraviolet and Visible Spectroscopy 2.11) Molecular Species that Absorb Ultraviolet and Visible Radiation 2.12) Scope 2.13) Procedural Details 2.14) Quantitative Analysis 2.15) Infrared Absorption Spectroscopy 2.16) Molecular Species That Absorb Infrared Radiation 2.17) Sample Handling Techniques 2.18) Stretching and Bending Vibrations 2.19) Qualitative Applications 2.20) Structural Analysis

3. Atomic Spectroscopy based on Flame Atomization; Theory, Instrumentation and Application
3.1) Fundamental Principals
3.2) Flame Atomic Absorption Spectroscopy
3.3) Sample Atomization
3.4) Flame atomizer
3.5) Properties of flame
3.6) Instrumentation for Flame Atomic Absorption Spectroscopy
3.7) Line Sources
3.8) Source Modulation
3.9) Interferences
3.10) Quantitative Analysis by Atomic Absorption Spectroscopy
3.11) Detection Limits and Accuracy
3.12) Flame Emission Spectroscopy
3.13) Instruments
3.14) Interferences
3.15) Comparison with Atomic Absorption Spectroscopy

4. An Introduction to Chromatographic Separations
4.1) A General description of chromatography
4.2) Classification of chromatographic methods
4.3) Migration rates of solutes
4.4) Retention time
4.5) Capacity factor
4.6) Selectivity factor
4.7) The Efficiency of chromatographic columns
4.8) Quantitative description of column efficiency
4.9) Variables that affect column efficiency
4.10) Column resolution
4.11) Effect of capacity and selectivity factors on resolution
4.12) Effect of resolution on retention time
4.13) The general elution problem
4.14) Applications of chromatography
4.15) Qualitative Analysis by comparing retention times of a standard and the unknown
4.16) Quantitative Analysis

5. Gas-Liquid Chromatography
5.1) Scope of gas-liquid chromatography
5.2) Apparatus
5.3) Carrier gas supply
5.4) Sample injection system
5.5) Columns
5.6) Detectors
5.7) Stationary Phases for gas-liquid chromatography
5.8) Applications of gas-liquid chromatography

6. High Performance Liquid Chromatography
6.1) Scope of liquid chromatography
6.2) Apparatus
6.3) Mobile phase reservoirs and solvent treatment systems
6.4) Pumping systems
6.5) Sample injection systems
6.6) Liquid chromatography columns
6.7) Column thermostats
6.8) Detectors
6.9) High performance partition chromatography
6.10) Normal-and reversed-phase packings
6.11) Choice of mobile and stationary phases
6.12) Applications
6.13) High performance ion-exchange chromatography
6.14) Ion chromatography (anion and cation)
6.15) Applications
6.16) High-performance size-exclusion chromatography
6.17) Packings
6.18) Applications

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment / Quiz	10%	CLO3
Lab Exercise	Laboratory practical	20%	CLO4
Test	Test 1	15%	CLO2
Test	Test 2	15%	CLO1

Reading List

Reference Book Resources

- **Skoog, West, Holler and Crouch 2004, *Fundamentals of Analytical Chemistry*, 8 Ed., Thomson Brooks/Cole**
- **Christian, G 2006, *Analytical Chemistry*, 6 Ed., John Wiley & Sons**
- **Skoog, J. J. Leary 1992, *Principles of Instrumental Analysis*, 4 Ed., Saunders Coll Publishing**
- **Skoog, West and Holler 1994, *Analytical Chemistry: An introduction*, 6 Ed.**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources