



UNIVERSITI TEKNOLOGI MARA

CHM312: INSTRUMENTAL ANALYSIS

Course Name (English)	INSTRUMENTAL ANALYSIS APPROVED
Course Code	CHM312
MQF Credit	4
Course Description	This is an introduction to the theory and applications of the instruments used for chemical analysis such as FES, NMR and MS. Further discussion on sample handling and applications of GC and HPLC will be undertaken. This course will also introduce the students to methods of preparation and handling of real samples to be analysed by FES, NMR, MS, GC and HPLC. Students are also required to individually perform a series of laboratory experiments as well conduct a short project in any topic relevant to industrial chemistry applications.
Transferable Skills	Demonstrate ability to communicate clearly and confidently and show leadership quality. Demonstrate analytical skills using scientific apparatus and instruments. Demonstrate ability to investigate problems and provide solutions.
Teaching Methodologies	Lectures, Blended Learning, Lab Work
CLO	CLO1 Define terms and relate the concepts in chemical separation and spectroscopic analysis CLO2 Discuss the operation of the instruments and analyze related spectrum and data. CLO3 Outline the procedures for sample preparation, conduct experiment, examine and interpret data and report the experimental findings. CLO4 Verbally communicate the suggested methodology and the experimental findings.
Pre-Requisite Courses	No course recommendations
Topics	
1. Nuclear Magnetic Resonance 1.1) Theory 1.2) (Introduction, High resolution NMR, Chemical shift and spin-spin coupling 1.3) Instrument and sample handling 1.4) Applications 1.5) Qualitative identification of pure substances - the structure of unknown	
2. Mass Spectrometry 2.1) Introduction 2.2) Theory (Ionisation of vaporised molecules into fragments of ions, Record of molecular weight from the measurement of the mass to charge ratio (m/e value)) 2.3) The Mass Spectrometer (Ion chamber and ionisation, Acceleration region, Magnetic analyser or electrostatic analyser, Detector, Detection device) 2.4) The Mass Spectrum (2 forms (plot of m/e values against relative abundance and tabular form of m/e values with relative abundance) 2.5) Interpretation of spectrum (fragmentation of ions (brief explanation with examples on isotope abundance, metastable ions, molecular ion abundance in relation to molecular structure, recognition of molecular ions (even electron rule) and selected examples of mass spectra of hydrocarbon - aliphatic compounds, ketone, ether, amine)	

3. Fluorimetry

3.1) Theory (Fluorescence, Fluorescence spectrum, Excitation spectrum, Molecular structure, Fluorescence intensity as related to concentration)

3.2) Instrument : Fluorometer (Filter fluorometer, Spectrofluorometer)

3.3) Applications (Minerals and Phosphors, Organic and organometallic compounds, e.g. Uranium salt, Ruthenium and Aluminium)

4. Gas Chromatography

4.1) Efficiency of column (Plate number and plate height, HETP (height equivalent to theoretical plate), Variance and standard deviation, Band broadening (Longitudinal diffusion, Mass transfer to and from the stationary phase, Mass transfer in mobile phase, Effect of flow rate of mobile phase and other variables in plate height))

4.2) Sample handling

5. High Performance Liquid Chromatography

5.1) Developing a LC method (Method development) (Selection of liquids to be used as the mobile phase, Selection of stationary phase, Selection of column, Selection of detector, Scouting and gradient elution)

5.2) Sample preparation for LC with examples (Conventional methods (extraction, concentration and filtration), Solid phase extraction, Optimization)

5.3) Qualitative and quantitative analysis (Qualitative (use of retention data, retention plots, peak shifting techniques), Quantitative (internal standard))

Assessment Breakdown	%
Continuous Assessment	70.00%
Final Assessment	30.00%

Details of Continuous Assessment	Assessment Type	Assessment Description	% of Total Mark	CLO
	Assignment	Case Study Report	20%	CLO3
	Practical	Experiments and Summary Written Report	30%	CLO2
	Presentation	Video Presentation of Short Project	20%	CLO4

Reading List	Recommended Text	<ul style="list-style-type: none"> • Skoog, D.A, West, D.M., Holler, F.J., Crouch, S.R. 2004, <i>Fundamentals of Analytical Chemistry</i>, 8th Ed., Thomson Learning • Skoog, D.A., Holler, F.J., Nieman, T.A. 1998, <i>Principles of Instrumental Analysis</i>, 5th Ed., Thomson Learning • Harris, C.H 2003, <i>Quantitative Chemical Analysis</i>, 6th Ed., W.H. Freeman and Co. New York • Zubrick, J.W 2004, <i>The Organic Chem Lab Survival Manual</i>, 6th Ed., John Wiley & Sons • Pavia, D.L., Lampman, G.M., Kriz, G.S 2001, <i>Introduction To Spectroscopy</i>, 3rd Ed., Thomson Learning
Article/Paper List	This Course does not have any article/paper resources	
Other References	This Course does not have any other resources	