University of the West of Scotland

Module Descriptor

Session: 2024/25

Title of Module: Analytical Chemistry			
Code: CHEM09002	**SCQF Level: 9 (Scottish Credit and Qualifications Framework)**	**Credit Points: 20**	**ECTS: 10 (European Credit Transfer Scheme)**
School:	School of Computing, Engineering and Physical Sciences		
Module Co-ordinator:	Callum McHugh		

Summary of Module

The following topic materials will be presented:

Chromatography: A more extended treatment of sorption mechanisms and fundamental concepts in chromatography - plate theory, Van Deemter treatment and capacity factor as applicable to Gas Chromatography (GC) and High-Performance Liquid Chromatography (HPLC) will be presented together with coverage of the principles of operation of detectors, types, and selection of stationary phase; capillary columns and instrumental requirements. Quantitative procedures as applicable to chromatographic methods in general will be detailed. Atomic Spectroscopy: instrumentation, sample vaporisation, quantitative measurements, and interferences. Molecular absorption spectrometry; UV/visible and infrared. Quantitative methods, internal standards. Fluorescence analysis; principles and applications. Voltammetry: electrode systems; DC polarography, characteristics, pulse polarography normal and differential, detection limits and resolution. Stripping voltammetry, cathodic and anodic, linear sweep, and differential pulse; applications, limitations, and interferences. Potentiometry; ion-selective electrodes, calibration and selectivity, detection limits and response times; theory and construction of electrodes, glass, liquid ion-exchange, neutral carrier, and insoluble salt types; applications and limitations of ion-selective electrodes. Introduction to electrochemical sensors. Gas sensors e.g. Clark cell (oxygen sensor), CO_2, NH_3. The use of carbon and proton NMR spectroscopy for structure identification.

A series of laboratory exercises designed to reinforce and complement the lecture material.
The Graduate Attributes relevant to this module are:

- Academic: critical thinker, analytical problem solving, autonomy, group work
- Personal: motivation, time keeping
- Vocational: collaboration, research, analytical techniques
- This module will be prefaced with a review of the scope and philosophy of analytical chemistry. Choice of method, sampling collection and preparation. A series of laboratory exercises designed to reinforce and complement the lecture material by application of instrumental techniques to “real” samples as far as practicable will be completed.

Module Delivery Method					
Face-To-Face	**Blended**	**Fully Online**	**HybridC**	**Hybrid 0**	**Work-Based Learning**
☒	☐	☐	☐	☐	☐
See Guidance Note for details.					

Campus(es) for Module Delivery						
The module will **normally** be offered on the following campuses / or by Distance/Online Learning: (Provided viable student numbers permit) (tick as appropriate)						
Paisley:	Ayr:	Dumfries:	Lanarkshire:	London:	Distance/Online Learning:	Other:
☒	☐	☐	☐	☐	☐	Add name

Term(s) for Module Delivery					
(Provided viable student numbers permit).					
Term 1	☐	Term 2	☒	Term 3	☐

Learning Outcomes: (maximum of 5 statements) **These should take cognisance of the SCQF level descriptors and be at the appropriate level for the module.** At the end of this module the student will be able to:	
L1	Display knowledge of modern instrumental analysis, particularly chromatography, spectroscopy, and electrochemistry.
L2	Show critical understanding of importance of sampling, pretreatment, calibration and data handling for the significance and reliability of derived results.
L3	Acquire and develop analytical and associated data handling and processing skills in a series of laboratory instrumental chemical analytical experiments.

Employability Skills and Personal Development Planning (PDP) Skills	
SCQF Headings	During completion of this module, there will be an opportunity to achieve core skills in:
Knowledge and Understanding (K and U)	SCQF Level **9** Broad integrated knowledge of the fundamental techniques of chromatography, spectroscopy, and electrochemistry available to the analytical scientist.

Practice: Applied Knowledge and Understanding	SCQF Level **9** Undertake a series of experiments featuring the above techniques in both a qualitative and quantitative context in the analysis of 'real' samples.	
Generic Cognitive skills	SCQF Level **9** Undertaking critical analysis of the available methodologies to devise appropriate analytical protocols.	
Communication, ICT and Numeracy Skills	SCQF Level **9** Bringing information together from a variety of sources, using information retrieval systems and appropriate IT skills, to produce written reports for assignments and laboratory exercises. Using appropriate numerical and mathematical skills to evaluate analytical data generated from laboratory exercises and 'dry lab' exercises.	
Autonomy, Accountability and Working with others	SCQF Level **9** Working effectively with others in laboratory environment and identifying and addressing individual/personal learning needs in the subject area associated with the module.	
Pre-requisites:	Before undertaking this module, the student should have undertaken the following:	
	Module Code: CHEM08004	**Module Title:** Chemical Analysis and Evaluation
	Other:	Or, suitable appropriate background.
Co-requisites	**Module Code:**	**Module Title:**

*Indicates that module descriptor is not published.

Learning and Teaching
In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. This module covers a wide variety of theoretical, conceptual, and practical areas, which require a range of knowledge and skills to be displayed and exercised. Delivery of its syllabus content therefore involves a diversity of teaching and assessment

methods suitable to the learning outcomes of the module; these include formal lectures, structured tutorials (work closely integrated with the lecture material), laboratory exercises to develop practical skills and familiarisation with equipment and experimental techniques, completion and submission of written coursework making use of appropriate forms of IT and VLE, and independent study.

Learning Activities	**Student Learning Hours** (Normally totalling 200 hours): (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture/Core Content Delivery	20
Tutorial/Synchronous Support Activity	8
Laboratory/Practical Demonstration/Workshop	20
Independent Study	152
	200 Hours Total

****Indicative Resources: (eg. Core text, journals, internet access)**

The following materials form essential underpinning for the module content and ultimately for the learning outcomes:

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D A Skoog, D A West, F J Holler and S R Crouch "Fundamentals of Analytical Chemistry" 9th Edition

Robinson, J.W., Frame, E.M.S. and Frame, G.M. (2014) "Undergraduate instrumental anaysis" CRC Press

NMR Self Learning Text, G. L. Patrick

Lundanes, E., Reubaset, L. and Greibrokk, T. "Chromatography: basic principles, sample preparations and related methods" Wiley VCH

Miller, J. N., and Miller, J. C., “Statistics and Chemometrics for Analytical Chemistry”, 5th Edition, Pearson Education Limited 2005

(**N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)

Attendance and Engagement Requirements

In line with the Student Attendance and Engagement Procedure: Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time. For the purposes of this module, academic engagement equates to the following: Attendance of all on-campus sessions (classes and laboratories), and submission of assessments.

Equality and Diversity
The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code. This module is suitable for any student with appropriate chemistry background, however it should be noted that in order for you to complete this module the laboratory element of coursework will require to be undertaken, disability support can be provided where necessary, consequently, if disability support is needed to complete this part of the module, then the University's Health and Safety Officer should be consulted to make sure that safety in the laboratory is not compromised.
(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)

Supplemental Information

Divisional Programme Board	Physical Sciences
Assessment Results (Pass/Fail)	Yes ☐No ☒
School Assessment Board	Physical Sciences
Moderator	Mostafa Rateb
External Examiner	M. Paterson
Accreditation Details	This module is accredited by the Royal Society of Chemistry (RSC) as part of the BSc (Hons) Chemistry programme and the Chartered Society of Forensic Sciences (CSFS) as part of the BSc (Hons) Forensic Science programme.
Changes/Version Number	2.20 Module Delivery: From Hybrid-C to Face-to-Face Assessment: Change from "unseen open book" to "unseen class test" Coordinator: Updated to Yalinu Poya

	Accreditation Details: Updated to include CSFS accreditation Indicative Resources: Updated

Assessment: (also refer to Assessment Outcomes Grids below)
Assessment 1:Unseen class test (50 %)
Assessment 2: Coursework: Laboratory work/reports and written tutorial work (50%)
(N.B. (i) **Assessment Outcomes Grids** for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed. (ii) An **indicative schedule** listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.)

Assessment Outcome Grids (See Guidance Note)

Component 1					
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Unseen class test	✓	✓	✓	50	2

Component 2					
Assessment Type (Footnote B.)	**Learning Outcome (1)**	**Learning Outcome (2)**	**Learning Outcome (3)**	**Weighting (%) of Assessment Element**	**Timetabled Contact Hours**
Workbook/ Laboratory notebook/diary/ training log/learning log	✓	✓	✓	50	36
Combined Total for All Components				**100%**	**38 hours**