Module Descriptor

Title	Advanced Analytical Techniques		
Session	2025/26	**Status**	Published
Code	CHEM10002	**SCQF Level**	10
Credit Points	20	**ECTS (European Credit Transfer Scheme)**	10
School	**Computing, Engineering and Physical Sciences**		
Module Co-ordinator	Dr Mohammed Yaseen		

Summary of Module

This module examines a range of modern analytical chromatographic and spectroscopic techniques. Discussion topics will include the quality control in analytical measurement; methods of analysis & validation, Two dimensional NMR Structure elucidation, Raman spectroscopy, Scanning and Transmission electron microscopy, AFM, chromatographic methods and strategy in analytical investigation.

Quality Control in Analytical Measurement

Laboratory design and method; reference methods; reference materials; traceability; accreditation schemes (NAMAS, VAM etc).

Atomic Spectroscopic Techniques

Review of atomic absorption spectrometry atomization processes in flame and electrothermal devices (ie the graphite furnace); interferences (chemical and spectral); control of chemical interferences by chemical modification and platform atomization; control of spectral interferences; application areas.

Atomic emission spectrometry - influence of temperature; excitation processes; local thermal equilibrium (LTE) conditions and non-LTE conditions, spectral interferences. Principles of inductively coupled plasma mass spectrometry: instrument design and components, sample introduction methods, ion transport and mass spectral interferences, use of alternative sampling techniques and reaction cell technologies. Examples of applications including process, environmental and forensic analysis.

Chromatographic Methods

Examples and applications of combined spectroscopy-chromatographic techniques – to include GC-MS, and LC-MS. Ionisation techniques. Also IRMS. Spectral manipulation and spectral libraries. Applications to structural elucidation and determination.

Strategy in Analytical Investigation

Problems of trace analysis. Sampling extraction techniques. A general review of the use and range of techniques for problem-solving in analytical chemistry. The use of a combination of techniques in analytical investigations including approach to chemical speciation of organics and inorganics

Graduate Attribute relevant to module as shown;

Analytical, problem solver, critical, communication, motivation, thoughtful

Module Delivery Method	On-Campus[1] ☒	Hybrid[2] ☐	Online[3] ☐	Work -Based Learning[4] ☐
Campuses for Module Delivery	☐ Ayr ☐ Dumfries	☐ Lanarkshire ☐ London ☒ Paisley	☐ Online / Distance Learning ☐ Other (specify)	

Terms for Module Delivery	Term 1	☒	Term 2	☐	Term 3	☐
Long-thin Delivery over more than one Term	Term 1 – Term 2	☐	Term 2 – Term 3	☐	Term 3 – Term 1	☐

Learning Outcomes	
L1	Demonstrate a critical understanding of modern instrumentation and the strategies for analysis of analytes in complex matrices
L2	Demonstrate skills required to tackle complex analytical problems such as those encountered in e.g. forensic and environmental analysis
L3	Show a detailed knowledge of the complementary nature of various techniques and demonstrate the ability to identify the most suitable technique for a particular analysis
L4	Acquire and develop analytical and associated data handling and processing skills in a series of laboratory instrumental chemical analytical experiments
L5	

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 10 Gaining knowledge and critical understanding of the analytical techniques which may be employed in the chemical analysis of complex multi-component samples eg in process streams and final products in fine chemical industries, forensic materials etc.
Practice: Applied Knowledge and Understanding	SCQF 10

[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

	Apply knowledge of these techniques in the analysis of complex samples taking into account matrix variability.
Generic Cognitive skills	**SCQF 10** Undertaking critical analysis of the available methodologies to devise appropriate analytical protocols for sample preparation and analysis.Be able to interpret data information from the examination of instrumental data using current professional approaches.
Communication, ICT and Numeracy Skills	**SCQF 10** Use the wide range of skills expected of a professional scientist to present information in written and verbal reports. Using appropriate numerical and analytical skills to interpret and evaluate complex spectro-analytical data generated from laboratory exercises and 'dry-lab' exercises.
Autonomy, Accountability and Working with Others	**SCQF 10** Working effectively with others in laboratory environment and identifying and addressing individual/personal learning needs in the subject area associated with the module. Exercising autonomy and initiative in practical and problem based learning.

Prerequisites	**Module Code** CHEM09002	**Module Title** Analytical Chemistry
	Other or equivalent	
Co-requisites	**Module Code**	**Module Title**

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.

Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below:	**Student Learning Hours** (Note: Learning hours include both contact hours and hours spent on other learning activities)
Lecture / Core Content Delivery	24
Tutorial / Synchronous Support Activity	12
Laboratory / Practical Demonstration / Workshop	12
Independent Study	152
Please select	
Please select	
TOTAL	200

Indicative Resources

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

Egerton R. (2016) Physical Principles of Electron Microscopy: An Introduction to be TEM, SEM, and AEM (Springer) ISBN 978-3-319-39877-8

Santinder, A (2010) Chiral separation methods for pharmaceutical and biotechnological products (Wiley) ISBN 9780470406915

Procházka, M; (2016) Surface-Enhanced Raman Spectroscopy (Springer) ISBN 978-3-319-23992-7

(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:

The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies.

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.](#)

Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice. Specialist assistive equipment, support provision and adjustment to assessment practice in accordance with the University's policies and regulations.

(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	Engineering Physical Sciences
Overall Assessment Results	☐ Pass / Fail ☒ Graded

Module Eligible for Compensation	☐ Yes ☒ No
	If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.
School Assessment Board	Physical Sciences
Moderator	Dr Callum McHugh
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.
Module Appears in CPD catalogue	☐ Yes ☒ No
Changes / Version Number	2.17

Assessment (also refer to Assessment Outcomes Grids below)
Assessment 1
Unseen class test (60%)
Assessment 2
Coursework laboratory reports (2x15%), Short test (10%)
Assessment 3
(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.)

Component 1							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Unseen class test	☒	☒	☒	☐	☐	60	2

Component 2							
Assessment Type	**LO1**	**LO2**	**LO3**	**LO4**	**LO5**	**Weighting of Assessment Element (%)**	**Timetabled Contact Hours**
Essay Laboratory/ notebook Class test (written)	☒	☐	☒	☒	☐	40	13

Component 3

Assessment Type	LO1	LO2	LO3	LO4	LO5	Weighting of Assessment Element (%)	Timetabled Contact Hours
	☐	☐	☐	☐	☐		
Combined total for all components						100%	15 hours

Change Control

What	When	Who