UNIVERSITY of BRADFORD

Module Descriptor

Module Details	
Module Title	Separation Science & Mass Spectrometry
Module Code	CFS7027-B
Academic Year	2023/4
Credits	20
School	School of Chemistry and Biosciences
FHEQ Level	FHEQ Level 7

Contact Hours	
Type	Hours
Tutorials	5
Practical Classes or Workshops	9
Directed Study	163.5
Laboratories	6
Online Lecture (Asynchronous)	16.5

Availability	
Occurrence	Location / Period
BDA	University of Bradford / Semester 2

Module Aims

This module will provide you with specialist knowledge in the principles of separation science and mass spectrometry. This covers: sample preparation, instrumental fundamentals and design, including case studies related to applications in specialist areas and recent advances.

The specialist knowledge is reinforced by the 'hands on' practical component and will include use of the analytical centre instruments, collecting and analysing data, troubleshooting and method development/enhancement. The practical sessions will also involve following written experimental protocols, working in a small group, and working to deadlines.

Outline Syllabus

Separation Science:

Module Introduction. Principles of separation science (chromatography, mobile and stationary phases, differences between HPLC/GC). Instrumental techniques split into two separate topics: GC & HPLC: GC - Injection (SS, HS, COC, PTV), columns (capillary/packed, stat. phases), mobile phase (He vs N2 vs H2), detection (FID, ECD, NPD, FPD) etc). HPLC - Apparatus overview, injection, stationary phase, mobile phase, detection. Sample preparation (solvent extraction, derivatisation methods, pre-concentration, difficult samples, contamination, pure/complex mixtures, degraded). Method development - how to affect separation, peak shape etc to split to GC & HPLC: GC - stationary/mobile phase consideration, compound volatility, temperature profiling, sample amounts, detection (selectivity and sensitivity). HPLC - mobile phase (composition, gradients, modifiers, pH), stationary phase (type, particle size, column dimensions, temperature etc all relating to resolution equation), detection (selectivity and sensitivity). Trouble shooting, peak shapes etc, improving chromatographic resolution. Other separation methods (ion chromatography, related areas, hyphenated techniques (GC-MS, HPLC-MS, GC-C-IRMS...), high throughput and other techniques (UPLC, fast GC, GCGC).

Mass Spectrometry:

Module introduction. Principles of mass spectrometry. Instrument fundamentals. Ionisation: electron ionisation (EI), chemical ionisation (CI), fast atom bombardment (FAB), electrospray (ESI), matrix assisted laser desorption ionisation (MALDI). Instrument fundamentals. Fragmentation and rearrangement (isotope rations, C, Cl, Br.., N rule, McLafferty, common fragments), including post-source decay. Interpretation of data (artefacts and limitations, adducts, contamination, data tools, theoretical rearrangements, example spectra). MS/MS Chromatography, hyphenated techniques, (GC-MS, LC-MS). Sample preparation: solvents, derivatisation (TMS, methylation), standards, quantification. Other separation.., MSMS, QTOF. Recent developments in mass spectrometry.

Learning Outcomes

Outcome Number	Description
01	Evaluate and apply knowledge and understanding of the theories of instrumental analysis, including sample preparation and analysis.
02	Describe recent advances in the subject area.
03	Manipulate samples for selection, preparation and analysis.
04	Analyse, interpret and critically review experimental data generated with the selected techniques.
05	Identify poor quality analytical results and suggest/apply remedial action.
06	Apply skills in problem-solving and written communication.

Learning, Teaching and Assessment Strategy

This module will be presented as a series of lectures and workshops/laboratory sessions. The lectures will describe sample preparation and instrumental techniques covering the fundamentals to recent developments. The lectures will include case studies enabling you to think across your own discipline and explore other fields. The lectures will be supported by practical workshops and 'hands-on' sessions with relevant samples. Formative progress tests will be used to revise previous content with feedback and questions from students.
The assessment will be used to assess your learning and to enable you to demonstrate your problem-solving and interpretation skills.

Mode of Assessment			
Type	Method	Description	Weighting
Summative	Laboratory Report	Student will submit a laboratory report detailing analysis of sample(s) and interpretation of experimental data.	50%
Summative	Examination - Closed Book	Formal closed-book exam (2 hours) covering the taught syllabus. Short questions followed by longer essay type questions.	50%

Reading List
To access the reading list for this module, please visit https://bradford.rl.talis.com/index.html

Please note:
This module descriptor has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but minor changes may occur given the interval between publishing and commencement of teaching. Upon commencement of the module, students will receive a handbook with further detail about the module and any changes will be discussed and/or communicated at this point.

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