UNIVERSITY of BRADFORD

# Module Descriptor

## Separation Science and Mass Spectrometry

| | |
|---|---|
| Module Code: | CFS7027-B |
| Academic Year: | 2018-19 |
| Credit Rating: | 20 |
| School: | School of Chemistry and Biosciences |
| Subject Area: | Chemistry and Forensic Science (ceases 2016) |
| FHEQ Level: | FHEQ Level 7 (Masters) |

Pre-requisites:

Co-requisites:

### Contact Hours

| Type | Hours |
|---|---|
| Lectures | 12 |
| Seminar | 3 |
| Practical classes and | 18 |
| Directed Study | 167 |

### Availability Periods

| Occurrence | Location/Period |
|---|---|
| BDA | University of Bradford / Semester 2 (Feb - May) |

### 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, CI, 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. Ohter separation.., MSMS, QTOF. Recent developments in mass spectrometry.

## Module Learning Outcomes

*On successful completion of this module, students will be able to...*

1. Evaluate and apply knowledge and understanding of the theories of instrumental analysis, including sample preparation and analysis.
2. Describe recent advances in the subject area.
3. Manipulate samples for selection, preparation and analysis.
4. Analyse, interpret and critically review experimental data generated with the selected techniques.
5. Identify poor quality analytical results and suggest/apply remedial action.
6. 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 | Length | Weighting | Final Assess' |
|---|---|---|---|---|---|
| Summative | Laboratory Report | Student will submit a laboratory report detailing analysis of sample(s) and interpretation of experimental data. | -2000 words | 50% | No |
| Summative | Examination - closed book | A formal exam covering the taught syllabus. Short questions followed by longer essay type questions. | 2 hours | 50% | Yes |

## Legacy Code (if applicable)

## Reading List

To view Reading List, please go to **rebus:list**.