Module Specification

Advanced Analytical Science

Version: 2023-24, v3.0, 21 Jul 2023

Contents

Part 1: Information

Module title: Advanced Analytical Science

Module code: USSKBQ-30-3

Level: Level 6

For implementation from: 2023-24

UWE credit rating: 30

ECTS credit rating: 15

Faculty: Faculty of Health & Applied Sciences

Department: HAS Dept of Applied Sciences

Partner institutions: None

Field: Applied Sciences

Module type: Module

Pre-requisites: Instrumental Analytical Science 2023-24

Excluded combinations: None

Co-requisites: None

Continuing professional development: No

Professional, statutory or regulatory body requirements: None

Part 2: Description

Overview: Pre-requisites: Students must have taken Instrumental Analytical Science USSKB9-15-2

Features: Not applicable

Educational aims: See Learning Outcomes

Outline syllabus: Gas chromatography
Instrumental requirements for capillary GC. Sample injection using split, splitless

and on-column methods-a critique of different approaches. "Dead-volume" requirements of the system. Backflushing column switching and 2-dimensional methods. Theory of chromatography. Retention factor, separation factor, phase ratio. Column efficiency and resolution. The Van Deemter equation.

High Performance Liquid Chromatography
A detailed consideration of instrumentation for HPLC. Comparison with technique and applications of GC, classical column liquid chromatography and TLC. Separation mechanisms especially bonded phase chromatography with octadecylsilyl columns. Gradient elution in HPLC; theory and instrumental requirements. Ion chromatography and ion-pair chromatography. Optimisation of HPLC mobile phase. Current research in the analysis of drugs.

Coupled Techniques
Coupled chromatographic and spectroscopic techniques (especially GC-MS and HPLC-MS). The electrospray and atmospheric chemical ionisation interfaces in LC-MS. Collision-induced ion decomposition.

Electrochemical Methods
New electrode materials eg chemically modified carbon electrodes, surface modification with immobilised enzymes. Amperometric sensors and biosensors. Applications in pharmaceutical, environmental and biomedical analysis. Effect of capacity current on sensitivity, normal and differential pulse polarography. Applications. Stripping voltammetry. Preconcentration of metals by amalgam formation and of organics by adsorption at electrode surfaces. Applications.

Spectroscopy
Aspects of atomic spectroscopy: scope and application of absorption, emission and mass spectrometry to Forensic and Pharmaceutical Science for the investigation of various evidence types e.g. glass, paint, soils and gunshot residues. The wider applications of these techniques in chemical analysis laboratories will also be considered.
NMR spectroscopy; principles of the technique and applications.

High Energy Techniques
X-Ray fluorescence and X-Ray Diffraction. Theoretical background. Generation of X-rays. Preparation of samples. Electron spectroscopy for chemical analysis (ESCA). Scanning electron microscopy, EDAX methods.

Part 3: Teaching and learning methods

Teaching and learning methods: Scheduled Learning
Scheduled learning will include interactive lectures, problem-solving classes (for example in the interpretation of mass spectra and infra-red spectra) and practical classes. Practical classes will aim to emphasise the fundamental principles of various analytical techniques that are important in forensic science, and the effect of various instrumental parameters on the results.
Lectures will be supported by additional reading material posted on Blackboard and the use of handouts. Case studies will be used to introduce some procedures .

Independent Learning
Students will be expected to spend a significant amount of time in private study consulting relevant text books, journal articles and recommended web sites. The possibilities and limitations of internet site use will be emphasised. Independent study will make up the total number of hours of study for this module to the notional 300 hours.

Module Learning outcomes: On successful completion of this module students will achieve the following learning outcomes.

MO1 Appreciate both the theoretical principles and applications of advanced analytical techniques.

MO2 Be familiar with the operation and uses of advanced equipment such as gas-chromatography/mass spectrometry.

MO3 Understand the use of sophisticated databases and library searching as performed in mass spectrometry.

MO4 Be prepared for a career if desired in analytical science in industry or in a research environment.

MO5 Have some appreciation of novel research methods (such as in sensors) in the analytical field and their potential impact in forensic science and related areas.

MO6 Compare and contrast different analytical approaches for the solution of a given analytical problem.

Hours to be allocated: 300

Contact hours:

Independent study/self-guided study = 234 hours

Face-to-face learning = 66 hours

Total = 300

Reading list: The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://uwe.rl.talis.com/modules/usskbq-30-3.html

Part 4: Assessment

Assessment strategy: Assessment 1:
Examination: 3 hours.
This online seen examination carried out over a 24 hour period will examine a broad area of the module material. The examination will consist of a mixture of calculation questions, essay-type questions and short answer questions. The paper will be formulated such that it is not possible for students to avoid completely a particular subject area of the module material. The duration of the examination will be 3 hours Preparation for the exam will be encouraged by the provision of workshops and problem-solving classes, supported by material from Blackboard.

Assessment 2:
This assessment will involve the submission of two detailed practical reports chosen

from the suite of practicals that students will perform. Marks will be allocated for researching the background of the practical, for the experimental results obtained, for the discussion of these results, and for answering questions at the end of the report. Thus, a wide variety of different skills will be assessed.

All work is marked in line with the Department's Generic Assessment Criteria and will conform with university policies for the setting, collection, marking and return of student work. Assessments are described in the Module handbook that is supplied at the start of module and detailed marking schemes for elements of coursework, where appropriate, are provided in advance.

Assessment tasks:

Examination (Online) (First Sit)
Description: Online examination (24 hours)
Weighting: 60 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Report (First Sit)
Description: Practical report
Weighting: 40 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Examination (Online) (Resit)
Description: Online Examination (24 hours)
Weighting: 60 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Report (Resit)
Description: Practical Report
Weighting: 40 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO2, MO3, MO4, MO5, MO6

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Forensic Science [Sep][FT][Frenchay][3yrs] BSc (Hons) 2021-22

Forensic Science [Sep][FT][Frenchay][4yrs] MSci 2021-22

Forensic Science [Sep][SW][Frenchay][4yrs] BSc (Hons) 2020-21

Forensic Science [Sep][SW][Frenchay][5yrs] MSci 2020-21

Forensic Science {Foundation} [Sep][FT][Frenchay][5yrs] MSci 2020-21

Forensic Science {Foundation} [Sep][FT][Frenchay][4yrs] BSc (Hons) 2020-21

Forensic Science {Foundation} [Sep][SW][Frenchay][5yrs] BSc (Hons) 2019-20

Forensic Science {Foundation} [Sep][SW][Frenchay][6yrs] MSci 2019-20