Module Specification

Instrumental Analytical Science

Version: 2023-24, v3.0, 16 Jun 2023

Contents

Part 1: Information

Module title: Instrumental Analytical Science

Module code: USSKB9-15-2

Level: Level 5

For implementation from: 2023-24

UWE credit rating: 15

ECTS credit rating: 7.5

Faculty: Faculty of Health & Applied Sciences

Department: HAS Dept of Applied Sciences

Partner institutions: None

Field: Applied Sciences

Module type: Module

Pre-requisites: Chemistry for Forensic Science and Data Analysis 2023-24, Chemistry in Context 2023-24, Scientific Skills 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 Scientific Skills USSJRW-30-1 AND Chemistry in Context USSJRT-30-1 OR Chemistry for Forensic Science and Data Analysis USSKC5-30-1.

Features: Not applicable

Educational aims: See Learning Outcomes

Outline syllabus: Introduction:

Terms and definitions. Macro and microanalytical methods. Trace and ultra-trace analytical procedures. Classical and Instrumental procedures. Factors involved in the choice of analytical methods. Precision and accuracy of analytical methods. Internal standards, standard addition, matrix matched standards. Use of National Institute of Standards (NIST) reference materials. Sample pre-treatment procedures.

Separation Methods:

Instrumentation for gas and high performance liquid chromatography. Sample injection. Modes of separation-types of column, detectors. Applications in forensic and pharmaceutical science. Pyrolysis GC and its application to the identification of polymers. (e.g. car paints and plastics in forensic science) and microbiological samples. Headspace analysis. Comparison of GC and LC methodology-advantages and disadvantages of the techniques.

Mass spectrometry:

Construction of a mass spectrometer. Sample introduction; linked GC and HPLC-MS. Sample ionisation and ion separation. Drug screening using Matrix Assisted Laser Desorption Ionisation (MALDI). Identification of drugs on banknotes using two dimensional MS. Other applications in forensic science. Library Searches using National Institute of Standards and other data bases of mass spectra.

Ion Selective Electrodes:

Theoretical considerations. Selectivity Coefficients. Direct potentiometry and potentiometric titrations. Applications.

Polarography and voltammetry:

Basic principles of polarography. Hydrodynamic voltammetry, amperometry in stirred solution. Oxygen electrode and glucose measurement. Linear sweep and cyclic

voltammetry. Use in studying redox processes. Applications.

Spectroscopy:

Principles and applications of UV and IR spectroscopy. Sample preparation methods. Applications in forensic and pharmaceutical Science.

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 e.g. rapid identification of contaminated banknotes using mass spectrometry.

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 150 hours.

Contact Hours:

The total contact hours in this module are 33 distributed between lectures, workshops/seminars and practical sessions.

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

MO1 Perform an instrumental analysis of some complexity in the laboratory using equipment with computer control and sophisticated data handling.

MO2 Understand the role of Analytical Science in the Forensic Science laboratory.

MO3 Work safely in a laboratory while using a variety of techniques.

MO4 Gain an appreciation of the application of instrumental analysis in forensic science

MO5 Understand the factors involved in the choice of an analytical method to solve a given problem.

MO6 Discuss the relevant theory and principles of instrumental analysis.

MO7 Discuss data processing in the light of a deeper understanding of theoretical principles

Hours to be allocated: 150

Contact hours:

Independent study/self-guided study = 117 hours

Face-to-face learning = 33 hours

Total = 150

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/usskb9-15-2.html

Part 4: Assessment

Assessment strategy: Assessment 1 is a practical report. This assessment will involve the submission of a detailed practical report chosen from the suite of practical classes 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. Examples of practical work include building and testing a Visible spectrometer from the basic components; investigation of the parameters in gas chromatography that influence the optimum separation of fire accelerants.

Opportunities exist for formative assessment in practical work that is not given in for marking.

Assessment 2 is an Online Examination:
This online exam, 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.

Preparation for the exam will be encouraged by the provision of workshops and problem-solving classes, supported by material from Blackboard.

Assessment tasks:

Report (First Sit)
Description: Practical report
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO3, MO4

Examination (Online) (First Sit)
Description: Online examination (24 hours)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO4, MO5, MO6, MO7

Report (Resit)
Description: Practical report
Weighting: 50 %
Final assessment: No
Group work: No
Learning outcomes tested: MO1, MO3, MO4

Examination (Online) (Resit)
Description: Online examination (24 hours)
Weighting: 50 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO2, MO4, MO5, MO6, MO7

Part 5: Contributes towards

This module contributes towards the following programmes of study:

Forensic Science [Frenchay] MSci 2022-23

Forensic Science [Frenchay] BSc (Hons) 2022-23

Forensic Science {Foundation} [Sep][SW][Frenchay][5yrs] BSc (Hons) 2021-22

Forensic Science {Foundation} [Sep][FT][Frenchay][5yrs] MSci 2021-22

Forensic Science {Foundation} [Sep][SW][Frenchay][6yrs] MSci 2021-22

Forensic Science {Foundation} [Sep][FT][Frenchay][4yrs] BSc (Hons) 2021-22