

## MODULE DESCRIPTOR

### Module Title

Analytical Science

Reference	PL2601	Version	1
Created	April 2023	SCQF Level	SCQF 8
Approved	June 2023	SCQF Points	30
Amended	August 2021	ECTS Points	15

### Aims of Module

To provide students with the principles and applications of a range of chromatographic and spectroscopic techniques. To develop the understanding of error in analytical science and the appropriate methods of statistical methods for the assessment of analytical data. To provide students with knowledge and understanding of the principles and applications of a given range of techniques relevant to Analytical and Forensic Science such as X-Ray, Atomic Spectroscopy Electrochemistry, ICP and Quality Assurance.

### Learning Outcomes for Module

On completion of this module, students are expected to be able to:

- 1 Distinguish different types of error in analytical science and how they interact, knowing how to form reliable hypotheses, carry out significance testing and perform simple data analysis tasks.
- 2 Report the theoretical principles and applications of molecular spectroscopy and a range of chromatographic techniques.
- 3 Compare the theoretical principles and applications of a range of simple and advanced calibration techniques.
- 4 Compute a range of electrochemical, X-ray and atomic spectroscopic techniques.
- 5 Report the advantages of Quality Assurance and Quality Control implementation as well as laboratory accreditation schemes in the analytical and forensic laboratory.

### Indicative Module Content

Calibration methods investigation such as: normal, standard additions, internal standards. Statistics for analytical science: Understanding errors, statistical tests, statistical significance testing. Analysis of variance. Investigate different a range of analytical techniques such as: Chromatographic separations: gas, high performance liquid and thin layer chromatography, capillary electrophoresis. Introduction to analytical spectroscopy: absorption and emission of radiation by molecules. Beer-Lambert Law. Instrumentation, techniques, applications of ultra-violet/visible and infrared spectrophotometry. Introduction to mass spectrometry. Basic electrochemistry: standard potential, IUPAC convention of cell representation, determination of cell potential, galvanic and electrolytic cells, liquid junction potentials. Potentiometry: reference and ion selective electrodes, direct potentiometry, titrations. Coulometry & conductivity: cell construction, Faraday's Laws, electrogravimetry, titrations. Voltammetry: polarography, LSV, DPV X-rays: X-ray production, wavelength and energy dispersive X-ray fluorescence spectrometry, Bragg's law. Quality: the role and practice of QA/QC including QA manual, standards, control charts, auditing, laboratory accreditation, reference materials and method of validation. Basic instrumentation, techniques and applications of flame atomic absorption & emission spectroscopy.

### Module Delivery

This is a lecture based module supplemented by tutorials, on-line support material and guided reading.

### Indicative Student Workload

	Full Time	Part Time
Contact Hours	72	N/A
Non-Contact Hours	228	N/A
Placement/Work-Based Learning Experience [Notional] Hours	N/A	N/A
TOTAL	300	N/A
<i>Actual Placement hours for professional, statutory or regulatory body</i>		

### ASSESSMENT PLAN

If a major/minor model is used and box is ticked, % weightings below are indicative only.

#### Component 1

Type:	Examination	Weighting:	100%	Outcomes Assessed:	1, 2, 3, 4, 5
Description:	Closed book written exam.				

**MODULE PERFORMANCE DESCRIPTOR****Explanatory Text**

Component 1 (Written Exam) comprises 100%. A minimum of a Grade D is required to pass the module.

Module Grade	Minimum Requirements to achieve Module Grade:
<b>A</b>	A
<b>B</b>	B
<b>C</b>	C
<b>D</b>	D
<b>E</b>	E
<b>F</b>	F
<b>NS</b>	Non-submission of work by published deadline or non-attendance for examination

**Module Requirements**

Prerequisites for Module	Successful completion of Stage 1 Forensic and Analytical Science or equivalent.
Corequisites for module	None.
Precluded Modules	None.

**INDICATIVE BIBLIOGRAPHY**

- 1 SKOOG, D.A., HOLLER, F.J. AND CROUCH, S.R. *Principles of Instrumental Analysis* . Current Edition. Thomson Brooks/Cole.
- 2 PRICHARD, F.E. *Quality Assurance in Analytical Chemistry* . Current Edition. Chemistry Laboratory. Wiley.
- 3 MONK, P.M. *Fundamentals of Electroanalytical Chemistry* . Current Edition. Wiley
- 4 CURRELL, G. AND DOWMAN, A. *Essential Mathematics and Statistics for Science* . Current Edition. Wiley-Blackwell. Chichester, United Kingdom.