University of the
West of England

MODULE SPECIFICATION

Code: USSJRW-30-1 **Title:** Scientific Skills **Version:** 1

Level: 1 **UWE credit rating:** 30 **ECTS credit rating:** 15

Module type: Standard

Owning Faculty: Health and Life Sciences **Field:** Applied Sciences

Faculty Committee approval: Quality and Standards Committee **Date:** March 2011

Approved for Delivery by: N/A

Valid from: September 2011 **Discontinued from:**

Pre-requisites:
None

Co-requisites:
None

Entry Requirements:
None

Excluded Combinations:
None

Learning Outcomes:

The student will be able to:

- address scientific problems using appropriate mathematical and statistical skills; assess their individual capabilities in analysis and presenting experimental data and recognise the degree of experimental uncertainty in experimental measures
- analyse forensic and other data by formulating hypotheses and making decisions based on appropriate statistical tests;
- for simple scenarios and evidence types evaluate the strength of evidence using probabilities and Bayesian statistics;
- perform some simple statistical modelling by applying basic statistical distributions to real life problems;
- use electronic resources that will also support their problem solving skills throughout their undergraduate course;
- describe the functions of the components of basic analytical instruments and operate analytical instruments at a basic level,
- recognise and describe a range of routine analytical techniques available for the chemical analysis of substances of relevance in forensic science
- prepare and analyse simple biological or chemical samples using the above techniques appropriately;
- record experimental data in an appropriate manner, use it for the calculation of concentrations and other parameters of simple biological or chemical test samples and in the calibration of instruments;
- have gained the appropriate skills integral to the Graduate Development Programme;.

Syllabus Outline:

Data Collection
Practical methods in analytical science, including:
- General aspects of analysis
- Spectroscopy: instrumentation and applications of UV-vis absorption, infrared and NMR spectroscopy and atomic spectroscopy
- Chromatography: thin layer chromatography, gas chromatography and high-performance liquid-chromatography
- Electrophoresis and electrochemical methods of analysis

Data Analysis
- Scientific equations and formulae
- Linear relationships and regression
- Exponential and logarithmic functions. Equations of growth and decay
- Use of EXCEL to display and analyse scientific information

Data Assessment
- Descriptive statistics. Confidence intervals.
- Hypothoses testing t-test, F-test, Chi-squared test contingency tests
- Probability and introduction to Bayesian statistics
- Binomial, normal and Poisson distributions

Portfolio of activities contributing to the Graduate Development Programme

Teaching and Learning Methods:

The learning in the module during the first semester is carefully structured in units from the core text, which has itself evolved out of the learning materials developed specifically for this module. These units include explicit performance attainment targets identified by indicative questions and self-assessment tests. The resources also include direct tutorial material, and references to published material, software, internet and intranet resources. Where possible, and appropriate, the mathematical and statistical topics are presented and tested in the context of scientific problems. Specific use is made of computer workshop exercises to provide the broad context of scientific inquiry.

The learning processes of the students are based on:
 A clear knowledge of expected performance through indicative questions associated with the tutorial material.
 Selection of students into one of two study streams: standard and advanced.
 Weekly lectures/tutorials which establish the core direction of the module (syllabus content) and provide navigation for the students through the learning resource material.
 The testing of progress through self-assessment questions linked to portfolio assessment.
 Extensive tutorial support via Blackboard, including video learning.
 'Drop-in' and individual support to address specific problems.

All students sit an initial diagnostic test that concentrates mainly on Entry Level Skills. The itemised results of this test will be fed back to the students so that they can identify any deficiencies in this area. Each student will be expected to work through tutorial material and self-assessment questions appropriate to any Entry Level deficiencies.

Support for student learning in all topic areas will be given through weekly lectures/tutorials, which will be integrated with the self-assessment tests to ensure focussed help can be given to those students who need help in the particular areas. Every other week, the students will develop IT and data analysis skills through a 1 hour computer-based workshop.

The Portfolio assessments will include the requirement to attempt on-line self-assessment tests, together with specific IT and paper-based assignments.

The analytical science will be taught through a combination of lectures, which will include short audio/visual presentations,tutorials, which will require preparation and follow-up work to be done by the student and practicals where students will get valuable hands on experience of analytical methods

Graduate Development programme will be addressed through small group tutorials with the students' individual GDP tutor.

Reading Strategy:

All students will be encouraged to make full use of the print and electronic resources available to them through membership of the University. These include a range of electronic journals and a wide variety of resources available through web sites and information gateways. The University Library's web pages provide access to subject relevant resources and services, and to the library catalogue. Many resources can be accessed remotely. Students will be presented with opportunities within the curriculum to develop their information retrieval and evaluation skills in order to identify such resources effectively.

Any **essential reading** will be indicated clearly, along with the method for accessing it, e.g. students may

be expected to purchase a set text, be given or sold a print study pack or be referred to texts that are available electronically, etc. This guidance will be available either in the module handbook, via the module information on Blackboard or through any other vehicle deemed appropriate by the module/programme leaders.

If **further reading** is expected, this will be indicated clearly. If specific texts are listed, a clear indication will be given regarding how to access them and, if appropriate, students will be given guidance on how to identify relevant sources for themselves, e.g. through use of bibliographical databases.

Indicative Reading List:

Currell G and Dowman A A, Mathematics and Statistics for Science, (Second edition) Wiley-Blackwell, 2009

Crow J., Bradshaw T. & Monk P., 2006, Chemistry for the Biosciences, OUP

Higson S.P.J., 2003, Analytical Chemistry, OUP

Potter G.W.H., 1994, Analysis of Biological Molecules, Chapman & Hall

Reed, R et al., 1998, Practical Skills in Biomolecular Sciences, Addison Wesley Longman

Skoog D.A., Holler F.J & Nieman T.A., Principles of Instrumental Analysis, 1998, Harcourt Brace

Assessment:

Weighting between components A and B (standard modules only) A: 40% B: 60%

FIRST ATTEMPT

First Assessment Opportunity

Component A *(controlled)*		**Element Wt (Ratio)**
Description of each element		*(within Component)*
EX1	Examination (1.5 hour) - examining the material covered in the maths and stats tutorials and computer workshops (Assessment Period 1)	1
EX2	Examination (1.5 hour) - examining the material covered in the analytical science lectures, practicals and tutorials (Assessment Period 2)	1
	Final Assessment	

Component B		**Element Wt (Ratio)**
Description of each element		*(within Component)*
CW1	Maths and stats problem solving exercise	1
CW2	Laboratory work sheets and data analysis	1

Second Assessment Opportunity (further attendance at taught classes is not required)

Component A *(controlled)*			**Element Wt (Ratio)**
Description of each element			*(within Component)*
EX3	Examination (3 hours)	**Final Assessment**	1

Component B		**Element Wt (Ratio)**
Description of each element		*(within Component)*
CW1	Maths and stats problem solving exercise	1
CW2	Exercise in Typical Analytical Calculation and Result Interpretation	1

SECOND (OR SUBSEQUENT) ATTEMPT Attendance at taught classes is not required.

Specification confirmed by ……Date ……
(Associate Dean/Programme Director)