MODULE SPECIFICATION PROFORMA

Module Code:	LND310

Module Title:	Introduction to Experimental Design and Mathematical Analysis

Level:	3	**Credit Value:**	20

Cost Centre(s):	GAHT, GAFS	JACS3 **code**:	G120

Faculty:	Faculty of Arts, Science and Technology	**Module Leader:**	Dr Ian Ratcliffe

Scheduled learning and teaching hours	50 hrs
Guided independent study	150 hrs
Placement	0 hrs
Module duration (total hours)	200 hrs

Programme(s) in which to be offered (not including exit awards)	Core	Option
BSc (Hons) Chemistry (with Foundation Year)	✓	☐
BSc (Hons) Forensic Science (with Foundation Year)	✓	☐
FdSc Animal Studies (with Foundation Year)	✓	☐
BSc (Hons) Equine Science and Welfare Management (with Foundation Year)	✓	☐
BSc (Hons) Animal Science (with Foundation Year)	✓	☐

Pre-requisites
None

Office use only
Initial approval: 12/12/2018 Version no:1
With effect from: 01/09/2019
Date and details of revision: Version no:

MODULE SPECIFICATION

Module Aims

The aim of this module is to equip students with essential skills that will enable them to:
(i) design and carry out experiments or surveys in the laboratory and field, and
(ii) collect, process and interpret experimental data collected.

To achieve these aims the module will explore the principles of experimental design and teach students to critically review experiments and data.

Students will also be introduced to ways in which the scientific community communicate numerical data, and key mathematical concepts that underpin it.

Intended Learning Outcomes

Key skills for employability

KS1	Written, oral and media communication skills
KS2	Leadership, team working and networking skills
KS3	Opportunity, creativity and problem solving skills
KS4	Information technology skills and digital literacy
KS5	Information management skills
KS6	Research skills
KS7	Intercultural and sustainability skills
KS8	Career management skills
KS9	Learning to learn (managing personal and professional development, self-management)
KS10	Numeracy

At the end of this module, students will be able to		Key Skills	
1	Design and successfully execute a simple laboratory or field experiment, with due regard to safety and ethics.	KS3	KS6
		KS5	KS10
2	Use graphical and statistical techniques in interpretation of scientific data.	KS3	KS5
		KS4	KS10
3	Present experimental data orally to an audience with support of appropriate presentation software.	KS1	KS10
		KS4	
4	Solve number-based problems of relevance to the natural and physical sciences.	KS3	KS10

Transferable skills and other attributes

- Problem solving
- Mathematical applications
- Design, analysis, and synthesis
- ICT
- Presentation skills

Derogations
None

Assessment:
Indicative Assessment Tasks:
Assessment One: A presentation based on a short experiment designed and executed by the student. It will contain elements of data analysis and interpretation of evidence collected during the experiment. Assessment Two: Coursework: completion of a number of worksheets comprising mathematical problems aligned with natural and physical science topics.

Assessment number	Learning Outcomes to be met	Type of assessment	Weighting (%)	Duration (if exam)	Word count (or equivalent if appropriate)
1	1-3	Presentation	50	10 mins	n/a
2	4	Coursework	50	n/a	1,500 word equivalent

Learning and Teaching Strategies:
The experimental design component of the course will be delivered by means of lectures and workshops and incorporate laboratory sessions where students will first develop their experimental procedures and then carry them out. The mathematical analysis component will be delivered by lectures supported by tutorial sessions and directed study. Formative assessment involves tutorial questions and summative assessment is by coursework assignments and presentation.

Syllabus outline:
Use of theories and models to explain observations and cause and effect in science Experimental design Dependent and independent variables Accuracy and precision Sampling Replication Reproducibility Data analysis Producing and interpreting graphs Numbers, scientific notation and significant figures. Algebra and manipulation of algebraic expressions. Powers, indices, exponentials and logarithms. Some simple rules of differentiation. Integration: reversing differentiation. Averages Percentages Introduction to probability. Use of statistics in experimental analysis Use of ICT in data analysis

Indicative Bibliography:
Essential reading
Ruxton, G.D. & Colegrave, N. (2016) *Experimental Design for the Life Sciences*. Oxford: Oxford University Press Rowland, M. (2017) Bridging GCSE and A-level Maths Student Book. 2nd ed. London: Collins Neill, H & Johnson, T. (2013) *Mathematics: A Complete Introduction: The Easy Way to Learn Maths (Teach Yourself).* Hodder and Stoughton.

Other indicative reading

Lobban, C. and Schefter, M. (2017), *Writing Undergraduate Lab Reports*. Cambridge: University Printing House

Page, S., Berry, J. & Hampson, H. (2002) *Mathematics - A Second Start.* 2nd ed. Cambridge: Woodhead Publishing.

For Forensic Science students:

Thompson, R.B. & Fritchman Thompson, B. *Illustrated Guide to Home Forensic Science Experiments: All Lab, No Lecture (Diy Science).* San Francisco: Maker Media, Inc