Module Details

Module Code:	DATA S8002
Full Title:	Data Handling and Modelling APPROVED
Valid From::	Semester 1 - 2018/19 (September 2018)
Language of Instruction:	English
Duration:	1 Semester
Credits::	5
Module Owner::	Valerie McCarthy
Departments:	Unknown
Module Description:	This course provides an in depth analysis of data handling techniques, providing information on appropriate methods for sorting, storing and using data, particularly in the manipulation of large complex datasets. Students will become proficient in applying scientific data to appropriate statistical tests and how to import data to data-handling programs, manipulate and graph them. The emphasis of the course is on the use of these methods in processing research data and the interpretation of analysis results using appropriate software (e.g. Microsoft Excel, R Statistical Program). The modelling component of this module will include a combination of lectures, tutorials and interactive practical classes that will allow the student to become proficient in the practical use and application of environmental dynamic computer models. These skills are highly relevant in today's working environment.

Module Learning Outcome	
On successful completion of this module the learner will be able to:	
#	Module Learning Outcome Description
MLO1	Critically assess the importance of different types of data and assess the rationale for different methods of data sorting, storage, visualisation, presentation and analyses, including quantitative and qualitative approaches.
MLO2	Select and utilise appropriate IT software (with particular emphasis on Microsoft Excel and R) to organise, store, manipulate and analyse scientific data, format scientific figures and tables and present data.
MLO3	Evaluate the strengths and limitations of different types of catchment and lake models.

Pre-requisite learning
Module Recommendations
This is prior learning (or a practical skill) that is strongly recommended before enrolment in this module. You may enrol in this module if you have not acquired the recommended learning but you will have considerable difficulty in passing (i.e. achieving the learning outcomes of) the module. While the prior learning is expressed as named DkIT module(s) it also allows for learning (in another module or modules) which is equivalent to the learning specified in the named module(s).
No recommendations listed

Module Indicative Content

Collecting and interpreting data
Ecological relevance of data; natural variation and seasonality; analysis and interpretation of biological, chemical and physical data; handling large data sets including dealing with missing data: open source and other national data sets (e.g. meteorological data, flow data; census data)

Data storage and organisation
Defining data, data collection, ensuring reliability and validity of collected data, design of spreadsheets, spreadsheet structure, basic workbook operation, key functions of data entry and formatting in Microsoft Excel, data sorting, use of cell references, sorting and filtering data in Excel, VLOOKUP and macro functions in Excel, data integrity, recognising the importance of the use of master copies and working copies, entering and accessing information in a simple database, introduction to a range of database software, introduction to concepts in data ownership, retention, protection and sharing.

Data Visualisation
Grouping data, using Pivot Tables in Excel, use of formulas and functions in Excel, selection and construction of appropriate graphical summaries of data in Excel, curve fitting and plotting, use of graphics to support data exploration, creating and formatting tables in Excel, introduction to the range of additional graphical software packages.

Data Interpretation
Identifying appropriate statistical analyses, introduction to statistical software with a particular emphasis on using the R Statistical Program, selecting and extracting raw data in appropriate formats for interpretation of specific statistical analyses using a range of statistical software with a particular focus on 'R', dealing with outliers and incomplete or missing data.

Environmental models
Environmental models including conceptual models of ecosystem processes; principles of model building using both empirical and mechanistic modelling approaches; commonly used models in catchment and freshwater systems; introduction to air pollution dispersion models.

Practicals in environmental and ecosystem modelling
Hand-on modelling practicals using catchment and lake models e.g. GWLF in Vensim PLE, General Lake Model (GLM); simulations of lake water column changes using data collected with in-situ sensors and the open source GLM model. Watershed Ecosystem Tool (using a QGIS plug-in). Use of air dispersion model.

Module Assessment

Assessment Breakdown	%
Course Work	100.00%

Module Special Regulation

Assessments

Full Time On Campus

Course Work			
Assessment Type	Class Test	**% of Total Mark**	20
Marks Out Of	0	**Pass Mark**	0
Timing	End-of-Semester	**Learning Outcome**	3
Duration in minutes	1		
Assessment Description			
During the modelling component there will be a classroom based assessment and presentation using either a lake or catchment dynamic computer model.			
Assessment Type	Continuous Assessment	**% of Total Mark**	30
Marks Out Of	0	**Pass Mark**	0
Timing	Every Week	**Learning Outcome**	3
Duration in minutes	0		
Assessment Description			
The students will be required to complete a set of exercises related to environmetal modelling exercises.			
Assessment Type	Continuous Assessment	**% of Total Mark**	30
Marks Out Of	0	**Pass Mark**	0
Timing	Every Week	**Learning Outcome**	1,2
Duration in minutes	0		
Assessment Description			
The students will carry out a variety of practical exercises using suitable software relating to the sorting, storage, visualisation and analyses of complex datasets.			
Assessment Type	Presentation	**% of Total Mark**	20
Marks Out Of	0	**Pass Mark**	0
Timing	S1 Week 10	**Learning Outcome**	1,2
Duration in minutes	0		
Assessment Description			
Presentation on the methodology employed to collect, orgainise, manipulate and appropriately analyse and visually represent a dataset.			

No Project

No Practical

No Final Examination

Module Workload

Workload: Full Time On Campus

Workload Type	Contact Type	Workload Description	Frequency	Average Weekly Learner Workload	Hours
Lecturer-Supervised Learning (Contact)	Contact	Application and use of data handling techniques and software; introduction to environmental and ecosystem modelling.	Every Week	4.00	4
Independent Study	Non Contact	No Description	Every Week	3.00	3
Practical	Contact	Hands-on data analysis and modelling practicals.	Every Week	2.00	2
				Total Weekly Learner Workload	9.00
				Total Weekly Contact Hours	6.00

This module has no Part Time On Campus workload.

Workload Type	Contact Type	Workload Description	Frequency	Average Weekly Learner Workload	Hours
Lecturer-Supervised Learning (Contact)	Contact	Application and use of data handling techniques and software; introduction to environmental and ecosystem modelling.			

Module Resources

Recommended Book Resources

Calvin Dytham,. (2003), Choosing and Using Statistics; A Biologist's Guide, 2nd. Blackwell Publishing, UK, [ISBN: 13 978-1-4051].

Andy Field, Jeremy Miles, Zoe Field. (2012), Discovering Statistics Using R, 1st. SAGE Publication Ltd., London, [ISBN: 978-1-4462-00].

Supplementary Book Resources

Ellen F. Monk. (2013), Problem-solving cases in Microsoft Access and Excel, 10th. Cengage Learning, Melbourne, [ISBN: 1133629806].

Zuur, Alain, Ieno, Elena N., Meesters, Erik. A Beginner's Guide to R, Springer, [ISBN: 978-0-387-938].

Chunlong Zhang. (2007), Fundamentals of Environmental Sampling and Analysis, Wiley, [ISBN: 978-0-471-710].

This module does not have any article/paper resources

Other Resources

Web resource, US National Association for Geoscience Teachers.. Project EDDIE: Environmental Data-Driven Inquiry & Exploration, https://serc.carleton.edu/eddie/enviro_d ata/index.html

Web resource, Nielsen et al.. Watershed Ecosystems Tool, Aarhus University, http://projects.au.dk/wet/

Web resource, CSO database direct, CSO. CSO database, http://www.cso.ie/en/databases/index.htm l