MODULE TITLE	**Hydroinformatics Tools**	**CREDIT VALUE**	**15**
MODULE CODE	**ECMM124**	**MODULE CONVENER**	**Prof Guangtao Fu (Coordinator)**

DURATION: TERM	**1**	**2**	**3**
DURATION: WEEKS	**12 weeks**	**0**	**0**

Number of Students Taking Module (anticipated)	**0**

DESCRIPTION - summary of the module content

Hydroinformatics (or water informatics) can be seen as a synergetic use of modelling tools and Information and Communication Technologies (ICT) within a single methodological approach dealing with physical, social and economic aspects of sustainable water management. This interdisciplinary field, which transcends traditional boundaries of water/environmental science and engineering, informatics/computer science (including Artificial Intelligence, data mining and optimisation techniques) and environmental engineering, has applications in various areas of water management, including:
development and application of decision-support systems, simulation and optimization models to improve understanding and provide solutions to water engineering problems;
computational tools and techniques and their effective application to managing risk and uncertainties associated with water systems;
cross-disciplinary complex system approaches to water resource management;
understanding of water systems, including technical, socio-economic and environmental issues.

On this module, you will improve your understanding of water systems (supply, drainage, flood management, structural/non-structural measures, risk management, their impact on social structures/interactions, etc), ICT and operations research techniques (simulation, optimisation, data mining/ machine learning, Geographic Information Systems, Bayesian Belief Networks, etc.) with a view of integrating them into a systems analytic context to analyse and solve problems in water resource design, planning and management practice.

By the end of this module, you should have a strong grasp of a number of Hydroinformatics tools and be able to develop or use the developed tools to model and optimise various water resource systems, as well as present your findings making sure the content is accurate, teaches the audience something, but in a way that is new, updated and technologically advanced.

AIMS - intentions of the module

This module aims to give you an advanced understanding of a number of data analytics and artificial intelligence technologies and their application to water management problems. It also offers practical experience in using these technologies within the urban water management context.

This module covers the topics of data analytics, water systems modelling and optimisation methods, using a problem-based learning approach in the case studies, and examining them through tutorials and assignments. You will develop independent learning skills through a combination of guided learning, background reading, private study and computational analysis.

INTENDED LEARNING OUTCOMES (ILOs) (see assessment section below for how ILOs will be assessed)

On successful completion of this module, **you should be able to**:

Module Specific Skills and Knowledge:

1 understand the systems analysis approach to solving complex problems in water systems engineering;

2 comprehend a number of hydroinformatics methods and tools;

3 critically appraise the use of hydroinformatics methods and tools for a variety of water management problems.

Discipline Specific Skills and Knowledge:

4 be aware of physical, social and economic aspects of sustainable water management;
5 identify suitable methods and tools for water problem solving;

6 critically assess research results;

7 evidence some practical experience of using hydroinformatics methods and tools.

Personal and Key Transferable/ Employment Skills and Knowledge:

8 show enhanced independent learning;

9 demonstrate strong report and presentation skills;

10 reveal improved skills in using computer software.

SYLLABUS PLAN - summary of the structure and academic content of the module

Systems approach to formulate water management problems and develop engineered solutions;
Classical and intelligent optimisation strategies – linear programming and evolutionary computing;
Data analytics and artificial intelligence methods – linear regression, artificial neural networks, Bayesian belief networks;
Geographic Information System;
Cellular automata and grid-based methods;
System dynamics modelling;
Application examples in water management: complex water network design, asset management, flood management.

LEARNING AND TEACHING

LEARNING ACTIVITIES AND TEACHING METHODS (given in hours of study time)

Scheduled Learning & Teaching Activities	48.00	**Guided Independent Study**	102.00	**Placement / Study Abroad**	

DETAILS OF LEARNING ACTIVITIES AND TEACHING METHODS

Category	Hours of study time	Description
Scheduled learning activities	48	Lectures and tutorials
Guided independent study	102	Assessment preparation; private study

ASSESSMENT

FORMATIVE ASSESSMENT - for feedback and development purposes; does not count towards module grade

Form of Assessment	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Questions posed and answered in the class	Various durations	All	Verbal (in class)

SUMMATIVE ASSESSMENT (% of credit)

Coursework	30	Written Exams	70	Practical Exams	

DETAILS OF SUMMATIVE ASSESSMENT

Form of Assessment	% of Credit	Size of Assessment (e.g. duration/length)	ILOs Assessed	Feedback Method
Written exam	70	2 hours - January Exam	All	Written (on request)
Assignment on practical application of hydroinformatics tools	30	40 hours	All	Written

DETAILS OF RE-ASSESSMENT (where required by referral or deferral)

Original Form of Assessment	Form of Re-assessment	ILOs Re-assessed	Time Scale for Re-reassessment
All above	Written exam (100% - 2 hours)	All	Referral/deferral period

RE-ASSESSMENT NOTES

Reassessment will be by a single written exam only worth 100% of the module. For deferred candidates, the mark will be uncapped. For referred candidates, the mark will be capped at 50%.

RESOURCES

INDICATIVE LEARNING RESOURCES - The following list is offered as an indication of the type & level of information that you are expected to consult. Further guidance will be provided by the Module Convener

ELE: http://vle.exeter.ac.uk
Web based and Electronic Resources:
Loucks, D P van Beek, E; Stedinger, J R; Dijkman, J P M; Villars, M . Water Resources Systems Planning and Management: An Introduction to Methods, Models and Applications.
Online (available through ELE) - UNESCO 2005 - 9231039989
Other Resources:
Reading list for this module:

Type	Author	Title	Edition	Publisher	Year	ISBN	Search
Set	Pyle D	Data Preparation for Data Mining		Morgan Kaufmann	1999	978-1558605299	[Library]
Set	Ross T J	Fuzzy Logic with Engineering Applications	2nd	John Wiley	2004	978-0470860755	[Library]

CREDIT VALUE	15	ECTS VALUE	7.5
PRE-REQUISITE MODULES	None		
CO-REQUISITE MODULES	None		
NQF LEVEL (FHEQ)	7	AVAILABLE AS DISTANCE LEARNING	No
ORIGIN DATE	Tuesday 10 July 2018	LAST REVISION DATE	Thursday 05 October 2023
KEY WORDS SEARCH	Hydroinformatics; optimisation; modelling; machine learning; neural networks; genetic algorithms; cellular automata.		