

Module Title:	Data Science and Machine Learning 1
Language of Instruction:	English
Credits:	5
NFQ Level:	8
Module Delivered In	1 programme(s)
Teaching & Learning Strategies:	<p>There will be 4 hours for practical work and lectures. The practical sessions will provide students with the immediate opportunity to implement and reinforce the material presented in the lectures. Formal lectures, group-based activities, class discussion, case studies and laboratory sessions may be used in the presentation of this module. Typically, the lectures will be short (20-30 minute lectures) with the practical sessions providing students with the immediate opportunity to implement and reinforce the material presented in the short lectures. Lectures - communication of knowledge and ideas from the lecturer to the student. Students will be encouraged to engage in active discussion of material during lectures. Computer Laboratories – instruction classes will typically take place in computer lab. Problem Solving Exercises – students will work as individuals and as part of a team to develop solutions to data science problems using software engineering. Students will be working in a small team on an assigned case study or project. E-Learning – This module may be supported with on-line learning materials (Blackboard). Independent Learning – the emphasis on self-directed independent learning is intended to develop strong and autonomous work and learning practices.</p>
Module Aim:	<p>The aim of this module is to provide students with a comprehensive understanding of and ability to evaluate and utilise data science tools and techniques ethically and legally in organisations from a software engineering perspective.</p>
Learning Outcomes	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Understand, evaluate and communicate key principles, theories and techniques (particularly software engineering technologies) with respect to data, data technologies and data infrastructure in organisations from a software engineering perspective.
LO2	Understand, evaluate, communicate and apply key principles, theories and techniques (particularly software engineering technologies) with respect to data analytics and related introductory machine learning techniques in organisations from a software engineering perspective.
LO3	Understand, evaluate and communicate the key principles, theories and techniques behind ethics, data and legal standards as they relate to data science from a software engineering perspective.
Pre-requisite learning	
Module Recommendations	
<i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
Incompatible Modules	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
Co-requisite Modules	
No Co-requisite modules listed	
Requirements	
<i>This is prior learning (or a practical skill) that is mandatory before enrolment in this module is allowed.</i>	
No requirements listed	

Module Content & Assessment

Indicative Content

Data

1. Types of Data - structured (e.g. relational), unstructured (text), semi-structured data (XML, JSON), qualitative and quantitative data, types of data, numeric, textual, mixed, qualitative, quantitative etc. 2. Data Modelling and Data Curation Conceptual, logical, physical modelling, ER diagrams, semantic modelling, etc. management of data, data lifecycle, curation for data discovery, retrieval, maintenance of quality, ensuring data correctness and value, allow for re-use. 3. Data Preparation (data sets and data relations) Planning, data collection/storage (structured and unstructured data), feature generation, data selection, Data Cleaning - filtering, completion, correction, standardisation/merging, transformation, 4. Data Post-processing - interpretation, documentation, evaluation.

Data Infrastructure

1. General data infrastructure considerations Data warehouses, databases (SQL, NoSQL, etc.), cloud infrastructures 2. Hadoop, MapReduce and alternatives

The Data Science Process

1. Data Science/Data Analytics Process Data science process models such as ASUM-DM, CRISP-DM, SEMMA, MTDSP, etc.

Introduction to AI, Machine Learning and Deep Learning

1. What are AI, ML, DL 2. Representations and software tools, techniques and technologies and representations used in ML and DL 3.. Generalised linear models - linear, multiple, logistic regression 3. Introduction to supervised, unsupervised, semi-supervised, reinforcement learning etc. 4. Training, dev and test sets etc.

Standards and Ethics

1. Ethics Standards for and legal requirements for ethical use of data 2. Data Standards and Legal Matters Data Protection (in particular Ireland and EU) Freedom of Information (in particular Ireland and EU)

Assessment Breakdown	%
Project	60.00%
End of Module Formal Examination	40.00%

No Continuous Assessment

Project

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Project	Practical programming project - the purpose of this applied project is to allow the learner, for example, to follow the data science process and prepare data so that statistical/ML techniques can be applied to the data to gain insights. This project may/may not have a significant group aspect at the discretion of the module lecturer and will typically involve a significant applied/programming component	1,2,3	60.00	Week 12

No Practical

End of Module Formal Examination

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Formal Exam	Final written en of module examination	1,2,3	40.00	End-of-Semester

SETU Carlow Campus reserves the right to alter the nature and timings of assessment

Module Workload

Workload: Full Time		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	12 Weeks per Stage	2.00
Estimated Learner Hours	15 Weeks per Stage	5.13
Laboratory	12 Weeks per Stage	2.00
Total Hours		125.00

Module Delivered In

Programme Code	Programme	Semester	Delivery
CW_KCSOF_B	Bachelor of Science (Honours) in Software Development	7	Mandatory