

<b>Module Title:</b>	Data Science
<b>Language of Instruction:</b>	English
<b>Credits:</b>	10
<b>NFQ Level:</b>	8
<b>Module Delivered In</b>	No Programmes
<b>Teaching &amp; Learning Strategies:</b>	<p>There will be 3 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>
<b>Module Aim:</b>	<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>
<b>Learning Outcomes</b>	
<i>On successful completion of this module the learner should be able to:</i>	
LO1	Understand, evaluate, communicate and apply key principles, theories and techniques with respect to data in organisations from a software engineering perspective.
LO2	Understand, evaluate and communicate key principles, theories and techniques (particularly software engineering technologies) with respect to data infrastructure in organisations from a software engineering perspective.
LO3	Understand, evaluate, communicate and apply key principles, theories and techniques (particularly software engineering technologies) with respect to data analytics and machine learning in organisations from a software engineering perspective.
LO4	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.
<b>Pre-requisite learning</b>	
<b>Module Recommendations</b>	
<i>This is prior learning (or a practical skill) that is recommended before enrolment in this module.</i>	
No recommendations listed	
<b>Incompatible Modules</b>	
<i>These are modules which have learning outcomes that are too similar to the learning outcomes of this module.</i>	
No incompatible modules listed	
<b>Co-requisite Modules</b>	
No Co-requisite modules listed	
<b>Requirements</b>	
<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. The Data Continuum and Types of Data Structured (e.g. relational), unstructured (text), semi-structured data (XML, JSON), qualitative and quantitative data, types of data, numeric, textual, mixed etc. Data representation including XML, SFML, databases, CSV files, text 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, 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

**Data Analytics and Machine Learning**

1. Data Analytics Process CRISP-DM, SEMMA, ETL etc. 2. Data Analytics and Machine Learning Supervised learning, unsupervised learning, neural networks, SVM, descriptive & inferential statistics, correlation, regression, forecasting, classification, clustering, (k-means etc.), decision trees, nearest neighbour, visualisation association rules etc.

**Data Science Technologies for Software Engineering**

1. Software engineering tools for data analytics\* Python, R, Java, C++ etc. Statistical tools e.g. SPSS, MATLAB etc. Social media API's e.g. Twitter, Facebook etc. Visualisation tools and API's e.g. Tableau, Google Charts etc. Web and Mobile Analytics and Insights APIs - Twitter, Google analytics, etc. Additional appropriate tools as required. \*Please note that software engineering tools for data analytics and data science will be used throughout the module

**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	%
Continuous Assessment	30.00%
Project	30.00%
End of Module Formal Examination	40.00%

**Continuous Assessment**

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Practical/Skills Evaluation	In-lab programming tests/active participation 1	1,2,3	15.00	Week 8
Practical/Skills Evaluation	In-lab programming tests/active participation 2	1,2,3	15.00	Week 15

**Project**

Assessment Type	Assessment Description	Outcome addressed	% of total	Assessment Date
Project	Practical programming project	1,2,3,4	30.00	n/a

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	1,2,3,4	40.00	End-of-Semester

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

**Module Workload**

<b>Workload: Full Time</b>		
<i>Workload Type</i>	<i>Frequency</i>	<i>Average Weekly Learner Workload</i>
Lecture	30 Weeks per Stage	4.00
Estimated Learner Hours	30 Weeks per Stage	2.00
Total Hours		180.00

