**Module Descriptor**

| Title | Fundamentals of Data Science | | |
|---|---|---|---|
| Session | 2025/26 | Status | Published |
| Code | COMP09118 | SCQF Level | 9 |
| Credit Points | 20 | ECTS (European Credit Transfer Scheme) | 10 |
| School | Computing, Engineering and Physical Sciences | | |
| Module Co-ordinator | Graham Parsonage | | |

**Summary of Module**

The ability to extract value from the large amounts of data that are being captured is immensely important for businesses, industries, and sectors across a multitude of domains/ Data science is the field dedicated to extractinxg insights and value from large volumes of data. It is multidisciplinary, drawing from computer science, mathematics, statistics, and domain-specific knowledge to analyse the data and uncover patterns, trends, and actionable insights.

To thrive in such a data-rich environment, professionals need a solid foundation in data science, which this module will address. It focuses on building essential software development and subject knowledge skills to implement data science solutions.

Students will be introduced to the key concepts and techniques used in the data science ecosystem and explore the various stages of the data science lifecycle including data preparation, handling, exploration and visualisation, modelling, and results interpretation. This will be achieved through the utilisation of a suitable programming language such as Python or R, depending on the student's programme.

Throughout this module, students will be exposed to real-world practical examples and problems and learn how data science can be used to tackle them and gain insight from the available data.

The syllabus of this module will include the following (Python version):

Data Science Introduction

•        Definition and rationale

•        Software tools: Jupyter Notebooks, Numpy, SciPy, ScikitLearn, Matplotlib, Pandas

Mathematical and Statistical Foundations

•        Matrices, Vectors and the implementation of operations on those using suitable scientific computing tools such as NumPy

•        Introduction to statistics: population, sample, central tendency (mean, mode, median), variability (range, standard deviation, variance), hypothesis testing

Data Science Lifecycle:

•	Data collection and analysis: data sources, data types, exploratory data analysis (EDA), and data visualisation

•	Data preprocessing: data manipulation, feature selection and engineering

•	Data modelling: statistical models, line fitting, forecasting

•	Evaluation: performance metrics and visualisation


Machine Learning

•	Classification, Regression

•	Supervised Learning and Unsupervised Learning


This module will work to develop a number of the key 'I am UWS' Graduate Attributes to make those who complete this module:,

•	Universal: Critical Thinker; Ethically minded, and Research-minded

•	Work-Ready: Problem-Solver; Effective Communicator; and Ambitious

•	Successful: Autonomous, Resilient; and Driven

| Module Delivery Method | On-Campus[1]  ☒ | Hybrid[2]  ☐ | Online[3]  ☒ | Work -Based Learning[4]  ☐ |
|---|---|---|---|---|
| Campuses for Module Delivery | ☐ Ayr  ☐ Dumfries | ☒ Lanarkshire  ☐ London  ☒ Paisley | ☒ Online / Distance Learning  ☐ Other (specify)  Online Delivery / Distance Learning applies to delivery in the BSc (Hons) Data, AI and Software Engineering programme only | |
| Terms for Module Delivery | Term 1 ☒ | Term 2 ☐ | Term 3 ☐ | |

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[1] Where contact hours are synchronous/ live and take place fully on campus. Campus-based learning is focused on providing an interactive learning experience supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment. On-campus contact hours will be clearly articulated to students.

[2] The module includes a combination of synchronous/ live on-campus and online learning events. These will be supported by a range of digitally-enabled asynchronous learning opportunities including learning materials, resources, and opportunities provided via the virtual learning environment.  On-campus and online contact hours will be clearly articulated to students.

[3] Where all learning is solely delivered by web-based or internet-based technologies and the participants can engage in all learning activities through these means. All required contact hours will be clearly articulated to students.

[4] Learning activities where the main location for the learning experience is in the workplace. All required contact hours, whether online or on campus, will be clearly articulated to students

| Long-thin Delivery over more than one Term | Term 1 – Term 2 | ☐ | Term 2 – Term 3 | ☐ | Term 3 – Term 1 | ☐ |
|---|---|---|---|---|---|---|

| Learning Outcomes | |
|---|---|
| L1 | Discuss the suitability of real-world data sources for processing within the data science lifecycle |
| L2 | Demonstrate an understanding of the mathematical and statistical foundations used in data science and applied to data |
| L3 | Select and apply suitable data preprocessing, visualisation and modelling techniques using a suitable programming language |
| L4 | Demonstrate an understanding of the various steps within the data science lifecycle and the tools and techniques used within each step |
| L5 | Implement data science methods effectively across the data science lifecycle |

| Employability Skills and Personal Development Planning (PDP) Skills | |
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| **SCQF Headings** | **During completion of this module, there will be an opportunity to achieve core skills in:** |
| **Knowledge and Understanding (K and U)** | **SCQF 9** An understanding of the scope and defining features of data science and associated tools<br><br>A critical understanding of a range of concepts within the data science lifecycle<br><br>Knowledge of mathematical and statistical foundations underlying data science methods |
| **Practice: Applied Knowledge and Understanding** | **SCQF 9** Using a range of the principal professional techniques and practices by developing a software-based solution to a data science problem |
| **Generic Cognitive skills** | **SCQF 9** Identify and analyse routine professional problems associated with real-world data sources |
| **Communication, ICT and Numeracy Skills** | **SCQF 9** Present and convey, formally, information on implemented data science solutions<br><br>Interpret, use and evaluate numerical and graphical data to achieve goals/targets. |
| **Autonomy, Accountability and Working with Others** | **SCQF 9** Exercise initiative and self-management in the completion of the module coursework |

| Prerequisites | Module Code COMP07027 | Module Title Introduction to Programming |
|---|---|---|
| | **Other** Or a similar introductory programming module. | |
| Co-requisites | Module Code | Module Title |

| Learning and Teaching |
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| In line with current learning and teaching principles, a 20-credit module includes 200 learning hours, normally including a minimum of 36 contact hours and maximum of 48 contact hours. |

| Learning Activities During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | Student Learning Hours (Note: Learning hours include both contact hours and hours spent on other learning activities) |
|---|---|
| Lecture / Core Content Delivery | 18 |
| Tutorial / Synchronous Support Activity | 6 |
| Laboratory / Practical Demonstration / Workshop | 24 |
| Independent Study | 152 |
| Please select | |
| Please select | |
| **TOTAL** | 200 |

| Indicative Resources |
|---|
| **The following materials form essential underpinning for the module content and ultimately for the learning outcomes:** |
| James, G. et al. (2023) An Introduction to Statistical Learning. Springer. Raschka, S. et al. (2022) Machine Learning with PyTorch and Scikit-Learn: Develop Machine Learning and Deep Learning Models with Python. Packt Publishing. Vanderplas, J.T. (2017) Python data science handbook : essential tools for working with data. Beijing Etc.: O'reilly, Cop. |
| **(N.B. Although reading lists should include current publications, students are advised (particularly for material marked with an asterisk*) to wait until the start of session for confirmation of the most up-to-date material)** |

| Attendance and Engagement Requirements |
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| **In line with the Student Attendance and Engagement Procedure, Students are academically engaged if they are regularly attending and participating in timetabled on-campus and online teaching sessions, asynchronous online learning activities, course-related learning resources, and complete assessments and submit these on time.** |
| **For the purposes of this module, academic engagement equates to the following:** |
| The School of Computing, Engineering and Physical Sciences considers attendance and engagement to mean a commitment to attending, and engaging in, timetabled sessions. You will scan your attendance via the scanners each time you are on-campus and you will login to the VLE several times per week. Where you are unable to attend a timetabled learning session due to illness or other circumstance, you should notify the Programme Leader that you cannot attend. Across the School an 80% attendance threshold is set. If you fall below this, you will be referred to the Student Success Team to see how we can best support your studies. |

| Equality and Diversity |
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| **The University's Equality, Diversity and Human Rights Procedure can be accessed at the following link: UWS Equality, Diversity and Human Rights Code.**<br><br>Aligned with the University's commitment to equality and diversity, this module supports equality of opportunity for students from all backgrounds and learning needs. Using the VLE, material will be presented electronically in formats that allow flexible access and manipulation of content. This module complies with University regulations and guidance on inclusive learning and teaching practice.  This module has lab-based teaching and as such you are advised to speak to the Module Co-ordinator to ensure that specialist assistive equipment, support provision and adjustment to assessment practice can be put in place, in accordance with the University's policies and regulations. |
| **(N.B. Every effort will be made by the University to accommodate any equality and diversity issues brought to the attention of the School)** |

**Supplemental Information**

| Divisional Programme Board | Computing |
|---|---|
| **Overall Assessment Results** | ☐ **Pass / Fail** ☒ **Graded** |
| **Module Eligible for Compensation** | ☐ **Yes** ☒ **No**<br>**If this module is eligible for compensation, there may be cases where compensation is not permitted due to programme accreditation requirements. Please check the associated programme specification for details.** |
| **School Assessment Board** | Business & Applied Computing |
| **Moderator** | Jacob Koenig |
| **External Examiner** | A Malhi |
| **Accreditation Details** | |
| **Module Appears in CPD catalogue** | ☒ **Yes** ☐ **No** |
| **Changes / Version Number** | 1.01 |

| Assessment (also refer to Assessment Outcomes Grids below) |
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| **Assessment 1** |
| A written class test in which students will need to demonstrate their understanding of the fundamental data science topics and methodologies. (30%) |
| **Assessment 2** |
| A portfolio (practical) in which students will use a real-life dataset and need to analyse, design, and apply data science methodology to gain insight into the data. (70%) |
| **Assessment 3** |
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| (N.B. (i) Assessment Outcomes Grids for the module (one for each component) can be found below which clearly demonstrate how the learning outcomes of the module will be assessed.<br><br>(ii) An indicative schedule listing approximate times within the academic calendar when assessment is likely to feature will be provided within the Student Module Handbook.) |

| Component 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Class Test (written) | ☒ | ☒ | ☐ | ☐ | ☐ | 30 | 1 |

| Component 2 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Practical Portfolio | ☒ | ☐ | ☒ | ☒ | ☒ | 70 | |

| Component 3 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| | ☐ | ☐ | ☐ | ☐ | ☐ | | |
| **Combined total for all components** | | | | | | 100% | 1 hours |

**Change Control**

| What | When | Who |
|---|---|---|
| Attendance and Engagement and Equality and Diversity Statements | 21/01/25 | R Moffat |
| Guidance Note 23-24 provided & general housekeeping to text across sections. | 12/12/23 | D Taylor |
| Updated Student Attendance and Engagement Procedure & updated UWS Equality, Diversity and Human Rights Code | 19/10/23 | C Winter |
| Updated contact hours | 14/09/21 | H McLean |
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