**Module Descriptor**

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| **Title** | Intelligent Systems | | |
| **Session** | 2025/26 | **Status** | Published |
| **Code** | COMP11071 | **SCQF Level** | 11 |
| **Credit Points** | 20 | **ECTS (European Credit Transfer Scheme)** | 10 |
| **School** | **Computing, Engineering and Physical Sciences** | | |
| **Module Co-ordinator** | Keshav Dahal | | |

**Summary of Module**

This module covers the fundamentals of Intelligent Systems and provides the theoretical background for its most used Artificial Intelligence (AI) techniques. The module then focuses on several application case studies of these technologies in different real-life scenarios. The students learn how to apply different AI technologies for solving various practical problems and how to develop simple intelligent systems. The aim is to provide a way to train students in carrying out hands-on tasks, while developing their creative thinking and preparing them to the industrial requirements. The module will develop a range of graduate attributes. Knowledge in the principles behind the Artificial Intelligence techniques will develop skills of critically evaluating the generalised AI methods for specific applications of intelligent systems. The students will gain a systematic understanding of the characteristics, feasibility and the supporting mathematics of commonly used AI approaches and their application in intelligent systems. This module provides a way to train students in carrying out hands-on tasks, while developing their creative thinking and preparing them for future employment.

Outline Syllabus:

1. Introduction to Intelligent systems and AI.

2. Expert Systems. Expert System Case Studies.

3. Search strategies, Heuristics, Traveling Salesman Problem (TSP) examples, Case studies.

4. Fuzzy Sets and Systems: Fuzzy Sets. Fuzzy Variables. Fuzzy Implications and Reasoning. Fuzzy Inference Systems. Implementations. Application Case Studies.

5. Evolutionary computation techniques: Genetic Algorithms. Genetic operators. Implementations. Application Case Studies.

6. Artificial Neural Networks: Perceptron Learning Rule. Sigmoid functions. Back-propagation. Supervised Learning. Unsupervised Learning. Neural Net Implementations. Application Case Studies.

| Module Delivery Method | On-Campus[1] ☒ | Hybrid[2] ☐ | Online[3] ☐ | Work -Based Learning[4] ☐ |
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| **Campuses for Module Delivery** | ☐ Ayr<br>☐ Dumfries | ☐ Lanarkshire<br>☐ London<br>☒ Paisley | ☐ Online / Distance Learning<br>☐ Other (specify) | |

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| **Terms for Module Delivery** | Term 1 | ☐ | Term 2 | ☒ | Term 3 | ☐ |
| **Long-thin Delivery over more than one Term** | Term 1 – Term 2 | ☐ | Term 2 – Term 3 | ☐ | Term 3 – Term 1 | ☐ |

| **Learning Outcomes** | |
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| **L1** | Analyse the need for, and effectiveness of, various artificial intelligence (AI) techniques for data analysis and intelligent optimisation process; |
| **L2** | Evaluate and implement simple intelligent systems applied to specific real-life problems both systematically and creatively; |
| **L3** | Demonstrate abilities to build simple versions of AI applications and familiarity with full-scale versions of AI applications |
| **L4** | N/A |
| **L5** | N/A |

| **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 11**<br>Knowledge & understanding of working principle of common AI techniques. Mastery of fundamental ideas and techniques of AI. |
| **Practice: Applied Knowledge and Understanding** | **SCQF 11**<br>Knowledge of practical skills to apply basic theoretical concepts to design and implementation of simple intelligent systems. |
| **Generic Cognitive skills** | **SCQF 11**<br>Students will develop ability to critically examine and appreciate the central issues in the main sub-areas of AI and ability to apply AI techniques. |

[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

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| **Communication, ICT and Numeracy Skills** | **SCQF 11**<br>Compiling individual report students will develop communication skills as well as the ability to write technical report. Students will gain a systematic understanding supporting mathematics of AI techniques. |
| **Autonomy, Accountability and Working with Others** | **SCQF 11**<br>Students will be encouraged to work with others in tutorials and lab sessions for finding information and solving problems on the assigned task. In doing so, students will develop a sense of accountability to the other members. |

| **Prerequisites** | **Module Code** | **Module Title** |
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| | **Other** | |
| **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**<br>During completion of this module, the learning activities undertaken to achieve the module learning outcomes are stated below: | **Student Learning Hours**<br>(Note: Learning hours include both contact hours and hours spent on other learning activities) |
| Lecture / Core Content Delivery | 20 |
| Tutorial / Synchronous Support Activity | 10 |
| Laboratory / Practical Demonstration / Workshop | 10 |
| Independent Study | 160 |
| Please select | |
| Please select | |
| **TOTAL** | 200 |

| **Indicative Resources** |
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| **The following materials form essential underpinning for the module content and ultimately for the learning outcomes:**<br>• Module Resources on Aula/Moodle<br>• Octave/MATLAB with Neural network, fuzzy toolbox and GA tool box<br>• The World Wide Web<br>• Artificial Intelligence: A Guide to Intelligent Systems (3rd Edition), Michael Negnevitsky, Pearson, 2011.<br>• Building Intelligent Systems - A Guide to Machine Learning Engineering, Geoff Hulten, Springer, 2018 |

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| • Artificial Intelligence & Data Mining Applications in the E&P Industry (Digital Edition), Shahab D. Mohaghegh, Saud Al-Fattah and Andrei Popa, Society of Petroleum Engineers (SPE) – 2011.<br>• Research articles. |
| **(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.**<br>**For the purposes of this module, academic engagement equates to the following:**<br>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**

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| **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** | Bikrant Koirala |

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| **External Examiner** | R Menzies |
| **Accreditation Details** | |
| **Module Appears in CPD catalogue** | ☐ **Yes** ☒ **No** |
| **Changes / Version Number** | 2.06 |

| **Assessment (also refer to Assessment Outcomes Grids below)** |
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| **Assessment 1** |
| Practical Coursework (50%)<br>Three components of formal written reports (weighted 50%) with lab implementation will be required from each student summarizing their finding on the course topics – agreed by the module coordinator, to evaluate LO3. This will test their level of understanding about the theoretical concepts, methodologies, and case studies discussed during the lectures and tutorials. These formal written reports must be submitted before the due dates. |
| **Assessment 2** |
| A Formal Adapted Examination (50%)<br>Students will be required to take a formal written/adapted examination (weighted 50%). The exam will comprise questions (Multiple choice, descriptive and numerical problem solving). Questions will mainly assess student's understanding about the theoretical topics covered in the lectures, to evaluate LO1 and LO2. |
| **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>(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** | | | | | | | |
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| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Unseen closed book Exam (standard) | ☒ | ☒ | ☐ | ☐ | ☐ | 50 | 2 |

| **Component 2** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Assessment Type** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **Weighting of Assessment Element (%)** | **Timetabled Contact Hours** |
| Report of practical/ field/ clinical work | ☐ | ☐ | ☒ | ☐ | ☐ | 50 | 8 |

| **Component 3** |
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| Assessment Type | LO1 | LO2 | LO3 | LO4 | LO5 | Weighting of Assessment Element (%) | Timetabled Contact Hours |
|---|---|---|---|---|---|---|---|
| | ☐ | ☐ | ☐ | ☐ | ☐ | | |
| **Combined total for all components** | | | | | | 100% | 10 hours |

**Change Control**

| What | When | Who |
|---|---|---|
| Attendance Update & EDI Update | 21/01/2025 | A Adamson |
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