MODULE SPECIFICATION

Part 1: Information			
Module Title	Foundations of AI [TSI]		
Module Code	UFCF7X-12-1	Level	Level 4
For implementation from	2021-22		
UWE Credit Rating	12	ECTS Credit Rating	6
Faculty	Faculty of Environment & Technology	Field	Computer Science and Creative Technologies
Department	FET Dept of Computer Sci & Creative Tech		
Module Type:	Standard		
Pre-requisites	None		
Excluded Combinations	None		
Co-requisites	None		
Module Entry Requirements	None		
PSRB Requirements	None		

Part 2: Description

Educational Aims: In addition to the learning outcomes the educational experience may explore, develop, and practise but not formally discretely assess the following:

- Working as a team member
- IT skills in context
- Presentation skills

Outline Syllabus: 1. Introduction to Artificial Intelligence:

What we mean by Artificial Intelligence: the Turing/Searle debate; “strong vs. weak” Artificial Intelligence; Symbolic Processing vs. Computational Intelligence.
The “Black-Box” model of computer systems, and problem solving as search.
Problem types and decomposition: Pattern recognition, modelling and prediction, action selection, planning, optimisation, simulation.
Hybrid systems and the need for an appropriate choice of paradigms for different parts of a decomposed problem.
Some key technologies for different types of models e.g. Rule-sets, decision trees, multi-layer perceptron’s.
Perspective of computers as Finite State Machines, statebased and hierarchical architectures for

robots/agents, and their relationship to planning.

2. Search as a metaphor for learning:

Search landscapes, idea that search could be either through complete solutions, or constructive in nature. Combinatorial explosion and Global/local search heuristics.
Single member uninformed search strategies (depth/ breadth-first) and their relationship to Computer Science concepts such as queues and stacks.
Design of heuristic quality functions. Single member search (branch-and-bound, best-first, A*).
Single member heuristic based search (hill-climbers) Illustrated for combinatorial (e.g. rule-set induction) and continuous (e.g. ANN weights) problems.
Population-based search exemplified by: Genetic Algorithm for combinatorial optimisation, Evolution Strategy for continuous domain (optimisation or models e.g. weights of ANN); Ant Colony for population-based constructive search; Genetic programming and Pittsburgh Learning Classifier System to evolve models (decision trees and rule sets respectively) and boids/flocking algorithms for simulation.

3. Symbolic Knowledge Representation:

Knowledge and meta-knowledge; production rules; logic systems; problems of knowledge acquisition. Logic and its limitations:
Logic database (statements, facts, assertions, variables and rules); inference mechanism (search strategy, backtracking); deduction and abduction.
Structure of rule-based systems. Expert systems. Domain of symbolic processing and search techniques: notion of well-defined problems; state-space graphs and trees.
Modern symbolic approaches exemplified by Semantic Web.

4. Alternative forms of Knowledge Representation:

Fuzzy and Probabilistic reasoning: Fuzzy sets, hedges, fuzzy
inference engines. Naïve Bayesian Networks.
Sub-symbolic: exemplified by Natural and Artificial Neural Networks. Simulation of simple neuron-like structures; neuron as a simple computing element, pattern associator; emergent properties; perceptron's; multi-layer neural networks. Back propagation and evolution as alternative learning mechanisms.
Implicit knowledge representation exemplified by instance-based learning (Nearest Neighbour), Case-Based reasoning and variants.

Teaching and Learning Methods: Each numbered section of the syllabus, as detailed above, represent equal amounts of teaching.

Scheduled Learning
Materials will be introduced via lectures. Tutorials will use a mixture of group-work and individual activities to ground the materials covered in the lectures. Activities will cover a range of paper based and practical exercises. The latter will illustrate various topics within the context of developing an AI application for a game-playing scenario.

Seminars will highlight recent research and present case studies from real life applications to illustrate the theoretical subjects covered. As the module progresses, students will be expected to participate in group research and presentations of selected topics during these seminars.

Independent Learning
Students will be expected to learn independently by carrying out reading and directed study outside taught classes. Therefore, additional materials, group activities, discussion exercises and individual practical experience of implementing and using Artificial Intelligence solutions.

Part 3: Assessment

In addition to the tutorials, formative assessment will be provided via regular self-assessment tests.

Assessed piece of coursework will be delivered in the form of a series of tasks which the students should complete independently and then report their findings.

First Sit Components	Final Assessment	Element weighting	Description
Portfolio - Component B		50 %	Coursework - a series of tasks which the students should complete independently and then report their findings.
In-class test - Component A	✓	50 %	In-class test - (3 hours)
Resit Components	**Final Assessment**	**Element weighting**	**Description**
Set Exercise - Component B		50 %	Coursework - Solutions to a series of AI problems.
In-class test - Component A	✓	50 %	In-class test (3 hours)

Part 4: Teaching and Learning Methods

Learning Outcomes

On successful completion of this module students will achieve the following learning outcomes:

Module Learning Outcomes	Reference
Identify different types of problem (optimisation, modelling, simulation), and associated state-based models	MO1
Explain the concept of learning as search, and illustrate different individual and population-based search methods	MO2
Identify different paradigms for representing problems and knowledge (e.g. symbolic, fuzzy, probabilistic and sub-symbolic), and explain their main features and differences	MO3
Formulate appropriate representations of problems and associated knowledge	MO4
Use criteria to discriminate, select and apply appropriate paradigms	MO5
Design and implement intelligent solutions using at least two different architectures	MO6
Design and implement a range of different search methods	MO7

Contact Hours

Independent Study Hours:	
Independent study/self-guided study	96
Total Independent Study Hours:	96
Scheduled Learning and Teaching Hours:	
Face-to-face learning	64

	Total Scheduled Learning and Teaching Hours:	64
	Hours to be allocated	120
	Allocated Hours	160
Reading List	*The reading list for this module can be accessed via the following link:* https://rl.talis.com/3/uwe/lists/597809CD-3D3F-050E-ABF4-3135F1DB3287.html?lang=en-gb&login=1	

Part 5: Contributes Towards
This module contributes towards the following programmes of study: Computer Science and Software Development [Oct][FT][TSI][4yrs] BSc (Hons) 2020-21 Computer Science and Software Development [Oct][PT][TSI][5yrs] BSc (Hons) 2020-21 BSc (Hons) 2020-21 Computer Science and Software Development [Feb][FT][TSI][4yrs] BSc (Hons) 2020-21 Computer Science and Software Development [Feb][PT][TSI][5yrs] BSc (Hons) 2020-21 BSc (Hons) 2020-21