# Module Specification

## Knowledge-based and Hybrid Systems

Version: 2025-26, v2.0, Approved

**Contents**

## Part 1: Information

**Module title:** Knowledge-based and Hybrid Systems

**Module code:** UFCEN1-15-M

**Level:** Level 7

**For implementation from:** 2025-26

**UWE credit rating:** 15

**ECTS credit rating:** 7.5

**College:** College of Arts, Technology and Environment

**School:** CATE School of Computing and Creative Technologies

**Partner institutions:** None

**Field:** Computer Science and Creative Technologies

**Module type:** Module

**Pre-requisites:** None

**Excluded combinations:** None

**Co-requisites:** None

**Continuing professional development:** No

**Professional, statutory or regulatory body requirements:** None

## Part 2: Description

**Overview:** This module will introduce students to the knowledge-based paradigm of Artificial Intelligence (AI). Students will gain an understanding of both deterministic and probabilistic approaches, their principles, characteristics and applications to real-world problems.

Putting together this understanding with experience of machine learning and optimisation algorithms from prior modules, the module will then cover how to

decompose large problems into smaller tasks, select appropriate algorithms to solve the sub-tasks, and co-ordinate the outcomes of components within a hybrid architecture.

The module gives students the opportunity to learn skills in how to select, apply and evaluate solutions involving a range of techniques using the state-of-the-art software tools.

**Features:** Not applicable

**Educational aims:** The module introduces students to the paradigm of knowledge-based systems and different forms of knowledge representation and logic.

It then covers the concept of decomposing a large problem into smaller parts and selecting appropriate forms of AI (for example, knowledge-based, machine learning or heuristic optimisation) to solve the sub-tasks.

The module places an emphasis on the practical applications of knowledge-based techniques, enabling students to gain hands-on experience in developing knowledge-based solutions to real-world problems.
The module also enables students to gain core competency in identifying, and formulating context-appropriate responses to, the ethical and societal concerns surrounding the construction and deployment of AI-based solutions

**Outline syllabus:** The module material is roughly divided into two parts:

Knowledge-Based AI: This part focus into Symbolic AI and the knowledge paradigm, emphasizing the development of AI system capable of capturing human expertise and automatically reasoning with it.
Some of the topics covered:
Logic and Rule-Based Systems
Knowledge Graphs and Ontologies
Bayesian Models
Fuzzy Logic Systems

Hybrid AI: Building on prior modules topics, this part of the module focuses on methodologies to create Hybrid AI system by combining computational methods (Machine Learning and Optimization algorithms) with knowledge-based techniques
Some of the topics covered:
Neurosymbolic AI
Neuro and Genetic Fuzzy Systems
Multi-Agent Systems
Graph and Logic Neural Networks

## Part 3: Teaching and learning methods

**Teaching and learning methods:** Lectures will introduce the core concepts and algorithmic essences of each topic listed in the syllabus. Each topic will be explained and illustrated with intuitive examples, expanded with developing the practical solutions to the real-world problems.

Practical classes will provide supervised activities to cover different problem domains, with an emphasis on developing students' experience to build solutions to real-world problems using contemporary techniques.

A combination of online resources and scheduled sessions will offer students the necessary background and tools to enhance their understanding.

Independent learning study hours will include essential and exploratory reading, practical study, assignment preparation and completion.

**Module Learning outcomes:** On successful completion of this module students will achieve the following learning outcomes.

**MO1** Critically evaluate Knowledge-based AI paradigms considering context specific requirements, scalability & correctness, ethical and social implications.

**MO2** Design, implement and evaluate knowledge-based and hybrid AI architectures, justifying methodology as appropriate including ethical considerations.

**MO3** Analyse large complex model by decomposing them into sub-problems solvable using different AI paradigms.

**Hours to be allocated:** 150

**Contact hours:**

Independent study/self-guided study = 126 hours

Face-to-face learning = 24 hours

**Reading list:** The reading list for this module can be accessed at readinglists.uwe.ac.uk via the following link https://rl.talis.com/3/uwe/lists/44DEB312-D9A3-D8DA-3B66-87EB7C0DCC79.html?lang=en-GB

## Part 4: Assessment

**Assessment strategy:** To build confidence, weekly lab sessions and end-of-topic 'reflection' sessions will provide the opportunity for informal feedback and discussions.

The learning outcomes will be formally assessed through a individual portfolio of materials.

For the portfolio deliverables, students will individually demonstrate the practical skills learned in the lab sessions to create elements of a hybrid solution to a problem. For example, they may develop an automated help-desk assistant. Alongside the software deliverables and evidence of how the software runs, they will independently address a broader set of questions about the organisational, ethical, and societal concerns taken into consideration when designing and implementing knowledge-based systems.

The resit attempt will be assessed in the same way as the first attempt.

**Assessment tasks:**

**Portfolio** (First Sit)

Description: Individual portfolio of materials
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3

**Portfolio** (Resit)
Description: Individual portfolio of materials
Weighting: 100 %
Final assessment: Yes
Group work: No
Learning outcomes tested: MO1, MO2, MO3

## Part 5: Contributes towards

This module contributes towards the following programmes of study:

Artificial Intelligence [Frenchay] MSc 2025-26