Module Definition Form (MDF)

Module code: MOD009165	**Version:** 1 **Date Amended:** 07/Feb/2023

1. Module Title
Robotics and Machine Intelligence

2a. Module Leader
Muhammad Usman Bhutta

2b. School
School of Engineering and the Built Environment

2c. Faculty
Faculty of Science and Engineering

3a. Level
6

3b. Module Type
Standard (fine graded)

4a. Credits
15

4b. Study Hours
150

5. Restrictions

Type	Module Code	Module Name	Condition
Pre-requisites:	None		
Co-requisites:	None		
Exclusions:	None		
Courses to which this module is restricted:			

LEARNING, TEACHING AND ASSESSMENT INFORMATION

6a. Module Description

Robotics and Machine Intelligence models and analyses human and robot behaviour, including human-robot interaction and collaboration. You will develop an understanding of the basic principles of how to design userfriendly human-robot interaction systems. As artificial intelligence and robotics become more integrated into our daily life, simplifying many everyday tasks, it is hard to imagine how we could manage without them. Artificial intelligence, robotics, machine learning and deep learning are transforming heavily regulated industries, such as automotive, food and agriculture, construction, healthcare and life sciences, financial services and trading. Over the last decade, substantial progress has been achieved. This module will explore human-robot interaction and etiquette through three fundamental questions about communication between a human and a robot. How should a robot move differently in the presence of a human? How should it understand hints in terms of postures and eye emotions? How should it learn from user feedback? This module will answer these questions and reveal the scale of the impact of human-robot interaction systems on modern society.

6b. Outline Content

• Robotics: Introduction to robotics

• Design, Components and Programming of a robotic system (e.g. mechanical arm, controller, electrical drive, hydraulic drive, etc.)

• Modelling of kinematics and dynamics

• Sensing, control and human-robot interaction technologies

• Design and build a small robot for a particular application (e.g. space/aerospace, automotive, driverless cars, renewable energy, healthcare, agriculture, mining, etc.)

• AI and ML: Introduction to Artificial Intelligence (AI) and Machine Learning (ML)

• Applications of AI in robotics • Unsupervised, supervised and reinforcement learning

• ML in robot path planning, navigation, positioning, and obstacle avoidance.

6c. Key Texts/Literature

The reading list to support this module is available at: https://readinglists.aru.ac.uk/

6d. Specialist Learning Resources

Specialist laboratory equipment STM Arm-based processor

7. Learning Outcomes (threshold standards)		
No.	**Type**	**On successful completion of this module the student will be expected to be able to:**
1	Knowledge and Understanding	Select and apply appropriate artificial intelligence (AI) and machine learning (ML) algorithms in robotic systems and recognise their limitations.
2	Intellectual, practical, affective and transferrable skills	Analyse complex robotics and machine learning problems to reach substantiated conclusions using the first principles of mathematics and engineering principles.
3	Intellectual, practical, affective and transferrable skills	Apply knowledge of the theory and implementation of Robotics to the solution of complex engineering problems.
4	Intellectual, practical, affective and transferrable skills	Select and apply appropriate technologies and processes for AI and ML problems and recognise their scope and limitations.

8a. Module Occurrence to which this MDF Refers				
Year	**Occurrence**	**Period**	**Location**	**Mode of Delivery**
2026/7	ZZF	Template For Face To Face Learning Delivery		Face to Face

8b. Learning Activities for the above Module Occurrence			
Learning Activities	**Hours**	**Learning Outcomes**	**Details of Duration, frequency and other comments**
Lectures	24	1-4	Lecture 3 hrs for 8 weeks
Other teacher managed learning	12	1, 3, 4	Lab 3 hrs for 4 weeks
Student managed learning	114	1-4	Self-study
TOTAL:	150		

9. Assessment for the above Module Occurrence

The assessment for some modules includes a presentation (see below for details on how this particular module is assessed). We recognise that presenting, especially to a large group, can cause significant anxiety or distress for some students. If this may affect you, please contact your Module Leader or the Disability and Neurodiversity Service as early as possible. We will work with you to consider appropriate reasonable adjustments. Depending on your individual needs, these might include, for example, presenting to a smaller group or presenting only to a member of academic staff.

Assessment No.	Assessment Method	Learning Outcomes	Weighting (%)	Fine Grade or Pass/Fail	Qualifying Mark (%)
010	Coursework	1 3 4	60 (%)	Fine Grade	30 (%)
Report (1500 words), maps to Engineering Council Learning Outcomes C3, C13					
Assessment No.	**Assessment Method**	**Learning Outcomes**	**Weighting (%)**	**Fine Grade or Pass/Fail**	**Qualifying Mark (%)**
011	Coursework	2	40 (%)	Fine Grade	30 (%)
In-Class Test (1.5 hours), maps to Engineering Council Learning Outcome C2					

In order to pass this module, students are required to achieve an overall mark of 40% (for modules at levels 3, 4, 5 and 6) or 50% (for modules at level 7*).

In addition, students are required to:
(a) achieve the qualifying mark for each element of fine graded assessment as specified above
(b) pass any pass/fail elements

[* the pass mark of 50% applies for all module occurrences from the academic year 2024/25 – see Section 3a of this MDF to check the level of the module and Section 8a of this MDF to check the academic year]