Unit and programme catalogues

Programme specification: Robotics (MSc) in 2020/21

Programme organisation

Programme code	4EMAT002T
Programme type	Postgraduate Taught Degree
Programme director(s)	Helmut Hauser
Faculty	Faculty of Engineering
School/department	Department of Engineering Mathematics
Teaching institution	Universities of Bristol and the West of England
Awarding institution	Universities of Bristol and the West of England
Mode of study	Full Time
Programme length	1 years (full time)

Programme aims

This MSc aims to provide the background and focus to prepare students to understand, design and implement robotic systems as well as comprehend the foundational methods and relevant theories. The structure allows students from a variety of backgrounds in Engineering, Mathematics, Physics and related disciplines to acquire the skills to become Robotics practitioners and researchers. The programme is designed to expose students to three fundamental themes: Perception, Action and Cognition. We also promote a hands-on approach to develop intelligent actuating and sensing systems with the final dissertation based at the Bristol Robotics Laboratory, the most comprehensive Robotics Lab in the United Kingdom.

Programme outcomes

Knowledge and Understanding

Programme Intended Learning Outcomes	Learning and Teaching Methods
1. The ability to understand design and implement robotic systems that link Action, Perception and Cognition.	Students in this course are expected to have an Engineering, Physics, Mathematical or related background.

2. Under the theme Action: the modelling and implementation of control strategies for multi-degree of freedom systems and their operation in space and in the proximity of human operators or collaborators.
3. Under the theme Perception: the algorithmic and operational principles of perception in time-critical systems with an emphasis on robot vision.
4. Under the theme Cognition: the foundational aspects of uncertainty modelling, decision making and learning in artificial and natural systems.
5. The integration of a wide variety of methods to include 3D animation principles, navigation, localisation, DSP design and robot programming.
6. The acquisition of skills to write, evaluate and conduct research in Robotics.
7. The implementation of a real robotic system that combines Action, Perception and Cognition.

The teaching is a combination of lecture units and hands-on practicals as part of units at both UoB and UWE. The combination of seminars, lectures and laboratory assignments addresses outcome 1 in a broad manner.

Learning outcome 1 the ability to understand design and implement robotic systems that link Action, Perception and Cognition is handled by the overall programme's structure.

The structure considers two terms. Term 1 is taught at both UoB and UWE. Group practicals as part of the unit are carried out in the Bristol Robotics Laboratory (BRL). For group cohesion, most units in term 1 are mandatory; the activity at BRL is important to set the scene well within Robotics.

To provide student choice within the broad area that comprises robotics, they will be able to choose one optional unit in Term 1 and a further three in Term 2. A research skills unit of 15 credits is split across the first and second terms.

For the second term, two core units, Robotic Systems PG, and a choice of Intelligent Adaptive Systems or Medical Robotics and Image-Guided Surgery, provide further integration and foundational aspects and are complemented by 3 optional units to be selected from a broad set of units across the faculties of Science and Engineering.

Finally the dissertation worth 60 credits is based at BRL.

In terms of theme coverage we have the following structure.

Learning outcome 2 (Action) is covered by units Robots Fundamentals, Intelligence and Adaptive Systems / Medical Robotics and Image-Guided Surgery (C), Technology and Context of Robotic Autonomous Systems (C), Bio-inspired Artificial Intelligence (C), Advanced Dynamics (O), Control Theory (O), Advanced Techniques in

multidisciplinary design (O), and Animation Production (O).

Learning outcome 3 (Perception) is covered by units Image Processing and Computer Vision (C), Uncertainty Modelling for Intelligent Systems (O), Technology and Context of Robotics Autonomous Systems (C), as well as by aspects from Robotic Systems PG (C).

Learning outcome 4 (Cognition) is covered by units Robotics Fundamentals (C) and Intelligent and Adaptive Systems / Medical Robotics and Image-Guided Surgery (C), Uncertainty Modelling for Intelligent Systems (O), Computational Neuroscience (O), Learning in autonomous systems(O), Introduction to Artificial Intelligence (O), and Advanced DSP &FPGA Implementation (O).

Learning outcome 5 (integration) is covered by Robots Fundamentals (C), Robotic Systems PG (C) Technology and Context of Robotics Autonomous Systems (C), the Dissertation (C), and some of the optional units, for example, Virtual Product Development (O) and Design Verification (O).

Learning outcome 6 The acquisition of skills to write, evaluate and conduct research in Robotics will be principally covered by the Research Preparation unit (C).

Learning outcome 7 the implementation of a real robotic system that combines Action, Perception and Cognition as per learning outcome 7 is expected to be covered by the Project (C), however smaller examples of integration as part of a team will be considered in Robotic Systems PG (C).

Methods of Assessment

The learning outcomes are assessed in the specific units using a range of methods to include coursework which is both practical and theoretical, essays, exams and presentations.

	A final dissertation will be expected as part of the project unit which will likely include a presentation to markers. This dissertation is the programme's principal system integration point where students will demonstrate the skills learned throughout the course. In particular students will demonstrate the ability to design, analyse, implement and evaluate a robotic system under the supervision of BRL academic staff and potentially in collaboration with industry partners. This project is likely to coalesce aspects from the three main strands of the course to include aspects of perception, action and decision making in a working system and guided by the design and integration principles that the students have been exposed to. Further skills such as delivery of results under time constraints and scientific and technical writing will be also demonstrated through the writing of the dissertation.

Intellectual Skills and Attributes

Programme Intended Learning Outcomes	**Learning and Teaching Methods**
1. Ability to understand a complex robotic system. 2. Capability to identify the requirements and specifications of tasks which are appropriate to be solved using an acting and perceiving intelligent system. 3. Critically evaluate robotic systems and designs. 4. Conduct research in the area of Robotics. 5. Identify the relevant literature and sources to accomplish the above.	Intellectual skills are developed through individual and team work on case studies, in class and coursework challenges and written assignments. Students are exposed to designing and evaluating robot systems in the first term and this continues on the second term in the units Intelligent and Adaptive Systems and Robotic Systems respectively. Skills for literature and research consultation and evaluation are further developed in the Research Preparation unit.
	Methods of Assessment
	The learning outcomes are assessed in the specific units using a range of methods to include coursework which is

	both practical and theoretical, essays, exams and presentations. A final dissertation will be expected as part of the project unit which is fundamentally about designing and evaluating a robotic system and therefore an indication of the integration and convergence skills to be developed during the MSc.

Other Skills and Attributes

Programme Intended Learning Outcomes	Learning and Teaching Methods
1. Work effectively as part of a team demonstrating time management, team coordination and or leadership. 2. Access state of the art literature resources in Robotics and related areas. 3. Structure and communicate ideas effectively in writing and orally. 4. Plan and design projects in several stages.	Through team and individual work, the student will develop the skills to coordinate and lead projects from the planning to the implementation. Relevant units include Robots Mechanics, Intelligence and Programming, Robotic Systems, Research Skills and The Project unit. **Methods of Assessment** The learning outcomes are assessed in the specific units using a range of methods to include coursework which is both practical and theoretical, essays and presentations.

Intellectual Development

Statement of expectations from the students at each level of the programme as it/they develop year on year.

Level M/7 - Postgraduate Certificate	60 credits must be completed in the foundation modules in particular in both or at least one of the units Robots Mechanics, Intelligence and Programming and/or Robotic Systems.
Level M/7 - Postgraduate Diploma	120 credits to be completed on the taught modules for the Diploma.

Level M/7 - Postgraduate Masters	180 credits will result in a full Masters Degree after the completion of 120 credit taught modules and 60 credits from the project dissertation module.

Intended Learning Outcome Mapping

RoboticsMSc ILO mapping Sept 2017.docx

The intended learning outcome mapping document shows which mandatory units contribute towards each programme intended learning outcome.

Other information

Admissions Information

For information on the admissions requirements for this programme please see details in the postgraduate prospectus at http://www.bristol.ac.uk/prospectus/postgraduate/ or contact the relevant academic department.

Additional Information

NB: Teaching for this programme is delivered at both the University of Bristol and the University of the West of England campuses. Students attending the programme will be given free transport passes to travel between the two universities.

Source For Further Information

https://courses.uwe.ac.uk/H67B1/robotics

http://www.bristol.ac.uk/engineering/departments/engineering-mathematics/courses/postgraduate/

Programme structure by entry cohort

Year 1 (2020/21 entry cohort)

Unit Name	Unit Code	Credit Points	Status
Robotics Systems	EMATM0054	20	Mandatory
Robotic Fundamentals (UWE, UFMF4X-15-M)	EMATM0033	15	Mandatory
Introduction to Artificial Intelligence	EMATM0044	10	Mandatory
		185	

Unit Name	Unit Code	Credit Points	Status
Dissertation	EMATM0055	60	Mandatory
Robotics Research Technology and Methods	EMATM0058	20	Mandatory
Machine Vision (UWE, UFMFRR-15-M)	EMATM0056	15	Mandatory
Human-Robot Interaction (UWE, UFMFHP-15-M)	EMATM0043	15	Mandatory
One UWE and one UoB option to be chosen from the following list:			
Optional units are subject to timetabling constraints of the teaching timetables at both the University of Bristol and the University West of England.			
Bio-Inspired Artificial Intelligence	EMATM0029	10	Optional
Intelligent Information Systems	EMATM0042	10	Optional
Transport and Mobility Modelling	EMATM0021	10	Optional
Advanced Control & Dynamics (UWE, UFME7F-15-M)	EMATM0031	15	Optional
Assistive Robotics (UWE UFMFSR-15-M)	EMATM0059	15	Optional
Soft Robotics	EMATM0057	10	Optional
		185	

Progression/award requirements

The pass mark set by the University for any level 7(M) unit is 50 out of 100.

For detailed rules on progression please see the Regulations and Code of Practice for Taught Programmes and the relevant faculty handbook.

Exit awards

All taught masters programmes, unless exempted by Senate, must allow the opportunity for students to exit from the programme with a postgraduate diploma or certificate.

To be awarded a postgraduate diploma, students must have successfully completed 120 credit points, of which 90 must be at level M/7.

To be awarded a postgraduate certificate, students must have successfully completed 60 credit points, of which 40 must be at level M/7.

Degree classifications:

An award with Merit or Distinction is permitted for postgraduate taught masters, diplomas and certificates, where these are specifically named entry-level qualifications. An award with Merit or Distinction is not permitted for exit awards where students are required to exit the programme on academic grounds. An exit award with Merit or Distinction may be permitted where students are prevented by exceptional circumstances from completing the intended award.

The classification of the award in relation to the final programme mark is as follows:

Award with **Distinction***: at least 65 out of 100 for the taught component overall and, for masters awards, at least 70 out of 100 for the dissertation. **Faculties retain discretion to increase these thresholds.

Award with **Merit***: at least 60 out of 100 for the taught component overall and, for masters awards, at least 60 out of 100 for the dissertation. Faculties retain discretion to increase these thresholds.

* The MA in Law has separate regulations for awarding distinction and merit.

** For the award of Distinction, the Faculty of Engineering requires at least 70 out of 100 for the taught component overall and, for masters awards, at least 70 out of 100 for the dissertation.

Diploma/certificate stages:

All taught masters programmes, unless exempted by Senate, must allow the opportunity for students to choose, or be required, to leave at the postgraduate diploma or certificate stage.

To be awarded a postgraduate diploma, students must have successfully completed 120 credit points, of which 90 must be at level M/7.

To be awarded a postgraduate certificate, students must have successfully completed 60 credit points, of which 40 must be at level M/7.

Additional progress information

Due to the different sizes of units at the two Universities, some students will gain 185 credit points.

Please note: This specification provides a concise summary of the main features of the programme and the learning outcomes that a typical student might reasonably be expected to achieve and demonstrate if he/she takes full advantage of the learning opportunities that are provided. More detailed information on the learning

outcomes, content and teaching, learning and assessment methods of each module can be found in the course handbook or on-line at http://www.bris.ac.uk. The accuracy of the information contained in this document is reviewed by the University and may be checked by the Quality Assurance Agency for Higher Education.

Related links

What's running in 2020/21
Structure by entry cohort
Programmes available in the Department of Engineering Mathematics

Print full programme specification