Programme Title: MSc Advanced Robotics

Programme Specification (PG)

Awarding body / institution:	Queen Mary University of London
Teaching institution:	Queen Mary University of London
Name of final award and programme title:	MSc in Advanced Robotics
Name of interim award(s):	
Duration of study / period of registration:	1 Year
QMUL programme code(s):	H6H3
QAA Benchmark Group:	Engineering
FHEQ Level of Award:	Level 7
Programme accredited by:	Accreditation is being sought from IMechE, IET and BCS
Date Programme Specification approved:	
Responsible School / Institute:	School of Engineering & Materials Science

Schools / Institutes which will also be involved in teaching part of the programme:

School of Electronic Engineering & Computer Science

Collaborative institution(s) / organisation(s) involved in delivering the programme:

NA

Programme outline

The MSc in Advanced Robotics is designed for graduate engineers, scientists and entrepreneurs who want to extend their knowledge and skills in robotics engineering – an area gaining importance at a rapid pace. The interface where Engineering comes together with Computer Science brings about new opportunities for innovation in industry and research. Robotics applications are becoming more and more widespread, and include factory automation equipment, a wide range of household appliances, such as automated vacuum cleaners and lawn mowers, self-drive cars and electro-mechanical devices for the entertainment sector. Other application areas include minimally invasive surgery, rehabilitation and the care for the disabled and elderly. Its significance as a discipline has been recognised by the IET, IMechE, BSC and the Alan Turing Institute.

This MSc programme provides a well-balanced structure of advanced robotics modules and an individual project aiming to bestow the students with the knowhow and capabilities to apply the principles of mechanical engineering, electronics and computing to create modern robotic systems. To achieve this, students will be trained on the fundamentals of mechanics, sensors and actuators, control, electronics, artificial intelligence and machine learning, and will apply the gained knowledge to the design and construction of sensor based, computer controlled, intelligent electro-mechanical robotics systems, as part of the programme.

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The programme is in-line with national and international trends. Robotics is an area of great scientific and industrial interest, strongly supported by the Government. The field of robotics is developing at a tremendous rate. The prognosis of robotics playing an increasingly important role in all branches of industry can be observed. Robotics is poised to develop into a multi-million pound business across a range of industries, including manufacturing, healthcare and entertainment.

Aims of the programme

This programme aims to educate students in the area of advanced robotics drawing from mechanical engineering, electronic engineering, materials science and computer science. Students will gain expertise and knowhow in the design, construction and interfacing of robotic systems. An important part of the programme will be for students to acquire fundamental knowledge in the functional properties of materials for the construction of robotic structures and to be introduced to artificial intelligence concepts to create smart machines suitable for new application areas.

This MSc programme in Advanced Robotics will be closely linked with the research activities of the Centre for Advanced Robotics @ Queen Mary (ARQ). The MSc projects are closely aligned with the research of the Centre and provide an ideal opportunity for the students to prepare themselves for work in industry. The extended individual research project will advance the students' research skills, and provide the opportunity to continue research at PhD level.

What will you be expected to achieve?

All modules are designed to meet the training needs of industry and have a strong input from experts in their sector. You will be taught by experts from QMUL with substantial experience in robotics, artificial intelligence, manufacturing, numerical methods, industrial applications of robotics and robotics research.

The individual research projects are designed by the academic staff in collaboration with the external organizations to develop the students' research capability and ability to create complete robotics systems that can operate in a range of possibly unstructured and dynamic environments, with students gaining expertise in kinematics, dynamics, control, electronics, programming, machine learning and material selection.

Academic Content:	
A 1	Advanced essential facts, fundamental concepts, principles and theories applicable to Robotics.
A 2	Advanced methods for robot design optimised for operation in a range of environments, material selection, advanced algorithms to achieve smart robots, principles of human-robot interaction, integrated sensors and sensor signal classification, robot actuators.
A 3	Research and communication skills: including detailed knowledge on robot modelling and control, robot design and fabrication, electronic circuitry and interfacing, programming for robot AI.

Disciplinary Skills - able to:

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B 1	Use a range of scientific software and computational tools for the development of robot AI, robot motion and task planning.
B 2	Carry out an individual research project in robotics engineering, including the ability to assimilate published knowledge and advance a subject area through research.
B 3	Be able to analyse, evaluate and interpret the results of experiments and research results. Prepare scientific/technical reports of an appropriate professional standard.

Attributes:	
C 1	Apply scientific knowledge and problem-solving skills in a wide range of theoretical and practical situations.
C 2	Be able to assess the relevance, importance and reliability of the ideas of others.
C 3	Engage critically with engineering knowledge and design principles.

How will you learn?

You will be taught by a small team of dedicated Robotics engineering specialists as well as academics from other fields of Engineering from the two schools (SEMS and EECS) involved in the Programme.

Acquisition of knowledge is achieved mainly through lectures and directed independent learning. Understanding is reinforced through a combination of workshops and problem classes, tutorials and laboratory classes (depending upon the module concerned), which include provision of regular feedback on submitted assignments. Additional learning support is made available through Queen Mary's online learning environment (QMplus), via the provision of various primers and guidance notes, online recordings and other supplementary learning materials. A range of software is available through the QMUL Student PC.

The programme can be completed in one-year on a full-time basis. The programme is comprised of core and optional modules. You will also complete an extensive six-month individual research project which is made up of a piece of individual research, and must include some element of originality and can be wholly experimental, wholly theoretical, or a mixture of the two.

How will you be assessed?

Assessment of the academic content of the programme is generally through a combination of unseen written examinations and assessed coursework. The exact nature of the coursework varies from module to module, but may include work in the form of problem sheets, essays, laboratory classes and associated reports or other types of written assignments. The coursework mark may also include a contribution from computer-based assessments and in-course tests.
In addition, the extended research project will be assessed by presentations, a final report and a two-to-one viva examination.

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

Students are required to register for six taught modules (15 credits each), including a compulsory module in cognitive robotics. In addition, students will do an individual project (90 credits), to commence in September but with the majority of the work (approximately 60 credits worth) being done over the summer.

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Sem A:
Core: 15 credits of Extended Research Project.
Elective: 3*15 credits
Sem B
Core: 15 credits of Extended Research Project.
Compulsory: Cognitive Robotics
Electives 2*15 credits
Sem C
Core: remaining 60 credits of Extended Research Project.

Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Introduction to Computer Vision	ECS709P	15	7	Elective	1	Semester 1
Data Mining	ECS766P	15	7	Elective	1	Semester 1
Computational Engineering	DENM004	15	7	Elective	1	Semester 1
Surgical Techniques and Safety	MELM003	15	7	Elective	1	Semester 1
Introduction to IOT	ECS782P	15	7	Elective	1	Semester 1
Electronic Sensing	ECS700P	15	7	Elective	1	Semester 1
Design for Human Interaction	ECS712P	15	7	Elective	1	Semester 1
Machine learning	ECS708P	15	7	Elective	1	Semester 1
Advanced Robotic Systems	ECS7004P	15	7	Elective	1	Semester 2
Artificial Intelligence	ECS759P	15	7	Elective	1	Semester 2
Numerical Optimisation in Engineering Design	DENM026	15	7	Elective	1	Semester 2
Real Time DSP	ECS732P	15	7	Elective	1	Semester 2
Machine Learning for Visual Data Analysis	ECS797P	15	7	Elective	1	Semester 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Clinical Measurements	DENM024	15	7	Elective	1	Semester 2
Deep Learning and Computer Vision	ECS795P	15	7	Elective	1	Semester 2
Cloud Computing	ECS781P	15	7	Elective	1	Semester 2
Real-Time and Critical Systems	ECS727P	15	7	Elective	1	Semester 2
Extended Research Project	DENM100	90	7	Core	1	Semesters 1-3
Cognitive Robotics	ECS794P	15	7	Compulsory	1	Semester 2

What are the entry requirements?

High 2:2 (>55%) BEng or BSc degree or equivalent qualification is required, usually in subjects with substantial Maths or Physics content. Robotics, Mechatronics, Engineering (including Mechanical, Electrical, Electronics, Bioengineering or similar), or Computer Science. Non relevant degree subjects may be considered if there is evidence of sufficient study in Maths/Physics/ Engineering or related modules.
A minimum of IELTS 6.5 or equivalent is required for non-native English speakers.

How will the quality of the programme be managed and enhanced?

At Institutional level, the programme will be managed and enhanced through an Annual Programme Review.
At School level, the Programme will be managed by a Programme Director, who sits on the School's Education Board, chaired by the School's Director of Education.
The day-to-day running of the Programme will be monitored by the School's Student Experience Group.
Additionally, student feedback (via SSLC and Module Evaluations) will be considered.

How do we listen to and act on your feedback?

The Postgraduate Taught Programmes Staff-Student Liaison Committee (SSLC) provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each MSc Proogramme and appropriate representation from staff within the school. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. The SSLC meets regularly throughout the year.
In addition, Students sit on a variety of School committees concerned with Education provision.
More immediate concerns and issues can be addressed via online forums (at module, programme and School level), anonymous suggestion boxes and via persoanal tutors and project supervisors.

What academic support is available?

All students will have all the standard induction, advice and supervisory arrangements normally offered to students within SEMS. The School handbook will be provided (and made accessible at all times) to students, where all the channels of support will be outlined. These include the support channels within the School and also those available at College level.

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Each module has a module coordinator, whose role is to ensure that the module runs smoothly, and that an appropriate level of information is provided to students of the module.

Project-work is carried out under the guidance of a specific academic member of staff, whose role includes the provision of academic and technical guidance, as well as monitoring your progress throughout the project.

Programme-specific rules and facts

NA

Specific support for disabled students

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.
Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)
• Arranging DSA assessments of need
• Special arrangements in examinations
• Accessing loaned equipment (e.g. digital recorders)
• Specialist one-to-one "study skills" tuition
• Ensuring access to course materials in alternative formats (e.g. Braille)
• Providing educational support workers (e.g. note-takers, readers, library assistants)
• Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Links with employers, placement opportunities and transferable skills

SEMS and EECS enjoy a wealth of collaborative links with like-minded research centres across the world, in the USA, Europe, and Asia, and a regular flow of international research visitors contribute to the lively and cosmopolitan atmosphere. In addition, if you are viewing the (post)graduate courses in the college then additional information such as the individual course lecture notes are made available as well as previous years' examinations papers, and other useful resources like an extensive database of potential employers that have expressed an interest in employing our postgraduates in the past.

The staff involved in SEMS and EECS have strong links and research collaboration with industrial partners. SEMS and EECS offer a high-level of training in a range of engineering disciplines and computer science, with coverage of all the major areas to an advanced level. Graduates of this MSc programme generally have significantly more experience in these areas than would be the case for graduates of the corresponding BSc/BEng degree, and have experience of undertaking an extended research project. Graduates can therefore be expected to possess a wider range of practical skills, and a greater ability to undertake independent research studies. The degree is therefore particularly suitable for those seeking to pursue a career as a professional in robotics, design and manufacturing as well as research in robotics.

Graduates of SEMS and EECS degree courses are generally recognised by employers as having good technical and transferable skills: including skills in theoretical/numerical analysis, experiments, application of commercial software, problem solving, communication, IT and computation, independent research, and time management.

Opportunities for employment within the field of robotics engineering would include careers in the following areas:
robotics manufacturing; manufacturing in general; electronics; computing and artificial intelligence; teaching and education.

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Opportunities for employment outside the field of robotics would include careers in the following areas: finance; commerce; civil service; technical sales; information technology.

Programme Specification Approval

Person completing Programme Specification:	Prof Kaspar Althoefer
Person responsible for management of programme:	Prof Kaspar Althoefer
Date Programme Specification produced / amended by School / Institute Learning and Teaching Committee:	
Date Programme Specification approved by Taught Programmes Board:	

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