

PROGRAMME SPECIFICATION

Degrees:

Programme Title	Final Award	Duration of study/ years	Programme & route codes	Level
Robotics and Artificial Intelligence	MSc	1	PMSF-QMENNG1/ PSAR0Z	7

Ownership	
Awarding institution:	Queen Mary University of London
Teaching institution	Queen Mary University of London
Academic Department(s) involved in programme delivery	School of Engineering and Materials Science
Main location(s) of study	Mile End Road, London
External references	
QAA Benchmark Group	Engineering
External Accreditor (if applicable)	Institution of Mechanical Engineers IMechE
Accreditation received	2024 (IMechE)
Accreditation renewal	

Specification Details	
Programme Lead	Dr Lorenzo Jamone
Student cohorts covered by specification	2024 entry
Date of introduction of programme	September 2019
Date of programme specification / amendment	15 November 2024
Approval by School Education Committee	15 November 2024
Submitted to Directorate of Governance & Legal Services	16 November 2024

1. Programme Overview

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 you with the knowhow and capabilities to apply the principles of mechanical engineering, electronics and computing to create modern robotic systems. To achieve this, you 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.

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.

A 90 credit research project is to be undertaken using our research activities and our state of the art facilities. Several high performance computing clusters owned by the university support a full spectrum of computational research. The project 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.

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.

2. Learning outcomes for the programme

In this degree programme we place strong emphasis not only on the technical content of our modules, but also on cross disciplinary skills vital for an engineer to be effective in the work place. We embed these skills in the technical modules on the programme, to ensure that the technical knowledge and understanding works as you progress through your degree, and also to allow you to graduate with skills you can apply to a range of future careers.

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 your research capability and ability to create complete robotics systems that can operate in a range of possibly unstructured and dynamic environments.

2.1 Academic Content

- Advanced essential facts, fundamental concepts, principles and theories applicable to Robotics.
- 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.
- Research and communication skills: including detailed knowledge on robot modelling and control, robot design and fabrication, electronic circuitry and interfacing, programming for robot AI.

2.2 Discipline specific

- Use a range of scientific software and computational tools for the development of robot AI, robot motion and task planning.
- Carry out an individual research project in robotics engineering, including the ability to assimilate published knowledge and advance a subject area through research.
- Analyse, evaluate and interpret the results of experiments and research results. Prepare scientific/technical reports of an appropriate professional standard.
- Critically assess feasibility of analytical, computational and experimental techniques in use and propose practical methods for their improvement.

2.3 Attributes

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

3 Learning and teaching approaches

Teaching methods are tailor-made to suit the size of classes and the nature of the subject. Each module has a combination of methods including lectures, tutorials, laboratory sessions, industrial visits, workshops and group work. QMUL degrees combine face to face teaching and practical experiences with supported and structured on-line learning. Our virtual learning platform is referred to as QMplus. Through this platform you will be able to find details about your modules, assessments, timetables and other activities.

Projects throughout the programme are designed for you to exercise independent thinking, research and problem solving skills. Group work enhances your communication, organisational as well as technical skills.

3.1 Employers Links

The school has an active Industrial Liaison forum (ILF). This forum has a direct impact on the programmes by encouraging employers to sponsor and support the students and to provide real design case studies to engage the students throughout the curriculum. Recent case studies that have been taught and assessed were delivered by Bridgestone, DePuys, Baxter, Artis, Corus, BAe, DSTL, Rolls Royce. The ILF takes place twice a year, in Autumn and Spring.

SEMS enjoys 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.

The staff involved in SEMS have strong links and research collaboration with industrial partners. SEMS 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 degree programmes 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.

3.2 Assessment methods

You can expect a variety of different types of assessment methods:

Written assessment

- Examinations
- Progress tests
- Online assignments and quizzes
- Report and other writing
- Peer assessment

Practical assessment

- Laboratory/workshop practicals
- Design work
- Programming tests
- CAD & simulation tool tests

Oral assessment

- Oral presentations
- Poster presentations
- Group presentations
- Design presentations

Assessments allow you to demonstrate that you have met the intended learning outcomes for each module and contribute towards your achievement of the programme learning outcomes. There are summative (formal) assessments during and/or at the end of each module and well as ongoing formative (informal – no marks) through the degree. Examinations are intended to assess understanding rather than recall. Group assessments may incorporate peer marking.

Assessments operate in accordance with QMUL Regulations and established procedures.

Feedback is provided through a number of formats, including:

- Oral (e.g. face to face during or after face-to-face sessions, video)
- Personal (e.g. discussion with staff)
- Interactive (e.g. Team Based Learning, peer-to-peer, online quizzes)
- Written (e.g. solutions, model answers, comments on work)

You will receive feedback on intermediate assessments such as project plan, progress reports, courseworks. This feedback may be summarised for the whole cohort or be directed towards your work individually. The final project thesis will be assessed in September and the student

will also complete a presentation as well as an oral examination.

Feedback is intended to help you learn and you are encouraged to engage with it, reflect upon it and discuss it with your module organiser. Feedback will be provided on coursework and practical assessments within an appropriate time. Feedback on examination performance is available upon request from the module leader and overall class performance feedback on a question-by-question basis may also be provided.

3.3 Support of students

We aim to support all students throughout their time with us. We encourage students to develop independently but this does not mean that you need to be alone. We know that support and encouragement from staff and fellow students is very important throughout your degree.

The Student Support Officer for SEMS is the first contact for any personal support; they can be contacted by email: sems-office@qmul.ac.uk with any questions or to arrange an appointment.

3.3.1 Advisor arrangements

You will be allocated an Advisor when you register. You will meet with your Advisor at least twice per semester, but can always book more meetings if you need help.

3.3.2 Central support services Disability and Dyslexia Service

QMUL 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 QMUL students.

Advice and Counselling

QMUL offers a wide range of advice, guidance and self-help material. These free and confidential professional services are available to all students.

4 Programme structure

Taught modules accounting for 45 credits will be taught in the first semester, from September until December; a further 45 credits of taught modules will be taught in the second semester, from January until April. All taught module examinations will be in the standard examination periods during January and May. The 90 credit Research Engineering project will be completed over 3 semesters.

The modules making up the programme are presented in the table below. The indicative study programme in each of the streams is as follows, but there is some flexibility depending on the student's background and interests.

Module	Semester	Title		Credit
EMS715P	A,B,C	Extended Research Project	Core	90
EMS714P	A	Modern Robotics: Fundamentals and applications	Compulsory	15
EMS740P	A	Machine Learning and Artificial Intelligence for Engineering	Compulsory	15
EMS727P	A	Mechatronics	Compulsory	15

EMS729P	B	Cognitive Robotics	Compulsory	15
2 from:				
EMS707P	B	Digital Signal Acquisition and Processing	Elective	15
EMS701P	B	Medical Robotics and Surgical Techniques	Elective	15
EMS704P	B	Simulation and Model-based Systems Engineering	Elective	15
EMS705P	B	Environment, Ethics and Economics in Engineering Design	Elective	15
EMS741P	B	Deep Learning for Data and Image Analysis	Elective	15

Note: The modules, structure and assessments presented in this Programme Specification are correct at time of publication but might change as a result of student and staff feedback and the introduction of new or innovative approaches to teaching and learning. You will be consulted and notified in a timely manner of any changes to this document.

5 Entry requirements

Students will be admitted according to the entry requirements found at:

<https://www.sems.qmul.ac.uk/pgadmissions/>

6 Quality assurance

6.1 Student Voice Committee (SVC) meetings

The School has a Student Voice Committee and students on this programme are represented on this committee. The committee meets twice during each semester and is made up of the following members:

- Academic Lead for Student Experience (Chair)
- Student Support Officer (Secretary)
- Directors of the relevant programmes
- At least one student representing the relevant programmes

The elections for the postgraduate representatives are organised through the Student Union. SVC agendas and minutes are found on the SEMS QMplus landing page. Relevant items on the minutes are referred to the appropriate School committees for consideration and feedback.

6.2 Evaluating and improving the quality and standards of teaching and learning

We assess our provision of teaching by:

- Module review by means of student experience questionnaires and module organisers' reports.
- Annual staff appraisal.
- Peer observation of teaching.
- External examiners' reports.
- Periodic Programme Review by the University.

The Committees within SEMS that have responsibility for monitoring and evaluating quality and standards are

- Education Committee
- Student Experience Committee
- Academic Standards Committee
- Student Voice Committee
- Subject Examination Boards
- Degree Examination Boards

The ways we receive student feedback on the quality of teaching and your learning experience are:

- Annual Postgraduate Taught Experience Survey (PTES)
- Student Voice Committee
- Student Questionnaire evaluation for each of your modules
- Student forums on QMplus, including module and programme specific forums as well as ones covering more general topics
- Discussions with Advisors.

6.3 Staff development

Our staff are continuously engaging with professional development activities, including courses and workshops related to teaching and learning.