Programme Title: MEng Robotics Engineering, MEng Robotics Engineering with Industrial Experience

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Programme Specification

Awarding Body/Institution	Queen Mary University of London
Teaching Institution	Queen Mary University of London
Name of Final Award and Programme Title	MEng (Hons) Robotics Engineering MEng (Hons) Robotics Engineering with Industrial Experience MEng (Hons) Robotics Engineering with year abroad
Name of Interim Award(s)	
Duration of Study / Period of Registration	4/5
QM Programme Code / UCAS Code(s)	H67B, H67C, H67E, H67X
QAA Benchmark Group	Engineering
FHEQ Level of Award	Level 7
Programme Accredited by	Institute of Mechanical Engineers
Date Programme Specification Approved	
Responsible School / Institute	School of Engineering & Materials Science

Schools which will also be involved in teaching part of the programme
School of Electronic Engineering & Computer Science

Institution(s) other than Queen Mary that will provide some teaching for the programme

Programme Outline

Our brand new Robotics Engineering programme, the first of its kind in the UK, combines the best elements of the Schools of Electronic Engineering and Computer Science and of Engineering and Materials Science. The two Schools have combined their state-of-the-art teaching facilities and internationally leading research with a programme designed to cover a wide range of general and specialised topics in the field of robotics engineering.

The programme offers the opportunity to gain in-depth technical knowledge of robotics engineering, as well as hands-on experience and numerous transferable skills through engagement with industry.

Whether your interests lie in the robotics used in medicine or manufacturing, in ways robots can be made more intelligent or constructed of different materials, this programme will provide the foundations and specialist knowledge you need.

The choice of modules available allows you to get a general grounding in the science and engineering underlying robotics engineering, like applied mechanics, control engineering, software engineering and intelligent systems and to specialise in areas like industrial (manufacturing and logistic) robotics, medical robotics, cognitive robotics, or soft robotics. By the end of the

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programme, successful students will have the skills to design, program and build robots from beginning to end of the construction process, to serve a wide range of applications in the modern world.

The first two years of the Robotics Engineering MEng programme at QMUL provide a firm grounding in subjects fundamental to all branches of Engineering, including Dynamics, Software Engineering, Signal Processing and Control. These subjects are developed further in Robotics Design modules, which run through all four years and include group and individual project work.

The third year gives you the opportunity to specialise in a specific stream of Robotics Engineering: Intelligent Robotics, Industrial and Logistic Robotics or Medical Robotics. It also includes an individual project, which centres around the design and build of a robotic system for a specific application. The choice of project topic is not prescriptive, and you will be encouraged to choose a topic of mutual interest to you and your supervisor.

In the fourth year you will undertake further specialised modules as well as a group design project, which emphasises the benefits of teamwork and is often linked to industry. You will learn to function as part of a team and allocate work and responsibilities to team members, as well as developing an industrial link and gaining experience to add to your CV. Where possible projects are multi-disciplinary, with groups including students from other Engineering streams. You will also develop many transferable skills and your group will have responsibility for the overall management of the project including its finances.

The Robotics Engineering MEng degree programmes are accredited by the Institution of Mechanical Engineers (IMechE), the Institution of Engineering and Technology (IET) and the British Computer Society (BCS) and fully meet the academic benchmark requirements for registration as a Chartered Engineer. Students are entitled to become graduate members of IMechE, IET and BCS on graduation. Enrolment as a student member of the institutions is also encouraged.

Aims of the Programme

The MEng Robotics Engineering degree programmes at QMUL provide students with the fundamental training needed to become a professional engineer along with the specialist expertise in Robotics Engineering needed to take advantage of career opportunities in a wide range of industries. They aim to produce graduates who will take on leadership roles and do this by emphasising group project work with industrial involvement and encouraging self-learning and workload management.

They produce graduates:
- with sufficient technical knowledge to undertake leading roles as engineers across the engineering sector.
- with the personal and interpersonal skills to work closely and communicate effectively with colleagues in a work environment.
- with sufficient management and design knowledge to successfully integrate into and manage engineering projects.

What Will You Be Expected to Achieve?

Graduates from the programme will be expected to have:-

	Academic Content:
A1	Knowledge of the scientific and engineering principles necessary to underpin an education and career in Engineering.
A2	Understanding of mathematical principles underpinning Engineering, in addition to the mathematical methods, tools and notations used in the analysis of Robotics Engineering problems.
A3	An understanding of concepts from a range of areas including some outside Engineering, and the ability to apply them effectively in Engineering projects.
A4	An awareness of developing technologies related to Robotics Engineering.
A5	Knowledge of the regulatory, ethical, economic and environmental issues underpinning the Engineering professions, especially associated with Robotics Engineering, and how an engineer must operate within these.

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A 6	Knowledge of the design process and of project management.
A 7	Business and Management skills.

Disciplinary Skills - able to:	
B 1	Apply engineering principles to analyse Robotics Engineering problems.
B 2	Extract data pertinent to an unfamiliar problem, and apply it, particularly in relation to the Robotics Engineering field.
B 3	Apply quantitative methods and computer software relevant to engineering disciplines, to solve Robotics Engineering problems.
B 4	Use fundamental knowledge to investigate new and emerging technologies.
B 5	Learn new theories, concepts, methods etc. in unfamiliar situations.
B 6	Develop, monitor and update a plan, to reflect a changing operating environment.
B 7	Plan and perform safe experimental work in laboratory settings
B 8	Work effectively with computing tools for data analysis and processing, as well as modelling, simulation and design.
B 9	Utilise team working and project management skills to effectively work with colleagues on engineering projects and to effectively manage and lead engineering projects.
B 10	Develop proficiency in analytical and computational technologies towards the design or analysis of robotics engineering systems
B 11	Exercise professional judgement in robotics engineering related problems solving, considering ethical, economic and environmental issues.

Attributes:	
C 1	Engage critically with knowledge, and apply it in a rigorous way.
C 2	Use a range of communication technologies to engage with a range of audiences.
C 3	Critically evaluate the reliability of information from different sources.
C 4	Use information for evidence based decision making.
C 5	Use quantitative data confidently and competently.
C 6	Develop the necessary transferable skills to be effective in the workplace.
C 7	Develop an awareness of Health and Safety.

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C 8	Be able to isolate the key facts from complex, often contradictory information.

QMUL Model Learning Outcomes - Level 4:	
D 1	Identify and discuss their own career aspirations or enterprise skills and knowledge and how they impact on others
D 2	Identify and discuss what their own role in their programme and/or subject discipline might mean to them for future (
D 3	Identify and demonstrate the perspectives or problem solving techniques of different disciplines
D 4	Demonstrate connections between different theoretical perspectives within your discipline

How Will You Learn?

Teaching materials are delivered through a combination of lectures, problem solving classes, laboratory practicals, and a variety of coursework. In addition problem-based learning plays a role in your first and second years.
You will undertake a major individual research project in the third year, and a substantive industrially led group research project in the fourth year, both of which are designed to assimilate and utilise knowledge gained throughout the degree towards approaching a real Robotics Engineering problem.

The 3rd year project allows you to participate in the specialist internationally-recognised research taking place within the School of Engineering and Materials Science and the School of Electronic Engineering and Computer Science. The 4th year project is a group design project worth half of the final year. These exciting student-led projects are frequently sponsored by industry and provide a valuable insight into real life robotics engineering design and project management.

How Will You Be Assessed?

Assessment is continuous throughout the degree, with written reports, projects, presentations, group work and exams (exams take place in the summer only). The degree programme has eight modules per year split over two semesters, and most are assessed by a combination of coursework and an end of year exam. Some modules, such as the research and design projects, count for two or four modules. In the third and fourth year, you can select from a range of module options allowing you to tailor your degree to specific areas of interest within your specialist degree programme.

How is the Programme Structured?
Please specify the full time and part time programme diets (if appropriate).

The Robotics Engineering MEng programme at QMUL is an integrated 4 year programme accredited by the Institution of Mechanical Engineers, the Institution of Engineering and Technology, and the British Computer Society. This means students will have satisfied the academic requirements for progression to chartered engineer status (CEng).

Whilst at University, you gain a solid foundation in Robotics Engineering by studying core Engineering modules such as Mathematics, Dynamics, Software Engineering, Signal Processing and Control. In addition, you take specialist Robotics Engineering modules starting in year 1 and these increase in number throughout the degree programme. In years 3 and 4, you are able to choose a specific Robotic Engineering stream (Intelligent Robotics, Industrial and Logistic Robotics, Medical Robotics).

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This allows you to tailor your degree programme to match your own Robotics Engineering interests and career intentions.

We also offer the MEng degree 'with Industrial Experience' where you would take a year working in a Robotics Engineering related industrial position between your third and fourth years of study. You are paid by the company during this year which also counts towards their degree. If you are not registered on a 'with Industrial Experience' programme you can opt into it at any stage prior to taking your placement. You would extend your studies by a year as you undertake a structured programme at one of our many partner companies. To support this activity we employ full time Industrial Placement Managers in both Schools, who supports you through the application process and then manages the programme whilst you are on the placement. Recent placement employers include: DSTL, RollsRoyce, DePuy, Aloca, Microsoft, ARTIS, GE, Caterham F1 & Philips. This exciting opportunity gives you a valuable insight into future careers and enhances employability.

Please see attached programme schematic.

QMUL Model

Students are required to undertake the equivalent of one module (15 credits in 2017/18) per year of study which has been identified as meeting the requirements of the QMUL Model. Each of these modules has been designed to combine the best of QMUL's academic excellence with your ability to identify and develop your skills, networks and experience. This will help to ensure you become a graduate who can undertake further study or secure graduate employment in areas that interest you, and will support your ability to position yourself to find the right job or opportunity for you. The relevant module for your first year of study in 2017/18 is indicated below.

Where more than one module is specified, this is because pertinent elements from these modules have been identified as being appropriate to the QMUL Model and when studied together, deliver the equivalent content of one 15-credit QMUL Model module.

The QMUL Model modules for future years and associated Learning Outcomes will be identified as your studies continue.

Should Professional, Statutory and Regulatory Body requirements apply to your programme of study, these will be taken into account in the specification of QMUL Model requirements.

Academic Year of Study   FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Procedural Programming	ECS401U	15	4	Compulsory	1	Semester 1	No
Digital Circuit Design	ECS412U	15	4	Compulsory	1	Semester 1	No
Aspects of Robotics (Robotics I)	ECS426U	15	4	Compulsory	1	Semester 1	Yes
Mathematics and Computing for Engineers 1	DEN4122	15	4	Compulsory	1	Semester 1	No

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Analogue Electronic Systems	ECS409U	15	4	Compulsory	1	Semester 2	No
Signals and Information	ECS411U	15	4	Compulsory	1	Semester 2	No
Engineering Mechanics: Dynamics	DEN4108	15	4	Compulsory	1	Semester 2	Yes
Mathematics and Computing for Engineers 2	DEN4123	15	4	Compulsory	1	Semester 2	Yes
Skills for Robotics Engineering	ECS425U	0	4	Compulsory	1	Semesters 1 & 2	No

Academic Year of Study   FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
C Programming	ECS501U	15	5	Compulsory	2	Semester 1	No
Microprocessor Systems Design	ECS502U	15	5	Compulsory	2	Semester 1	No
Engineering Materials for Design	DEN5002	15	5	Compulsory	2	Semester 2	No
Electronic Devices and Applications	ECS517U	15	5	Compulsory	2	Semester 1	No
Design and Build Project in Robotics Engineering (Robotics II)	ECS526U	15	5	Compulsory	2	Semester 2	No
Control Systems Analysis and Design	DEN5200	15	5	Compulsory	2	Semester 2	No
Engineering Mechanics: Statics	DEN4102	15	4	Compulsory	2	Semester 2	No
Engineering Design Methods	MAT4002	15	5	Compulsory	2	Semester 1	No

Academic Year of Study   FT - Year 3

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Digital Signal Processing	ECS602U	15	6	Compulsory	3	Semester 1	No
Modeling and Control of Robotic Systems	DEN6336	15	6	Compulsory	3	Semester 1	No
Computability, Complexity and Algorithms	ECS651U	15	6	Elective	3	Semester 1	No
Computer Aided Engineering for Solids and Fluids	DEN331	15	6	Elective	3	Semester 1	No
Advanced Robotic Systems (Robotics III)	ECS653U	15	6	Compulsory	3	Semester 2	No
Interaction Design	ECS612U	15	6	Compulsory	3	Semester 2	No
Artificial Intelligence	ECS629U	15	6	Elective	3	Semester 2	No
Industrial Robotics and Mechatronics	DEN6408	15	6	Elective	3	Semester 2	No
Medical Robotics Techniques	DEN6409	15	6	Elective	3	Semester 2	No
Individual Project	DEN318	30	6	Compulsory	3	Semesters 1 & 2	No
Neuromuscular Bioelectricity and Biomechanics	DEN5302	15	5	Elective	3	Semester 1	No

Academic Year of Study   FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Machine Learning	ECS708U	15	7	Compulsory	4	Semester 1	No
Introduction to Computer Vision	ECS709U	15	7	Elective	4	Semester 1	No
Embedded Systems	ECS714U	15	7	Elective	4	Semester 1	No
Computational Engineering	DEN401	15	7	Elective	4	Semester 1	No

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Advanced Spacecraft Design: Manoeuvring and Orbital Mechanics	DEN7335	15	7	Elective	4	Semester 1	No
Surgical Techniques and Safety	DEN412	15	7	Elective	4	Semester 1	No
Cognitive Robotics (Robotics IV)	ECS794U	15	7	Compulsory	4	Semester 2	No
Real-time DSP	ECS732U	15	7	Elective	4	Semester 2	No
Machine Learning for Visual Data Analysis	ECS797U	15	7	Elective	4	Semester 2	No
Critical Systems	ECS727U	15	7	Elective	4	Semester 2	No
Numerical Optimisation in Engineering Design	DEN7026	15	7	Elective	4	Semester 2	No
Clinical Measurements	DEN406	15	7	Elective	4	Semester 2	No
Research and Design Team Project	MAT7400	60	7	Compulsory	4	Semesters 1 & 2	No

What Are the Entry Requirements?

Minimum Entry Requirements with A-levels are:
AAA or 360 points from 3 A-levels
Must include maths A-level and at least one science A-level (physics, biology, or chemistry).
Maths A-level must be an A or above

Other qualifications:
International Baccalaureate - 36 points or above overall, with maths and a science (physics, chemistry or biology) at higher level 6
European Baccalaureate - 85% or above including maths and science
French Baccalaureate - 15/20 overall, with 15/20 in maths and science
HE Advanced Diploma - Grade A or above overall, with Maths A-level grade A or above

How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between the Schools and its students. The committee consists of student representatives from each year of the programme, together with appropriate representation from staff within the Schools. It is designed to respond to both the general needs of students, and subject specific concerns, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

The chair of the SSLC sits on the School's Education and Learning Committee, which advises the School's Director of Taught Programmes on all matters relating to the delivery of taught programmes at School level, and ensures that student feedback is fed into the reviewing of modules and programmes. Student views are also incorporated in the Committee's work in other ways, such as through the National Student Survey (NSS), student module evaluations and module forums. We also use the forums to listen to student feedback on an individual module basis and develop materials and support classes to address comments or requests suggested in the forum. In addition, the school have Senior Tutors dedicated for UG students who will be the first point

for pastoral and general programme and teaching & learning issues.

All Schools operate an Annual Programme Review (APR) of their taught undergraduate and postgraduate provision. APR is a continuous process of reflection and action planning which is owned by those responsible for programme delivery; the main document of reference for this process is the Taught Programmes Action Plan (TPAP) which is the summary of the School's work throughout the year to monitor academic standards and to improve the student experience.

Academic Support

Academic support for individual modules is the responsibility of the module organiser and co-organiser(s). These are supported by Teaching Assistants and post-graduate students, many of whom will have studied the modules themselves as undergraduates in the School. In addition there is technician support available for practical sessions.
Academic support for the programme as a whole, including choosing optional modules and possible transfer between programmes is provided in the first instance by the Personal Tutor, with further guidance available from the Senior Tutor and Programme Director, the latter having overall responsibility for the programme structure. The Programme Director in turn reports to the relevant Discipline Teaching Group in the School, the Chair of which is a member of the School's Education and Learning Committee.

We additionally have a School Office, with many student facing staff available to support student learning and one full time Student Support Officer. These staff members will help with coursework submission, time tabling concerns and other general administration as well as providing pastoral support and further guidance on dealing with extenuating circumstances. We also have staff designated to support students in achieving industrial placements and providing careers advice.

Programme-specific Rules and Facts

The Programme operates under the standard QMUL rules for MEng programmes.

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

We place a strong emphasis on supporting our students in achieving quality graduate positions at the end of their degrees. In the

first year, all students take a transferable skills module, designed to both support them through the transition to university life, and also introduce the important employability skills they will need in later life. We run an extensive range of employability training events, with weekly timetabled careers slots and field trip visits to more than 20 collaborating companies. Our relationships with both the Careers Group and Student Services are strong in SEMS and EECS, and we co-deliver our training in study skills and career development for maximum benefit.

Since 2011 SEMS have had a placement officer working in the school dedicated to supporting our new "with Industrial Experience" programmes which have grown immensely in popularity in the last few years. EECS also has a dedicated Industrial Placement Manager who provides continuous support to UG/PG students on employability and career pathways. Both officers are part of the faculty-wide initiative on enhancing students' employability.

The School has run Industrial Liaison Forums (ILFs) each academic year since the School was formed in 2007. Since 2010, the Autumn event is focused on encouraging more industrial participation in our research programmes, rewarding excellence by allowing companies to present student prizes for academic excellence across the School and also as a way of allowing companies and our students to interact through themed panel sessions and a careers fair. The Spring event aims to showcase our best third year project students and all of our group MEng projects. EECS also offers a spring 'Research Showcase' event where industrial partners a encouraged to participate in our Teaching & Learning Industrial Advisory Board and Committee to inform our continuous curriculum review and update. This event again allows extensive networking opportunities between employers and placement providers with all of our students in SEMS. Typically these events are attended by over 50 companies including our regular student prizes sponsors: Tata Steel, Eaton Industries, JRI, GSK, RollsRoyce, Apatech, Morgan Cruicible, ARTIS, NPL, TWI, Becker Coatings; Advanced Healthcare Ltd & Apatech. Many of these companies are also actively engaged in student projects and in addition to these our events are also attended by additional companies that also collaborate with projects such as: Jaguar Land Rover, Alcoa, Perryman, DSTL, BAe, Airbus, Corin, DePuy, Baxter's Healthcare, Google, BT, IBM, Phillips, Morgan Stanley, BBC, Microsoft Research, Selex ES, Agilent, Norman Foster Partners and many others. In recent times we have extended these events to encourage participation from our more recent alumni as well.

These forums have a direct impact by encouraging employers to sponsor and support the student projects and to provide real engineering case studies to engage the students throughout the curriculum. Many of these companies also support our lecture programme in individual modules. Recent case studies that have been taught and assessed were delivered by companies including Tata, Gillette, Sugru, JRI, DuPuy, Apatech, Artis, BAe, DSTL, Rolls Royce, Perryman and Advanced Healthcare ltd.

Programme Specification Approval

Person completing Programme Specification	Dr Adrian Briggs
Person responsible for management of programme	Prof Kaspar Althoefer
Date Programme Specification produced/amended by School Learning and Teaching Committee	9 Jan 2019
Date Programme Specification approved by Taught Programmes Board	

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