

## Programme Specification

Awarding Body/Institution	Queen Mary University of London
Teaching Institution	Queen Mary University of London
Name of Final Award and Programme Title	BEng (Hons) Aerospace Engineering/BEng (Hons) Aerospace Engineering with Industrial Experience
Name of Interim Award(s)	
Duration of Study / Period of Registration	3/4 years
QM Programme Code / UCAS Code(s)	H421/H401
QAA Benchmark Group	Engineering
FHEQ Level of Award	Level 6
Programme Accredited by	Royal Aeronautical Society and the Institution of Mechanical Engineers
Date Programme Specification Approved	1 Nov 2016
Responsible School / Institute	School of Engineering & Materials Science

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

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

### Programme Outline

The BEng degrees in Aerospace engineering is a 3 year programme that is part of a suite of programmes offered in Aerospace Engineering at Queen Mary University of London.

Aerospace technology has grown out of the problems of design, construction, and operation of vehicles that manoeuvre above the Earth's surface - ground-effect machines, helicopters, aircraft and spacecraft. Design of such vehicles has always been challenging, because they operate in a hostile environment, and also because they have to be lightweight, efficient and reliable. These same requirements apply not only to future spacecraft and high performance transport aircraft, but also to the next generation of ground transportation, such as high-speed trains, cars, over-water transportation, sport vehicles. Future work is anticipated in zero gravity and manufacturing of high-purity materials and medicines, and the design of solar-powered satellites.

Aerospace engineering is a field where state-of-the-art technologies are applied every day. It is an exciting profession with outstanding career opportunities in which physical sciences, mathematics and computers are combined in the design of air and space vehicle systems and components to achieve high performance with limited size and weight. This requires aerospace engineers to constantly develop and apply the most advanced technologies.

The suite of Aerospace Engineering degree programme at QMUL is delivered by a large number of specialist academic staff. Key specialities in Aerospace Engineering at QMUL are as follows:

- Computational and experimental aerodynamics
- Computational structural analysis
- Flight dynamics, control and simulation
- Propulsion
- Space engineering

The first two years of the Aerospace Engineering programme at QMUL provides a firm grounding in subjects fundamental to all branches of engineering, including Design, Thermodynamics, Fluid Mechanics, Solid Mechanics and Dynamics. They also provide an insight into process engineering, computing and training in workshop practice. The aerospace-specific modules (Exploring Aerospace Engineering in the first year and Aerothermodynamics of Fluid Flows and Composites for Aerospace Applications in the second year) differentiate this programme from other programmes of study in the School.

The third year gives students the opportunity to specialise in subjects such as Flight Dynamics and Control, Aircraft Propulsion, Aircraft Structural Analysis, Aircraft Design, and Spacecraft Design. One popular activity is attendance at the Flight Testing short course at Cranfield College of Aeronautics, where in-flight experiments are conducted in an instrumented Jet stream aircraft. Taking readings from instruments while the aircraft is undergoing a stall is an enlightening experience! The third year also includes a compulsory module on Computational Engineering and an individual project, which may be a detailed design study, an experimental and/or theoretical investigation, or a critical review of a topic in aerospace engineering of mutual interest to the student and supervisor.

The Aerospace Engineering BEng programmes are accredited by the Royal Aeronautical Society (RAeS) and the Institution of Mechanical Engineers (IMechE) and meet the benchmark requirements for registration as an Incorporated Engineer. Students will be required to complete a further period of approved learning (eg an MSc) in order to fully meet the benchmark requirements for registration as a Chartered Engineer. In any case students are entitled to become graduate members of RAeS and IMechE on graduation. Enrolment as a student member of the IMechE is also encouraged. The School is a Corporate Member of RAeS.

## Aims of the Programme

Given the rapid developments in aerospace technology, the Schools's overall goal is to teach you how to respond to these changes and advance with them. Teaching is directed not only towards securing you a job in the aerospace industry when you complete the degree programme, but also providing a springboard to research and management positions in civil and military aviation, not to mention careers in government.

The curriculum development for Aerospace students is based on carefully selected goals for the educational program and is closely linked to the needs of aerospace industry. The overall goal is to train engineers who are able to respond to the rapid developments in aerospace technology. Training is not only directed towards future top positions in the aerospace industry and research institutions, but also in other engineering fields. This programme aims to satisfy the requirements of industry and at the same time be interesting and rewarding to the student.

The BEng Aerospace Engineering degree programmes at QMUL provide students with the fundamental training needed to become a professional engineer along with the specialist expertise in Aerospace Engineering needed for a career in the Aerospace sector. However, graduates are not limited to careers in the Aerospace sector, but will acquire the skills needed to take advantage of career opportunities in a wide range of industries.

They will produce graduates:

- with sufficient technical knowledge to undertake roles as engineers in the Aerospace sector and other related industries.
- 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 engineering projects.

## What Will You Be Expected to Achieve?

Students who complete the degree programme will be expected to have:

Academic Content:	
A 1	Knowledge of the scientific principles necessary to underpin an education in Aerospace Engineering
A 2	Understanding of mathematical principles underpinning Aerospace Engineering and Engineering more generally, in addition to the mathematical methods, tools and notations used in the analysis of Aerospace Engineering problems.
A 3	An understanding of concepts from a range of areas including some outside engineering, and the ability to apply them effectively in Aerospace Engineering projects.
A 4	Knowledge of the regulatory, ethical, economic and environmental issues underpinning the Aerospace Engineering profession, and how an engineer must operate within these.
A 5	Knowledge of design process and project management
A 6	Knowledge of business and management techniques.

Disciplinary Skills - able to:	
B 1	Apply engineering principles to analyse key Aerospace Engineering problems.
B 2	Extract data pertinent to an unfamiliar problem, and apply it, particularly in relation to the Aerospace Engineering field.
B 3	Apply quantitative methods and computer software relevant to engineering disciplines, to solve Aerospace Engineering problems.
B 4	Use fundamental knowledge to investigate new and emerging technologies.
B 5	Plan and perform safe experimental work in laboratory settings
B 6	Work effectively with computing tools for data analysis and processing, as well as modelling, simulation and design.
B 7	Utilise team working and project management skills to effectively work with colleagues on engineering projects.

Attributes:	
C 1	Engage critically with knowledge, and apply it in a rigorous way.
C 2	Use communications technologies competently to engage with a range of audiences.
C 3	Critically evaluate the reliability of different sources of information.
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.

C7	Develop an awareness of Health and Safety.
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QMUL Model Learning Outcomes - Level 4:	
D1	Identify and discuss their own career aspirations or enterprise skills and knowledge and how they impact on others
D2	Identify and discuss what their own role in their programme and/or subject discipline might mean to them for future employment
D3	Identify and demonstrate the perspectives or problem solving techniques of different disciplines
D4	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, designed to assimilate and utilise knowledge gained throughout the degree towards approaching a real Engineering problem. This project allows you to participate in the specialist internationally-recognised research taking place within the School of Engineering and Materials Science. It provides a valuable insight into real life research 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 late Spring only). The degree programme has eight modules per year split over two semesters. The third year research project counts for two modules. In the third year, you can select from a range of module options allowing you to tailor your degree to specific areas of interest within the Medical Engineering degree programme.

### How is the Programme Structured?

Please specify the full time and part time programme diets (if appropriate).

The Aerospace Engineering BEng degree at QMUL is accredited by the Royal Aeronautical Society and the Institution of Mechanical Engineers, which means students can progress to Chartered Engineer status (CEng).

Whilst at University, you gain a solid foundation in Engineering by studying core Engineering modules such as Mathematics, Solid Mechanics, Design, Dynamics and Fluid Mechanics. In addition, you take specialist Aerospace Engineering modules starting in year 1 and these increase in number throughout the degree programme. In year 3, you are able to choose your modules from a broad range of Aerospace Engineering module options (see programme structure below). This allows you to tailor your degree programme to match your own Aerospace Engineering interests and career intentions.

We also offer a BEng degree 'with Industrial Experience' where you would take a year working in a Aerospace Engineering related industrial position either after your second or third years of study. You are paid by the company during this year which also counts towards your 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 a full time Industrial Placement Manager in the School, 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, Alcoa, 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
Engineering Design Methods	MAT4002	15	4	Compulsory	1	Semester 1	<input type="checkbox"/> Yes
Mechanics of Fluids I	DEN4101	15	4	Compulsory	1	Semester 1	<input type="checkbox"/> Yes
Mathematics and Computing for Engineers 1	DEN4122	15	4	Compulsory	1	Semester 1	<input type="checkbox"/> No
Exploring Aerospace Engineering	DEN4005	15	4	Compulsory	1	Semester 1	<input type="checkbox"/> No
Mathematics and Computing for Engineers 2	DEN4123	15	4	Compulsory	1	Semester 2	<input type="checkbox"/> No

Programme Title: BEng Aerospace Engineering, BEng Aerospace Engineering with Industrial Experience

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Engineering Mechanics: Dynamics	DEN4108	15	4	Compulsory	1	Semester 2	<input type="checkbox"/> No
Engineering Mechanics: Statics	DEN4102	15	4	Compulsory	1	Semester 2	<input type="checkbox"/> No
Thermodynamics I	DEN107	15	4	Compulsory	1	Semester 2	<input type="checkbox"/> No
Transferable Skills for Engineers and Materials Scientists	MAT4444	0	4	Compulsory	1	Semesters 1 & 2	<input type="checkbox"/> No

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Design for Manufacture	DEN5101	15	5	Compulsory	2	Semester 1	<input type="checkbox"/> No
Grad, Div and Curl: Vector Calculus for Engineering	DEN5122	15	5	Compulsory	2	Semester 1	<input type="checkbox"/> No
Engineering Instrumentation	DEN5109	15	5	Compulsory	2	Semester 1	<input type="checkbox"/> No
Aerothermodynamics of Fluid Flows	DEN5242	15	5	Compulsory	2	Semester 1	<input type="checkbox"/> No
Engineering Materials for Design	DEN5002	15	5	Compulsory	2	Semester 2	<input type="checkbox"/> No
Solid Mechanics	DEN5102	15	5	Compulsory	2	Semester 2	<input type="checkbox"/> No
Control Systems Analysis and Design	DEN5200	15	5	Compulsory	2	Semester 2	<input type="checkbox"/> No
Low Speed Aerodynamics	DEN233	15	5	Compulsory	2	Semester 2	<input type="checkbox"/> No

Academic Year of Study FT - Year 3

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
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Programme Title: BEng Aerospace Engineering, BEng Aerospace Engineering with Industrial Experience

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Individual Project	DEN318	30	6	Core	3	Semesters 1 & 2	No
Computer Aided Engineering for Solids and Fluids	DEN331	15	6	Compulsory	3	Semester 1	No
Stability and Control of Aircraft	DEN303	15	6	Compulsory	3	Semester 1	No
Aircraft Design	DEN6305	15	6	Elective	3	Semester 1	No
Spacecraft Design: Manoeuvring and Orbital Mechanics	DEN6335	15	6	Elective	3	Semester 1	No
Aircraft Propulsion	DEN306	15	6	Elective	3	Semester 2	No
Aerospace Structures	DEN307	15	6	Elective	3	Semester 2	No
High Speed Aerodynamics	DEN6405	15	6	Elective	3	Semester 2	No
Composites for Aerospace Applications	MAT5030	15	5	Elective	3	Semester 2	No

### What Are the Entry Requirements?

Minimum Entry Requirements with A-levels are:

ABB or 320 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 a B or above

Other qualifications:

International Baccalaureate - 34 points or above overall, with maths and a science (physics, chemistry or biology) at higher level 6

European Baccalaureate - 80% or above including maths and science

French Baccalaureate - 14/20 overall, with 15/20 in maths and science

HE Advanced Diploma - Grade B or above overall, with Maths A-level grade B 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 School and its students. The committee consists of student representatives from each year of the programme, together with appropriate representation from staff within the School. 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.

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 BEng programmes. Students on the "with Industrial Experience" version need a year 1 average of at least 55% to progress to year 2 of the programme. Failure to achieve this will result in a transfer to the version without Industrial Experience.

## 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 we co-deliver our training in study skills and career development for maximum benefit.

Since 2011 we 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.

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. 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 Crucible, 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, 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.

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## Programme Specification Approval

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**Person completing Programme Specification**

Prof Vassili Toropov/Dr Henri Huijberts

**Person responsible for management of programme**

Dr Fariborz Motallebi

**Date Programme Specification produced/amended by School Learning and Teaching Committee**

1 Nov 2016

**Date Programme Specification approved by Taught Programmes Board**

1 Nov 2016