

**PROGRAMME SPECIFICATION**

Degrees:

Programme Title	Final Award	Duration of study/ years	Programme & Route code	Level
Materials Science and Engineering	BEng	3	UBEF-QMMTLS1/ USMSEZ	6
Materials Science and Engineering with industrial experience in year 3/4	BEng	4	UBEF-QMMTLD1/ USMSIZ USEF-QM5MTB2/ USMSIZ	6
Materials Science and Engineering with year abroad	BEng	4	UBEF-QMMTLY1/ USMSYZ	6
Materials Science and Engineering	MEng	4	UMEF-QMMTLS1/ USMSEZ	7
Materials Science and Engineering with industrial experience in year 3/4/5	MEng	5	UMEF-QMMTLE2/ USMSIZ USEF-QM6MTL1/ USMSIZ USEF-QM6MTL3/ USMSIZ	7
Materials Science and Engineering with year abroad in year 3	MEng	5	UMEF-QMMTLX1/ USMSYZ	7

<b>Ownership</b>	
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
<b>External references</b>	
QAA Benchmark Group	Engineering
<b>External Accreditor (if applicable)</b>	Institution of Materials, Minerals and Mining
Accreditation received	2022

<b>Specification Details</b>	
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Submitted to Directorate of Governance & Legal Services	11 December 2023
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## 1. Programme Overview

The UK government has identified as part of its Industrial Strategy Grand Challenges to put the UK at the forefront of the industries of the future. The Four Grand Challenges are focused on the global trends which will transform our future: artificial Intelligence and data; ageing society; clean growth and the future of mobility. We have developed our undergraduate programmes to ensure that future cohorts of the materials graduates are well equipped to cope with all of these newly emerging engineering challenges.

The first year has been designed to offer a very broad skills-based engineering background, to discover how materials engineering interacts with all the different engineering disciplines in practice. Our experiential based learning approach will provide you with not only technical content but also to become equipped with the essential skills required to become a practicing engineer.

In the 2nd year we have moved away from studying materials segregated in their traditional classes. This will help you focus on and develop understanding and experience of the relationships between the structure and composition of materials and the specific properties and functionality they possess. The broad range of applications we will consider will require multidisciplinary thinking, which is the fundamental attribute of a materials science graduate.

In the 3rd year, you will use your newly acquired skills and knowledge to help identify and then solve these grand engineering challenges that will be core to your working experience for the next 50 years. This can be achieved for example by looking at methods to facilitate materials discovery using data analytics; developing bespoke devices for personalised healthcare; ensuring that environmental impact is at the heart of all engineering decision making and to ensure that sustainable energy sources can be exploited in the next generation of transportation systems. The programme will continue to discuss the state-of-the-art discoveries from our own research as well as the latest ideas that we have developed with our extensive industrial network of collaborators. Ensuring that after graduation you will have all the knowledge and skills required to enter the highly valued materials engineering discipline.

The third-year design project will build on your interests within an industrially focused area and integrated into the School's world-leading research activities. This double-module will integrate core disciplinary topics and apply creative thinking to design a product to meet a specification. This is an industry-focused module aiming to simulate a real-world professional environment where you will work independently and will also come together in a group to solve a complex specification, negotiate with clients, produce and assess a complex design, and develop a business case. A particular focus is placed on innovative designs, as well as assessing and improving a product from a sustainability perspective.

Students who choose to take the MEng degree will carry out an extensive project linked to industry or research, for half of your final year. It will have a focus on solving real engineering research and design problems.

The programme aims to:

- provide an engineering education of a standard recognised to be amongst the highest in UK institutions
- take a multi-disciplinary approach to the elements of engineering, including design

- offer challenging programmes which provide graduates with a clear pathway to Chartered Engineering status
- prepare graduates with discipline-specific knowledge and transferable skills that will equip you for employment and continued professional development through self-learning.

The MEng programme additionally aims to develop

- an appreciation of the relative merits and financial implications of a proposed engineering solution as they affect those who must put them into practice
- the detailed skills needed for you to undertake a research / development / design project in depth, understanding the technical, financial and time limitations

## 2. Learning outcomes for the programme

In this degree programme we place strong emphasis not only on the technical content of our modules, such as mechanics, thermodynamics and design, 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 or higher-level study. We have mapped our modules to a range of attributes that we would like you to develop, within the areas of creativity, resilience, communication, technical and professional practice in order to produce well-rounded, interested and highly employable graduates.

The programme will develop concepts and disciplinary skills related to the academic content and graduate attributes, which are listed below. Over the duration of your programme you will develop the tools to recognise and record your development in these areas.

### 2.1.1 Academic Content

#### BEng

<b>A1</b>	<b>Core scientific principles.</b> Understand the core engineering, scientific and mathematical principles needed to underpin Materials Science and Engineering professions.
<b>A2</b>	<b>Disciplinary concepts.</b> Understand, apply and critique a broad range of disciplinary concepts related to Materials Science and Engineering.
<b>A3</b>	<b>Problem solving.</b> Apply engineering approaches to solve a wide range of problems, relating to risks, costs, safety, reliability, aesthetics and environmental impact.
<b>A4</b>	<b>Key technologies.</b> Fundamentally understand state-of-the-art technologies related to Materials Science and Engineering.
<b>A5</b>	<b>Systems design and optimisation.</b> Design and optimise a broad range of products, processes and systems, based on key technical and sustainability related factors.
<b>A6</b>	<b>Experimental design and delivery.</b> Plan, execute and communicate the outputs of an experiment or project.
<b>A7</b>	<b>Experimental approaches.</b> Use and integrate a wide range of computational and

<b>A9</b>	<b>Engineering responsibility.</b> Understand the roles and responsibility of engineers in society and their impact on both a local and global context.
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## MEng

<b>A1</b>	<b>Core scientific principles.</b> Systematic understanding of the core engineering, scientific and mathematical principles needed to underpin materials science and engineering professions.
<b>A2</b>	<b>Disciplinary concepts.</b> Understand, apply and critique a broad range of advanced disciplinary concepts related to materials science and engineering.
<b>A3</b>	<b>Problem solving.</b> Deal with complex issues systematically and creatively. Apply engineering approaches to solve a wide range of advanced problems, relating to risks, costs, safety, reliability, aesthetics and environmental impact in the absence of complete data or information.
<b>A4</b>	<b>Key technologies.</b> Comprehensive understanding of advanced state-of-the-art technologies their capabilities and limitations related to materials science and engineering.
<b>A5</b>	<b>Systems design and optimisation.</b> Design and optimise a broad range of products, processes and systems, based on key technical and sustainability related factors. Make design decisions in complex and unpredictable situations.
<b>A6</b>	<b>Experimental design and delivery.</b> Critically evaluate current research and methodologies and where appropriate, proposed new hypothesis. Plan, execute and communicate the outputs of an experiment or project.
<b>A7</b>	<b>Experimental approaches.</b> Use and integrate a wide range of advanced computational and experimental approaches to solve materials science and engineering problems and be able to interpret the results affected by uncertainties.
<b>A8</b>	<b>Engineering economics.</b> Advanced understanding of economic evaluation and business principles and their impact relevant to engineering.
<b>A9</b>	<b>Engineering responsibility.</b> Fully understand the roles and responsibility of engineers in society and their impact on both a local and global context. Exercise initiative and personal responsibility for ensuring continuous professional development.

### 2.1.2 SEMS graduate attributes

Five areas related to the graduate attributes you will develop whilst you are studying in SEMS have been defined as Resilience, Creativity, Communication, Professional Practice and Technical.

#### Resilience (R1-R3)

In your studies and career there may be times where things do not go exactly how you planned. Being resilient is all about your ability to cope with setbacks and criticism, motivate yourself to overcome obstacles, and stay calm under pressure. You might explore your resilience when reflecting on how you have adapted to a problem-based learning exercise as part of your programme or attend workshops that explore the importance of this skill for your personal and professional development.

**Creativity (C1 - C4)**

### Communication (Co1 – Co4)

Good communication skills are important not only for helping you to express your own ideas but to listen and provide feedback to others. You will be asked to show your ability to communicate information both verbally, in writing and using other digital technologies to a range of audiences, in both individual and group situations.

### Professional Practice (P1 – P5)

From learning about effective ways to manage projects to considering the commercial aspects of developing a new product, you will need a range of knowledge and tools for future success in industry and research. You will be able to practice project management approaches through practical work in your modules, which will also develop an awareness of health and safety. You will also be introduced to topics such as intellectual property and research ethics.

### Technical (T1 – T6)

The fundamental practical attributes important for engineering careers from manufacturing techniques to the analysis and risk assessment of engineering systems and approaches are included in this area. Programming is increasingly important whether it is coding software such as MATLAB or Python or using other software to model and solve problems. Design projects will test your ability to analyse a complex engineering problem, select appropriate manufacturing techniques to help solve your specific challenge, and use statistics to understand the risks and uncertainty associated with your planned design. You will be introduced to computer programming software through taught modules and use your knowledge to interpret and model large amounts of data as part of practical assignments and projects.

By the end of your degree students from SEMS will be able to:

R1	Adversity	Adapt to changes in the face of adversity and an appreciation of how this feeds into life long learning.
R2	Self-development	Identify and appreciate the skills for personal and professional self-development.
R3	Long-term goals	Persevere and sustain interest in long-term goals.
Cr1	Critical thinking	Evaluate complex or contradictory information, data and processes in order to make judgements and decisions.
Cr2	Problem-solving	Identify and solve real world problems, developing creative solutions with a full awareness of sustainability.
Cr3	Product design	Apply creativity in product and systems design, incorporating different disciplinary and cultural perspectives.
Cr4	Systems	Evaluate, model and improve a range of multifaceted systems.
Co1	Verbal communications	Be effective in verbal communication, develop speaking and listening skills, and provide and receive constructive feedback.
Co2	Written	Convey complex technical, professional and other

Co3	Communication technologies	Use a range of digital technologies to facilitate effective verbal, graphical and visual communication of technical ideas with engineers, scientists, technicians and a lay audience.
Co4	Team work	Work effectively in a team, appreciating different team roles including leadership.
P1	Project management	Use project management tools and develop skills to deliver projects in industry, research and elsewhere.
P2	Ethics and codes of conduct	Understand and comply with professional engineering and scientific ethics and codes of conduct.
P3	Health and safety	Understand the importance of health and safety (H&S) from personal, professional and corporate responsibility viewpoints.
P4	Commercial awareness	Have a working knowledge of intellectual property (IP) considerations and other commercial aspects of product development.
P5	Regulation and quality assurance	Have a working knowledge and ability to comply with relevant regulatory frameworks, quality assurance processes and good laboratory practice.
T1	Manufacturing techniques	Evaluate and select the appropriate prototyping and manufacturing techniques.
T2	Laboratory and practical techniques	Plan, use and record data from laboratory and workshop techniques pertinent to the discipline of study.
T3	Risk and uncertainty	Evaluate risk and uncertainty using appropriate statistical methods applied to engineering and scientific problems and other evaluation methods.
T4	Design of experiments	Design tests and experiments to fabricate or synthesise different engineering systems, components or materials, and to measure or monitor their performance or properties.
T5	Computer programming	Use computer programming to model and solve science and engineering problems.
T6	Software tools	Use common software tools for engineering design & analysis.

### 3 Learning and teaching approaches

Teaching methods are tailor-made to suit the size of classes, the nature of the subject and the level of study. Each module has a combination of methods including lectures, tutorials, laboratory sessions, industrial visits, workshops and group work. QMUL degrees combine face

Projects throughout the programme are designed for you to exercise independent thinking, research and problem solving skills and are preferably undertaken in a related subject. Group projects enhance your communication, organisational as well as technical skills.

As a student graduating on the BEng programmes after three years you will be well-prepared to attain the Chartered Engineer status by study of a Matching Section such as an MSc, and many do this. Nationwide, these students provide the bulk of engineering graduates for employment, having a broad background in Engineering. However you will not have the professional multi-disciplinary group design experience nor the in-depth analysis capabilities of the final MEng year, although you can develop this through work experience.

The 4th Year, leading to the MEng degree, consists of advanced subjects and a major project in which a typical industrial environment is simulated. The project accounts for half of the final year and places a greater demand on you as an MEng student in terms of your organisational, interpersonal and problem-solving skills than you will have faced in earlier years. In addition to the project, you will take four elective modules. Fourth year options contain material usually covered at postgraduate level and involve specialisation. The 4th Year therefore will challenge you to develop and apply your intellectual prowess, problem-solving skills, independence and project-management skills. All these are central to the profile of a well-rounded engineer which industry wishes to see in graduates.

### **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 meets twice a year. The event in October runs in parallel with the SEMS prize day where companies award prizes to more than 30 of our best students. During the October event the projects that you will tackle in the academic year are planned and the second event in March is designed to help evaluate and review the projects.

### **3.2 Assessment methods**

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

Written assessment

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

Practical assessment

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



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, developmental assessments such as project plan and progress reports and on coursework assessments. This feedback may be summarised for the whole cohort or be directed towards your work individually

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.

QMUL's Policy on Assessment and Feedback and guidance on issuing provisional marks to students is available at: <https://arcs.qmul.ac.uk/policy/>

### **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](mailto:sems-office@qmul.ac.uk) with any questions or to arrange an appointment.

#### **3.3.1 Academic Advisor arrangements**

As a first year student you will be allocated an Academic Advisor when you register and this Advisor will normally remain with you for the whole of your time at QMUL. During the first year you will meet once a week during a designated timetabled slot. You may be given coursework exercises to bring along to these periods so that your progress can be monitored and supported. The Advisor system is the responsibility of the Director of Student Support.

#### **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: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites. You can access advice, guidance and support in the following areas:

- Specialist one-to-one "study skills" tuition
- Ensuring access to course materials in alternative formats
- 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

### 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. Details can be found at:

<https://www.welfare.qmul.ac.uk/student-advice-guides/>

### 3.4 Interruption of Study

The University's Interruption of Study Policy is available on the policy page:

<https://arcs.qmul.ac.uk/policy/>

## 4 Programme structure

Year 1				
module	semester	title		credit
EMS402U	A	Engineering Design	compulsory	15
EMS410U	A	Experimental Design and Practice 1	compulsory	15
EMS412U	A	Computational and Mathematical Modelling 1	compulsory	15
EMS430U	A	Materials Engineering	compulsory	15
EMS450U	B	Exploring Engineering	compulsory	15
EMS420U	B	Experimental Design and Practice 2	compulsory	15
EMS440U	B	Materials Chemistry	compulsory	15
EMS460U	B	Fluid Mechanics and Thermodynamics	compulsory	15
EMS499U	A&B	Skills for Engineers	compulsory	0

Year 2				
module	semester	outline title		credit
EMS519U	A	Materials for Biomedical Applications	compulsory	15
EMS522U	A	Materials for Sustainability	compulsory	15
EMS523U	A	Phase Transformations	compulsory	15
EMS524U	A	Structure and Properties of Materials	compulsory	15
EMS501U	B	Designing for Sustainable Manufacture	compulsory	15
EMS517U	B	Separation Processes	compulsory	15
EMS506U	B	Numerical methods and data science in engineering	compulsory	15
EMS527U	B	Materials Processing and Manufacturing	compulsory	15
FMS599U	A&B	Professional Skills for Engineers	compulsory	0

EMS607U	A	Catalysis and Reaction Design	compulsory	15
EMS619U	A	Biomedical device development	compulsory	15
EMS624U	A	Functional Materials	compulsory	15
EMS630U	B	Fundamentals of Electrochemical Engineering	compulsory	15
EMS625U	B	Failure of Materials	compulsory	15
EMS605U	B	Materials for Aerospace Applications	compulsory	15
EMS699U	A&B	Advanced Professional Skills for Engineers	compulsory	0

<b>Year 4</b>				
module	semester	title		credit
EMS700U	A&B	Industry / Research Project	core	60
EMS725U	A	Advanced Mechanical Modelling of Materials	compulsory	15
EMS753U	A	Nanotechnology and Nanomedicine	elective	15
EMS712U	A	Macromolecular Engineering	elective	15
EMS717U	A	Renewable Energy Sources	elective	15
EMS740U	A	Machine learning & Artificial Intelligence for Engineering	elective	15
EMS705U	B	Environment, Ethics and Economics in Engineering Design	compulsory	15
EMS761U	B	Solar Energy Engineering	elective	15
EMS732U	B	Digital Manufacture for Healthcare innovations	elective	15
EMS741U	B	Deep Learning for Data and Image Analysis	elective	15

The credit load for elective modules are to be balanced across semesters.

Students taking programmes which include a year abroad will take an additional year after your Year 2 studies

EMS597U	A&B	Materials Study Abroad	core	120
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Students taking programmes which include with industrial experience will take an additional year after your Year 2 or Year 3 studies

EMS697U	A&B	Materials Industrial Experience	core	120
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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.

below. If a student does not meet the EngC requirements below but meets Queen Mary's award requirements, they will graduate with a different degree programme title to distinguish that the programme is not accredited.

### **5.1 Engineering Council regulations from 2022 entry onwards**

#### **BEng**

Up to 45 Credits of failed modules are allowed but must achieve 30% or above.

#### **MEng**

Up to 60 Credits of failed modules, at levels 4 - 6, are allowed but must achieve 30% or above.

### **5.2 Progression**

Requirements for progression between years of study and for classifications of degrees are governed by the Academic Regulations of the Programme at the time of commencement of study.

### **5.3 Classification**

The marks from modules in each year contribute towards the final degree classification. In order to be considered for an award, students must have achieved the minimum number of credits at the required levels prescribed for that award.

Classification will be determined through:

- i. Aggregate Module marks for all modules
- ii. Year Weightings

For the BEng award, Year One is weighted at 10%, Year Two at 30% and Final Year at 60%.

For the MEng award, Year One is weighted at 6.25%, Year Two at 18.75%, Year Three at 37.5% and Final Year at 37.5%.

The University's sets the class of undergraduate degree that are awarded as follows:

- i. First 70.0% or above for the average weighted module results
- ii. Upper Second 60.0% or above for the average weighted module results
- iii. Lower Second 50.0% or above for the average weighted module results
- iv. Third 40.0% or above for the average weighted module results

### **5.4 Transferring to other programmes.**

It is possible to transfer to other programmes following the mechanism described in the undergraduate handbook which requires you to complete a change of programme request form. The request will be reviewed by the Programme Director of the Programme you wish to transfer to, considering your academic performance and reasons for requesting the change.

(<https://arcs.qmul.ac.uk/policy/>)

Changes between streams may be possible at the end of the completion of your first year, depending on your academic performance, the compatibility of the two programmes of study and capacity of the programme.

## **6 Entry requirements**

## **7 Quality assurance**

### **7.1 Student-Staff Liaison Committee (SSLC) meetings**

The School has a Student-Staff Liaison 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:

- Director of Student Experience (Chair)
- Student Support Officer (Secretary)
- Relevant academic staff
- At least one student representing each year cohort of each of the relevant programmes

The elections for the undergraduate representatives are organised through the Student Union. SSLC agendas and minutes are found on the SEMS QMplus landing page (<https://qmplus.qmul.ac.uk/course/view.php?id=13091>). Relevant items on the minutes are referred to the appropriate School committees for consideration and feedback.

### **7.2 Evaluating and improving the quality and standards of teaching and learning**

We assess our provision of teaching by:

- Module review by means of student feedback questionnaires and course organisers' reports.
- Annual staff appraisal.
- Peer observation of teaching.
- External examiners' reports.
- Periodic Internal Review by the College involving external panel members.
- Periodic Institutional Audit of the College by the Quality Assurance Agency.

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

- Education Committee
- Education Coordination Group
- Student Experience Committee
- Academic Standards Committee
- Teaching Development and Scholarship Committee
- Student-Staff Liaison Committee
- Subject Examination Boards – meet in June to confirm marks and prizes, and to consider progression and awards
- Degree Examination Boards – meet in July to confirm progression and awards
- Engineering and Mathematical Sciences Faculty Board
- University Quality Enhancement Committee.

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

- Annual National Student Survey
- Student-Staff Liaison Committee
- Student feedback questionnaire evaluation
- Student forums on the School's website, including module and programme specific forums as well as ones covering more general topics

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

## **8 Supporting Information**

All relevant policies including: academic regulations, admissions policy and accreditation of prior learning can be found in the Policy Zone:

<https://arcs.qmul.ac.uk/policy/>

QMUL is regulated by the Office for Students (OfS) [www.officeforstudents.org.uk/advice-and-guidance/the-register/](http://www.officeforstudents.org.uk/advice-and-guidance/the-register/)

**This document provides a definitive record of the main features of the programme and the learning outcomes that a typical student may reasonably be expected to achieve and demonstrate if s/he takes full advantage of the learning opportunities provided. This programme specification is primarily intended as a reference point for prospective and current students, academic and support staff involved in delivering the programme and enabling student development and achievement, for its assessment by internal and external examiners, and in subsequent monitoring and review.**