Queen Mary
University of London

PROGRAMME SPECIFICATION

Degrees:

Programme Title	Final Award	Duration of study/ years	Programme & Route code	Level
Biomedical Engineering	BEng	3	UBEF-QMENNG1/ USBMEZ	6
Biomedical Engineering with industrial experience in year 3/4	BEng	4	UBEF-QMENND1/ USBEIZ UBEF-QMENND2/ USBEIZ	6
Biomedical Engineering with year abroad	BEng	4	UBEF-QMENNF1/ USBEYZ	6
Biomedical Engineering	MEng	4	UMEF-QMENNG1/ USBMEZ	7
Biomedical Engineering with industrial experience in year 3/4/5	MEng	5	UMEF-QMENNE2/ USBEIZ UMEF-QMENNE1/ USBEIZ UMEF-QMENNE3/ USBEIZ	7
Biomedical Engineering with year abroad	MEng	5	UMEF-QMENNY1/ USBEYZ	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)	Institute of Materials, Minerals & Mining Institution of Mechanical Engineers Institute of Physics and Engineering in Medicine
Accreditation received	2022 (IOM3) 2024 (IMechE) 2023 (IPEM)

Specification Details	
Programme Lead	Prof Karin Hing
Student cohorts covered by specification	All cohorts
Date of introduction of programme	September 2021
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 Biomedical engineering programme at QMUL will support the development of professional Engineers who apply their engineering expertise to medicine and biology for healthcare purposes. Healthcare involves understanding how the healthy body functions, the diagnosis and treatment of disease and disability, as well as improving the quality of life of the population. Engineering expertise involves problem solving, defining problems and finding innovative and creative engineering solutions. This biomedical engineering programme will cover a broad range of engineering skills that cross disciplines and will help you to take advantage of career opportunities within, but not limited to the healthcare industry and profession. This will include understanding the design and development of artificial medical implants such as hip joints, heart valves and prosthetic limbs. It also encompasses medical technology such as surgical robots, nanomedicine, tissue engineering and diagnostic tools. Understanding how our bodies function, the biomaterials from which we are made and developing smart materials that can sense and regulate functions in our bodies will also be covered in this degree. You will study core engineering modules, alongside specialist biomedical engineering modules so you can develop in-depth basic and applied knowledge.

In the first two years you will study a prescribed series of 'compulsory' modules in order to cover all the necessary material and skills required for a professionally accredited programme, in the 3rd year you will have the freedom to choose a number of 'elective' modules that work with your own interests and exploit your own skill set. 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 healthcare related product, system or device 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.

By studying multiple disciplines involving modelling and computational techniques in engineering and biology, as a biomedical engineer at QMUL, you will develop a broad range of engineering skills relevant to both biomedical industry and research, being able to address clinical problems in medicine and contribute to the development of life enhancing and saving technologies. The modules in this programme show a breadth that is important and interesting to the programme, whilst they benefit from being delivered within an engineering environment.

The modules we deliver will include up-to-date material linked to our research, ensuring that you engage with the material, rather than listen and follow, and thereby are ready for the unpredictability of the world in the 21st century. We will ensure that you are supported in developing an understanding of technology, applications and ways of thinking that will support you wherever you decide to go in your future career.

As a biomedical Engineers from QMUL you will be able to

- Develop technological and engineering rich solutions for the future of modern medicine and healthcare
- Work on real-world projects in medicine and healthcare with life-changing potential
- Appreciate the value of Data Science and Artificial Intelligence
- Bridge communication between healthcare, medicine & engineering

- Develop a breadth and depth of engineering skills and knowledge and apply them to address problems in medicine and healthcare
- Gain awareness of issues related to our society, ethics and the profession in the medical device regulatory and industrial environment.

If you choose to take the MEng degree, you will have the opportunity, through undertaking an individual research or development project to work within research and industry led teams in partnership with clinicians, with a focus on solving real biomedical 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
- Educate you in the scientific and mathematical principles underpinning engineering
- Enable you to achieve your academic potential by providing a stimulating, friendly and supportive environment
- Offer challenging programmes which provide graduates with a clear pathway to Chartered Engineering status
- Prepare you 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, electronics, programming and computational modelling, system integration, 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 your technical knowledge and understanding develops together 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 graduate 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

A1	**Core scientific principles.** Understand the core engineering, scientific and mathematical principles needed to underpin Biomedical Engineering professions.
A2	**Disciplinary concepts.** Understand, apply and critique a broad range of disciplinary concepts related to Biomedical Engineering.
A3	**Problem solving.** Apply engineering approaches to solve a wide range of problems, relating to risks, costs, safety, reliability, aesthetics and environmental impact.
A4	**Key technologies.** Fundamentally understand state-of-the-art technologies related to Biomedical Engineering.
A5	**Systems design and optimisation.** Design and optimise a broad range of products, processes and systems, based on key technical and sustainability related factors.
A6	**Experimental design and delivery.** Plan, execute and communicate the outputs of an experiment or project.
A7	**Experimental approaches.** Use and integrate a wide range of computational and experimental approaches to solve biomedical engineering problems.
A8	**Engineering economics.** Understand economic evaluation and business principles relevant to engineering.
A9	**Engineering responsibility.** Understand the roles and responsibility of engineers in society and their impact on both a local and global context.

MEng

A1	**Core scientific principles.** Systematic understanding of the core engineering, scientific and mathematical principles needed to underpin biomedical engineering professions.
A2	**Disciplinary concepts.** Understand, apply and critique a broad range of advanced disciplinary concepts related to biomedical engineering.
A3	**Problem solving.** 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.
A4	**Key technologies.** Comprehensive understanding of advanced state-of-the-art technologies their capabilities and limitations related to biomedical engineering.
A5	**Systems design and optimisation.** 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.
A6	**Experimental design and delivery.** Critically evaluate current research and methodologies and where appropriate, proposed new hypothesis. Plan, execute and communicate the outputs of an experiment or project.
A7	**Experimental approaches.** Use and integrate a wide range of advanced computational and experimental approaches to solve biomedical engineering problems and be able to interpret the results affected by uncertainties.
A8	**Engineering economics.** Advanced understanding of economic evaluation and business principles and their impact relevant to engineering.

A9	**Engineering responsibility.** 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 study in SEMS have been defined as resilience, creativity, communication, professional practice and technical.

Resilience

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

As an engineer you will need to identify real-world problems and design creative approaches to solve them. You may develop your critical thinking abilities when reviewing complex, and sometimes, controversial information from sources, or showcase your creativity by coming up with innovative design approaches in laboratory and practical work.

Communication

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

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 be introduced to topics such as intellectual property and research ethics.

Technical

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 interfaces 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
R2	Self-worth	Recognise, respect and value the individual worth of yourself

R3	Long-term development	Identify clear personal, study and career goals, taking responsibility for your own development
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 communication	Convey complex technical, professional and other information in written form to suit a range of audiences.
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, seminars, 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, additional resources and other guided learning activities.

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 gaining and evidencing sufficient professional experience, 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 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 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, critical thinking, 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. Having graduated on the MEng programme, you have satisfied the academic requirements for attaining the Chartered Engineer status and you can apply for this status once you have gained and evidenced sufficient professional experience.

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, DePuy, Baxter, Artis, Corus, BAe, DSTL, Rolls Royce. The ILF takes place twice a year, in Autumn and Spring.

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

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) assessments throughout 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 timetabled 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, cohort level and individual 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 organisers. 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.

Your Advisor is first point of contact for any personal support; they can be contacted by email with any questions or to arrange an appointment. You can also contact the Student Support Officer via email on sems-office@qmul.ac.uk.

3.3.1 Advisor arrangements

As a first year student you will be allocated an Advisor when you register and this Advisor will normally remain with you for the whole of your time at QMUL. 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 at all campuses and all sites.

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

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	Title		Credit
EMS505U	A	Applied Solid Mechanics	Compulsory	15
EMS512U	A	Instrumentation and Measurements	Compulsory	15
EMS519U	A	Materials for Biomedical Applications	Compulsory	15
EMS521U	A	Cardiovascular Fluids Mechanics	Compulsory	15
EMS506U	B	Numerical Methods and Data Science in Engineering	Compulsory	15
EMS508U	B	Process Control	Compulsory	15
EMS501U	B	Designing for Sustainable Manufacture	Compulsory	15
EMS520U	B	Neuromechanics and Bioelectricity of Movement	Compulsory	15
EMS599U	A&B	Professional skills for engineers	Compulsory	0

Year 3				
Module	Semester	Title		Credit

EMS602U	A	Simulation Tools in Engineering Analysis and Design	Compulsory	15
EMS620U	A	Processing and Analysis in Biomedical Imaging	Compulsory	15
EMS619U	A	Biomedical Device Development	Compulsory	15
EMS690U	A&B	Integrated Design Project	Core	30
EMS615U	B	Biocompatibility	Elective	15
EMS618U	B	Cell and Tissue Mechanics	Elective	15
EMS628U	B	Advanced Robotics Systems	Elective	15
EMS622U	B	Sustainability Assessments for Design	Elective	15
EMS617U	B	Tissue Engineering and Regenerative Medicine	Elective	15

Year 4				
Module	Semester	Title		Credit
EMS724U	A	Computational Engineering	Elective	15
EMS718U	A	Nanotechnology and Nanomedicine	Elective	15
EMS762U	A	Clinical Bioengineering: Applications in Urology	Elective	15
EMS706U	A	Clinical Sensors and Measurements	Elective	15
EMS740U	A	Machine Learning and Artificial Intelligence for Engineering	Elective	15
EMS703U	A	Introduction to Systems Engineering	Elective	15
EMS700U	A&B	Industry / Research Project	Core	60
EMS709U	B	Computational Fluid Dynamics	Elective	15
EMS719U	B	Medical Ethics and Regulatory Affairs	Elective	15
EMS701U	B	Medical Robotics and Surgical Techniques	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

EMS598U	A&B	Engineering Study Abroad	Core	120

Students taking programmes which include with industrial experience will take an additional year after your Year 2 or Year 3 studies

EMS696U	A&B	Industrial Experience	Core	120

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 Quality assurance

5.1 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)
- Relevant academic staff
- At least one student representing each year cohort of the relevant programme

The elections for the undergraduate representatives are organised through the Student Union. SVC agendas and minutes are found on the SEMS QMplus landing page (https://qmplus.qmul.ac.uk/course/view.php?idnumber=SEMS-Home). Relevant items on the minutes are referred to the appropriate School committees, module organisers and programme directors for consideration and feedback.

5.2 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 National Student Survey
- Student Voice Committee
- Student Experience 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

5.3 Staff development

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