

Programme Title: MSc in Biomedical Engineering



Programme Specification

Awarding Body/Institution	Queen Mary, University of London
Teaching Institution	Queen Mary, University of London
Name of Final Award and Programme Title	MSc in Biomedical Engineering
Name of Interim Award(s)	
Duration of Study / Period of Registration	1 year full time
QM Programme Code / UCAS Code(s)	HBS3
QAA Benchmark Group	Masters degrees in Engineering
FHEQ Level of Award	Level 7
Programme Accredited by	IMechE
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

Biomedical Engineering is a field of engineering that relies on highly inter- and multi-disciplinary approaches to research and development, in order to address biological and medical problems. Specialists in this area are trained to face scientific and technological challenges that significantly differ from those related to more traditional branches of engineering. Nevertheless, at the same time Biomedical Engineering makes use of more traditional engineering methodologies and techniques, which are adapted and further developed to meet specifications of biomedical applications.

This MSc programme aims to prepare specialists with advanced knowledge and transferable skills in the field of Biomedical Engineering with a personalised curriculum of studies that can be defined by the student. This is aimed at offering the possibility of choosing modules, with high flexibility within a diversified and reach offer, so as to meet specific interests and expectations, as well as career plans. Students can take advantage of a Mentoring Service offered by the School to receive a help on how to optimally shape their personalised curriculum of studies (*).

(* While the School is committed to maximizing flexibility of choice, the School cannot guarantee that every choice of modules will be approved, owing to timetable constraints.

Programme Title: MSc in Biomedical Engineering

Applications are welcome from students with a background in Engineering or Physical Sciences (Chemistry, Physics, Mathematics and Materials Science).

The programme has strong roots within the well-recognised expertise of the academics that deliver the lectures, who have international standing in cutting-edge research in a diversity of topics of Biomedical Engineering. This fact ensures that the programme is delivered with the highest standards in the field. The students also benefit from access to state-of-the-art facilities and instrumentation while undertaking their research projects.

With the help of the Mentoring Service offered by the School, the students will be able to select a balanced combination of modules that will allow them to undertake careers in a wide range of professional ambits of interest within the biomedical field, including health care services, industry and scientific research.

Aims of the Programme

The Biomedical Engineering MSc programme aims to prepare specialists with advanced skills in experimental techniques, computational modelling, and in depth understanding of biomedical engineering approaches to medical and health problems. Depending on students' preferences, the programme will place particular emphasis on bioengineering approaches to either cell and tissue therapies, imaging and instrumentation, more traditional applications in everyday health care and orthopaedics, regulatory practice, or a combination of these areas. The principal aim is that the students completing this programme would develop their knowledge in this new field to an advanced level, in both experimental and computational areas, allowing them to contribute to the advancement of knowledge and technology in this area.

Further aims of the programme are as follow.

1. Teaching advanced experimental, computational and analytical techniques applicable to Biomedical Engineering in order to provide an advanced base of knowledge and skills
2. Teaching advanced biological and medical experimental techniques applicable to medicine and general healthcare.
3. Teaching modern biomedical techniques used in bioengineering, medical and healthcare units.
4. Implementation of taught material through a research/design project.
5. Providing students with insight into advanced developments and associated ethical and legal issues for their implementation in medical practice.
6. Enabling students to participate in advanced research and industrial developments in Biomedical Engineering.
7. Introducing the students to selected issues in commerce and law that they may encounter in industry.

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 and engineering principles necessary to underpin their education in the field of Biomedical Engineering
A 2	Ability to critically evaluate existing analytical and experimental techniques and propose practical methods for their improvement
A 3	An in-depth knowledge of the field of Biomedical Engineering, so as to be able to find practical solutions to biomedical engineering problems
A 4	Sufficient knowledge of the fundamentals of physiology and to be able to apply these to biomedical engineering applications
A 5	An understanding of how engineers and clinicians interface within the medical and biological sectors and the technological requirements of those sectors

A6	Knowledge of the regulatory framework governing the development of new Biomedical Engineering products
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Disciplinary Skills - able to:	
B1	Understand appropriate fundamental engineering principles related to applications in Biomedical Engineering
B2	Apply engineering principles to a range of medically- or biologically-related applications
B3	Recognise the responsibilities of the professional biomedical engineer
B4	Use fundamental knowledge to evaluate new and emerging medically- or biologically-related technologies
B5	Use appropriate technical and non-technical language to effectively communicate and interface with clinicians or biologists to formulate medical or biological problems from an engineering viewpoint
B6	Learn new theories, concepts, methods etc. in unfamiliar situations
B7	Develop, monitor and update a plan, to reflect a changing operating environment
B8	Plan and perform safe experimental work in laboratory settings
B9	Work effectively with computing tools for data analysis and processing, as well as modelling, simulation and design
B10	Exercise professional judgement in medically- or biologically-related problem solving, considering functional, ethical and economic issues
B11	Apply initiative and competence to the design, development and analysis/characterisation of biomedical materials, devices and systems

Attributes:	
C1	Be able to understand both the application and limitation of computational and experimental techniques available to biomedical engineers
C2	Engage critically with knowledge, and apply it in a rigorous way
C3	Be able to carry out a substantial piece of individual work whose structure and content is largely self-determined
C4	Have the ability to analyse and solve problems individually and in groups
C5	Have the ability to communicate knowledge and ideas verbally and in written reports
C6	Use communications technologies competently to engage with a range of audiences
C7	Critically evaluate the reliability of different sources of information
C8	Use information for evidence based decision making
C9	Use quantitative data confidently and competently

C 10	Develop the necessary transferable skills to be effective in the workplace
C 11	Develop awareness of Health and Safety

How Will You Learn?

Teaching materials are delivered through a combination of lectures, laboratory practicals, and a variety of coursework. Students complete a substantial research project in the field of Biomedical Engineering. The project consists of an individual piece of work, under the supervision of an academic member of staff. It can take either one, or a combination, of the following forms: (i) an experimental investigation; (ii) a computational exercise; (iii) the development of a piece of experimental apparatus; (iv) a design study; (v) a theoretical analysis; (vi) a review of a topic of current interest.

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. The research project will be assessed by the submissions of a written report and an oral examination by two examiners, including a short presentation and question and answers session.

How is the Programme Structured?

The Programme has a duration of one year, full time. Teaching takes place between September and April. Total 180 credits have to be taken: 120 credits of taught modules and 60 credits from a research project. The 120 credits of taught modules are obtained from 8 taught modules of 15 credits each: 60 credits are taught in the first semester from September to December and a further 60 credits are taught in the second semester from January to April. The 60 credit research project runs until the end of August. The preparation for the project begins in the module 'Research Methods and Experimental Techniques in Engineering' in the first semester. Exams take place in May - June.

PROGRAMME STRUCTURE

Compulsory modules:

- Physiology for Medical Engineers (SEMS module MELM009)
- Ethics and Regulatory Affairs (SEMS module DENM702)
- Research Methods and Experimental Techniques in Engineering (SEMS module DENM014)

Core module:

- Biomedical Engineering Project (SEMS module DENM006)

Specialising modules - at least 2 modules of choice out of the following options:

- Advanced Biomaterials (SEMS module MTRM071)

Programme Title: MSc in Biomedical Engineering

- Advanced Tissue Engineering and Regenerative Medicine (SEMS module MTRM064)
- Bioengineering in Urology (SEMS module DENM016)
- Biofluids and Solute Transport (SEMS module DENM322)
- Clinical Measurements (SEMS module DENM024)
- Mechanobiology (SEMS module DENM312)
- Nanotechnology and Nanomedicine (SEMS module MTRM803)
- Principles and Application of Medical Imaging (SEMS module DENM029)
- Principles and Applications of Bioelectricity (SEMS module DENM302)
- Science of Biocompatibility (SEMS module MTRM312)
- Surgical Techniques & Safety (SEMS module MELM003)
- Tissue Mechanics (SEMS module DENM311)

Specialising modules - up to 3 remaining modules of choice from the following options

- Advanced Materials Characterization Techniques (SEMS module MTRM066)
- Advanced Polymer Synthesis (SEMS module MTRM797)
- C++ for Image Processing (EECS module ECS756P)
- Computational Fluid Dynamics (SEMS module DENM010)
- Digital Signal Processing (EECS module ECS707P)
- Electronics (New level-7 EECS module)
- Foundations of Intellectual Property Law and Management (CCLS module IPLM702P)
- Introduction to Law for Scientists (CCLS module IPLM701P)
- Mechanics of Continua (SEMS module DENM008)
- Numerical Optimisation in Engineering Design (SEMS module DENM026)
- Real-time and Critical Systems (EECS module ECS727P)

Academic Year of Study 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Physiology for Medical Engineers	MELM009	15	7	Compulsory	1	Semester 2
Research Methods and Experimental Techniques in Engineering	DENM014	15	7	Compulsory	1	Semester 1
Ethics and Regulatory Affairs	DENM702	15	7	Compulsory	1	Semester 2
Digital Signal Processing	ECS707P	15	7	Elective	1	Semester 1
C++ for Image Processing	ECS756P	15	7	Elective	1	Semester 1
Electronics	ECS777P	15	7	Elective	1	Semester 1
Clinical Measurements	DENM024	15	7	Elective	1	Semester 2
Principles and Applications of Medical Imaging	DENM029	15	6	Elective	1	Semester 2

Programme Title: MSc in Biomedical Engineering

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Real-time and Critical Systems	ECS727P	15	7	Elective	1	Semester 2
Principles and Applications of Bioelectricity	DENM302	15	7	Elective	1	Semester 2
Advanced Tissue Engineering and Regenerative Medicine	MTRM064	15	7	Elective	1	Semester 1
Advanced Materials Characterization Techniques	MTRM066	15	7	Elective	1	Semester 1
Tissue Mechanics	DENM311	15	6	Elective	1	Semester 2
Advanced Polymer Synthesis	MTRM797	15	7	Elective	1	Semester 2
Mechanobiology	DENM312	15	7	Elective	1	Semester 2
Science of Biocompatibility	MTRM312	15	6	Elective	1	Semester 2
Nanotechnology and Nanomedicine	MTRM803	15	7	Elective	1	Semester 1
Biomedical Engineering Project	DENM006	60	7	Core	1	Semesters 1-3
Bioengineering in Urology	DENM016	15	7	Elective	1	Semester 1
Computational Fluid Dynamics	DENM010	15	7	Elective	1	Semester 2
Foundations of Intellectual Property Law and Management	IPLM702P	15	7	Elective	1	Semester 2
Introduction to Law for Scientists	IPLM701P	15	7	Elective	1	Semester 1
Numerical Optimisation in Engineering Design	DENM026	15	7	Elective	1	Semester 2
Surgical Techniques & Safety	MELM003	15	7	Elective	1	Semester 1

What Are the Entry Requirements?

Minimum of a 2:2 (55% or higher) degree or the equivalent international undergraduate degree.

We welcome applications from students with a background in physical sciences (Chemistry, Physics, Mathematics and Materials Science) or Engineering.

English at IELTS 6.5 (if needed) – details of equivalent English Qualifications available on the QMUL website.

How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee (SSLC) provides a formal means of communication and discussion between the students and the two Schools that organise this MSc programme. The committee consists of student representatives together with appropriate representation from staff within the two 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 through 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 PG survey, 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 Programme director, who also has 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 MSc 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.

SEMS 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 students. Typically these events are attended by over 50 companies including 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 the lecture programmes in individual modules.

Programme Specification Approval

Person completing Programme Specification

Dr Federico Carpi

Person responsible for management of programme

Dr Federico Carpi

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

Date Programme Specification approved by Taught Programmes Board