

Programme Title: MSc Biomedical Engineering (conversion)



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 Biomedical Engineering (conversion)
Name of Interim Award(s)	
Duration of Study / Period of Registration	1 calendar year
QM Programme Code / UCAS Code(s)	H3C2
QAA Benchmark Group	Engineering
FHEQ Level of Award	Level 7
Programme Accredited by	IMechE (will be sought)
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

N/A

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. As a result of the fact that people live longer, there is an increasing demand for specialists in Biomedical Engineering. To address this demand, this programme has been developed with a view to encouraging science and maths graduates to engage with the subject area, under a UK Government initiative funded by HEFCE. The programme title and employment prospects have been considered, both internally within QM and externally through industrial contacts.

This programme is aimed at students who already have a science background (e.g. biology, mathematics, chemistry, physics), and aims to convert them to engineers with unique expertise in the fundamentals of biomedical engineering as well as a specialisation in one of the areas of Imaging and Instrumentation, Tissue Engineering and Biomaterials, or Biofluids.

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

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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.

The programme structure is modular in format. During Semester A, students will take the compulsory module Engineering Methods, which exposes them to essential engineering techniques and philosophy. In Semester B, students will take the compulsory module Ethics and Regulatory Affairs. For the rest the students' taught curriculum is determined based on the specialisation they have chosen.

A 60 credit research project is to be undertaken using our research activities and our state of the art facilities. Several high performance computing clusters owned by the university support a full spectrum of computational research. Our well equipped laboratories include a wide range of tissue engineering, human performance, mechanical testing and materials synthesis and characterisation labs. Nanotechnology research is further supported by the facilities and expertise provided by Nanoforce, a company directly associated with the School.

Aims of the Programme

The Biomedical Engineering MSc conversion programme aims to convert students with a science background to engineers with skills in experimental techniques, computational modelling, and 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, or biofluids. The principal aim is that the students completing this programme would develop their knowledge in this new field to a level, in both experimental and computational areas that allows them to contribute to the advancement of knowledge and technology in this area.

Further aims of the programme are as follow.

1. Teaching experimental, computational and analytical techniques applicable to Biomedical Engineering in order to provide a base of knowledge and skills
2. Teaching 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 developments and associated ethical and legal issues for their implementation in medical practice.
6. Enabling students to participate in 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 evaluate existing analytical and experimental biomedical engineering techniques and propose practical methods for their improvement
A 3	Gain knowledge and research capability in one of the areas of Imaging and Instrumentation, Tissue Engineering and Biomaterials, or Biofluids.
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 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	Plan and perform safe experimental work in laboratory settings
B7	Exercise professional judgement in medically- or biologically-related problem solving, considering functional, ethical and economic issues
B8	Apply initiative and competence to the design, development and analysis/characterisation of biomedical materials, devices and systems

Attributes:	
C1	Engage critically with engineering knowledge and design principles
C2	Be able to assess both the application and limitation of mathematical, computational and experimental techniques available to an engineer.
C3	Demonstrate rounded intellectual development

How Will You Learn?

Through a wide range of different interactions including lectures, tutorials, laboratory classes, exercise classes and project supervisions. It is expected that the programme will demand between 1800 and 2000 hours in total to complete. About 10% of this time will be in scheduled lectures.

A significant amount of independent personal study is anticipated as part of this degree.

How Will You Be Assessed?

The taught modules will be assessed through both coursework and examinations. The details are as outlined in the individual module specifications. The examinations will all take place in the standard college examination periods in January and May. The

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final project thesis will be assessed in September and the student will also complete a presentation as well as an oral examination.

How is the Programme Structured?

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

A compulsory zero-credit module DENM122 Essential Mathematics Skills for Engineers will be studied pre-sessionally by Distance Learning and in workshops during Semester A. This module will be assessed by coursework only.

60 credits of taught modules will be taught in the first semester from September until December and a further 60 credits of taught modules will be taught in the second semester from January until April. All taught module examinations will be in the standard examination periods during January and May.

A 60 credit Biomedical Engineering project will be completed after the examination period in semester 3 (from June - September). Preparation for this research project will begin in the module on Engineering Methods taken in the first semester.

The modules making up the programme are presented in the table below.

In the first semester all students will take the compulsory module DENM114 Engineering Methods, and in the second semester all students will take the compulsory module DENM702 Ethics and Regulatory Affairs.

The further study programme for each of the streams is as follows.

Imaging and Instrumentation

Semester 1: DENM109 Engineering Instrumentation, MELM003 Surgical Techniques and Safety, ECS777P Electronics.

Semester 2: 3 modules from DENM024 Clinical Measurements, DENM029 Principles and Applications of Medical Imaging, DENM302 Principles and Applications of Bioelectricity, MELM009 Physiology for Medical Engineers.

Tissue Engineering and Biomaterials

Semester 1: MTRM064 Advanced Tissue Engineering and Regenerative Medicine, MTRM803 Nanotechnology and Nanomedicine, MTRM011 Materials Selection in Design.

Semester 2: 2 modules from DENM311 Tissue Mechanics, DENM312 Mechanobiology, MTRM071 Advanced Biomaterials, MELM009 Physiology for Medical Engineers.

Biofluids

Semester 1: DENM512 Grad, div and curl: Vector Calculus for Engineering OR DENM008 Mechanics of Continua, DENM331 Computer Aided Engineering for Solids and Fluids, DENM016 Biomedical Engineering in Urology.

Semester 2: DENM322 Biofluids and Solute Transport, DENM010 Computational Fluid Dynamics, MELM009 Physiology for Medical Engineers.

Academic Year of Study FT - Year 1

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Engineering Methods	DENM114	15	7	Compulsory	1	Semester 1
Grad, div and curl: Vector Calculus for Engineering	DENM512 (PG clone of DEN5122)	15	5	Elective	1	Semester 1
Engineering Instrumentation	DENM109 (PG clone of DEN5109)	15	5	Elective	1	Semester 1
Computer Aided Engineering for Solids and Fluids	DENM331	15	6	Elective	1	Semester 1
Materials Selection in Design	MTRM011	15	7	Elective	1	Semester 1
Surgical Techniques and Safety	MELM003	15	7	Elective	1	Semester 1
Electronics	ECS777P	15	7	Elective	1	Semester 1
Nanotechnology and Nanomedicine	MTRM803	15	7	Elective	1	Semester 1
Advanced Tissue Engineering and Regenerative Medicine	MTRM064	15	7	Elective	1	Semester 1
Biomedical Engineering in Urology	DENM016	15	7	Elective	1	Semester 1
Ethics and Regulatory Affairs	DENM702	15	7	Compulsory	1	Semester 2
Physiology for Medical Engineers	MELM009	15	7	Elective	1	Semester 2
Clinical Measurements	DENM024	15	7	Elective	1	Semester 2
Principles and Applications of Medical Imaging	DENM029	15	7	Elective	1	Semester 2
Computational Fluid Dynamics	DENM010	15	7	Elective	1	Semester 2
Tissue Mechanics	DENM311	15	7	Elective	1	Semester 2
Biomedical Engineering Project	DENM006	60	7	Core	1	Semesters 1-3

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Essential Mathematics Skills for Engineers	DENM122	0	4	Compulsory	1	Semester 1

What Are the Entry Requirements?

Minimum of a 2:1 degree or the equivalent international undergraduate degree.

We welcome applications from students with a background in science including Chemistry, Physics, Mathematics and Biology etc.

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 provides a formal means of communication and discussion between schools/institutes and its students. The committee consists of student representatives from each year in the school/institute together with appropriate representation from staff within the school/institute. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

The School operates an Education and Learning Committee, which advises the School Director of Taught Programmes on all matters relating to the delivery of taught programmes at school level including monitoring the application of relevant QM policies and reviewing all proposals for module and programme approval and amendment before submission to Taught Programmes Board. Student views are incorporated in the committee's work in a number of ways, such as through consideration of student surveys and input from Staff-Student Liaison Committees..

All schools/institutes operate an Annual Programme Review 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/institute's work throughout the year to monitor academic standards and to improve the student experience. Students' views are considered in this process through analysis of the PTES and module evaluations.

The School participates in the College's Annual Programme Review process, which supports strategic planning and operational issues for all undergraduate and taught postgraduate programmes. The APR includes consideration of the School's Taught Programmes Action Plan, which records progress on learning and teaching related actions on a rolling basis. Students' views are considered in the APR process through analysis of the PTES and module questionnaires, among other data.

Academic Support

During induction the students will be welcomed to the college by the programme leader. Early on in the programme the students will select an project supervisor based upon a wide choice of different project areas. This academic will then also act as a personal tutor. Many of the modules are taught to small classes and so a high level of personal support will also be available from the module organisers in the majority of the taught modules.

Programme-specific Rules and Facts

The programme adheres to the standard Academic Regulations for taught postgraduate 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 Henri Huijberts

Programme Title: MSc Biomedical Engineering (conversion)

Person responsible for management of programme

Dr Federico Carpi

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

29 Feb 2016

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