Programme Title: BEng Medical 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	BEng (Hons) Medical Engineering/BEng (Hons) Medical Engineering with Industrial Experience
Name of Interim Award(s)	
Duration of Study / Period of Registration	3/4 years
QM Programme Code / UCAS Code(s)	HBC8/HBD8
QAA Benchmark Group	Engineering
FHEQ Level of Award	Level 6
Programme Accredited by	Institute of Mechanical Engineers
Date Programme Specification Approved	1 Nov 2016
Responsible School / Institute	School of Engineering & Materials Science

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

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

Programme Outline

The BEng degree in Medical Engineering is a 3 year programme that is part of a suite of programmes offered in Medical Engineering at Queen Mary university of London. Medical Engineering is the diverse and exciting subject that covers the science and engineering responsible for many of the latest advances in medicine. It encompasses the design and development of artificial medical implants such as hip joints, heart valves and prosthetic limbs, as well as the development of wide ranging medical technologies including surgical robots, nanomedicine, tissue engineering, diagnostic tools and rehabilitation equipment. Another branch of Medical Engineering focuses on the physics and chemistry of how our bodies function and the biomaterials from which we are made. This might involve understanding the mechanical properties of living cells, or measuring the forces and movements of a patient walking. In all these areas, Medical Engineers are pushing forward the frontiers of medicine, developing new ways to diagnose and treat medical problems, diseases and injuries.

The suite of Medical Engineering degree programmes at QMUL is one of the largest in the country, with a particularly extensive number of specialist academic staff. Key specialities in Medical Engineering at QMUL are as follows:
- Tissue Engineering and Regenerative Medicine
- Orthopaedic Implants
- Biomechanics and Mechanobiology: from whole patients to single cells

- Diagnostic Systems and Instrumentation
- Biofluids (Experimental and Computational)
- Biomaterials

The first two years of the Medical Engineering programme provides a firm grounding in subjects fundamental to all branches of Engineering, including Design, Fluid Mechanics, Solid Mechanics and Dynamics. They also provide an insight into computing and training in workshop practice. Alongside this fundamental engineering training, students learn the basic biology, chemistry and medicine required to work in the medical engineering field, and additionally are introduced to concepts of working at the engineering and medicine interface.

The third year gives you the opportunity to specialise in some areas of Medical Engineering of particular interest to you. It also includes an individual project, which may be an experimental research project, a theoretical investigation, a detailed design study, or a critical review of a topic in Medical Engineering of mutual interest to yourself and your supervisor.

The Medical Engineering BEng(Hons) programmes are accredited by the Institution of Mechanical Engineers (IMechE) and meet the benchmark requirements for registration as an Incorporated Engineer. Students will be required to complete a further period of approved learning (e.g. and MSc) in order to fully meet the benchmark requirements for registration as a Chartered Engineer. In any case stuents are entitled to become graduate members of IMechE on graduation. Enrolment as a student member of the IMechE is also encouraged.

Aims of the Programme

The BEng Medical Engineering degree programmes at QMUL provide students with the fundamental training needed to become a professional engineer along with the specialist expertise in Medical Engineering needed to take advantage of career opportunities in medicine and the health care industries. As professional engineers they will be able to reflect relevant specialisms across the medical engineering field with the ability to adapt to new technological advancements. This degree subsequently provides an attractive option for students that are interested in the broad area of Medical Engineering or for those that are seeking an alternative to medicine.

It will produce graduates:
- with sufficient technical knowledge to undertake roles as engineers across the engineering sector
- who are sufficiently proficient in medical terminology to converse with clinical and surgical staff
- with the personal and interpersonal skills to work closely and communicate effectively with colleagues in a work environment
- with sufficient management and design knowledge to successfully integrate into engineering projects
- with the ability to undertake and complete a major piece of independent research work on a given topic in Medical Engineering.

What Will You Be Expected to Achieve?

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

Academic Content:	
A1	Knowledge of the scientific principles necessary to underpin their education in Engineering, with special reference to Medical Engineering principles.
A2	Understanding of mathematical principles underpinning Engineering, particularly Medical Engineering, in addition to the mathematical methods, tools and notations used in the analysis of Engineering problems.
A3	An understanding of medically related concepts, and the ability to apply them effectively in Engineering projects.
A4	An awareness of existing and developing technologies related to Medical Engineering
A5	An understanding of how engineers and clinicians interface within the sector and the technological requirements of the medical sector

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A6	An appreciation of the ethical, economic and environmental issues underpinning the Medical Engineering profession and how an engineer must operate within these.
A7	Appreciation that regulatory bodies govern the development of new Medical Engineering products.
A8	Knowledge of the design process and engineering project management
A9	Knowledge of relevant Business and Management principles

Disciplinary Skills - able to:	
B1	Apply engineering principles to analyse key Medical Engineering problems
B2	Extract data pertinent to an unfamiliar problem, and apply it, particularly in relation to the medical field.
B3	Apply quantitative methods and computer software relevant to engineering disciplines, to solve Medical Engineering problems.
B4	Effectively communicate and interface with clinicians to formulate engineering solutions to medical problems
B5	Follow and update a plan, to reflect a changing operating environment
B6	Perform safe experimental work in laboratory settings
B7	Understand computing tools for data analysis and processing, as well as modelling, simulation and design.
B8	Utilise team working skills to effectively work with colleagues on medical engineering projects
B9	Understand how to use analytical and computational technologies towards the design or analysis of medical engineering devices or systems, or solving problems relevant to medical engineering
B10	Exercise professional judgement in medical engineering related problems solving, considering ethical and economic issues
B11	Apply initiative and creativity to the design development and analysis of medical engineering devices or solutions.
B12	Understand the relevance of both computation and experimental approaches to addressing engineering problems

Attributes:	
C1	Engage critically with knowledge, and apply it in a rigourous way
C2	Use communication approaches competently to engage with a range of audiences
C3	Critically evaluate the reliability of different sources of information
C4	Use information for evidence based decision making
C5	Use quantitative data confidently and competently

C 6	Develop the necessary transferable skills to be effective in the workplace
C 7	Develop and awareness of Health and Safety

QMUL Model Learning Outcomes - Level 4:	
D 1	Identify and discuss their own career aspirations or enterprise skills and knowledge and how they impact on others
D 2	Identify and discuss what their own role in their programme and/or subject discipline might mean to them for future e
D 3	Identify and demonstrate the perspectives or problem solving techniques of different disciplines
D 4	Demonstrate connections between different theoretical perspectives within your discipline

How Will You Learn?

Teaching materials are delivered through a combination of lectures, problem solving classes, laboratory practicals, and a variety of coursework. In addition problem-based learning plays a role in your first and second years.

You will undertake a major individual research project in the third year, designed to assimilate and utilise knowledge gained throughout the degree towards approaching a real Engineering problem. This project allows you to participate in the specialist internationally-recognised research taking place within the School of Engineering and Materials Science. It provides a valuable insight into real life research and project management.

How Will You Be Assessed?

Assessment is continuous throughout the degree, with written reports, projects, presentations, group work and exams (exams take place in the late Spring only). The degree programme has eight modules per year split over two semesters. The third year research project counts for two modules. In the third year, you can select from a range of module options allowing you to tailor your degree to specific areas of interest within the Medical Engineering degree programme.

How is the Programme Structured?

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

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

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We also offer a BEng degree 'with Industrial Experience' where you would take a year working in a Medical Engineering related industrial position either after your second or third years of study. You are paid by the company during this year which also counts towards your degree. If you are not registered on a 'with Industrial Experience' programme you can opt into it at any stage prior to taking your placement. You would extend your studies by a year as you undertake a structured programme at one of our many partner companies. To support this activity we employ a full time Industrial Placement Manager in the School, who supports you through the application process and then manages the programme whilst you are on the placement. Recent placement employers include: DSTL, RollsRoyce, DePuy, Aloca, Microsoft, ARTIS, GE, Caterham F1 & Philips. This exciting opportunity gives you a valuable insight into future careers and enhances employability.

QMUL Model

Students are required to undertake the equivalent of one module (15 credits in 2017/18) per year of study which has been identified as meeting the requirements of the QMUL Model. Each of these modules has been designed to combine the best of QMUL's academic excellence with your ability to identify and develop your skills, networks and experience. This will help to ensure you become a graduate who can undertake further study or secure graduate employment in areas that interest you, and will support your ability to position yourself to find the right job or opportunity for you. The relevant module for your first year of study in 2017/18 is indicated below.

Where more than one module is specified, this is because pertinent elements from these modules have been identified as being appropriate to the QMUL Model and when studied together, deliver the equivalent content of one 15-credit QMUL Model module.

The QMUL Model modules for future years and associated Learning Outcomes will be identified as your studies continue.

Should Professional, Statutory and Regulatory Body requirements apply to your programme of study, these will be taken into account in the specification of QMUL Model requirements.

Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Engineering Design Methods	MAT4002	15	4	Compulsory	1	Semester 1	Yes
Mechanics of Fluids	DEN4101	15	4	Compulsory	1	Semester 1	Yes
Mathematics and Computing for Engineers 1	DEN4122	15	4	Compulsory	1	Semester 1	No
Clinical Problems in Biomedical Engineering and Materials	MAT4003	15	4	Compulsory	1	Semester 1	No
Mathematics and Computing for Engineers 2	DEN4123	15	4	Compulsory	1	Semester 2	No
Engineering Mechanics: Statics	DEN4102	15	4	Compulsory	1	Semester 2	No

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Engineering Mechanics: Dynamics	DEN4108	15	4	Compulsory	1	Semester 2	No
Clinical Solutions in Biomedical Engineering and Materials	MAT4004	15	4	Compulsory	1	Semester 2	No
Transferable Skills for Engineers and Materials Scientists	MAT4444	0	4	Compulsory	1	Semesters 1 & 2	No

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Design for Manufacture	DEN5101	15	5	Compulsory	2	Semester 1	No
Grad, div and curl: Vector Calculus for Engineering	DEN5122	15	5	Compulsory	2	Semester 1	No
Engineering Instrumentation	DEN5109	15	5	Compulsory	2	Semester 1	No
Neuromuscular Bioelectricity and Biomechanics	DEN5302	15	5	Compulsory	2	Semester 1	No
Engineering Materials for Design	DEN5002	15	5	Compulsory	2	Semester 2	No
Control Systems Analysis and Design	DEN5200	15	5	Compulsory	2	Semester 2	No
Solid Mechanics	DEN5102	15	5	Compulsory	2	Semester 2	No
Fluid Mechanics of the Cardiovascular System	DEN5300	15	5	Compulsory	2	Semester 2	No

Academic Year of Study FT - Year 3

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Individual Project	DEN318	30	6	Core	3	Semesters 1 & 2	No

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Computer Aided Engineering for Solids and Fluids	DEN331	15	6	Compulsory	3	Semester 1	No
Tissue Engineering and Regenerative Medicine	MAT311	15	6	Compulsory	3	Semester 1	No
Materials Selection in Design	MAT602	15	6	Compulsory	3	Semester 1	No
Implant Design	DEN6437	15	6	Compulsory	3	Semester 2	No
Tissue Mechanics	DEN6311	15	6	Elective	3	Semester 2	No
Principles and Application of Medical Imaging	DEN324	15	6	Elective	3	Semester 2	No
Robotics	DEN408	15	6	Elective	3	Semester 2	No

What Are the Entry Requirements?

Minimum Entry Requirements with A-levels are:
ABB or 320 points from 3 A-levels
Must include maths A-level and at least one science A-level (physics, biology, or chemistry).
Maths A-level must be a B or above

Other qualifications:
International Baccalaureate - 34 points or above overall, with maths and a science (physics, chemistry or biology) at higher level 6
European Baccalaureate - 80% or above including maths and science
French Baccalaureate - 14/20 overall, with 14/20 in maths and science
HE Advanced Diploma - Grade B or above overall, with Maths A-level grade B or above

How Do We Listen and Act on Your Feedback?

The Staff-Student Liaison Committee provides a formal means of communication and discussion between the School and its students. The committee consists of student representatives from each year of the programme, together with appropriate representation from staff within the School. It is designed to respond to both the general needs of students, and subject specific concerns, as well as act as a forum for discussing programme and module developments. Staff-Student Liaison Committees meet regularly throughout the year.

The chair of the SSLC sits on the School's Education and Learning Committee, which advises the School's Director of Taught Programmes on all matters relating to the delivery of taught programmes at School level, and ensures that student feedback is fed into the reviewing of modules and programmes. Student views are also incorporated in the Committee's work in other ways, such as through the National Student Survey (NSS), student module evaluations and module forums. We also use the forums to listen to student feedback on an individual module basis and develop materials and support classes to address comments or requests suggested in the forum.

All Schools operate an Annual Programme Review (APR) of their taught undergraduate and postgraduate provision. APR is a continuous process of reflection and action planning which is owned by those responsible for programme delivery; the main document of reference for this process is the Taught Programmes Action Plan (TPAP) which is the summary of the School's work throughout the year to monitor academic standards and to improve the student experience.

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Academic Support

Academic support for individual modules is the responsibility of the module organiser and co-organiser(s). These are supported by Teaching Assistants and post-graduate students, many of whom will have studied the modules themselves as undergraduates in the School. In addition there is technician support available for practical sessions.

Academic support for the programme as a whole, including choosing optional modules and possible transfer between programmes is provided in the first instance by the Personal Tutor, with further guidance available from the Senior Tutor and Programme Director, the latter having overall responsibility for the programme structure. The Programme Director in turn reports to the relevant Discipline Teaching Group in the School, the Chair of which is a member of the School's Education and Learning Committee.
We additionally have a School Office, with many student facing staff available to support student learning and one full time Student Support Officer. These staff members will help with coursework submission, time tabling concerns and other general administration as well as providing pastoral support and further guidance on dealing with extenuating circumstances. We also have staff designated to support students in achieving industrial placements and providing careers advice.

Programme-specific Rules and Facts

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

Specific Support for Disabled Students

Queen Mary has a central Disability and Dyslexia Service (DDS) that offers support for all students with disabilities, specific learning difficulties and mental health issues. The DDS supports all Queen Mary students: full-time, part-time, undergraduate, postgraduate, UK and international at all campuses and all sites.

Students can access advice, guidance and support in the following areas:
• Finding out if you have a specific learning difficulty like dyslexia
• Applying for funding through the Disabled Students' Allowance (DSA)
• Arranging DSA assessments of need
• Special arrangements in examinations
• Accessing loaned equipment (e.g. digital recorders)
• Specialist one-to-one "study skills" tuition
• Ensuring access to course materials in alternative formats (e.g. Braille)
• Providing educational support workers (e.g. note-takers, readers, library assistants)
• Mentoring support for students with mental health issues and conditions on the autistic spectrum.

Links With Employers, Placement Opportunities and Transferable Skills

We place a strong emphasis on supporting our students in achieving quality graduate positions at the end of their degrees. In the first year, all students take a transferable skills module, designed to both support them through the transition to university life, and also introduce the important employability skills they will need in later life. We run an extensive range of employability training events, with weekly timetabled careers slots and field trip visits to more than 20 collaborating companies. Our relationships with both the Careers Group and Student Services are strong in SEMS, and we co-deliver our training in study skills and career development for maximum benefit.
Since 2011 we have had a placement officer working in the school dedicated to supporting our new “with Industrial Experience” programmes which have grown immensely in popularity in the last few years.

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The School has run Industrial Liaison Forums (ILFs) each academic year since the School was formed in 2007. Since 2010, the Autumn event is focused on encouraging more industrial participation in our research programmes, rewarding excellence by allowing companies to present student prizes for academic excellence across the School and also as a way of allowing companies and our students to interact through themed panel sessions and a careers fair. The Spring event aims to showcase our best third year project students and all of our group MEng projects. This event again allows extensive networking opportunities between employers and placement providers with all of our students in SEMS. Typically these events are attended by over 50 companies including our regular student prizes sponsors: Tata Steel, Eaton Industries, JRI, GSK, RollsRoyce, Apatech, Morgan Cruicible, ARTIS, NPL, TWI, Becker Coatings; Advanced Healthcare Ltd & Apatech. Many of these companies are also actively engaged in student projects and in addition to these our events are also attended by additional companies that also collaborate with projects such as: Jaguar Land Rover, Alcoa, Perryman, DSTL, BAe, Airbus, Corin, DePuy, Baxter's Healthcare, Norman Foster Partners and many others. In recent times we have extended these events to encourage participation from our more recent alumni as well.

These forums have a direct impact by encouraging employers to sponsor and support the student projects and to provide real engineering case studies to engage the students throughout the curriculum. Many of these companies also support our lecture programme in individual modules. Recent case studies that have been taught and assessed were delivered by companies including Tata, Gillette, Sugru, JRI, DuPuy, Apatech, Artis, BAe, DSTL, Rolls Royce, Perryman and Advanced Healthcare ltd.

Programme Specification Approval

Person completing Programme Specification	Dr Hazel Screen/ Dr Henri Huijberts
Person responsible for management of programme	Prof Martin Knight
Date Programme Specification produced/amended by School Learning and Teaching Committee	1 Nov 2016
Date Programme Specification approved by Taught Programmes Board	1 Nov 2016

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