Queen Mary University of London

Programme Specification

Awarding Body/Institution	Queen Mary University of London
Teaching Institution	Queen Mary University of London
Name of Final Award and Programme Title	MSci Biomaterials for Biomedical Sciences/MSci Biomaterials for Biomedical Sciences with Industrial Experience/MSci Biomaterials for Biomedical Sciences with Year Abroad
Name of Interim Award(s)	
Duration of Study / Period of Registration	4/5 years (plus optional year in industry or year abroad)
QM Programme Code / UCAS Code(s)	J5B3 (with year in industry), J5B4, JB4Y (with year abroad)
QAA Benchmark Group	Materials
FHEQ Level of Award	Level 7
Programme Accredited by	Accreditation by Institute of Materials, Minerals and Mining.
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 Biological & Chemical Sciences

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

Programme Outline

The MSci degree in Biomaterials for Biomedical Sciences is a 4 year integrated masters programme, complementing programmes offered in Materials and Biomedical Sciences, Dental Materials and Medical Engineering at Queen Mary University of London. The Biomaterials for Biomedical Sciences programme aspires to produce highly skilled, motivated, creative and team-work oriented graduates, which the healthcare-related industry needs in order to regulate, assess the efficacy and improve the delivery, quality and longevity of the next generation of interventional and therapeutic medical devices and treatments.

The Biomaterials for Biomedical Sciences programmes at QMUL are designed to equip students with an understanding of the complexity and aggressive nature of the biological environment, the varied ways in which biomaterials can respond to this environment, the physiological control mechanisms and biomaterials properties that can modulate the host response, the uses and limitations of current and emerging biomedical materials, the tools that can be used to help predict or monitor behavior and the importance of interdisciplinary thinking, ethics and regulatory approval in next generation biomedical materials development and optimisation. All of which will be underpinned by knowledge of the structure-properties relationship in materials, how this relates materials performance and life time to its synthesis/chemistry and processing routes, and knowledge

of basic human physiology and pathology.

The first two years of the Biomaterials for Biomedical Sciences (BfBS) programme provides a firm grounding in subjects fundamental to Biomaterials and Biomedical Sciences in addition to modules introducing the specific challenges and solutions materials face when used in the physiological and clinical environment, and the key practical skills required to assess biomedical materials performance.

The third year gives students the opportunity to specialise in an area of the biomaterials and biomedical sciences of particular interest through participation in an individual project, which is usually an experimental research project, but may be a theoretical investigation, a detailed design study, or a critical review of a topic in the biomaterials and biomedical sciences. There is also an elective module choice to enable students to further tailor their learning to their interests.

In the fourth year students have 2 further elective module choices as well as a group design project, which emphasises the benefits of teamwork and is often linked to industry. The project is an excellent opportunity to consolidate learning from previous years, with a focus of solving a real industrial biomaterials problem. Students learn to function effectively as a team, allocating work and responsibilities appropriately, as well as developing an industrial link and gaining experience to add to their CV. Where possible projects are multi-disciplinary, with groups including students from other Engineering and Materials Science streams such as Medical Engineering, Materials Science or Dental Materials. They also develop many transferable skills and will have the responsibility for the overall management of the project including its finances.

It is anticipated that the degree programmes will be accredited by the Institute of Materials, Mineral and Mining (IOMMM), enabling students to become graduate members of IOMMM on graduation, and to apply for CSci or CEng status, subject to appropriate CPD being undertaken in the work place. Enrolment as a student member of the IOMMM is also encouraged.

Aims of the Programme

The overall aims of the programme are:
• to provide an education in biomaterials and biomedical sciences of a standard recognized to be amongst the highest in UK institutions;
• to take a multi-disciplinary approach to the elements of biomedical materials science, including an understanding of soft and hard tissue structure and properties, key diseases and basic biomechanics
• to educate our students in the scientific and mathematical principles underpinning biomaterials and biomedical sciences
• to enable all our students to achieve their academic potential by providing a stimulating, friendly and supportive environment;
• to offer challenging programmes which provide our graduates with a clear pathway to Chartered Engineering status;
• to prepare our graduates with discipline-specific knowledge and transferable skills that will equip them for employment and continued professional development through self-learning.
• to develop an appreciation of the relative merits of a proposed biomaterials based solution and the ability to convey these merits to those who need translate them into clinical or medical artefacts and the financial implications.

Specific aims include:
• analytical, creative, organisational, practical and communication skills,
• problem-recognition and solving abilities
• competence in discipline-specific topics which contribute to the solution of problems applied to biomaterials selection, implant or device specification, design and evaluation
• an appreciation of how theoretical and practical approaches in biomaterials and biomedical sciences can be combined to arrive at a solution balanced to optimise in vivo performance
• an appreciation of the financial context of the development of a medical device or novel biomaterial
• an understanding of the relationship between the biomaterials and biomedical sciences disciplines and social, ethical, economic and environmental issues and constraints.
• the detailed skills needed to undertake a research/ development/ design project in depth, including understanding the technical, financial and time limitations

What Will You Be Expected to Achieve?

Acquire a body of contemporary factual knowledge incorporating the fundamental principles of Biomaterials and Biomedical Sciences and develop the ability to apply this knowledge in the selection, design and biomedical evaluation of materials for/in medical devices.

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Academic Content:	
A 1	Knowledge of the fundamental principles of materials science and engineering necessary to underpin their education in Biomedical Materials
A 2	The application of materials science principles to biomedical materials as applied to problems of materials development and selection, implant or device specification and design
A 3	The biomedical science based principles behind physiological systems and how this translates into biocompatibility within the human organism
A 4	The principles of engineering and materials science behind the structure - function relationships in biomaterials and hierarchical anatomical systems
A 5	Knowledge of the mathematical principles underpinning materials science, in addition to the mathematical methods, tools and notations used in the statistical and conventional analysis of materials.
A 6	An understanding of concepts from a range of areas, particularly those related to medicine, and the ability to apply them effectively in biomedical materials science projects
A 7	An awareness of developing technologies related to the biomaterials and biomedical sciences
A 8	An understanding of how scientists, engineers and clinicians interface within the medical sector and the technological requirements of the medical sector
A 9	Knowledge of the ethical and moral issues underpinning the biomaterials profession and how a biomedical materials scientist must operate within these
A 10	Knowledge of the regulatory framework governing the development of new medical products

Disciplinary Skills - able to:	
B 1	Apply biomaterials science and engineering principles to a range of medically related problems and applications
B 2	Extract data pertinent to an unfamiliar problem, and apply it, particularly in relation to the biomedical field
B 3	Apply quantitative methods and relevant computer software, to solve and statistically analyse biomaterials problems
B 4	Demonstrate creativity and innovation in the synthesis of solutions
B 5	Use fundamental knowledge to investigate new and emerging biomedical related technologies
B 6	Effectively communicate and interface with clinicians and biomaterials specialists to formulate medical problems from a biomaterials or biomedical sciences viewpoint
B 7	Learn and apply new theories, concepts, methods in unfamiliar situations
B 8	Develop, monitor and update a plan, to reflect a changing operating environment

Attributes:

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C 1	Engage critically with knowledge, and apply it in a rigourous way
C 2	Use communications technologies competently to engage with a range of audiences, from specialist to non-specialist
C 3	Critically evaluate the reliability of different sources of information
C 4	Use information for evidence based decision making
C 5	Develop a spirit of enquiry and a desire for continued learning throughout their careers
C 6	Use quantitative data confidently and competently
C 7	Develop the necessary transferable skills to be effective in the workplace, such as autonomous working, project planning and financial management
C 8	Work effectively within a group to develop and maintain positive working relationships
C 9	Develop effective leadership skills to positively guide, influence and empathise with others

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 the your first and second years.

You will undertake an individual research project in the third year which will be designed to assimilate and utilise knowledge gained throughout the degree towards approaching a real Biomaterials and Biomedical sciences problem.

In the fourth year you will undertake a group design project, which develops multi-disciplinary team working skills and is often linked to industry.

The 3rd and 4th year projects allows you to participate in the specialist internationally recognised research taking place within the School of Engineering and Materials Science.

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 15 credit units per year split over two semesters, where a subject module is typically worth 15 credits and most are assessed by a combination of coursework and an end of year exam.

Some modules, such as the Student Centred Learning, Individual Research Project and Research and Design Team Project modules count for more than one unit, are worth 30-60 credits and are assessed via a combination of presentation and written assignments.

How is the Programme Structured?

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

The Biomaterials for Biomedical Sciences MSci programme at QMUL is a 4 year programme which we anticipate will be accredited by the Institute of Materials, Minerals and Mining, which means students can progress to chartered Scientist status (CSci) or chartered Engineer status (CEng) with the appropriate work experience following graduation.

The programme has a modular structure with typically eight modules being studied in each year. 15 compulsory modules (59% of the programmes credits) are shared with other QMUL Materials streams over the 4 years. These have been designed to ensure that all the key aspects of materials science are delivered to all our materials students. The differentiation between the programmes is determined by the stream specific modules offered either as additional compulsory or elective modules designed to provide insight into specialist areas.

In year 1 and 2 students develop practical and problem solving skills within our student centred learning modules. These modules are designed to equip students with the ability to undertake a self led research project within the 3rd year and a group research and design project in year 4.

We also offer the 5 year MSci degree 'with Industrial Experience' where students spend a year working in a Biomedical or Biomaterials related industrial position typically between their third and fourth years of academic study. Students are paid by the company during this year which also counts towards their degree. If Students are not registered on a 'with Industrial Experience' programme they can opt into it at any stage prior to taking their placement. To support this activity we employ a full time Industrial Placement Manager in the School, who supports the students through the application process and then manages the programme whilst you are on the placement. This exciting opportunity gives students a valuable insight into future careers and enhances employability.

The "with Year Abroad" version of the programme enables students to study the full degree at QMUL with an additional year abroad with one of our internationally excellent partner universities. Between the second and third years of of your QMUL programme you will spend a year at a partner university abroad. A total equivalent to 120 credits of study should be completed during this year, and you should pass at least 90 credits to have this study recognised.

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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
Materials Science 1: Properties of Matter	MAT100	15	4	Compulsory	1	Semester 1	No
Clinical Problems in Biomedical Engineering and Materials	MAT4003	15	4	Compulsory	1	Semester 1	No
The Human Cell	MAT4115	15	4	Compulsory	1	Semester 2	No
Transferable Skills for Engineers and Materials Scientists	MAT4444	0	4	Compulsory	1	Semesters 1 & 2	No
Student Centred Learning 1	MAT106	30	4	Core	1	Semesters 1 & 2	Yes
Materials Science 2 - Processing and applications	MAT206	15	4	Compulsory	1	Semester 2	No
Molecules to Materials	MAT4001	15	4	Compulsory	1	Semester 1	No
Biomolecules of Life	MAT4123	15	4	Compulsory	1	Semester 2	No

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Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Chemistry for Materials	MAT5002	15	5	Compulsory	2	Semester 1	No
Polymers	MAT313	15	5	Compulsory	2	Semester 1	No
Surfaces and Interfaces in Medical Materials	MAT212	15	5	Compulsory	2	Semester 1	No
Student Centred Learning 2	MAT308	30	5	Core	2	Semesters 1 & 2	No
Structural Characterisation	MAT400	15	5	Compulsory	2	Semester 2	No
Medical Physiology	MAT5222	15	5	Compulsory	2	Semester 2	No
Mathematics for Materials Scientists	MAT115	15	4	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
Materials Selection in Design	MAT602	15	6	Compulsory	3	Semester 1	No
Tissue Engineering and Regenerative Medicine	MAT311	15	6	Compulsory	3	Semester 1	No
Introduction to Human Pathology	MAT6222	15	6	Compulsory	3	Semester 1	No
Individual Undergraduate Research Project	MAT500	30	6	Core	3	Semesters 1 & 2	No
Tissue Mechanics	DEN6311	15	6	Compulsory	3	Semester 2	No
Science of Biocompatibility	MAT6312	15	6	Compulsory	3	Semester 2	No
Manufacturing Processes	MAT601	15	6	Compulsory	3	Semester 2	No

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Academic Year of Study FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester	QMUL Model
Advanced Structure-Property Relationships in Materials	MAT706	15	7	Compulsory	4	Semester 1	No
Nanotechnology and Nanomedicine	MAT7803	15	7	Elective	4	Semester 1	No
Introduction to Law for Science and Engineering	IPLM701U	15	7	Elective	4	Semester 1	No
Research and Design Team Project	MAT7400	60	7	Compulsory	4	Semesters 1 & 2	No
Advanced Materials Characterisation Techniques	MAT804	15	7	Compulsory	4	Semester 2	No
Chemical and Biological Sensors	MAT707	15	7	Elective	4	Semester 2	No
Advanced Polymer Synthesis	MAT7797	15	7	Elective	4	Semester 2	No
Clinical trials and regulatory affairs	TBCxxx	15	6	Elective	4	Semester 2	No
Drug discovery and design	TBCxxx	15	6	Elective	4	Semester 2	No
Foundations of Intellectual Property Law and Management	IPLM702U	15	7	Elective	4	Semester 2	No

What Are the Entry Requirements?

Minimum Entry Requirements with A-levels are:

AAA or 360 points from 3 A-levels

Must include two from either Maths, Chemistry, Biology or Physics
Maths/science subjects; A-level must be an A or above

Other qualifications:
International Baccalaureate - 36 points or above overall, with two from Maths, Physics, Biology, or Chemistry at higher level 6
European Baccalaureate - 85% or above including maths and/or science
French Baccalaureate - 15/20 overall, with 15/20 in maths and/or science
HE Advanced Diploma - Grade A or above overall, with Maths or science A-level grade A 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

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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.

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 MEng/MSci 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.

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 MSci/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	HJC Huijberts
Person responsible for management of programme	Dr Karin Hing
Date Programme Specification produced/amended by School Learning and Teaching Committee	14 Aug 2017
Date Programme Specification approved by Taught Programmes Board	