Programme Title: BSc (Eng) Intelligent Biomedical Engineering

Programme Specification (UG)

Awarding body / institution:	Queen Mary University of London + Beijing University of Posts and Telecc
Teaching institution:	QMUL + Beijing University of Posts and Telecommunications
Name of award and field of study:	BSc Intelligent Biomedical Engineering
Name of interim award(s):	
Duration of study / period of registration:	4 years
QMUL programme code / UCAS code(s):	
QAA Benchmark Group:	Engineering, but benchmarks subsumed by UKSPEC
FHEQ Level of Award :	Level 6
Programme accredited by:	
Date Programme Specification approved:	
Responsible School / Institute:	Faculty of Science and Engineering

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

School of Physical and Chemical Sciences

Collaborative institution(s) / organisation(s) involved in delivering the programme:

Beijing University of Posts and Telecommunications (BUPT)

Programme outline

This programme is intended to respond to a growing demand for high-skilled graduates who can apply the latest scientific, computational, digital and analytical techniques to solve problems and create new products and services in the Biomedical sector. This demand is demonstrated by the growth in careers such as biomedical engineer, healthcare analysist, bioinformatics data scientist and health information systems engineer, as well as the increased visibility of the impact of digital, computing and analytical technologies on the healthcare sector.

BSc Intelligent Biomedical Engineering is a four year BSc degree. Students will develop a solid mathematical, engineering and computing foundation, together with technical language and academic skills, during the first year of the programme. Subsequent modules are structured around several main areas, including biomedicine, data analytics, machine learning, digital technology and processing, and computational biology. BSc Intelligent Biomedical Engineering is the third programme to be delivered by Queen Mary School Hainan, a transnational education institution launched by QMUL in partnership with the BUPT in the Hainan Province in 2022. As such, the programme and its modules have been designed collaboratively using research-informed input from the Faculty of Science and Engineering and BUPT, and incorporates the latest computing and data science technologies and approaches developed in the biomedical domain.

Students on this programme benefit from combining the expertise from BUPT and QMUL in core areas such as digital

technologies, data science, artificial intelligence (AI) and machine learning, computational biology and biomedical engineering. This will allow graduates to negotiate a rapidly evolving world, and address problems from a range of perspectives as designers, not merely users, of technologies. The programme incorporates research informed teaching in which students will be involved with the latest and future technologies in computational biomedical engineering. In addition, the programme will also include the key skills aspects already incorporated into the other QMUL-BUPT JEI programmes.

Aims of the programme

This program focuses on delivering core principles of Biomedical Engineering and equipping graduates with a strong foundation in both engineering and computational intelligence.

Graduates will develop:
- Core knowledge of biomedical systems, medical imaging, biomedical signal processing, and human-machine interaction.
- Skills for designing and implementing software, with a focus on biomedical data processing, medical imaging, and healthcare technology
- A strong understanding of AI, machine learning, and data analytics to enhance biomedical applications and decision-making in healthcare.
- Pactical skills in developing, optimising, and testing intelligent biomedical systems, including AI-powered diagnostics and wearable health technologies

Students will advance their engineering and mathematical skills, including data analysis and computational modelling, while also refining their ability to communicate findings effectively in both clinical and technical environments. Through hands-on projects and interdisciplinary collaboration, they will gain experience in applying intelligent approaches to real-world biomedical challenges.

Graduates of this program will be well-prepared for careers in medical technology, AI-driven healthcare solutions, biomedical research, and digital health innovation. The combination of engineering expertise, artificial intelligence, and biomedical sciences will equip them with the necessary skills to drive advancements in intelligent healthcare systems, medical diagnostics, and next-generation biomedical technologies.

What will you be expected to achieve?

In this degree program, we place strong emphasis not only on the technical aspects of our modules, such as mathematics, programming, intelligent systems and biomedical engineering, but also on interdisciplinary skills essential for a biomedical engineer to thrive in the healthcare and medical technology sectors. These skills are embedded within the technical modules to ensure that your knowledge evolves as you progress through the programme, equipping you with expertise that can be applied across a wide range of career paths or advanced research opportunities.

The curriculum is designed to develop key graduate attributes, including resilience, creativity, communication, technical proficiency, and professional practice. These attributes ensure that you will graduate as a well-rounded, highly skilled, and employable professional, capable of contributing to the future of intelligent biomedical engineering. Throughout your studies, you will engage with concepts and technical skills aligned with both academic learning and professional competencies. You will also gain the tools to track and reflect on your growth in these areas.

The program's Graduate Attributes have been developed in consultation with industry leaders and are structured into five key areas, ensuring alignment with the evolving demands of biomedical technology and healthcare innovation.

Resilience (R1-R3)
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 (Cr1 – Cr4)
As a biomedical 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 developing innovative design approaches in (computer) laboratory and practical work.

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Communication (Co1 – Co4)
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 (P1 – P5)
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 practise project management approaches through practical work in your modules. You will also be introduced to topics such as intellectual property and research ethics.

Technical (T1 – T4)
The fundamental practical attributes important for scientific/engineering careers from computational techniques to the analysis and risk assessment of systems and approaches are included in this area. Design projects will test your ability to analyse a complex problem, select appropriate computational 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.

We have further mapped the programme learning outcomes onto the Engineering Council's outcomes, which are indicated by the "EngC" labels below.

Please note that the following information is only applicable to students who commenced their Level 4 studies in 2017/18, or 2018/19

In each year of undergraduate study, students are required to study modules to the value of at least 10 credits, which align to one or more of the following themes:

- networking
- multi- and inter-disciplinarity
- international perspectives
- enterprising perspectives.

These modules will be identified through the Module Directory, and / or by your School or Institute as your studies progress.

Academic Content:	
A 1	Apply knowledge of mathematics, statistics, natural science, computer science and engineering principles to the solution of complex problems. Some of the knowledge will be at the forefront of the particular subject of study. [EngC1]
A 2	Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed. [EngC3]
A 3	Select and evaluate technical literature and other sources of information to address complex problems. [EngC4]
A 4	Design solutions for complex problems that meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards. [EngC5]

A 5	Apply an integrated or systems approach to the solution of complex problems. [EngC6]
A 6	Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts. [EngC7]
A 7	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct. [EngC8]

Disciplinary Skills - able to:	
B 1	Adopt a holistic and proportionate approach to the mitigation of security risks. [EngC10]
B 2	Adopt an inclusive approach to science and engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion. [EngC11]
B 3	Select and apply appropriate technologies and processes, recognising their limitations. [EngC13]
B 4	Discuss the role of quality management systems and continuous improvement in the context of complex problems. [EngC14]

Attributes:	
C 1	Identify and appreciate the skills for personal and professional self-development. [R2/EngC18]
C 2	Evaluate complex or contradictory information, data and processes in order to make judgements and decisions. [Cr1/ EngC2]
C 3	Identify and solve real world problems, developing creative solutions with a full awareness of sustainability. [Cr2]
C 4	Apply creativity in product and systems design, incorporating different disciplinary and cultural perspectives. [Cr3]
C 5	Evaluate, model and improve a range of multifaceted systems. [Cr4]
C 6	Be effective in verbal communication, develop speaking and listening skills, and provide and receive constructive feedback. [Co1]
C 7	Convey complex technical, professional and other information in written form to suit a range of audiences. [Co2]
C 8	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. [Co3/EngC17]
C 9	Work effectively in a team, appreciating different team roles including leadership. [Co4/EngC16]
C 10	Understand and comply with professional scientific ethics and codes of conduct. [P2]
C 11	Plan, use and record data from laboratory techniques pertinent to the discipline of study. [T1/EngC12]
C 12	Evaluate risk and uncertainty using appropriate statistical methods applied to scientific and engineering problems and other evaluation methods. [T2/EngC9]

How will you learn?

All taught modules involve interactive in-room delivery, problem solving coursework, case studies and independent study. Many

also have laboratory work, which for this degree includes coding, engineering/technical practical exercises as well as e.g. drawing and prototyping. In-room delivery is used to introduce principles and methods and also to illustrate how they can be applied in practice. Coursework allows students to develop their skills in problem solving and to gain practical experience. Laboratory work provides students with the guidance and help while solving a problem using a wide range of tools and techniques. This allows students to learn-by-doing in order to complement the in-room delivery. QMUL Science and Engineering Graduate Attributes are available for all Queen Mary School Hainan students to identify students' attributes and develop students' knowledge, skills and behaviour that employers value.

How will you be assessed?

The assessment of most of the taught modules takes place through a written examination and practical coursework. Some modules also include in-class tests as a component in assessment, while others will be assessed entirely through project work.

The final year project is examined on the basis of a written report, a formal oral presentation, and a demonstration of the piece of software or hardware developed by the student. In addition to the final year project, other modules introduce project and critical group working skills necessary for working in industry after graduation.

How is the programme structured?

Please specify the structure of the programme diets for all variants of the programme (e.g. full-time, part-time - if applicable). The description should be sufficiently detailed to fully define the structure of the diet.

Most modules are shown with a value of 15 credits. This is to simplify the procedure to fit the QMUL system. The exception is Personal Development Plan (PDP) which is worth 0 credits, but included as part of the Engineering Environment module. Engineering Environment is a mix of QMUL and BUPT modules that do not have any specific credits and counts 5% towards the award of Honours and exists in all Queen Mary School Hainan programmes. PDP counts towards Engineering Environment but does not have any real credits by itself, although it is shown on the transcript.

The module load is not symmetrical across semesters as the technical modules are balanced with Chinese compulsory modules, which are not shown and are part of BUPT's diet. All modules are taught in English and every module must be passed for a degree to be awarded (Chinese regulations) - so all are shown as core.

Queen Mary School Hainan programmes have two components: technical content and Chinese compulsory topics The degree is awarded on the basis of the technical content, but the compulsory topics must be passed to get a degree to comply with Chinese MoE requirements.

Only modules shown on the QMUL transcript counting towards the award of Honours are included; other Chinese compulsory topicd are not shown, nor are short summer semester modules, but these must all be passed for the award of the degree so a pass/fail module is included to allow that to be handled at QM.

Note that each module is assigned credits based on contact time. Again these are Chinese requirements.

Academic Year of Study FT - Year 1

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Technical Language and Academic Study Skills 1	QHF3004	15	3	Core	1	Semester 1
Linear Algebra	BHU3007	15	3	Core	1	Semester 1

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Advanced Mathematics 1	BHU3008	15	3	Core	1	Semester 1
Introduction to Computing and Programming	BHU3003	15	3	Core	1	Semester 1
Technical Language and Academic Study Skills II	QHF3005	15	3	Core	1	Semester 2
Advanced Mathematics 2	BHU3009	15	3	Core	1	Semester 2
Physics C	BHU3012	15	3	Core	1	Semester 2
Introduction to Data Science Programming	QHP4701	15	4	Core	1	Semester 2
Personal Development Plan & Entrepreneurial Skills 1	QHF3001	0	3	Core	1	Semester 2

Academic Year of Study FT - Year 2

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Personal Development Plan & Entrepreneurial Skills 2	QHF4001	0	4	Core	2	Semester 1
Algorithms and Data Structures	BHU4002	15	4	Core	2	Semester 1
Probability Theory and Mathematical Statistics	BHU4001	15	4	Core	2	Semester 1
Electric and Magnetic Fields	BHU3011	15	3	Core	2	Semester 1
Exploratory Data Analysis	QHP5701	15	5	Core	2	Semester 1
Introduction to Artificial Intelligence	QHE4102	15	4	Core	2	Semester 2
Introduction to Clinical Problems	BHU4013	15	4	Core	2	Semester 2
Introduction to Electronic Systems	BHU4012	15	4	Core	2	Semester 2

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Digital Circuit Design	BHU4011	15	4	Core	2	Semester 2
Medical Imaging Technology and Physics	BHU4014	15	4	Core	2	Semester 2

Academic Year of Study FT - Year 3

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Personal Development Plan & Entrepreneurial Skills 3	QHF5001	0	5	Core	3	Semester 1
Principles of Machine Learning	QHM5703	15	5	Core	3	Semester 1
Fundamentals of DSP	QHE5107	15	5	Core	3	Semester 1
Human Biology	QHE5111	15	5	Core	3	Semester 1
Embedded systems	QHE5112	15	5	Core	3	Semester 1
Digital Image and Video Processing	QHE5110	15	5	Core	3	Semester 2
Biomedical Signal Processing	QHE5001	15	5	Core	3	Semester 2
Visual Computing	BHU6002	15	6	Core	3	Semester 2
Deep Learning with Neural Networks	QHM6702	15	6	Core	3	Semester 2
Principles of Brain and Cognitive Sciences	BHU5002	15	5	Core	3	Semester 2

Academic Year of Study FT - Year 4

Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester

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Module Title	Module Code	Credits	Level	Module Selection Status	Academic Year of Study	Semester
Sensors, Wearables and Brain-Computer Interfaces	QHE5002	15	6	Core	4	Semester 1
Smart Hospital and Health Data Management	BHU6001	15	6	Core	4	Semester 1
Mathematical Biology for Biological Data Analysis	QHM6706	15	6	Core	4	Semester 1
Project	QHM6706	30	6	Core	4	Semesters 1 & 2
Engineering Environment (Intelligent Biomedical Engineering)	BHU6XXX	15	6	Core	4	Semester 2
Chinese Compulsory Topics	BHU6XXX	0	6	Core	4	Semester 2

What are the entry requirements?

Pass the minimum entry requirements for BUPT. As a national key university, all entrants to BUPT must score above the top line in the Chinese national entrance examinations. Specifically, all participating students must have achieved Level 1 in the national PRC university entrance examination (generally known as the "Gaokao"). The level is approximately equivalent to the top 2-3% of the population in China of that age group. In addition, students must demonstrate sufficient English skills to ensure that they can meet the demands of studying a degree programme which is taught in English.

How will the quality of the programme be managed and enhanced? How do we listen to and act on your feedback?

The management of the programme is overseen by the Director of Education and a joint Academic Committee that meets every semester and comprises academics from both QMUL and BUPT. The committees' role is to discuss and resolve ongoing issues and raise areas for proactive improvement to the educational offer to students, as well as monitoring the application of relevant QMUL policies and reviewing all proposals for module and programme approval and amendment before submission to the Taught Programmes Board. . This extends not only from academic matters but also infrastructure and how other improvements can be met to improve the student experience.

Programme Reviews and a tri-annual Extended Programme Review of the taught undergraduate provision are conducted at Queen Mary School Hainan. The process is normally organised by the Dean and Vice-Dean of Queen Mary School Hainan who are responsible for the completion of the school's Programme Reviews. Students' views are considered in this process through analysis of the module evaluations and feedback collected and discussed by the student voice committee (SVC) which in the context of Queen Mary School Hainan BUPT, as agreed in the Articles of Association signed by QMUL and BUPT , is called the Student-Staff Liaison Committee (SSLC). In addition, BUPT conducts a biannual review of all programmes.

The SSLC provides a formal means of communication and discussion between QMUL and BUPT, and Queen Mary School Hainan students. The committee consists of student representatives from each year together with appropriate representation from staff within QMUL and BUPT. It is designed to respond to the needs of students, as well as act as a forum for discussing programme and module developments. SSCLs meet every semester.

At faculty level, the TNE (Transnational Education) Committee advises on educational management of the different QMUL programmes in China. Advice and direction is on all matters relating to the delivery and content of taught programmes, including monitoring the application of relevant QM policies and reviewing proposals for module amendments and

replacements, as well as programme approval and amendment before submission to University level 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 the SSLC. All QM schools operate a Programme Review of their taught undergraduate and postgraduate provision. Students' views are again considered in this process through analysis of various programme surveys and the module evaluations.

Academic support is provided by academic teaching staff. This may be when teaching in Hainan, through timetabled class activities or through regular office hours and students are expected to regularly attend the timetabled office hours. When not in Hainan, academic support is also provided by QMUL lecturers electronically by email or online meetings. Additional academic support is also provided though QMPlus in the form of additional reading material, lecture recordings, lecture PDFs and other video and audio files.

What academic support is available?

Induction and pastoral support is provided through BUPT. Students are organised into "classes" of 30 as in the usual Chinese model. Each class has a tutor who provides pastoral support. One male and one female tutor sleep on campus every night so there is 24/7 access to pastoral support.

Feedback mechanisms from students are: (i) directly to the lecturers (ii) to their tutor (as described above) and (iii) through an SSLC that meets every semester. Because of the large numbers of students, a separate SSLC is held for each cohort.
For every module, whether taught by QMUL or BUPT, formal office hour or tutorial slots are provided. In addition QMUL staff can give advice and supervision remotely using a variety of techniques including MS Teams, and Tencent Conference .

How inclusive is the programme for all students, including those with disabilities?

The following steps have been taken to enhance inclusivity
• Class size: Most lectures are taught in class sizes of only up to 100 students, experimental/computer rooms at much lower numbers that permits greater interaction with teachers and demonstrators
• English support: In the academic skills modules, small timetabled English support classes are provided to help developing skills for succeeding in Higher education and to improve aspects of English communication and confidence
• Module learning: Individual module learning outcomes are clear and presented on module web pages along with additional supplementary academic support varying from module to module
• Module web pages: Individual module web pages give students direct access to teaching material, such as lecture PDFs and recordings of the days lecture, additional reading and study support
• Teaching material: Teaching material available for students includes the following, PDF or PPTs of lecture slides, recording, handouts for practicals and additional study resources. In general, content will be available electronically wherever possible.
• Internet access: Off-site access to study material will be available through BUPT's VLE for BUPT's modules and QMPlus for QM delivered modules.
• Physical disabilities and neurodiversity requirements are accommodated on an individual need basis. This is provided by BUPT in accordance with provincial and national regulations in China.
• QMUL support structures are also available to Hainan students.

Programme-specific rules and facts

Special Regulations apply to this programme. These regulations are specified in the Academic Regulations for all the Joint Educational Institute programmes between QMUL and BUPT, and are made available to our students, who are encouraged to consult and understand them. Programme specific rules include:
- To progress, a student must have an accumulated failure of fewer than 20 Chinese credits ourstanding from technical or Chinese compulsory modues.
- Assessment: Reattempts shall be taken at the next available opportunity , up to twice per module.
- Different marking scales are used for QM and NCU, and the procedures for conversion are tabulated in the academic regulations

Links with employers, placement opportunities and transferable skills

There is an Industrial Advisory Committee consisting of senior staff from the Chinese Industry. A dedicated Industrial Liaison Manager is part of the Queen Mary School Hainan team to develop links with industry and industrial projects, to ensure that

projects are appropriate and to monitor their progress. A good industrial project provides excellent experience for an engineering undergraduate. There are opportunities for internships for all year 3 summer students and frequent invited industry lectures to year 3 and 4 students.

Programme Specification Approval

Person completing Programme Specification:	Dr Nikesh Bajaj
Person responsible for management of programme:	Dr Nikesh Bajaj
Date Programme Specification produced / amended by School / Institute Education Committee:	7 Feb 2025
Date Programme Specification approved by Taught Programmes Board:	