

PROGRAMME SPECIFICATION

KEY FACTS

Programme name	MEng Biomedical Engineering
Award	MEng (Hons)
School	School of Mathematics Computer Science and Engineering
Department or equivalent	Department of Electrical and Electronic Engineering
UCAS Code	BH82
Programme code	USBIMM
Type of study	Full Time
Total UK credits	480
Total ECTS	240

PROGRAMME SUMMARY

The MEng (Honours) programme in Biomedical Engineering is an advanced four year undergraduate programme, aimed at developing graduates for work in a rapidly growing medical engineering industry. The programme provides you with basic knowledge in electronic engineering, mathematics and signal processing, and specialised knowledge in areas of biomedical engineering such as biomedical instrumentation, biomedical optics, biosensors, radiation physics, respiratory and cardiovascular measurements and medical imaging. The programme includes extensive design and project work in Programme Stages 3 and 4.

The Programme consists of four Programme Stages (years), each contributing 120 credits to the final degree. The programme shares Programme Stage 1 and Programme Stage 2 with the BEng programme in Biomedical Engineering. You can transfer from this programme to the MEng programme only at the end of Programme Stage 2 of the BEng.

You are required to successfully complete each year of study before progressing to the next year. Each academic year is typically delivered over 20 contact weeks, five examination weeks, and five reflective learning weeks. This is a full time study programme, with optional placement year. The placement year occurs between Programme Stage 2 and Programme Stage 3, or Programme Stage 3 and Programme Stage 4 of the programme. It carries no academic credit but is highly recommended to you because you will be working in a professional place related to your course of studies and you will be able to establish contacts with industry/NHS for your project work after you return to university and for working opportunities in the future.

Certificate / Programme Stage One

For all of you completing Programme Stage one or the Certificate in Biomedical Engineering you will be able to discuss underlying concepts and principles associated with electronics, design and biomedical engineering and interpret these within the context of your practice. Programme Stage 1 is designed to give you broad knowledge in anatomy and physiology, introduction to biomedical engineering, electronic circuit design, mathematics, digital logic, and other basic skills and science appropriate to the formation of a biomedical engineer.

Diploma / Programme Stage Two

For all of you completing Programme Stage Two or the Diploma in Biomedical Engineering you will build on your previous knowledge and experience. You will develop skills of enquiry in your subject and develop different approaches to problem-solving as well as identify the limitations of your knowledge. In Programme Stage 2, you will obtain advanced skills in biomedical instrumentation, biomedical optics, physiological measurement, electronics and mathematics, and also basic skills in engineering management.

BEng Degree / Programme Stage Three

For all of you completing Programme Stage Three you will further develop a coherent systematic, detailed knowledge of your discipline. You will be able to develop techniques for practice drawing on research and scholarship demonstrating your role as a reflective practitioner. Programme Stage 3 includes individual project work and a range of specialized modules in biomedical engineering such as medical imaging, radiation physics and imaging, biosensors, and biosignals and image processing.

MEng (Honours) / Programme Stage Four

For all of you completing the MEng (Honours) Degree Programme Stage Four of the programme you will have extended your knowledge related to Biomedical Engineering by exploring this from different perspectives which will have broadened your expertise and skills. Your ability to continue to evaluate current evidence in Biomedical Engineering enables you to develop some originality in your practice and approach scholarly activity. In Programme Stage 4 you will develop essential skills in advanced design group work and advanced knowledge in principle areas of Biomedical Engineering. You will be given a choice of modules which enables you to specialize in your preferred field of Biomedical Engineering. Such modules (of which you chose four) are clinical engineering practice, cardiovascular diagnostics and therapy, lasers and optoelectronics, telemedicine, medical electronics, and computer vision.

The Programme is delivered by the School of Mathematics Computer Science and Engineering with support from the School of Health Sciences.

Aims

The overall aim of the MEng programme is to provide a well-rounded education and also specialised training for a professional career in the industries underpinned by the biomedical engineering discipline. This will include the research, development, design, production, and management aspects of those industries.

The specific aims of the programme are to produce graduates who:

- have a broad and in-depth knowledge and understanding of biomedical engineering
- are equipped to play leading roles in the healthcare technology industry, NHS, the professions and public service
- have a sound theoretical and practical education in biomedical engineering and relevant subjects, who will qualify for appropriate exemptions to membership of professional institutions by providing modules of appropriate standard
- are able to undertake and complete a major piece of independent research work

- on a given topic in biomedical engineering
- are able to meet the needs of industry, healthcare institutions (NHS) and commerce by providing distinctive courses which reflect the demand for qualified graduates and by teaching engineering design concepts relevant to bioengineering
- have the ability to reflect relevant specialisations in medical instrumentation, and physiological monitoring systems based on the teaching and research strengths of the field
- can develop the ability to adapt to new healthcare technologies and to seek and assimilate new information
- have a sound knowledge and practical understanding of engineering management in a professional environment
- are able to acquire effective oral, written and IT communication skills and interpersonal skills to develop a positive aptitude for independent thinking and action
- are aware of their professional and ethical responsibilities, as well as the global and societal impact of engineering solutions

WHAT WILL I BE EXPECTED TO ACHIEVE?

On successful completion of this programme, you will be expected to be able to:

Knowledge and understanding

- demonstrate a deep knowledge and thorough understanding of analytical engineering subjects at advanced level
- demonstrate a comprehensive understanding of the scientific principles of your own specialisation and related disciplines
- demonstrate an awareness of developing technologies related to your own specialisation
- demonstrate and apply detailed and comprehensive knowledge and understanding of the essential facts, concepts, principles and theories of bioengineering design, bio-signals, physiological measurement, and medical imaging
- discuss and apply your wide knowledge and comprehensive understanding of the design process applicable to engineering in general and to biomedical engineering in particular
- demonstrate a sufficient knowledge and understanding of human anatomy and physiology and relate such knowledge in the design and development of medical technologies which will aid in the prognosis, diagnosis and monitoring of patients
- have a good understanding of business and management principles as applied to engineering in general and to biomedical engineering in particular
- evaluate the role of the professional engineer with a focus on bioengineering in the wider issues relating to society and the environment

Skills

- demonstrate proficiency with analytical, computational and experimental

techniques (including assessing the limitations of the results obtained), coupled with experience and decision-making, to solve problems relevant to biomedical engineering

- demonstrate proficiency in the application of analytical, computational and CAD techniques specifically to the analysis and design of biomedical devices and systems
- gather, integrate and critically evaluate information from various sources including technical literature
- exercise professional judgement in biomedical engineering and in clinical support and take account of non-technical issues such as economics and benefit to society
- plan and perform safely experimental work in a laboratory and appropriate clinical environment
- use laboratory equipment for data measurement, processing, interpreting and analysis
- work effectively with IT tools - to program and to use computational packages for modelling, design and simulation of physiological phenomena and medical equipment
- communicate effectively in technical and non-technical languages, written, oral and graphical forms to individuals and large audiences
- demonstrate proficiency in the use of scientific and medical literature effectively and research for information to create ideas for future development
- demonstrate the capacity to build team working skills and work with other staff in the hospital or industrial environment
- apply initiative, creativity and innovation to design, construct and test a system, component or process to meet specifications
- demonstrate the ability to adapt to new technologies and their implementation in the hospital/clinical environment

Values and attitudes:

- show appreciation of the value of biomedical engineering to society and to the global economy
- demonstrate a willingness to take on the responsibilities of a biomedical engineer in enforcing and maintaining safety standards in the clinical context and for patient use and management of medical equipment
- show commitment to continuous improvement to enhance professional skills and benefit society
- maintain and develop an awareness of safety and environment
- put the needs of the team ahead of your own needs
- demonstrate a willingness to take on the professional and ethical responsibilities of engineers in society

This programme has been developed in accordance with the QAA Subject Benchmark for Engineering.

HOW WILL I LEARN?

The programme is designed to enable you to acquire and develop generic and subject-specific knowledge and understanding, thinking, practical and transferable skills. This is achieved through a diverse and carefully planned teaching and learning programme

based upon lectures, tutorials, practical work, and design projects.

Taught modules, which may be single or double, are designed to provide the bulk of the formal teaching of mathematical and subject-specific engineering subjects. Single taught modules normally comprise 20 hours of lectures, 10 hours of problem, example and revision classes, and minimum of 15 hours of coursework and/or laboratory classes. Single modules are run for one term and double modules are run over two terms.

Detailed laboratory exercises are in place which will enable you to understand further the underlying theory of a particular subject.

An essential feature of this programme is the projects. There is one 30-credit Individual project in Year 3, one Individual 15-credit project in Year 4 and one Group Design project in Year 4. Individual projects typically include a detailed design study, and experimental and/or theoretical investigation of a topic in biomedical engineering. Engagement in such a project may allow you to interact with members of the School's various research teams or clinical teams.

The programme is interdisciplinary and is taught by staff from the School of Mathematics Computer Science and Engineering, and the School of Health Sciences. Also, the programme includes lectures from hospital consultants and experts in medical technology who explain how technologies are currently used in clinical practice.

Increased breadth and depth of knowledge and understanding is assured by providing appropriate core and a wide choice of elective modules, all at M level, in Programme Stages 3 and 4. In addition, industrial relevance and breadth of study is provided by study of engineering management (at all Programme Stages) and industrial topics, and by doing enhanced industrially-relevant group and individual projects. The Individual project combines the skills and knowledge obtained in the Programme. You will be encouraged to present the design process and perform comprehensive testing of the developed applications and analyse in detail the existing technological solutions. You will be expected to dedicate a substantial number of hours for self-directed learning. The support will be available for this. Learning material will be made available on Moodle, the University Virtual learning environment. In addition, academic members of staff will be available throughout the academic year to provide you with tutorial support.

WHAT TYPES OF ASSESSMENT AND FEEDBACK CAN I EXPECT?

Assessment and Assessment Criteria

The Programme consists of four Programme Stages. Each Programme Stage is delivered in one full academic year and totals 120 credit points. Each Programme Stage includes route core modules, and Programme Stage 4 includes elective modules too, as listed elsewhere in the Programme Specification. Modules are assessed through the following methods: written examination, laboratory report submission, project report submission, presentation and/or class test.

Written examinations are organised either in January or in the May examination period. The pass mark for all assessment in U-level modules (modules with code EE) is 40/100, and for M-level modules (modules with codes EPM/EEM/INM) it is 50/100. Progression

rules are detailed elsewhere in the Programme Specification.

Feedback on assessment

Assessment Criteria and Grade-Related Criteria will be made available to you to support you in completing assessments. These may be provided in programme handbooks, module specifications, on the virtual learning environment or attached to a specific assessment task.

Feedback on your work will be provided in a number of ways. Each module has practical component and you will receive immediate feedback on your work in the laboratories. Feedback will also be given on all your written assignments. You will normally be provided with feedback within three weeks of the submission deadline or assessment date. This would normally include a provisional grade or mark. For end of module examinations or an equivalent significant task (e.g. an end of module project), feedback will normally be provided within four weeks. The timescale for feedback on final year projects or dissertations may be longer. The full policy can be found at:

https://www.city.ac.uk/__data/assets/pdf_file/0008/68921/assessment_and_feedback_policy.pdf

Assessment Regulations

In order to pass your Programme, you should complete successfully or be exempted from the relevant modules and assessments and will therefore acquire the required number of credits. You also need to pass each Programme Stage of your Programme in order to progress to the following Programme Stage. It is an IET requirement to obtain an aggregate mark of at least 50% in Programme Stage 2 and 50% in Programme Stage 3 of your Programme in order to maintain your place in the MEng Programme. For more specific information look at section “What Will I Study?”

The four Programme Stages (years) of the Programme do not carry identical weight towards your final degree classification. Programme Stage 1 results are not included in your final degree calculation, Programme Stages 2, 3, and 4 are included, according to the weighting specified in this programme specification (see What Award Can I Get? section for details). It is necessary to pass all components of the module (typically both the written exam and the coursework) in order to pass a module, as specified in module specifications.

The pass mark for each module is 40% except for the M-level modules (EEM, EPM and INM modules What Will I Study? section) where the pass mark is 50%.

If you fail an assessment component or a module, the following will apply:

1. Compensation: where you fail up to a total of one sixth of the total credits of a Programme Stage at first or resit attempt, you may be allowed compensation if:
 - Compensation is permitted for the module involved (see the What will I Study section of the programme specification), and
 - It can be demonstrated that you have satisfied all the Learning Outcomes of the

modules in the Programme Stage, and

- A minimum overall mark of no more than 10 % below the module pass mark has been achieved in the module to be compensated, and
- An aggregate mark of 40% (50% for Programme Stage 4) has been achieved for the Programme Stage.

Where you are eligible for compensation at the first attempt, this will be applied in the first instance rather than offering a resit opportunity.

If you receive a compensated pass in a module you will be awarded the credit for that module. The original component marks will be retained in the record of marks and your original module mark will be used for the purpose of your Award calculation.

2. Resit: Where you are not eligible for compensation at the first attempt, you will be offered one resit attempt.

If you are successful in the resit, you will be awarded the credit for that module. The mark for each assessment component that is subject to a resit will be capped at the pass mark for the module. This capped mark will be used in the calculation of the final module mark together with the original marks for the components that you passed at first attempt.

If you do not meet the pass requirements for a module and do not complete your resit by the date specified you will not progress to the next Programme Stage and the Assessment Board will require you to be withdrawn from the Programme.

If you fail to meet the requirements for a particular Programme Stage or the Programme, the Assessment Board will consider whether you are eligible for an Exit Award as per the table below.

If you would like to know more about the way in which assessment works at City, please see the full version of the Assessment Regulations at:

http://www.city.ac.uk/_data/assets/word_doc/0003/69249/s19.doc

WHAT AWARD CAN I GET?

Master of Engineering with Honours:

Programme Stage	HE Level	Credits	Weighting (%)	Class	% required
1	4	120	0	I	70
2	5	120	25	II upper division	60
3	6	120	37	II lower division	50
4	7	120	38		

Bachelor's Degree with Honours:

Programme Stage	HE Level	Credits	Weighting (%)
1	4	120	0
2	5	120	33
3	6	120	67

Class	% required
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I	70
II upper division	60
II lower division	50
III	40

Ordinary Degree:

Programme Stage	HE Level	Credits	Weighting (%)
1	4	120	0
2	5	120	33
3	6	60	67

Class	% required
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With Distinction	70
With Merit	60
Without Classification	40

Diploma of Higher Education:

Programme Stage	HE Level	Credits	Weighting (%)
1	4	120	33
2	5	120	67

Class	% required
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With Distinction	70
With Merit	60
Without Classification	40

Certificate of Higher Education:

Programme Stage	HE Level	Credits	Weighting (%)
1	4	120	100

Class	% required
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With Distinction	70
With Merit	60
Without Classification	40

WHAT WILL I STUDY?

Programme Stage 1

Programme Stage 1 consists of 7 modules totalling 120 credits. To pass Programme Stage 1, you must have acquired 120 credits.

Module Title	SITS Code	Module Credits	Core/ Elective	Can be compensated?	Level
Introduction to Biomedical Engineering	EE1409	15	C	Y	4
Engineering Science	EE1427	15	C	Y	4
General Mathematics	EE1460	20	C	N	4
Anatomy and Physiology	EE1466	15	C	Y	4
Engineering Practice	EE1500	10	C	Y	4
Digital Logic	EE1501	15	C	Y	4
Electronic Circuit Design 1	EE1502	30	C	N	4

Programme Stage 2

Programme Stage 2 consists of 7 compulsory modules, totalling 120 credit points. To pass Programme Stage 2 and maintain your place on the course, you must have acquired 120 credits, an aggregate mark of at least 50% (IET requirement), and have successfully completed the professional placement, if applicable. If you acquire 120 credit points in MEng Programme Stage 2 but your aggregate mark is less than 50% you will be transferred to Programme Stage 3 of the BEng in Biomedical Engineering Programme.

Module Title	SITS Code	Module Credits	Core/ Elective	Can be compensated?	Level
Programming and Design	EE1503	15	C	Y	4
Biomedical Optics	EE2506	15	C	Y	5
Pathology and Healthcare	EE2511	15	C	Y	5
Digital Electronics	EE2507	15	C	Y	5
Engineering Management 2	ET2052	15	C	Y	5
Engineering Mathematics 1	EX1002	15	C	N	4
Biomedical Instrumentation	EE2469	30	C	N	5

Professional Placement	ET2014
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Programme Stage 3

Programme Stage 3 consists of 7 compulsory modules, including a substantial Programme Stage 3 project, totalling 120 credit points. To pass Programme Stage 3, you must have acquired 120 credits and an aggregate mark of at least 50% (IET requirement), and have successfully completed the professional placement, if applicable.

If you fail to meet the requirements for MEng Programme Stage 3, having exhausted all resit opportunities then you may, at the discretion of the appropriate Assessment Board, be allowed credit towards a Bachelor of Engineering Degree for studies undertaken on the MEng Degree programme. If you meet the requirements for MEng Programme Stage 3 you may be awarded a BEng (Honours) degree, if you wish. In that case the MEng 3 modules will be shown in your final transcript with the acquired marks and credits.

Module Title	SITS Code	Module Credits	Core/ Elective	Can be compensated?	Level
MEng Individual Design Project	EEM400	30	C	N	7
Embedded and Real Time Systems	EE3422	15	C	Y	6
Biosignal and Image Processing	EE3438	15	C	Y	6
Biosensors	EE3431	15	C	Y	6
Medical Imaging	EEM300	15	C	Y	7
Biomechanics and Biomaterials	EE3439	15	C	Y	6
Engineering Management 3	ET3051	15	C	Y	6

Professional Placement	ET2014
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Programme Stage 4

Programme Stage 4 consists of two core modules totalling 30 credits, one 30 credit elective module and four elective modules of 15 credits each, as listed below. Selection of elective modules is subject to timetabling constraints.

Module Title	SITS Code	Module Credits	Core/ Elective	Can be compensated?	Level
Engineering Management 4 [Professional, Industrial and Management Studies (PIMS)]	ETM051	15	C	Y	7
MEng Individual Research Project	ETM068	15	C	N	7
MEng Group Design Project	ETM067	30	E	N	7
MEng Group Design Project (Biomedical Engineering)	ETM070	30	E	N	7
Clinical Engineering Practice	EPM603	15	E	Y	7
Cardiovascular Diagnostics and Therapy	EPM604	15	E	Y	7
Medical Electronics	EPM607	15	E	Y	7
Lasers and Optoelectronics	EPM911	15	E	Y	7
Telemedicine	INM339	15	E	Y	7
Computer Vision	INM460	15	E	Y	7

TO WHAT KIND OF CAREER MIGHT I GO ON?

Electrical and biomedical engineers today work in a range of industries. Their problem-solving skills and multidisciplinary education are well known and well respected in the industry in the UK and abroad.

Electrical engineers design, build and manage a large range of electronic systems, ranging from tiny sensor networks to large national power grids. Being an electrical engineer provides a career that is continuously changing, and is full of new discoveries. Electrical engineers develop devices and systems which have a huge impact on our everyday lives. They are responsible for developing wireless communication systems, medical imaging machines, and control systems which manage operation of large industrial processes.

Biomedical engineering is a relatively young branch of electrical engineering, focused completely on the design of electronic systems with medical applications. Modern provision of healthcare depends greatly on biomedical engineers, and this area of human development has only started. Becoming a biomedical engineer today promises an exciting career, bridging the advances in biomedical sciences with practical skills in delivering engineering projects in a growing field.

If you would like more information on the Careers support available at City, please go to:

<http://www.city.ac.uk/careers/for-students-and-recent-graduates>.

WHAT STUDY ABROAD OPTIONS ARE AVAILABLE?

At present these options are not available; they are still under development

WHAT PLACEMENT OPPORTUNITIES ARE AVAILABLE?

A valid placement is a period of Employment of at least six months full-time or equivalent in a role related to your course. The placement year occurs between Programme Stage 2 and Programme Stage 3, or Programme Stage 3 and Programme Stage 4 of the programme. You will be visited at least twice during the placement period, either by the Industrial Tutor or your Personal Tutor. The first visit should ideally take place within six weeks of the start of the placement and the second visit within six weeks of the end of the placement.

You will be helped by your Personal Tutor to arrange an industrially-linked final-year project with the Employer (where practical). You are required to organize the visits and send your Personal Tutor a summary of your current role within the placement company. You will also be required to submit a brief technical report upon your return to University and give a short presentation to your Personal Tutor and second-year Students. Currently the placement students receive an endorsement on their degree. There is no Academic credit assigned to the placement year.

WILL I GET ANY PROFESSIONAL RECOGNITION?

Accrediting Body: The Institute of Engineering and Technology

Nature of Accreditation

Accreditation of the MEng leads to fulfilment of the educational requirements for registration as a Chartered Engineer (CEng).

Accrediting Body: The Institute of Measurement and Control

Nature of Accreditation

Accreditation of the MEng leads to fulfilment of the educational requirements for registration as a Chartered Engineer (CEng).

Accrediting Body: The Institute of Physics and Engineering in Medicine

Nature of Accreditation

Accreditation of the MEng leads to fulfilment of the educational requirements for registration as a Chartered Engineer (CEng).

HOW DO I ENTER THE PROGRAMME?

Typical offers require one of the following:

A/AS-level: 360 UCAS tariff points, including 'A' Levels in two science subjects or in Mathematics and one science subject, with grade A or higher required in one science subject or Mathematics.

IB: 35, including 5 in High Level mathematics or physics.

14-19 Advanced Diploma: Engineering at grade A/300; A-level mathematics at grade B/100.

RPL/RPEL

Direct entry into Programme Stage 2: direct entry into Programme Stage 2 is possible following successful completion of Programme Stage 1 of a comparable accredited MEng/BEng (Honours) programme.

Suitable overseas qualifications are also considered. However, in all cases the final decision is subject to the satisfactory evaluation of prior qualifications by Admissions Tutor.

English language requirements:

IELTS: 6.0 with a minimum of 6.0 in the writing sub-test

GCSE: English language grade C.

Please note that TOEFL is not accepted as evidence of English language ability for students that require a Confirmation of Acceptance for Studies.

Candidates successfully completing City and Islington College Foundation course H606 with City are permitted to enter Programme Stage 1 of the programme if they achieve average mark of 75%.

This programme shares Programme Stage 1 and Programme Stage 2 with the BEng in Biomedical Engineering.

Students who obtain 120 credits and a minimum average mark of 60/100 in Programme Stage 2 of the BEng programme will be offered to transfer to MEng in Biomedical Engineering.

Scholarships

A range of scholarships are on offer for home and overseas students. Scholarships are awarded mostly on academic merit. A range of awards is given to students with best academic results.

Details of scholarships available to new undergraduate students can be found on City's website at <http://www.city.ac.uk/study/why-study-at-city/fees-and-finance/scholarships>.

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