Programme Specification: Post Graduate Taught

For students starting in Academic Year 2023/24

1. Course Summary

Names of programme and award title(s)	MSc Biomedical Engineering
Award type	Taught Masters
Mode of study	Full-time Part-time
Framework of Higher Education Qualification (FHEQ) level of final award	Level 7
Normal length of the programme	1 year full-time or 2 years part-time
Maximum period of registration	The normal length as specified above plus 3 years
Location of study	Guy Hilton Research Centre Keele Campus
Accreditation (if applicable)	MSc is accredited by the Institute for Physics and Engineering in Medicine
Regulator	Office for Students (OfS)
Tuition Fees	**UK students:** Full-time fee for 2023/24 is £11,500 Part-time fee for 2023/24 is £6,400 per year* **International students:** Full-time fee for 2023/24 is £21,900

How this information might change: *Please read the important information at http://www.keele.ac.uk/student-agreement/. This explains how and why we may need to make changes to the information provided in this document and to help you understand how we will communicate with you if this happens.*

** We reserve the right to increase fees in subsequent years of study by an inflationary amount. Please refer to the accompanying Student Terms & Conditions for full details. Further information on fees can be found at http://www.keele.ac.uk/studentfunding/tuitionfees/*

2. Overview of the Programme

The Master of Science degree (MSc) in Biomedical Engineering at Keele University was established in 1999 in partnership with Biomedical Engineering and Medical Physics at the University Hospital of North Staffordshire originally named, now UHNM. Restructuring since then has seen the course brought under the auspices of School of Pharmacy and Bioengineering within the Faculty of Medicine and Health Sciences at Keele University. Current teaching takes place in the Guy Hilton Research Centre and, combined with the strong clinical background and history of the departmental research, learners are exposed to a working research environment throughout the program delivery.

3. Aims of the programme

The objectives of the programme are to:

- provide postgraduate-level education leading to professional careers in biomedical engineering in industry, academia and a wide range of healthcare establishments such as medical organisations, medical research institutions and hospitals;
- provide an opportunity for in-depth research into specialist and novel areas of biomedical and clinical engineering;
- expose students to practical work in a hospital environment with hands-on knowledge of patient care involving technological developments at the forefront of the field;
- introduce students to exciting new fields such as regenerative medicine and novel technologies for physiological monitoring and diagnostics.

The course runs alongside an MSc course in Cell and Tissue Engineering, giving students unique access to specialists in that field, as well as more traditional topics in biomedical engineering such as physiological and functional measurement, medical device design and applications, and medical equipment management.

The goal of the course is to provide multi-disciplinary Masters level postgraduate training in Biomedical Engineering to prepare students for future employment across a range of technical and healthcare environments including academic research, medical devices industry, and hospital and other healthcare environments. This philosophy underpins the professional accreditation of the course by the Institute for Physics and Engineering in Medicine.

4. What you will learn

The intended learning outcomes of the programme (what students should know, understand and be able to do at the end of the programme), can be described under the following headings:

- Subject knowledge and understanding
- Subject specific skills
- Key or transferable skills (including employability skills)

Subject knowledge and understanding

Successful students will be able to:

- Apply core engineering and physical principles to solve clinically-relevant problems at the forefront of Biomedical Engineering;
- Display a systematic understanding of physiological and biomedical measurement and related quality management issues;
- Display a systematic understanding of the working principles behind the maintenance and management of medical equipment and associated safety procedures;
- Challenge, evaluate, modify, and develop the theory and practise surrounding Biomedical Engineering including social and ethical aspects.

Subject specific skills

Successful students will be able to:

- Use a range of ICT tools such as spreadsheets and programming languages to interpret and analyse data, including the use of modelling and statistics;
- Carry out a research project, including planning, implementation, and documentation of methods, findings and implications.

Key or transferable skills (including employability skills)

Successful students will be able to:

- Demonstrate skills associated with self-management and an ability to synthesize and evaluate information obtained from diverse sources and settings.

Keele Graduate attributes

Engagement with this programme will enable you to develop your intellectual, personal and professional capabilities. At Keele, we call these our ten Graduate Attributes and they include independent thinking, synthesizing information, creative problem solving, communicating clearly, and appreciating the social, environmental and global implications of your studies and activities. Our educational programme and learning environment is designed to help you to become a well-rounded postgraduate who is capable of making a positive

and valued contribution in a complex and rapidly changing world, whichever spheres of life you engage in after your studies are completed.

Please refer to the programme webpages for a statement of how you can achieve the Keele Graduate Attributes through full engagement in the programme and other educational opportunities at Keele. Further information about the Keele Graduate Attributes can be found here: http://www.keele.ac.uk/journey/

5. How is the programme taught?

Teaching is delivered primarily through lectures and seminars, and associated web-based Virtual Learning Environment materials. These are accompanied by tutorials, laboratory-based practical sessions, and research seminars by internationally and nationally known scientists, engineers and clinicians. In addition, students attend workshops and site visits, participate in problem-solving scenarios, and receive dedicated research project supervision. Reflective of postgraduate education, self-directed learning is also a major component during both full-time and part-time studies.

The diversity of learning and teaching methods encountered by students supports development of independent learning skills and critical thinking as well as the acquisition of subject specific knowledge. This enables students to meet the range of intended learning outcomes covering specific engineering and scientific principles and demonstration of independent research and problem solving.

6. Teaching Staff

There are 12 module leads, plus several other key staff members who have substantive teaching roles on the course. All teaching is managed and delivered by academic staff, with Doctorate-level training, as well as key clinical practitioners. Many staff members are Fellows of the Higher Education Academy ensuring a high standard of teaching.

The University will attempt to minimise changes to our core teaching teams, however, delivery of the programme depends on having a sufficient number of staff with the relevant expertise to ensure that the programme is taught to the appropriate academic standard.

Staff turnover, for example where key members of staff leave, fall ill or go on research leave, may result in changes to the programme's content. The University will endeavour to ensure that any impact on students is limited if such changes occur.

7. What is the structure of the programme?

The programme requires 180 credits for the Master's qualification. The student must gain 120 credits from taught modules which consist of five compulsory modules supplemented by a choice of three optional modules. The students have to undertake a research project and submit a dissertation with 60 credits.

The programme consists of two entry-level (level 6) conversion modules of 15 credits each (Engineering for Medical Applications) for those without an engineering background, and (Human Anatomy and Physiology) for those without a biological/medical science background to take. Level 6 module credits are included towards the total 180 credit requirement for the MSc degree but do not contribute to the numerical classification of the degree (e.g. distinction or merit).

Note of module prerequisites:

- MTE-40023 Biomechanics: Basic knowledge of trigonometry and (vector) calculus
- MTE-30001 Human Physiology and Anatomy: Compulsory for students entering the Biomedical Engineering course who cannot demonstrate previous knowledge of anatomy
- MTE-30003 Engineering for Medical Applications: Compulsory for students entering the Biomedical Engineering course who cannot demonstrate previous knowledge of engineering
- MTE-40026 Physiological Measurement: Basic knowledge of physics or electronics. In addition completion of undergraduate module in human physiology and anatomy. If not, the student will be required to attend the module on Human Physiology and Anatomy which will runs parallel with the module.
- MTE-40029 Medical Equipment and Technology Services Management: Bachelor's degree (or equivalent proof of training) in an approved discipline with appropriate competence in mathematics
- MTE-40031 Biomedical Signal Processing and Modelling: Knowledge of basic mathematics including algebra, trigonometry, differentiation and integration
- MTE-40038 Medical Device Design Principles: Appropriate mathematical competence, including algebra (e.g. elementary determinants, matrices and vectors), elementary differential and integral calculus and trigonometry

Year	Compulsory	Optional		Electives	
		Min	Max	Min	Max
Level 7	135	45	45	0	0

Module Lists

Level 7

Compulsory modules	Module Code	Credits	Period
Physiological Measurements	MTE-40026	15	Semester 1
Medical Equipment and Technology Services Management	MTE-40029	15	Semester 1
Experimental Research Methodology	MTE-40039	15	Semester 1-2
Biomedical Signal Processing and Analysing	MTE-40031	15	Semester 2
Medical Device Design Principles	MTE-40038	15	Semester 2
Project - medical technology	MTE-40015	60	Semester 3

Optional modules	Module Code	Credits	Period
Human Physiology and Anatomy	MTE-30001	15	Semester 1
Engineering for Medical Applications	MTE-30003	15	Semester 1
Biomechanics (15 credit module)	MTE-40023	15	Semester 1
Stem Cells: Types, Characteristics & Applications	MTE-40028	15	Semester 1
Cell and Tissue Engineering	MTE-40033	15	Semester 1
Biotechnology and Omics	PHA-40236	15	Semester 1
Disease Modelling & Therapy for Regenerative Medicine	MTE-40055	15	Semester 1-2
Bioreactors and Growth Environments	MTE-40022	15	Semester 2
Nanomagnetics in Nanomedicine	MTE-40030	15	Semester 2
Cell Biomechanics	MTE-40034	15	Semester 2
Biomaterials	MTE-40036	15	Semester 2
Medical Devices Design: Regulatory Frameworks	MTE-40049	15	Semester 2

January 2024 starters are required to take MTE-40049 Medical Device Design: Regulatory Frameworks as a compulsory module in addition to the other semester 2 compulsory components.

Learning Outcomes

The table below sets out what students learn in the programme and the modules in which that learning takes place. Details of how learning outcomes are assessed through these modules can be found in module

specifications.

Level 7

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
Apply core engineering and physical principles to solve clinically-relevant problems at the forefront of Biomedical Engineering	Biomaterials - MTE-40036 Engineering for Medical Applications - MTE-30003 Biomedical Signal Processing and Analysing - MTE-40031 Nanomagnetics in Nanomedicine - MTE-40030 Bioreactors and Growth Environments - MTE-40022 Disease Modelling & Therapy for Regenerative Medicine - MTE-40055 Cell and Tissue Engineering - MTE-40033 Stem Cells: Types, Characteristics & Applications - MTE-40028 Physiological Measurements - MTE-40026 Biomechanics (15 credit module) - MTE-40023 Medical Device Design Principles - MTE-40038 Cell Biomechanics - MTE-40034
Display a systematic understanding of physiological and biomedical measurement and related quality management issues	Physiological Measurements - MTE-40026 Biotechnology and Omics - PHA-40236 Biomedical Signal Processing and Analysing - MTE-40031 Biomaterials - MTE-40036
Display a systematic understanding of the working principles behind the maintenance and management of medical equipment and associated safety procedures	Medical Equipment and Technology Services Management - MTE-40029
Challenge, evaluate, modify, and develop the theory and practise surrounding Biomedical Engineering including social and ethical aspects	Project - medical technology - MTE-40015 Medical Device Design Principles - MTE-40038 Biomaterials - MTE-40036 Cell Biomechanics - MTE-40034 Nanomagnetics in Nanomedicine - MTE-40030 Bioreactors and Growth Environments - MTE-40022 Disease Modelling & Therapy for Regenerative Medicine - MTE-40055 Experimental Research Methodology - MTE-40039 Biotechnology and Omics - PHA-40236 Biomechanics (15 credit module) - MTE-40023 Stem Cells: Types, Characteristics & Applications - MTE-40028

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
Use a range of ICT tools such as spreadsheets and programming languages to interpret and analyse data, including the use of modelling and statistics	Biomedical Signal Processing and Analysing - MTE-40031 Disease Modelling & Therapy for Regenerative Medicine - MTE-40055 Biomechanics (15 credit module) - MTE-40023 Engineering for Medical Applications - MTE-30003
Carry out a research project, including planning, implementation, and documentation of methods, findings and implications	Project - medical technology - MTE-40015 Disease Modelling & Therapy for Regenerative Medicine - MTE-40055 Engineering for Medical Applications - MTE-30003

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
Demonstrate skills associated with self-management and an ability to synthesize and evaluate information obtained from diverse sources and settings	Medical Device Design Principles - MTE-40038 Cell Biomechanics - MTE-40034 Bioreactors and Growth Environments - MTE-40022 Experimental Research Methodology - MTE-40039 Cell and Tissue Engineering - MTE-40033 Medical Equipment and Technology Services Management - MTE-40029 Project - medical technology - MTE-40015 Stem Cells: Types, Characteristics & Applications - MTE-40028

8. Final and intermediate awards

Master's Degree	180 credits	You will require at least 150 credits at Level 7
Postgraduate Diploma	120 credits	You will require at least 90 credits at Level 7
Postgraduate Certificate	60 credits	You will require at least 40 credits at Level 7

9. How is the Programme Assessed?

A variety of assessment methods are used across the programme. These include coursework-based essays, written examinations, reports on laboratory-based practicals, essay-based examination, interactive oral presentations, and a dissertation based on the student research project. Clear marking guidelines accompany each mode of assessment where a mark of 50% or above is required to achieve a pass. Through adoption of the above assessment methods students are given an opportunity to display achievements spanning knowledge and problem-solving abilities, communication and research skills, development of practical skills, and critical thinking.

Formative assessment occurs in a continuous process driven by lecturer-led discussion sessions, one-on-one mentoring, and practice presentations and posters. Elements of peer feedback are also used in a formative way.

For January intake (students starting from Semester 2 in January), students taking MTE-40055 will have their assessments in final semester.

Marks are awarded for summative assessments designed to assess your achievement of learning outcomes. You will also be assessed formatively to enable you to monitor your own progress and to assist staff in identifying and addressing any specific learning needs. Feedback, including guidance on how you can improve the quality of your work, is also provided on all summative assessments within six working weeks of submission, unless there are compelling circumstances that make this impossible, and more informally in the course of tutorial and seminar discussions.

10. Accreditation

This MSc programme is accredited by the Institute for Physics and Engineering in Medicine.

11. University Regulations

The University Regulations form the framework for learning, teaching and assessment and other aspects of the student experience. Further information about the University Regulations can be found at: http://www.keele.ac.uk/student-agreement/

If this programme has any exemptions, variations or additions to the University Regulations these will be detailed in an Annex at the end of this document titled 'Programme-specific regulations'.

12. What are the typical admission requirements for the Programme?

See the relevant course page on the website for the admission requirements relevant to this programme: https://www.keele.ac.uk/study/

We welcome applications from people with a first or second-class degree (or equivalent) in engineering, physical or life sciences, medicine, or professions allied to medicine. We also welcome enquiries from people with other professional qualifications acceptable to the University. For international applicants, an English language IELTS score of 6.5 or above is required. The admission of 3+1+1 programme students will follow the additional agreement between Keele and the partner university.

Recognition of Prior Learning (RPL) is considered on a case-by-case basis and those interested should contact the Programme Director. The University's guidelines on this can be found here:

https://www.keele.ac.uk/qa/programmesandmodules/recognitionofpriorlearning/

13. How are students supported on the programme?

Support is provided throughout the study period with a broad range of student-centred activities. Initial support is provided during the Induction Week where orientation, study skills introductions, and welcoming events are held, led by the course and the university. Accompanying these events the course handbook, which students receive on their first day, details key course information, module structure, module content, assessment formats, and relevant University regulations.

All students are allocated an Academic Mentor at the beginning of the course. This offers an individual resource for assistance with both academic and personal issues where detrimental impacts on academic outputs can develop. Students are invited to meet with Academic Mentor twice a semester unless special needs require a greater frequency.

Students for whom English is not their first language are offered language classes, facilities and services by the University's Language Centre. In addition to credit-bearing postgraduate modules on English for academic study, students also have access to one-to-one tutorials for individual help and advice, and to a wealth of resources for self-study and practice. Incoming non-native English speaking students take a diagnostic English language assessment during their first week at Keele, after which personalised recommendations for modules or other forms of support are made.

14. Learning Resources

This course and teaching are based at the Guy Hilton Research Centre (GHRC), School of Pharmacy and Bioengineering. The administration team are based on Keele's main campus. Some teaching delivery will be held on Keele Campus, and sites in University Hospitals of North Midlands (UHNM).

Students have access to all the facilities in main campus and the UHNM Hospital campus. In particular students have access to a Computer Room at the Guy Hilton Research Centre and extensive IT facilities on the main campus; the Health Library on the hospital campus, and the University library located on the main campus. The main library, for example, houses study spaces that can be used for group work. On-line, physical and electronic data sources area available through Keele University Library. GHRC provides photocopy and printing facility to the students.

15. Other Learning Opportunities

Opportunities exist for research projects to be performed at other institutions either by prior arrangement or through regular offerings at the Robert Jones and Agnes Hunt Hospital, Oswestry and the University Hospital of North Midlands.

16. Additional Costs

As to be expected there will be additional costs for inter-library loans and potential overdue library fines, print and graduation. We do not anticipate any further costs for this programme.

17. Quality management and enhancement

The quality and standards of learning in this programme are subject to a continuous process of monitoring, review and enhancement.

- The School Education Committee is responsible for reviewing and monitoring quality management and enhancement procedures and activities across the School.
- Individual modules and the programme as a whole are reviewed and enhanced every year in the annual programme review which takes place at the end of the academic year.
- The programmes are run in accordance with the University's Quality Assurance procedures and are subject to periodic reviews under the Revalidation process.

Student evaluation of, and feedback on, the quality of learning on every module takes place every year using a variety of different methods:

- The results of student evaluations of all modules are reported to module leaders and reviewed by the Programme Committee as part of annual programme review.
- Findings related to the programme from the annual Postgraduate Taught Experience Survey (PTES), and from regular surveys of the student experience conducted by the University, are subjected to careful analysis and a planned response at programme and School level.
- Feedback received from representatives of students on the programme is considered and acted on at regular meetings of the Student Staff Voice Committee.

The University appoints senior members of academic staff from other universities to act as external examiners on all programmes. They are responsible for:

- Approving examination questions
- Confirming all marks which contribute to a student's degree
- Reviewing and giving advice on the structure and content of the programme and assessment procedures

Information about current external examiner(s) can be found here:
http://www.keele.ac.uk/qa/externalexaminers/currentexternalexaminers/

18. The principles of programme design

The programme described in this document has been drawn up with reference to, and in accordance with the guidance set out in, the following documents:

a. UK Quality Code for Higher Education, Quality Assurance Agency for Higher Education:
http://www.qaa.ac.uk/quality-code
b. Keele University Regulations and Guidance for Students and Staff: http://www.keele.ac.uk/regulations

Programme has been designed in accordance with the requirements from the professional body, the Institute for Physics and Engineering in Medicine. These are based on learning outcomes defined by the UK Standard for Professional Engineering Competence.

19. Annex - Programme-specific regulations

Programme Regulations: Biomedical Engineering

Final Award and Award Titles	MSc Biomedical Engineering
Intermediate Award(s)	Postgraduate Diploma Postgraduate Certificate
Last modified	June 2023
Programme Specification	https://www.keele.ac.uk/qa/programmespecifications

The University's Academic Regulations which can be found on the Keele University website (https://www.keele.ac.uk/regulations/)[1] apply to and regulate the programme, other than in instances where the specific programme regulations listed below over-ride them. These programme regulations list:

- *Exemptions* which are characterised by the omission of the relevant regulation.
- *Variations* which are characterised by the replacement of part of the regulation with alternative wording.
- *Additional Requirements* which set out what additional rules that apply to students in relation to this programme.

The following **exemptions, variations** and **additional requirements** to the University regulations have been checked by Academic Services and have been approved by the Faculty Education Committee.

A) EXEMPTIONS

The clause(s) listed below describe where an exemption from the University's Academic Regulations exists:

For the whole duration of their studies, students on this Programme are exempt from the following regulations:

- **No exemptions apply.**

B) VARIATIONS

The clause(s) listed below describe where a variation from the University's Academic Regulations exists:

Variation 1: module compensation

This programme varies from Regulation D5.4.

A variation of Regulation D5.4 Module Compensation on Taught Postgraduate Programmes and Regulation C7.11.4 will be run on these courses, in which compensation will be applied to modules, which, after all assessment attempts have been taken, have a mark above 45% (i.e. not limited to 45-49%).

On IPEM accredited courses, this will apply to a maximum of 20 credits, provided that a mark of at least 55% in one or more modules at least equivalent to the credit value of the failed module/s being compensated, is attained. Dissertation modules or equivalent final project modules cannot be compensated.

The intention of the variation is to enable students who have not reached the pass mark in all qualifying components, thereby resulting in a Qualified Fail, to be compensated in the above scenario.

As such, in accordance with Regulation D1.12 Reassessment, where a student achieves a fail a Qualifying Component, hence resulting in a Qualified Fail for a module, the student will be allowed reassessment procedures as defined in the regulations.

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[1] References to University Regulations in this document apply to the content of the University's Regulatory Framework as set out on the University website here https://www.keele.ac.uk/regulations/.

Version History

This document

Date Approved: 24 January 2024

What's Changed

January 2024 starters are required to take MTE-40049 Medical Device Design: Regulatory Frameworks as a compulsory module in addition to the other semester 2 compulsory components.

Previous documents

Version No	Year	Owner	Date Approved	Summary of and rationale for changes
1	2023/24	YING YANG	27 June 2023	
1.1	2022/23	YING YANG	22 August 2022	
1	2022/23	YING YANG	22 August 2022	