Programme Specification: Post Graduate Taught

For students starting in Academic Year 2022/23

1. Course Summary

Names of programme and award title(s)	MRes Bioengineering
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
Accreditation (if applicable)	n/a
Regulator	Office for Students (OfS)
Tuition Fees	**UK students:** Full-time fee for 2022/23 is £10,200 Part-time fee for students starting in 2022/23 is £5,600 per annum* **International students:** Fee for 2022/23 is £20,800

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

Bioengineering research is mainly a laboratory-based and practical discipline. It lies at the interface between engineering with biology and medicine. Bioengineering has contributed to the development of revolutionary and life-saving concepts such as surgical robots, artificial organs, advanced prosthetics, and new pharmaceuticals. There is an increasing demand for Bioengineers, which is linked to society's general shift towards utilisation of machinery and technology, and application of advanced therapies.

The School of Pharmacy and Bioengineering has established a strong reputation in the cutting-edge research in Molecular, Cellular & Tissue Engineering, and Biomedical Engineering, providing the essential resource to run the MRes Bioengineering programme.

MRes Bioengineering will provide multi-disciplinary Master's level Postgraduate research training in the bioengineering discipline. The course will be offered as one-year full-time or two year part-time MRes in

Bioengineering which will equip students with the necessary knowledge and skills for understanding and conducting bioengineering-related research.

There are two pathways for the MRes Bioengineering programme: A) Molecular, Cellular and Tissue Engineering); B) Biomedical Engineering. The course will involve work on a research project, integrated with lectures and research work. A list of available research projects from potential supervisors within the School will be provided to students when they enrol upon the course. The 120 credit research project offers an opportunity for students to demonstrate their advanced knowledge and writing skills in their chosen research theme. A variety of seminars and workshops will be provided to deepen and broaden students' research skill base. The taught modules will run over university semesters 1 and 2, with the research project (including write up) running over semesters 1-3.

3. Aims of the programme

The broad aims of the MRes Bioengineering programme are to:

- provide advanced academic training for individuals interested in pursuing doctoral studies or research-oriented careers in bioengineering disciplines, including those in a wide range of biotechnology and healthcare establishments.
- provide an opportunity for in-depth research into a specialist area within molecular, cellular, tissue engineering, and biomedical engineering.
- assist students to develop the skills of research design and data analysis, and provide an opportunity to attain advanced proficiency in bioengineering.
- provide knowledge and skills for understanding and complying with the ethics and governance requirements for laboratory based research.
- equip students to analyse and solve problems using an integrated, multidisciplinary approach.

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

Successful students will be able to:

- apply core and specific principles associated with Bioengineering in a research project;
- appraise research methods including literature search, research ethics, project plan, design , statistics, and experimental techniques;
- demonstrate comprehensive knowledge and understanding of background, concepts and theoretical basis related to the student's project;
- demonstrate communication skills including written and oral reports;
- appreciate health and safety issues to carry out experimental work;
- broaden their knowledge and understanding in areas of molecular, cellular & tissue engineering and biomedical engineering.

Subject specific skills

Successful students will be able to:

- plan and carry out experiments or modelling safely;
- demonstrate technical presentation using appropriate software;
- utilize experimental methods or computer-based tools to generate data, and analyse data using specific software including statistics;
- culture and maintain cells using laboratory techniques;
- perform measurements and analysis of data using specific instruments.

Key or transferable skills (including employability skills)

Successful students will be able to:

- display the independent working and problem-solving capacity in the research projects alongside critical literature review and data interpretation;
- develop the capacity to transfer scientific knowledge into practical application in current and subsequent career choice;
- understand research process, plan and manage projects, identify personal and professional

requirements for supporting lifelong learning.

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 graduate 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.

Further information about the Keele Graduate Attributes can be found here: http://www.keele.ac.uk/journey/

5. How is the programme taught?

Learning and teaching methods used on the programme vary according to the subject matter and level of the module.

Teaching is delivered through lectures and seminars, and supported with 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, and participate in problem-solving scenarios.

A dedicated research project lasting 7-8 months will be carried out by the student under the supervision of one or two supervisors. Students will attend group meetings, present, and interact with other PhD, Postdoc and researchers within the School of Pharmacy and Bioengineering.

Apart from these formal activities, students are also provided with regular opportunities to talk through particular areas of difficulty, and any special learning needs they may have, with their Personal Tutors or module lecturers on a one-to-one basis.

These various and diverse learning and teaching methods enable students to achieve the learning outcomes of the programme efficiently.

6. Teaching Staff

There are currently a number of staff on the programme who act as module leads. Several of these staff are Professors and some are Fellows of the Higher Education Academy. Other key staff members also have substantive teaching roles on the programme.

In addition to the taught modules, a large number of staff within the School of Pharmacy and Bioengineering can supervise a wide range of Bioengineering related projects. Many of them have had extensive experience of successfully supervising PhD and MPhil students.

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?

There are two pathways for the MRes Bioengineering programme: A) Molecular, Cellular and Tissue Engineering (MCT); B) Biomedical Engineering (BME).

To achieve an MRes award, students will need to pass 180 credits of material comprising: four modules at 15 credits each, and a dissertation (120 credits). A PGCert can be awarded if 60 credits are completed with an appropriate combination of different modules. The combination or selection of different modules for each pathway is listed in the chart below. The main course/research activity is devoted to a research project and dissertation (PHA-40196), which, if successfully completed, provides the additional 120 credits required for the Masters in Research qualification.

Advice will be provided to students based on their background to choose which pathway and optional modules. Once the modules are selected in Semester 1, the pathway is set through the whole year in order to navigate the programme, but does not form part of the intended award title.

Bioengineering programme	Structure of MRes	
Pathway	**Molecular, Cellular & Tissue Engineering (MCT)**	**Biomedical Engineering (BME)**
Taught modules (60 credits)	**MTE-40039** Seminar and Experimental Research Methodology (15 credits, semester 1-3)	
	PHA-40236 Biotechnology and Omics (15 credits, semester 1) **MTE-40033** Cell and Tissue Engineering (15 credits, semester 1)	**MTE-40026** Physiological Measurement (15 credits, semester 1)
	Select one 15 credit modules from: **MTE-40024** Human Physiology and Anatomy (Semester 1) OR **MTE-40028** Stem Cells: Types, Characteristics and Applications (Semester 1) OR **MTE-40022** Bioreactors and Growth Environments (Semester 2) OR **MTE-40030** Nanomagnetics in Nanomedicine (Semester 2) OR **MTE-40034** Cell Biomechanics (Semester 2) OR **MTE-40036** Biomaterials (Semester 2)	**Select two 15 credit modules from:** **MTE-30003** Engineering for Medical Applications (Semester 1) OR **PHA-40236** Biotechnology and Omics (Semester 1) **MTE-40023** Biomechanics (Semester 1) OR **MTE-40024** Human Physiology and Anatomy (Semester 1) OR **MTE-40029** Medical Equipment & Technology Services Management (Semester 1) OR **MTE-40022** Bioreactors and Growth Environments (Semester 2) OR **MTE-40030** Nanomagnetics in Nanomedicine (Semester 2) OR **MTE-40031** Biomedical Signal Processing and Modelling (Semester 2) OR **MTE-40036** Biomaterials (Semester 2) OR **MTE-40038** Medical Device Design Principles (Semester 2)
Research (120 credits)	**PHA-40196** Research Project (120 credits, semester 1-3)	

Year	Compulsory	Optional		Electives	
		Min	Max	Min	Max
Level 7	180	0	0	0	0

Please note: 15 (MCT pathway) or 30 (BME pathway) credits of optional modules must be selected depending on the compulsory modules assigned to each pathway (See program structure B3).

Module Lists

Level 7

Compulsory modules	Module Code	Credits	Period
Physiological Measurements	MTE-40026	15	Semester 1
Cell and Tissue Engineering	MTE-40033	15	Semester 1
Biotechnology and Omics	PHA-40236	15	Semester 1
Experimental Research Methodology	MTE-40039	15	Semester 1-3
Research Project	PHA-40196	120	Semester 1-3

Optional modules	Module Code	Credits	Period
Engineering for Medical Applications	MTE-30003	15	Semester 1
Biomechanics	MTE-40023	15	Semester 1
Human Physiology and Anatomy	MTE-40024	15	Semester 1
Stem Cells: Types, Characteristics & Applications	MTE-40028	15	Semester 1
Medical Equipment and Technology Services Management	MTE-40029	15	Semester 1
Bioreactors and Growth Environments	MTE-40022	15	Semester 2
Nanomagnetics in Nanomedicine	MTE-40030	15	Semester 2
Biomedical Signal Processing and Analysing	MTE-40031	15	Semester 2
Cell Biomechanics	MTE-40034	15	Semester 2
Biomaterials	MTE-40036	15	Semester 2
Medical Device Design Principles	MTE-40038	15	Semester 2

The choice of the three or four compulsory and one or two optional modules is specified in the course structure. For both pathways of the MRes Bioengineering programme [A) Molecular, Cellular and Tissue Engineering, MCT; B) Biomedical Engineering, BME], modules MTE-40039 and PHA-40196 are compulsory, while PHA-40236/MTE-40033 and MTE-40026 are compulsory for MCT and BME pathway, respectively.

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.

Subject Knowledge and Understanding	
Learning Outcome	**Module in which this is delivered**
apply core and specific principles associated with Bioengineering in doing a research project.	Research Project - PHA-40196
appraise research methods including literature search, research ethics, project plan, design , statistics, and experimental techniques.	Research Project - PHA-40196 Experimental Research Methodology - MTE-40039
demonstrate comprehensive knowledge and understanding of background, concepts and theoretical basis related to the student's project.	Research Project - PHA-40196
demonstrate communication skills including written and oral reports.	Physiological Measurements - MTE-40026 Biotechnology and Omics - PHA-40236 Research Project - PHA-40196 Experimental Research Methodology - MTE-40039 Engineering for Medical Applications - MTE-30003 Medical Equipment and Technology Services Management - MTE-40029 Stem Cells: Types, Characteristics & Applications - MTE-40028
carry out experimental work in accordance with health and safety issues.	Research Project - PHA-40196
broaden the knowledge and understanding in areas of molecular, cellular and tissue engineering and biomedical engineering.	Biomedical Signal Processing and Analysing - MTE-40031 Cell Biomechanics - MTE-40034 Biomaterials - MTE-40036 Medical Device Design Principles - MTE-40038 Biotechnology and Omics - PHA-40236 Nanomagnetics in Nanomedicine - MTE-40030 Medical Equipment and Technology Services Management - MTE-40029 Stem Cells: Types, Characteristics & Applications - MTE-40028 Physiological Measurements - MTE-40026 Human Physiology and Anatomy - MTE-40024 Biomechanics - MTE-40023 Bioreactors and Growth Environments - MTE-40022 Engineering for Medical Applications - MTE-30003 Cell and Tissue Engineering - MTE-40033

Subject Specific Skills	
Learning Outcome	**Module in which this is delivered**
plan and carry out experiments or modelling safely	Biomaterials - MTE-40036 Physiological Measurements - MTE-40026 Stem Cells: Types, Characteristics & Applications - MTE-40028 Research Project - PHA-40196 Biotechnology and Omics - PHA-40236 Cell Biomechanics - MTE-40034 Nanomagnetics in Nanomedicine - MTE-40030
demonstrate technical presentation using appropriate computer software	Research Project - PHA-40196 Experimental Research Methodology - MTE-40039
utilize experimental methods or computer-based tools to generate data, and analyse data using specific software including statistics.	Research Project - PHA-40196 Experimental Research Methodology - MTE-40039
perform measurements and analysis of data using scientific and medical instruments	Physiological Measurements - MTE-40026 Biotechnology and Omics - PHA-40236
culture and maintain cells using laboratory techniques	Cell and Tissue Engineering - MTE-40033 Stem Cells: Types, Characteristics & Applications - MTE-40028
Appraise advanced biotechnology and omics techniques for biomolecules and cells	Biotechnology and Omics - PHA-40236

Intellectual skills	
Learning Outcome	**Module in which this is delivered**
perform literature review and critical analysis on the research topics.	Biotechnology and Omics - PHA-40236 Experimental Research Methodology - MTE-40039 Medical Equipment and Technology Services Management - MTE-40029 Research Project - PHA-40196
analyse the research data, synthesize the research results, and critically discuss in order to improve general understanding of the research topics	Research Project - PHA-40196
plan, perform and write-up of a Bioengineering-related research project	Research Project - PHA-40196

Key or Transferable Skills (graduate attributes)	
Learning Outcome	**Module in which this is delivered**
display the independent working and problem-solving capacity in the research projects alongside critical literature review and data interpretation.	Research Project - PHA-40196
develop the capacity to transfer scientific knowledge into practical application in current and subsequent career choice.	Research Project - PHA-40196
understand research process, plan and manage projects, identify personal and professional requirements for supporting lifelong learning.	Research Project - PHA-40196

8. Final and intermediate awards

Master of Research in Bioengineering	180 credits	You will require at least 180 credits at Level 7
Postgraduate Diploma in Bioengineering	120 credits	You will require at least 120 credits at Level 7
Postgraduate Certificate in Bioengineering	60 credits	You will require at least 60 credits at Level 7

9. How is the Programme Assessed?

The wide variety of assessment methods used on this programme at Keele reflects the broad range of knowledge and skills that are developed as you progress through the degree programme. Teaching staff pay particular attention to specifying clear assessment criteria and providing timely, regular and constructive feedback that helps to clarify things you did not understand and helps you to improve your performance. The following list is representative of the variety of assessment methods used on your programme:

- A written dissertation based on the student research project,
- Oral presentations,
- Reports on laboratory-based practicals,
- Coursework-based essays,
- Written examinations,
- Essay-based examination.

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.

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 three 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 programme is not currently accredited by a professional body.

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?

Students with a first or second-class degree (or equivalent) in bioengineering, biotechnology, chemistry, life sciences, medicine, or professions allied to medicine are welcomed. We also encourage enquiries from people with other professional qualifications acceptable to the University.

International students require IELTS 6.5 with no subcategory lower than 6.0. When at Keele, students for whom English is not their first language are entitled to attend two-semester long modules on Academic English for postgraduate science students. Please note, this course is additional and does not form part of the programme credits.

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

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 a personal tutor 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 personal tutors twice a semester unless special needs require a greater frequency. More information is available in the University's Code of Practice on Personal Tutoring.

In addition, students will be allocated project supervisors during the first semester after discussing and interactions with a number of staff. Students will be frequently supervised by the supervisors during the second and third semesters.

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 is based within the School of Pharmacy and Bioengineering (PhaB) at the Guy Hilton Research Centre. The administration team are based in the Hornbeam Building on Keele's main campus. Teaching delivery and Research project supervision will be held at the Guy Hilton Research Centre, Keele Campus, RJAH Orthopaedic Hospital at Oswestry, and the Royal Stoke University Hospital site.

Students on this award are Keele students and have access to all the facilities that title conveys. 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 site, 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. In addition, students on this award may use the Health Library based at the Royal Stoke University Hospital.

15. Other Learning Opportunities

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

16. Additional Costs

Activity	Estimated Cost
Total estimated additional costs	£300

These costs have been forecast by the University as accurately as possible but may be subject to change as a result of factors outside of our control (for example, increase in costs for external services). Forecast costs are reviewed on an annual basis to ensure they remain representative. Where additional costs are in direct control of the University we will ensure increases do not exceed 5%.

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 Internal Quality Audit (IQA) 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. QAA Subject Benchmark Statement: https://www.qaa.ac.uk/docs/qaa/subject-benchmark-statements/sbs-engineering-15-masters.pdf?sfvrsn=fb91f681_16

c. The **UK** Standard for Professional Engineering Competence (**UK**-**SPEC**):
https://www.engc.org.uk/engcdocuments/internet/Website/UK-SPEC%20third%20edition%20(1).pdf

d. Keele University Regulations and Guidance for Students and Staff: http://www.keele.ac.uk/regulations

Version History

This document

Date Approved: 29 June 2022

What's Changed

New module added titled Biotechnology and Omics (PHA-40236)

Previous documents

Version No	Year	Owner	Date Approved	Summary of and rationale for changes
1	2022/23	WENWU LI	12 May 2022	