

MSc Advanced Biomedical Engineering Programme Specification

<https://www.bradford.ac.uk/courses/pg/advanced-biomedical-engineering/>

Academic Year:	2023/24
Degree Awarding Body:	The University of Bradford
Target Degree Award:	Master of Science in Advanced Biomedical Engineering [Framework for Higher Education Qualifications (FHEQ) Level 7]
Interim/exit Awards:	MSc Engineering (Biomedical) [FHEQ Level 7]; Postgraduate Certificate Advanced Biomedical Engineering [FHEQ Level 7]
Programme Admissions:	September
Programme duration:	12 months full time
Subject Benchmark Statement:	Engineering (QAA 2015)
Programme Accrediting Body:	IET – The Institution of Engineering and Technology IMECH-E The Institute of Mechanical Engineers

Please note: This programme specification has been published in advance of the academic year to which it applies. Every effort has been made to ensure that the information is accurate at the time of publication, but changes may occur given the interval between publishing and commencement of teaching. Any change which impacts the terms and conditions of an applicant's offer will be communicated to them. Upon commencement of the programme, students will receive further detail about their course and any minor changes will be discussed and/or communicated at this point.

Minor Modification Schedule

1. April 2018 – Curriculum structure updated following review
 2. March 2019 – Addition of optional modules from the Faculty of Life Sciences
 3. March 2020 – Minor amendments to availability of optional modules
 4. November 2020 – Specification reformatted and made accessible
 5. September 2021 – minor changes for 2021 academic year
 6. July 2022 – Annual changes for 2022 academic year. Minor curriculum amends, waiver wording, new title for the unaccredited award.
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Introduction

Biomedical Engineering is the application of engineering principles to the Biomedical and healthcare sector. It combines engineering expertise with biology to solve biomedical problems and improve the wellbeing of patients. Although less established than more traditional specialties such as electrical or mechanical engineering, it is nonetheless a growing discipline which is increasing in importance. Indeed, many significant diagnostic and therapeutic advances have been pioneered by biomedical engineers.

Biomedical engineering is a fast-evolving interdisciplinary field, which has been at the forefront of many biomedical advances in recent years. As such, it is a research-led discipline, which sits at the forefront of advances in medicine, engineering and biology. It is highly interdisciplinary in nature and requires engineers who are flexible, able to acquire new skills, and who have a broad knowledge base.

Given the research-lead nature of the discipline, there is demand for engineers who can work effectively in a research-lead environment and who can push forward technological boundaries. Consequently, there is need for people with advanced knowledge and skills, who have a good appreciation of developments in the clinical and biological fields. Thus, this MSc programme at the University of Bradford is designed to provide an advanced Biomedical engineering education and to give students an opportunity to develop advanced knowledge and understanding in specialist subject areas. In particular, the programme contains a large project component which allows students to develop advanced knowledge and research skills in their specialist area. As such, the programme also aims to develop a multidisciplinary understanding of the subject, which can be applied in a variety of clinical, biomedical and industrial settings.

The Faculty of Engineering and Digital Technologies places emphasis on both teaching and research, believing them to be mutually dependent. This MSc programme has grown out of the internationally recognised research activity of the Biomedical Engineering Research Team which has a long and established record of delivering Bachelors level teaching in the Biomedical and healthcare field. As such, the programme draws on the broad range of expertise within the Biomedical Engineering Research Team and integrates this in a coherent programme of study. The Biomedical Engineering Research Team has particular research strengths in Human movement analysis; Biomaterials science; Biophysics; Tissue/Cell Engineering; and Medical Electronic Devices. It has research links with local hospitals in Yorkshire and works closely with clinicians from these establishments. It has on going collaborative research with various commercial organizations, including, Smith and Nephew, DePuySynthes (J&J), Biomet Healthcare UK Ltd, GE Healthcare, BRI, LGI and Dyson Ltd.

The University

The University of Bradford has four key strategic objectives: excellence; internationalisation; equality and diversity; and sustainability. We believe in doing research and teaching to deliver career opportunities for our students as well as for economic development and job creation.

The Faculty of Engineering and Digital Technologies strongly believes that each programme subscribes to these four objectives through the three key streams of the University vision:

- The creation of knowledge through fundamental and applied research.
- The dissemination of knowledge by teaching students from all backgrounds.
- The application of knowledge for the prosperity and wellbeing of people.

Lecturers at Bradford are active researchers in their fields of expertise, developing new knowledge, contributing to peer-reviewed journals and books. This research permeates to their teaching practice giving students access to world leading professionals, equipment and ideas within the University's academic themes of Innovative Engineering, Advanced Healthcare and Sustainable Societies. Each year students will engage in enquiry-based projects allowing learning through research. The programmes of study will include research with an emphasis on application, experiential learning and real-world engagement. This will make a major contribution to students' skill sets, in the skills and attributes for enhanced employability.

We recognise that society benefits from the talents of all, and that the development of creative, collaborative engineers, skilled in communication and teamwork is vital. Diverse engineering teams are known to be more innovative. We help students to contribute to and learn from the varied perspectives of their tutors and peers. We want to equip our graduates with the knowledge and skills to respond to the many diverse needs of our businesses and communities.

The Faculty welcomes and celebrates the diverse cultural and national backgrounds of our students. We are committed to an educational experience that is inclusive, one where gender and ethnicity are central elements in developing engineering solutions that address the needs of a diverse society. The University currently holds Bronze Athena Swan accreditation from AdvanceHE.

Programme Aims

- Provide students with the advanced theoretical knowledge, concepts and skills necessary for original thought and problem analysis related to medical, clinical and biomedical engineering.
- Enable students to carry out independently, but under supervision, a specific research project in medical, clinical and biomedical engineering.
- Provide bridging information to non-specialists enabling them to extend their career opportunities.
- With reference to teaching and learning, the Faculty aims to produce postgraduates who aspire to challenging careers in industry, commerce and the public sector or to developing their own enterprises. Students should therefore be able to move directly into responsible roles in employment with a minimum of additional training. This aim is achieved by:

- Provide students with the academic and technical skills necessary to carry out research in medical, clinical and biomedical engineering within a supportive, structured environment in which students are encouraged to develop independent learning skills
- Developing subject knowledge and understanding, developing discipline skills and developing personal transferable skills, to enable graduates to pursue programmes of advanced study, or to move directly into responsible employment.

Programme Learning Outcomes

To be eligible for the FHEQ Level 7 award of Postgraduate Certificate, students will be able to:

1. Evidence comprehensive understanding of relevant scientific principles of discipline specialization, applying knowledge (possibly at discipline forefront), understanding, and skills to work with (incomplete or uncertain) information, quantifying the effect of this on the design, and using theory or experiment to mitigate deficiencies.
2. Select and apply appropriate advanced modelling and analysis methods and computational tools to critically evaluate complex and multidisciplinary problems in engineering, generate (optimized) solutions, and assess their limitations, robustness, and effects of changes in design parameters.
3. Evidence advanced level knowledge and understanding of a wide range of engineering materials and components.
4. Critically evaluate current problems and/or new insights informed by the specialization forefront and apply and adapt knowledge and comprehensive understanding of design processes and methodologies in unfamiliar situations.
5. Work effectively in a team in order to meet shared objectives.
6. Evidence awareness of the need for a high level of professional and ethical conduct in engineering, evidencing business and management practices relevant to engineering and engineers

Additionally, to be eligible for the FHEQ Level 7 award of Postgraduate Diploma, students will be able to:

7. Evidence understanding and critical evaluation of concepts relevant to discipline, some from outside engineering, and apply them effectively (including in engineering projects).
8. Integrate engineering knowledge and insight to investigate new and emerging technologies, applying professional judgements to balance risks, cost, benefits, safety, reliability and environmental impact.
9. Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

10. Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.
11. Apply skills in problem solving, communication, information retrieval, working effectively with general IT facilities to develop, monitor and update a plan for the solution of both technical and personnel contributions to meeting organisational need.
12. Plan self-learning to improve performance as a foundation for lifelong learning/CPD, and exercise initiative and personal responsibility in professional practice, which may be as a team member or leader, evidence good negotiation, written and oral communication skills.

Additionally, to be eligible for the FHEQ Level 7 Degree award of Master, students will be able to:

13. Plan, implement, monitor and adjust on an on-going basis, a self-directed individual research programme of work, evidencing collection and critical analysis of research data, use or adaptation of appropriate analysis tools to tackle unfamiliar problems (e.g., those with uncertain or incomplete data or specification), innovation, and application of relevant skills, reflection, and research methodologies in the production of an advanced technical report.

Curriculum

The curriculum map shows the core and optional units for this programme, which extends over 12 months. It is made up of a taught element of 120 credits and an individual research project element of 60 credits. Please note that the curriculum may change, subject to the University's programme approval, monitoring and review procedures, as improvements are made each year. More detail, including learning outcomes, is available for each unit in the module handbooks.

The taught element is structured in the form of 20 credit modules over the 2 semesters forming the "Academic Year" of September-May. In Semester 1, students study 40 core credits and choose 1 from 3 optional modules.

Sem 1: Postgraduate Certificate Modules

Study Period	Code	Title	Credit	Level	Type	Study Period for January Starters
SEM1	MHT7013-B	Regenerative Medicine	20	FHEQ 7	Core	Sept-Jan
SEM1	MHT7015-B	Telemedicine & E-Health	20	FHEQ 7	Core	Sept- Jan
SEM1	ENB7008-B	Supply Chain Management & Production	20	FHEQ 7	Option	Sept-Jan
SEM1	COS7049-B	Statistical Applications of Industrial Big Data	20	FHEQ 7	Option	Sept-Jan

Study Period	Code	Title	Credit	Level	Type	Study Period for January Starters
SEM1	COS7046-B	Big Data Visualisation	20	FHEQ 7	Option	Sept-Jan

Students will be eligible to exit with the FHEQ Level 7 award of Postgraduate Certificate if they have successfully completed 60 credits and achieved the award learning outcomes.

In Semester 2, students again study 40 core credits and select a final 1 option from 4.

Study Period	Code	Title	Credit	Level	Type	Study Period for January Starters
SEM2	MHT7008-B	Clinical Biomechanics	20	FHEQ 7	Core	Jan-May
SEM2	MHT7014-B	Clinical Diagnostics	20	FHEQ 7	Core	Jan-May
SEM2	CPE7004-B	Food and Pharmaceutical Processes Engineering	20	FHEQ 7	Option	Jan-May
SEM2	CFS7028-B	Imaging	20	FHEQ 7	Option	Jan-May
SEM2	CFS7018-B	Materials Characterisation	20	FHEQ 7	Option	Jan-May
SEM2	CPE7012-B	Polymer and Materials Engineering	20	FHEQ 7	Option	Jan-May

Students will be eligible to exit with the FHEQ Level 7 award of Postgraduate Diploma if they have successfully completed at least 120 credits and achieved the award learning outcomes.

The 60 credits MSc research project is carried out throughout the year and into the summer.

Study Period	Code	Title	Credit	Level	Type	Study Period for Jan Starters
SEM 123	ENG7002-E	MSc Project	60	FHEQ 7	Core	Jan - November

At the end of the programme, students will be eligible to exit with the FHEQ Level 7 Master's Degree award of MSc Engineering (Biomedical) if they have successfully completed at least 180 credits and achieved the award learning outcomes but not met the criteria for an accredited award.

Students will be eligible for the FHEQ Level 7 Master's Degree award of MSc Advanced Biomedical Engineering if they have successfully completed at least 180 credits, achieved the award learning outcomes and met the programme-specific accredited award criteria.

Learning and Teaching Strategy

The teaching and learning strategy takes into consideration the learning outcomes, the nature of the subject and the student intake, and the need for students to take greater responsibility for their own learning as they progress through the Programme.

Our strategy begins with the end in mind. We want students to become great engineers; that means great problem solvers, great team-workers with an inquisitive and curious mind. This should mean that by the end of their study with us they can move seamlessly into the world of work, academic research or become an entrepreneur.

The teaching and learning methods have been selected to engage students in developing their knowledge and understanding of engineering fundamentals, through formal learning opportunities such as lectures and tutorials, experiential learning through practical classes and lab sessions and informal and social learning through team-working in projects and competitions.

Study with us will include formal lectures (including those from visiting lecturers and invited speakers). Tutorials and seminars will often be in smaller groups and highly interactive. We want to develop students understanding of the vast array of opportunities open to today's professional engineer and therefore we look to incorporate aspects of real-world engineering problems and solutions where possible. To this end we make use of case studies, practical demonstrations, and provide lots of opportunities for students to design their own solutions.

As part of our focus on building a learning experience which will prepare students for the world of work our curriculum has been developed using the CDIO framework. This means that our learning strategy will be to encourage students to work in teams to Conceive potential solutions, Design new products processes or services, Implement (or model) and test those designs, and Operate the product or solution. In line with the CDIO philosophy students will have numerous opportunities to be an active learner, to work as an engineer on real-world projects. Students will operate analytical instruments in Semester 2, under supervision, during the initial phase of their research project.

The University of Bradford is well known for attracting students from a wide variety of backgrounds, experiences and countries. The University of Bradford encourages and supports women in engineering. Female staff and students are an integral part to the University of Bradford's Faculty of Engineering and Digital Technologies. The University of Bradford's modus operandi, Making Knowledge Work, is embedded in the philosophy of this programme.

Assessment Strategy

In the same way that our teaching and learning strategy is designed to prepare students for the world of work, academic research or entrepreneurship, our assessment methods incorporate a wide range of different methods designed to meet the needs of industry, the accrediting bodies as well as prepare students for a potential academic research career.

Assessment is a key part of the learning process, it is only through challenging themselves to express what they have learned or put it to practical use, can students complete the

learning journey and assess for themselves if they have understood what they have been taught and are able to apply and use those skills and knowledge.

There are two forms of assessment: formative and summative. Formative assessment provides an opportunity for our staff to give students feedback during their learning. This feedback is designed to help and guide student learning. All the modules will have some formative assessment, and this may be in various forms including discussions or questioning from the supervisor, tests, practical activities, et cetera. These formative activities are crucial if students are to make best use of their learning experience and they are designed to prepare students for their summative assessment.

Summative assessment is how we grade the work on a module and the details of this assessment will be available from the beginning of the module so that students understand how their grade will be determined. A main method of assessment (as is common on all professional engineering degree programmes) is by formal written examinations. Nevertheless, many of the assessments will be tailored to the most efficient ways the learning outcomes. Therefore, project work will often be assessed on the basis of the quality of the product produced as part of the project; we use practical tests to assess practical skills and written reports to show the depth of understanding of concepts and ideas.

Practical skills are often assessed via individual and group technical reports with the laboratory work linked with the taught modules. The methods of assessment of transferable skills are built in the structure of the examinations, case studies, laboratory demonstrations and project work.

Assessment Regulations

The University Taught Postgraduate Regulations, are available at the link: <https://www.bradford.ac.uk/regulations/>

The following exceptions to these regulations apply to this programme:

To gain an accredited MSc award, students must achieve 30% or more in assessment components of more than 30%. Students who achieve a mark of 40% or more for a module, but fail to achieve 30% in a qualifying component, will be permitted supplementary assessment in line with the University Postgraduate Assessment Regulations.

- To gain an accredited MSc award, students must achieve 180 credits in total, comprising 160 credits at 50% or above and 20 credits at 40% or above.
- Students who achieve a mark between 40%-49% in up to 60 credits worth of modules will be permitted one supplementary assessment attempt to support them to remain on the accredited MSc with no more than 2 attempts in any module.
- Compensation is only permitted in a maximum of 20 credits across the whole programme with a mark no lower than 40%.
- If the above requirements are not met, but the University's taught postgraduate regulations are otherwise complied with, then a non-accredited MSc degree will be awarded, MSc Engineering (Biomedical).

Admission Requirements

We take into consideration a number of factors when assessing your application. It's not just about your grades; we take the time to understand your personal circumstances and make decisions based on your potential to thrive at university and beyond.

In addition to satisfying the general admissions requirements of the University of Bradford, the typical applicant profile for this programme is to have at least an undergraduate degree classified at 2:2 or above in Biomedical/Medical Engineering, Clinical Technology, or related engineering/science field, from an accredited degree awarding body.

International students are welcome to apply and should check their country page website for details of equivalent qualifications: <https://www.bradford.ac.uk/international/country/>

For all students whose first language is not English, the standard postgraduate English language requirements for the University apply and these are listed at: <https://www.bradford.ac.uk/international/entry-requirements/>

Access and Recognition of Prior Learning

Applications are welcome from students with non-traditional qualifications, and/or significant personal/professional experience. Candidates who do not fulfil the normal entry requirements but have extensive industrial experience related to Medical/Biomedical Engineering are considered on an individual basis.

The University of Bradford has always welcomed applications from disabled students. To discuss adjustments or to find out more about support and access, you may wish to contact the Disability Service before you apply at www.bradford.ac.uk/disability/before .

Applications are particularly welcomed from women, returners to study (those aged 26+ at the start of the programme), armed forces families, carers and care leavers, estranged or orphaned learners, refugees and asylum seekers, and Romani or Traveller families.

If applicants have prior certificated learning or professional experience which may be equivalent to parts of this programme, the University has procedures to evaluate and recognise this learning in order to provide applicants with exemptions from specified modules or parts of the programme: www.bradford.ac.uk/teaching-quality/prior-learning/

Please note: The information above relates to the contemporary recruitment cycle at time of publication and therefore may now be out of date. The current entry requirements are published on the course website: <https://www.bradford.ac.uk/courses/pg/advanced-biomedical-engineering/>

Version Number	Brief description of Modification	Date of Approval (Faculty Board)
1	Curriculum structure updated following review	April 2018
2	Addition of optional modules from the Faculty of Life Sciences	March 2019
3	Minor amendments to availability of optional modules	March 2020

4	Updated January intake	December 2020
5	Specification reformatted and made accessible	February 2021
