UNIVERSITY of
BRADFORD

Faculty of Engineering
and Informatics

Department of Biomedical and Electronics Engineering

MSc Advanced Biomedical Engineering Programme Specification

Academic Year:	**2021/22**
Degree Awarding Body:	**University of Bradford**
Final and interim awards at Level 7 FHEQ (Framework for Higher Education Qualifications in England)	**Master of Science in Advanced Biomedical Engineering** **Postgraduate Diploma** **Postgraduate Certificate**
Programme duration:	**1-year full time**
QAA Subject benchmark statement(s):	**Engineering (2015)** **Masters degrees (2010)**
Programmes Accredited by	**IET**
Date last confirmed by Faculty Board	**August 2020**

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.

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 Informatics 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 Informatics 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 award of **Postgraduate Certificate** at FHEQ Level 7, students will be able to:

PLO1   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.

PLO2   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.

PLO3   Evidence advanced level knowledge and understanding of a wide range of engineering materials and components.

PLO4   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.

PLO5   Work effectively in a team in order to meet shared objectives.

PLO6   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 award of **Postgraduate Diploma** at FHEQ level 7, students will be able to:

PLO7   Evidence understanding and critical evaluation of concepts relevant to discipline, some from outside engineering, and apply them effectively (including in engineering projects).

PLO8   Integrate engineering knowledge and insight to investigate new and emerging technologies, applying professional judgements to balance risks, cost, benefits, safety, reliability and environmental impact.

PLO9   Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

PLO10 Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.

PLO11 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.

PLO12 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 award of **Degree of Master** at FHEQ level 7, students will be able to:

PLO13 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. The taught element is structured in the form of 20 credit modules over the two semesters forming the academic session. The 60 credits MSc research project is carried out throughout the year.

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 descriptors.

Postgraduate Certificate

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	Regenerative Medicine	Core	20	1	MHT7013-B
7	Telemedicine & E-Health	Core	20	1	MHT7015-B
7	Supply Chain Management & Production	Option	20	1	ENB7008-B
7	Big Data Systems and Analytics	Option	20	1	COS7006-B
7	Big Data Visualisation	Option	20	1	COS7046-B

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

Postgraduate Diploma

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	Clinical Biomechanics	Core	20	2	MHT7008-B
7	Clinical Diagnostics	Option	20	2	MHT7014-B
7	Polymer and Materials Engineering	Option	20	2	CPE7012-B
7	Imaging	Option	20	2	CFS7028-B
7	Materials Characterisation	Option	20	2	CFS7018-B
7	Food and Pharmaceutical Processes Engineering	Option	20	2	CPE7004-B

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

Degree of Master

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	MSc Project	Core	60	1,2,3	ENG7002-E

Students will be eligible for the award of **Degree of Master** if they have successfully completed at least 180 credits and achieved the award learning outcomes.

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 Informatics. 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

This Programme conforms to the standard University Taught Postgraduate Regulations, which are available at the link: https://www.bradford.ac.uk/regulations.

However, there is one exception to these regulations as listed below:

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.

If the above requirement is not met, but the University's taught postgraduate regulations are complied with, then a non-accredited MSc 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.

We specifically require that all applicants have a second-class Honours degree or equivalent in a Biomedical/Medical Engineering, Clinical Technology, or related engineering/science field.

The University of Bradford has always welcomed applications from disabled students, and these will be considered on the same academic grounds as are applied to all applicants. If applicants have some form of disability, they may wish to contact the programme leader before they apply.

Recognition of Prior Learning

Applications are welcome from students with non-standard qualifications or mature students (those over 21 years of age on entry) with significant relevant experience.

Candidates who do not fulfil the normal entry requirements but have extensive industrial experience in a related area are considered on an individual basis.

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.

Minor Modification Schedule

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	Specification reformatted and made accessible	November 2020
5	Minor changes for 2021 academic year	September 2021