UNIVERSITY of BRADFORD

Faculty of Engineering and Informatics

Department of Mechanical and Energy Systems Engineering

MSc Advanced Mechanical Engineering Programme Specification

Academic Year:	**2021/22**
Degree Awarding Body:	**University of Bradford**
Target and interim awards at Level 7 FHEQ (Framework for Higher Education Qualifications in England):	▪ **MSc Advanced Mechanical Engineering** ▪ MSc Engineering (Mechanical) ▪ PgDip Advanced Mechanical Engineering ▪ PgCert Advanced Mechanical Engineering
Programme accredited by:	**Institution of Mechanical Engineers – IMechE**
Programme duration:	▪ **12 months full-time (September intake)** ▪ **12 months full-time (January intake)**
QAA Subject Benchmark:	**Engineering (2015)**
Date last confirmed/approved by Faculty Board:	**October 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

Engineering is fundamental to the economic and social prosperity worldwide. It is a "people serving" profession whose activities not only manage humankind's environment but also create that environment itself. It requires well-qualified and motivated students who seek to be the future leaders within their profession. Studying at Bradford will be a foundation for life aimed at developing an appreciation of technical and managerial principles and competence in their application using a wide range of personal and professional skills.

The Master of Science (MSc) degree programme in Advanced Mechanical Engineering is designed to meet the needs of the 21st Century Mechanical Engineering related industries. The core modules will provide students with advanced understanding in solid mechanics, computer-aided modelling, simulation and optimisation, design methodologies and design analysis. The range of optional modules allows students to develop either an automotive engineering specialism or a manufacturing engineering specialism; alternatively, students may select from across the Department to build up a portfolio of expertise across these themes. The project modules will develop student's research and project management skills whilst undertaking in-depth study of a particular topic. The major MSc dissertation project is usually linked with on-going research within the Faculty of Engineering and Informatics.

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. Postgraduates will be able to move directly into responsible roles in employment with a minimum of additional training. The MSc will meet, in part, the exemplifying academic benchmark requirements for registration as a Chartered Engineer (CEng). Accredited MSc graduates who also have a BEng (Hons) accredited for CEng, will be able to show that they have satisfied the educational base for CEng registration.

This programme is accredited by IMechE. Accreditation aims to ensure that the MSc Advanced Mechanical Engineering degree meets the highest international standards.

Learning with and as part of a research community

The Faculty places emphasis on both teaching and research, believing them to be mutually dependent. We have particular research strengths in:

- Automotive Engineering (especially braking, engine tribology, engine mapping and calibration, turbo-charger testing, quality engineering in system and component design and manufacture).
- Materials Engineering (especially polymeric engineering and processing, composites and nanocomposites, recycling, product design and manufacture).
- In-line Monitoring and Control of Manufacturing Processes (instrumentation, sensors, computer-based data acquisition and control).
- Mechanical Dynamics and Control (especially machine tool dynamics and control, and vehicle dynamics and control).
- Computer Aided Modelling and Design (creation, virtual testing and prototyping).

We conduct this research jointly with many companies including Jaguar Land Rover, Ford, Sabic, Sinopec, Dow, SCG Chemical, Autodesk, Cummins, and their supplier bases as well as with UK Research Councils.

We value sustainability at Bradford and to that end we have embedded sustainable development across all our programmes. In a future where sustainability is to become increasingly important students will have sound understanding of the challenges and the potential for solutions in a world where the actions of human industry is creating new pressures on resources.

The Bradford Graduate

We aim to produce MSc graduates who are imaginative, innovative, versatile and competitive, who will be able to progress rapidly to professional positions of responsibility with minimal additional training, and who can provide technical, managerial and entrepreneurial leadership in specialist and interdisciplinary projects.

Upon graduation students will be able to work as:

a) Projects Engineer

b) Design Engineer

c) Operations Engineer or

d) Research and Development Engineer (R&D).

Students will have the capacity for professional growth to continue the path to Chartered Engineer (CEng) status. Students will develop high-level professional and interpersonal skills gained from learning through a team-based environment. An education where students have spent their time conceiving, designing, implementing and operating solutions to problems that they have tackled as part of a learning team.

As an engineering graduate from Bradford students have a real foundation for life. Students will be adept at working with complex value-added engineering systems and will be familiar with experimentation, system thinking and have a solid understanding of the business and enterprise context. In addition, the ability of an engineer to think clearly, logically and ethically is widely appreciated by many other professions and studies at Bradford may well be a stepping-stone to an alternative career in financial services, teaching, law, etc.

Alternatively, students could pursue a research career. They will have highly developed research skills and their personal tutor can help them identify postgraduate research opportunities here at Bradford or elsewhere. The third route open to students on graduation is to develop their own business. As a Bradford engineering graduate, they will have the skills to design and develop products processes or systems that could have serious commercial potential. We have a long track record of supporting and developing new companies and helping graduates on those first steps as an entrepreneur.

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.

The 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. 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 student's skill set, 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 different needs of our businesses and communities.

The University recognises the importance of providing pastoral support, taking into consideration all aspects of our students' journeys and development. All students are allocated a personal academic tutor, with whom they meet regularly to discuss and receive guidance on their learning and development. The University also operates a wide range of support services covering areas such as disability, counselling, faith advisors and careers.

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, and the Faculty is instrumental in organising events to celebrate occasions including International Women in Engineering Day (INWED), the UN International Day of Women and Girls in Science, and International Women's Day. We are members of WISE (https://www.wisecampaign.org.uk/) whose long-term vision is for gender balance in STEM, and we signpost students to networking events and specific upskilling opportunities offered via the organisation.

Our Faculty website has a specific page highlighting Women in Engineering for further information, visit: https://www.bradford.ac.uk/ei/women-in-engineering/

We contribute to Bradford Science Festival each year and participate in activities to celebrate national Science Week. The University has held Bronze Athena Swan accreditation (recognition of the Universities activities to advance women's careers in science, technology, engineering, medicine and mathematics) on an institutional level since 2015, demonstrating our commitment to striving for gender equality. In May 2021, the Faculty were successful in being awarded Bronze Athena Swan Accreditation.

Programme Aims

The programme is intended to:

- Give technical depth across the discipline of Mechanical Engineering and its applications.
- Provide breadth to encourage innovators of mechanical systems.
- Facilitate exposure to other engineering disciplines.
- Provide a supportive, structured environment in which students are encouraged to develop and enhance research skills and independent learning skills.
- Developing subject knowledge and understanding, developing discipline skills and developing personal transferable skills, to enable graduates to pursue programmes of further study, or to move directly into responsible employment.

Upon graduation students will have the capacity for meaningful interdisciplinary interaction, a leadership role, and professional growth, which may include Chartered Mechanical Engineer (CEng) status.

Programme Learning Outcomes

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

PLO 1 Demonstrate a comprehensive knowledge 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.

PLO 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.

PLO 3 Evidence advanced level knowledge of a wide range of engineering materials and components.

PLO 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.

PLO 5 Work effectively in a team in order to meet shared objectives.

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

PLO 7 Demonstrate a critical evaluation of concepts relevant to discipline, some from outside engineering, and apply them effectively (including in engineering projects).

PLO 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.

PLO 9 Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

PLO 10 Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.

PLO 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.

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

PLO 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 structure

Students study a total of 60 credits each in Semesters 1 and 2, plus the 60 credit MSc Project module across the whole year. The curriculum may change, subject to the University's programme approval, monitoring and review procedures.

The programme has two entry points: September and January. Students who enter via the September intake will carry out their studies via the usual semester sequence (1,2,3), whilst those students who enter onto the course in January will study semesters in the sequence 2,3,1.

September Intake:

September 2021 – January 2022

Module Code	Module Title	Type	Credits	Level	Semester
ENM7005-B	Modelling and optimisation	Core	20	7	1
MAE7013-B	Advanced Solid Mechanics	Core	20	7	1
COS7006-B	Big Data Systems and Analytics	Option	20	7	1
ENB7008-B	Supply Chain Management and Production	Option	20	7	1

January 2022 – May 2022

Module Code	Module Title	Type	Credits	Level	Semester
ENB7007-B	Risk Assessment and Management	Option	20	7	2
CPE7012-B	Polymer and Materials Engineering	Option	20	7	2
MAE7030-B	Vehicle Powertrain and Dynamics	Option	20	7	2
MAE7031-B	Automotive Tribology and Noise, Vibration and Harshness	Option	20	7	2
COS7045-B	Advanced Machine Learning	Option	20	7	2

September 2021 – September 2022

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

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.

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.

Students will be eligible for the award of **Degree of Master, Engineering (Mechanical)** if they have successfully completed 180 credits and achieved the award learning outcomes.

Students will be eligible for the award of **Degree of Master, Advanced Mechanical Engineering** if they have successfully completed 180 credits including 160 at 50% (and other applicable assessment regulations) and achieved the award learning outcomes. **Only this award is accredited by IMechE.**

January Intake:

January 2022 – May 2022

Module Code	Module Title	Type	Credits	Level	Semester
ENB7007-B	Risk Assessment and Management	Option	20	7	2
CPE7012-B	Polymer and Materials Engineering	Option	20	7	2
MAE7030-B	Vehicle Powertrain and Dynamics	Option	20	7	2
MAE7031-B	Automotive Tribology and Noise, Vibration and Harshness	Option	20	7	2
COS7045-B	Advanced Machine Learning	Option	20	7	2

January 2022 – January 2023

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

September 2022 – January 2023

Module Code	Module Title	Type	Credits	Level	Semester
ENM7005-B	Modelling and optimisation	Core	20	7	1
MAE7013-B	Advanced Solid Mechanics	Core	20	7	1
COS7006-B	Big Data Systems and Analytics	Option	20	7	1
ENB7008-B	Supply Chain Management and Production	Option	20	7	1

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.

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.

Students will be eligible for the award of **Degree of Master, Engineering (Mechanical)** if they have successfully completed 180 credits and achieved the award learning outcomes.

Students will be eligible for the award of **Degree of Master, Advanced Mechanical Engineering** if they have successfully completed 180 credits including 160 at 50% (and other applicable assessment regulations) and achieved the award learning outcomes. **Only this award is accredited by IMechE.**

Learning and Teaching Strategy

The programme's 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), but these will always be interactive and two way. We want to develop student's 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 Conceive Design Implement Operate (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. The PG/Dip students will operate analytical instruments, under supervision, during the initial phase of their research project.

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 that skill and knowledge. There are two forms of assessment formative assessment which provides an opportunity for our staff will give students feedback during their learning. This feedback is designed to help and guide 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 the grade will be determined.

Each assessment on the programme is tailored to the specific learning outcomes and is structured to ensure that the learning is embedded by application of knowledge to real world examples. 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

Whilst this Programme conforms to the general principles set out in the standard University Taught Postgraduate Assessment Regulations which are available at the link www.bradford.ac.uk/regulations the following exception(s) apply to these regulations:

- To gain an accredited MSc Advanced Mechanical Engineering award, 160 credits must have a minimum mark of 50% with the remaining 20 credits with marks at a minimum of 40%.
- 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 AME with no more than 2 attempts in any module.
- If the above requirements are not met, but the University's postgraduate regulations are complied with, then a non-accredited degree will be awarded with the title of MSc Engineering (Mechanical).

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

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.

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	Brief description of Modification	Date of Approval (Faculty Board)
2	January Start curriculum added	November 2018
3	COS7028-B Data Mining replaced with COS7045-B Advanced Machine Learning	March 2019
4	January intake study period amended to 12 months. COS7006-B Big Data Systems and Analytics changed to optional. ENB7008-B Supply Chain Management and Production moved to semester 1. Separate curriculum structure tables for September and January intakes.	March 2020
5	Specification reformatted and made accessible	October 2020
6	Annual changes for 2021 academic year	June 2021