



## Master/Bachelor of Engineering in Mechanical Engineering Programme Specification

Academic Year:	2021-2022
Degree Awarding Body:	University of Bradford
Final and interim awards:	<b>MEng Mechanical Engineering</b> [Framework for Higher Education Qualifications (FHEQ) level 7] <b>BEng Mechanical Engineering</b> [FHEQ level 6] <b>DipHE Mechanical Engineering</b> [FHEQ level 5] <b>CertHE Mechanical Engineering</b> [FHEQ level 4]
Programme accredited by:	<b>IMechE – Institution of Mechanical Engineers</b>
UCAS code and programme duration:	<b>H300</b> – BEng 3 years full time <b>H301</b> – BEng 4 years full time with sandwich/placement <b>H305</b> – MEng 4 years full time <b>H306</b> – MEng 5 years full time with sandwich/placement
QAA Subject benchmark statement:	<b>Engineering</b>
Date last confirmed by Faculty Board:	<b>March 2020</b>

**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 of the UK. It is the profession responsible for the creation of all material objects and systems necessary for modern life from concept to customer to decommissioning. Engineering is fundamental to the creation and sustainability of the environment itself.

Studying Mechanical Engineering at Bradford will be a foundation for life aimed at developing a deep understanding of fundamental and advanced technical principles, analytical tools, and competence in their application together with a wide range of management, personal and professional skills. An excellent way to develop these skills is to undertake an industrial placement as an integral part of the degree studies.

The integrated Master in Engineering (MEng) programme sets out to give technical depth across the discipline and in relevant specialist applications of technology, to provide breadth to encourage innovators, and facilitate exposure to other engineering disciplines.

Upon graduation students will have the capacity for meaningful interdisciplinary interaction, leadership roles, and professional growth, which may include seeking

Chartered Engineer (CEng) status. The MEng fully meets the exemplifying academic benchmark requirements for registration as a Chartered Engineer. To achieve CEng status students will also need to complete a period of postgraduate professional development in industry.

## Designed for the next generation of engineers.

Our programmes have been designed as part of the CDIO educational framework for producing the next generation of engineers. This will provide a learning experience that stresses the engineering fundamentals set within the context of Conceiving-Designing-Implementing-Operating (CDIO) real-world systems and products. This framework has been developed by universities across the globe and benefits from the ongoing collaborative experience of engineers and educationalists. This will mean that students' learning will reflect the real world, students will work in teams to solve real-world problems and in the process, they will develop professional skills alongside technical skills.

We also recognise that the future for engineers is one where they will be working in interdisciplinary teams to solve new, complex and evolving problems that will require innovative solutions. Students' abilities to work across engineering disciplines and collaboratively with experts in other specialist fields will be crucial to creating the solutions of tomorrow. We have designed our programmes to encourage and experience interdisciplinary working, to develop breadth as well as depth of skills and knowledge, and in this way, we believe students will be ideally equipped to be successful and employable. All our engineering students begin with an interdisciplinary year which ensures that all students have a good understanding of the breadth of what is encompassed by the word 'engineer'. This year provides them with fundamental skills and knowledge as well as specific projects that they will work on with other students in their discipline and a final project which will be on interdisciplinary project working with a range of engineers from different disciplines.

## Learning with and as part of a research community

The Department places emphasis on both teaching and research. We have particular research strengths in automotive engineering (especially component design and manufacturing quality); materials engineering (including the creation of complex components from powders, composites, and polymers); computer modelling and design (creation, virtual testing, and prototyping). We conduct this research jointly with many companies including Ford, Jaguar Land Rover, Sinopec, and this work shapes and informs our undergraduate programmes. During the later years of the MEng studies students can expect to interact with the research activities within the Department of Mechanical & Energy Systems Engineering.

We value sustainability at Bradford and to that end we have embedded sustainable development across all of 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.

We aim to produce MEng 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.

## The Bradford Graduate

All our programmes are designed to provide three progression routes for graduates. Upon graduation students will be equipped to be employed as an engineer. If this is their goal, they should seriously consider a placement year as this will be invaluable. Upon graduation students can expect to 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. 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.

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.

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.

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. As an engineering graduate from Bradford students have a real foundation for life.

This programme is accredited by IMechE. Accreditation aims to ensure that the MEng degree meets the highest international standards.

## 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 their 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 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 the Equality Challenge Unit.

Students will have many opportunities to contribute to their Higher Education Achievement Report (HEAR) whilst with us. They can gain here accreditation for becoming a student representative for their course, by becoming a student ambassador, helping with open days and applicant experience days, or by being a PAL leader. The peer assisted learning scheme or PAL is where students in stages two and three support new students of the University. The PAL scheme has been very successful, providing guidance on all aspects of being a student of Bradford. PAL leaders become mentors and role models for new students. We support people to become PAL leaders, but we also recognise their contribution through the HEAR.

## **Programme Aims**

The programme is intended to:

- Develop graduates with a solid grounding in engineering fundamentals and experience of interdisciplinary working.
- Enable graduates to develop the engineering, design, management and personal skills required to become professional Mechanical Engineers and in doing so, also equip them for careers in other professions.
- Provide the educational requirements (in compliance with UK-SPEC) when combined with a period of further learning to permit progression to Chartered Membership of the IMechE and registration with ECUK as a chartered engineer.

- Provide a challenging programme in terms of technical breadth and depth as well as supporting managerial and transferable skills in keeping UK-SPEC requirements of an accredited MEng programme.

## Programme Learning Outcomes

To be eligible for the award of **Certificate of Higher Education** at FHEQ level 4, students will be able to:

- PLO 1 Select and apply physical principles to describe fundamental engineering processes.
- PLO 2 Select and correctly apply quantitative methods to analyse the performance of engineering components systems.
- PLO 3 Select and use appropriate and relevant materials, equipment, tools, processes, or products.
- PLO 4 Apply simple computational techniques to simulate and visualise the solution to specified engineering problems.
- PLO 5 Apply skills in problem solving, working with others, information retrieval, and effective use of general IT facilities, and communicate work to technical and non-technical audiences.
- PLO 6 Exercise personal and professional responsibility, which may be as a team member, and include evidence of safe and effective workshop and lab practice.

Additionally, to be eligible for the award of **Diploma of Higher Education** at FHEQ level 5, students will be able to:

- PLO 7 Understand the essential concepts, principles and theories of Mechanical Engineering.
- PLO 8 Select mathematical and statistical methods necessary to underpin the engineering discipline and proficiently apply tools and notations in the modelling, analysis, solution, and evaluation of engineering problems.
- PLO 9 Apply analytical and computational methods to solve and visualize problems in the engineering discipline and to implement appropriate action.
- PLO 10 Apply problem-solving skills, technical knowledge and understanding to create/adapt and evaluate design solutions that are fit for purpose (inc. operation, maintenance, reliability etc.).
- PLO 11 Apply relevant practical and laboratory skills to obtain accurate data to evaluate system performance and/or validate system models.
- PLO 12 Plan and apply safe methods of construction and manufacture to semi-open projects, deriving solutions that consider technical, regulatory, and client requirements.
- PLO 13 Work effectively as a specialist within in a multidisciplinary team towards a shared objective.

Additionally, to be eligible for the award of **Degree of Bachelor** at FHEQ level 6, students will be able to:

- PLO 14 Generate innovative designs for products, systems, components or processes to fulfil new needs.
- PLO 15 Select, apply, and evaluate quantitative tools and data collection methods to underpin the engineering discipline, and apply a range of tools and notations proficiently and critically in the analysis and solution of engineering problems.
- PLO 16 Select, apply and effectively integrate knowledge of other engineering disciplines to support study and evaluation of the engineering discipline.
- PLO 17 Apply principles of organisation and management (project management, change management, health and safety, self-management) to achieve engineering objectives.
- PLO 18 Demonstrate comprehensive knowledge and understanding of the concepts, principles and theories underpinning Mechanical Engineering.
- PLO 19 Apply engineering principles to critically analyse problems to create innovative process and product designs, with systematic appreciation of key aspects of field of study, including acquisition of coherent and detailed knowledge informed by characteristics of the engineering discipline.
- PLO 20 Plan and implement an individual programme of work, monitoring and adjusting where appropriate in an on-going basis, utilising research skills to critically evaluate and report on technical literature and newly developed data, and reflect on personal and professional development to improve their performance.
- PLO 21 Describe and work effectively and collaboratively in different roles within a team, and evidence responsibility of engineers to consider environmental and socio-economic aspects in the development of sustainable solutions.
- PLO 22 Use appropriate discipline software packages in the modelling, simulation, analysis, design, and critical performance evaluation of composite engineering systems in the discipline.
- PLO 23 Correctly identify and use codes of practice and industry standards.

Additionally, to be eligible for the award of **Integrated Degree of Master** at FHEQ level 7, students will be able to:

- PLO 24 Apply and critically evaluate concepts, principles and theories underpinning Mechanical Engineering with knowledge in Advanced Solid Mechanics, Modelling and Optimisation as well as two other optional modules.
- PLO 25 Apply and critically evaluate comprehensive integrated or systems approaches to engineering problems through know-how of relevant discipline concepts, theories and technologies and their application, with ability to work with technical uncertainty.

- PLO 26 Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal.
- PLO 27 Extract and evaluate pertinent data and apply engineering analysis techniques to solve unfamiliar problems and communicate outcomes by a range of advanced techniques.
- PLO 28 Describe and critically evaluate different roles within an engineering team and exercise initiative and personal responsibility, which may be as a team member or leader.

## Curriculum

The map of the curriculum, which students will study, is detailed on the table below showing core (C) and optional (O) modules.

Each year, or stage of a degree programme comprises 2 semesters with 60 credits being studied in each semester. Some of the 20 credit modules have teaching and assessment, which occurs in both semesters.

The curriculum may change, subject to the University's programme approval, monitoring and review procedures.

### Stage 1 [Level 4]

Module Code	Module Title	Type	Credits	Level	Semester
MAE4013-B	Design, Build and Test (Mechanical)	Core	20	4	Both
ENM4004-B	Mathematical Methods and Applications	Core	20	4	Both
ELE4013-B	Electronics and Mechanics	Core	20	4	Both
ENG4007-B	Engineering Materials	Core	20	4	1
ENG4008-B	Thermofluids 1	Core	20	4	2
ENB4002-B	Computer Aided Engineering	Core	20	4	Both

At the end of stage 1 (level 4), students will be eligible to exit with the award of Certificate of Higher Education if they have successfully completed at least 120 credits and achieved the award learning outcomes.

### Stage 2 [Level 5]

Module Code	Module Title	Type	Credits	Level	Semester
ENM5005-B	Further Mathematics and Statistics	Core	20	5	Both
ENG5059-B	Materials and Manufacturing Technologies	Core	20	5	Both
MAE5013-B	Solid Mechanics and Vibration Analysis	Core	20	5	Both
ENG5060-B	Group Project	Core	20	5	Both
MHT5013-B	Instrumentation, Measurement and Control Systems	Core	20	5	Both
MAE5012-B	Thermofluids 2	Core	20	5	Both

At the end of stage 2 (level 5), students will be eligible to exit with the award of Diploma of Higher Education if they have successfully completed at least 240 credits and achieved the award learning outcomes.

### Stage 3 [Level 6]

Module Code	Module Title	Type	Credits	Level	Semester
ENG6003-D	Individual Research Project	Core	40	6	Both
ENG6004-B	Integrated Design	Core	20	6	1
MAE6018-B	Materials Failure Analysis and Reliability	Core	20	6	1
ENG6005-B	Sustainable Energy	Option	20	6	2
MAE6013-B	Advanced Fluid Mechanics with Aerodynamics	Option	20	6	2
MAE6017-B	Vehicle Design and Analysis	Option	20	6	2
ENB6010-B	Project Management and Six Sigma	Option	20	6	2
CPE6006-B	Petroleum Engineering	Option	20	6	2

At the end of Stage 3 (level 6), students will be eligible for the award of Degree of Bachelor in Engineering if they have successfully completed at least 360 credits and achieved the award learning outcomes.

### Stage 4 [Level 7]

Module Code	Module Title	Type	Credits	Level	Semester
ENG7011-D	Team Project	Core	40	7	Both
MAE7013-B	Advanced Solid Mechanics	Core	20	7	1
ENM7005-B	Modelling and Optimisation	Core	20	7	1
ENB7007-B	Risk Assessment and Management	Option	20	7	2
CPE7012-B	Polymer and Materials Engineering	Option	20	7	2
MAE7030-B	Vehicular Powertrain and Dynamics	Option	20	7	2
MAE7031-B	Automotive Tribology and Noise, Vibration and Harshness	Option	20	7	2

At the end of Stage 4 (level 7), students will be eligible for the award of Degree of Master in Engineering if they have successfully completed at least 480 credits and achieved the award learning outcomes.

### Placement and/or Study Abroad

This programme provides the option for students to undertake a work placement or period of study abroad prior to their penultimate year. Students wishing to take this option will be registered for or transferred to the placement year/sandwich programme.

- On successful completion of the ENG5002-Z, placement, students will be eligible for the award of University Diploma of Industrial Studies.
- On successful completion of the ENG5004-Z, study abroad experience, students will be eligible for the award of University Diploma of Industrial Studies (International).

For further information about study abroad opportunities please refer to <https://www.bradford.ac.uk/study/abroad>.

## **Learning and Teaching Strategy**

The teaching and learning strategy takes into consideration the learning outcomes that need to be achieved, progression through the levels of study, and the nature of the subject. One of the goals of Higher Education is that students develop lifelong learning skills and are increasingly able 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, mechanical engineering 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 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 be involved in project work from the start of their time with us and these projects will become more complex and challenging as their skills and knowledge develop. Students will also design equipment and procedures and use control and measuring techniques in a supportive and collaborative environment with their supervisors.

## **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 they 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 to give students feedback during their learning. This feedback is designed to help and guide their 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 written examinations which may be closed or open book. 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 BEng routes conform to the standard University Undergraduate Assessment Regulations which are available at the link below: [www.bradford.ac.uk/regulations](http://www.bradford.ac.uk/regulations). The following variations to these regulations apply for the MEng routes:

- To remain on the MEng programme, a stage progression average of 50% or above must be obtained.
- The MEng is a single classified award. The overall MEng award average is calculated from the weighted averages of Stage 2, 3 and 4 as follows; Stage 2 10%, Stage 3 40% and Stage 4 50%.
- If the MEng requirements are not met, but the University's undergraduate regulations are complied with, then a BEng will be awarded.

## 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.

The minimum entry requirements for the programme are as follows:

- GCSE English and Maths minimum grade C or grade 4.
- Applicants whose first language is not English must achieve a minimum IELTS score of 6.0 or its equivalent in another recognised test.

A typical offer to someone seeking entry through the UCAS scheme would be UCAS points 112 with Mathematics studied at A levels minimum grade C (or possibly AS Maths + a science A level minimum grade C). On completion of a UCAS form students will be invited to the Faculty for an Open Day where they will have the opportunity to meet staff, view the facilities and discuss “the Bradford experience” with current students.

The UCAS tariff applicable may vary and is published here:

<https://www.bradford.ac.uk/courses/ug/mechanical-engineering-meng/>. This link provides admission information relevant to the current recruitment cycle and therefore may be different to when this document was originally published.

## 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 Number	Brief description of Modification	Date of Approval (Faculty Board)
1	Minor updates to module titles and study periods Removal of optional module ENB7008-B Supply Chain Management and Production	March 2020
2	Specification reformatted and made accessible	October 2020
3	Annual changes for 2021 academic year	June 2021