

Academic Year:	2018-19
Degree Awarding Body:	University of Bradford
Partner(s), delivery organisation or support provider (if appropriate):	
Final and interim award(s):	<p>MEng (Honours) [Framework for Higher Education Qualifications (FHEQ) level 7]</p> <p>BEng (Honours) [Framework for Higher Education Qualifications (FHEQ) level 6]</p> <p>BEng (Ordinary) [Framework for Higher Education Qualifications (FHEQ) level 6]</p> <p>Diploma of Higher Education [Framework for Higher Education Qualifications (FHEQ) level 5]</p> <p>Certificate of Higher Education [Framework for Higher Education Qualifications (FHEQ) level 4]</p>
Programme accredited by (if appropriate):	Joint Board of Moderators (JBM)
Programme duration:	<p>BEng: 3 years full time, 4 years full time sandwich</p> <p>MEng: 4 years full time, 5 years full time sandwich</p>
UCAS code:	H220, H221, H290 and H291
QAA Subject benchmark statement(s):	Engineering
Date of Senate Approval:	July 2014
Date last confirmed and/or minor modification approved by Faculty Board	August 2017

## **Introduction**

Civil Engineering is fundamental to the economic and social prosperity of the UK. 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. Studies 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. Our commitment to this integration is such that we strongly encourage students to undertake a 12-month industrial placement as an integral part of their degree studies. Upon graduation students will have the educational background and capacity for professional growth necessary to seek Chartered Engineer (CEng) status. The MEng (Hons) Civil and Structural Engineering is designed to develop graduates who can provide the future leadership of the profession via abilities to deal with the complexities of the industry, demonstrate originality in problem solving and accept a high level of responsibility for their own work and personal development. The ability of such an engineer is also widely appreciated by many other professions and study at Bradford may well be a stepping-stone to an alternative career in accountancy, teaching, law etc – a real foundation for life. The Joint Board of Moderators’ accreditation ensures that the MEng degree meets the highest international standards.

The Faculty of Engineering and Informatics places emphasis on both teaching and research, believing them to be mutually dependent. We have particular research strengths in Structural Engineering; Geotechnics; Sustainability; Water Engineering; Acoustics; and Computer Modelling and Design. We conduct this research jointly with many companies including Bersche-rolt, Transport Research Laboratory, AngloFelt Industries, Incommunities, Yorkshire Water, Castle Cement, and many others. The industrial input of our partners like Arup, is one of the strength the course has.

## **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, their 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. Student’s ability 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 will provide

students 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 Faculty of Engineering and Informatics places emphasis on both teaching and research, believing them to be mutually dependent. We have particular research strengths in structural engineering, geotechnics, environmental water engineering, environmental acoustics and sustainability in the built environment. Our teaching is well aligned with the research expertise of members of staff. Studies in later stages of the programme will benefit from this expertise and students will undertake individual project work in one of these areas where they will be expected to display a considerable amount of initiative. 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/interdisciplinary projects.

### **The Bradford graduate**

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 producing peer-reviewed knowledge through publications in journal articles 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. Participating in programmes of study including research that include an emphasis on application, experiential learning and real world engagement will make a major contribution to students developing 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 of the diversity of the students and staff, and that addresses attainment gaps within our student body, particularly those between BME and white students. The University holds Bronze Athena Swan accreditation from the Equality Challenge Unit. Civil Engineering Society at the University of Bradford provides a social as well as academic platform for all students and staff to socialise, interact, share experience and run extra curriculum activities.

Upon graduation students will be able to work as a Civil Engineer. They will have the capacity for professional growth to continue the path to Chartered Engineer (CEng) status. However, unlike graduates from many other universities students will have high-level professional and interpersonal skills built from learning which has been developed 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, they will be familiar with experimentation, system thinking and have a solid understanding of the business and enterprise context. 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.

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. 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, students 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 students on those first steps as an entrepreneur.

The ability of an engineer to think clearly, and logically and ethically is widely appreciated by many other professions and studies at Bradford may well be a stepping stone to many alternative careers other than Engineering. As an engineering graduate from Bradford students will have a real foundation for life and for a lifetime of learning.

## **The University**

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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 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 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 HEAR accreditation for becoming 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.

## **BEng/MEng Civil and Structural Engineering**

### **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, leadership, business and personal skills required to become professional Civil and/or Structural Engineers and in doing so, also equip them for careers in other professions.
- Provide the educational base (in compliance with UK-SPEC) to permit progression to Chartered Membership of the Institution of Civil Engineers and/or the Institution of Structural Engineers and registration with EC<sup>UK</sup> 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:

- LO1 Understand basic fundamental concepts, principles and theories underpinning engineering with knowledge in: engineering mathematics, fluid mechanics, thermodynamics, heat transfer; materials; electronics, structures, measurement, design, safety, health and environment.
- LO2 Select and correctly apply quantitative methods to analyse the performance of engineering components systems.
- LO3 Select and use appropriate & relevant materials, equipment, tools, processes, or products.
- LO4 Apply simple computational techniques to simulate and visualise the solution to specified engineering problems.
- LO5 Apply skills in problem solving, working with others, information retrieval, and effective use of general IT facilities, and communicate work to technical & non-technical audiences.
- LO6 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:

- LO7 Understand principles and theories underpinning Civil and Structural Engineering with knowledge in: structural mechanics and analysis, water engineering, soil mechanics, concrete and steel structural design and Building Information Modelling.
- LO8 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.
- LO9 Apply analytical and computational methods to solve and visualize problems in the engineering discipline and to implement appropriate action
- LO10 Apply problem-solving skills, technical knowledge & understanding to create/adapt and evaluate design solutions that are fit for purpose (inc. operation, maintenance, reliability etc.).LO11 Plan & apply safe methods of construction to semi-open Civil Engineering projects, deriving solutions that consider Health and Safety, technical, regulatory, and client requirements.
- LO12 Apply relevant practical and laboratory skills to obtain accurate data to evaluate performance and/or validate models.
- LO13 Work effectively as a specialist within in a multidisciplinary team towards a shared objective.

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

- LO14 Systematically appreciate the key aspects of their field of study, including acquisition of coherent and detailed knowledge informed by aspects of Civil Engineering, materials, geotechnics, structures and design.
- LO15 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 & solution of engineering problems.
- LO16 Select, apply and effectively integrate knowledge of other engineering disciplines to support study and evaluation of the engineering discipline.
- LO17 Apply principles of organisation & management (project management, change management, health & safety, self-management) to achieve engineering objectives.

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

- LO18 Demonstrate knowledge and understanding of the engineering principles underpinning advanced concrete, steel and composite structural design, geotechnics, sustainability in the built environment within the context of construction and detailed and conceptual design.
- LO19 Apply engineering principles to critically analyse problems to create innovative process & product designs, with systematic appreciation of key aspects of field of study, including acquisition of coherent and detailed knowledge informed by characteristics of the civil and structural engineering discipline.
- LO20 Plan and implement an individual programme of work, monitoring & 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 & professional development to improve their performance.
- LO21 Describe and work effectively and collaboratively in different roles within a team, and evidence responsibility of engineers to consider environmental & socio-economic aspects in the development of sustainable solutions.
- LO22 Use appropriate discipline software packages in the modelling, simulation, analysis, design, and critical performance evaluation of composite engineering systems in the discipline.
- LO23 Correctly identify and use codes of practice and industry standards.

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

- LO25 Demonstrate a comprehensive knowledge and understanding of the engineering principles underpinning civil and structural engineering including geotechnics, structural dynamics and earthquake engineering, construction management, water and wastewater engineering within the context of construction.
- LO26 Apply and critically evaluate comprehensive integrated or systems approaches to engineering problems through know-how of relevant discipline concepts, theories, & technologies and their application, with ability to work with technical uncertainty.

- LO27 Apply engineering tools and research methodology to the critical analysis of complex and multi-disciplinary problems in order to create innovative designs and solutions.
- LO28 Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous & creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal.
- LO29 Extract & evaluate pertinent data and apply engineering analysis techniques to solve unfamiliar problems, and communicate outcomes by a range of advanced techniques.
- LO30 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

### Stage 1

FHEQ Level	Module Title	Type (Core/option/elective)	Credits	Semester (s)	Module Code
4	Design, Build and Test	C	20	1, 2	ENG4006-B
4	Mathematical Methods and Applications	C	20	1, 2	ENM4004-B
4	Electronics and Mechanics	C	20	1	ELE4013-B
4	Engineering Materials	C	20	1	ENG4007-B
4	Computer Aided Engineering	C	20	2	ENB4002-B
4	Thermofluids	C	20	2	ENG4008-B

At the end of stage 1, 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

FHEQ Level	Module Title	Type (Core/option/elective)	Credits	Semester (s)	Module Code
5	Further Mathematics and Statistics	C	20	1, 2	ENM5005-B
5	Design of Steel & Concrete Structures	C	20	1, 2	CSE5012-B
5	Water Engineering	C	20	1, 2	CSE5013-B



5	Soil Mechanics	C	20	1, 2	CSE5009-B
5	Structural Mechanics and Analysis	C	20	1	CSE5011-B
5	Structural Design Project	C	20	2	CSE5014-B

At the end of stage 2, 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

FHEQ Level	Module Title	Type (Core/option/elective)	Credits	Semester (s)	Module Code
6	Advanced Steel and Concrete Design	C	20	1,2	CSE6011-B
6	Feasibility Study	C	20	1	CSE6003-B
6	Geotechnical and Civil Engineering Design	C	20	1, 2	CSE6009-B
6	Sustainability in the Built Environment	C	20	1	CSE6010-B
6	Individual Research Project (Civil and Structural Engineering)	C	20	2	CSE6012-B
6	Transportation Studies	O	20	2	CSE6013-B
6	Sustainable Energy	O	20	2	ENG6005-B
6	Project Management and Six Sigma	O	20	2	ENB6010-B

Students will be eligible for the award of BEng Degree if they have successfully completed at least 360 credits and achieved the award learning outcomes.

### Stage 4

FHEQ Level	Module Title	Type (Core/option/elective)	Credits	Semester (s)	Module Code
7	Advanced Final Year Project	C	40	1, 2	CSE7011-D
7	Advanced Geotechnics	C	20	1	CSE7009-B
7	Construction Management	C	20	1	CSE7008-B

7	Water and Waste Water Treatment	O	20	2	CSE7013-B
7	Computational Fluid Dynamics and Finite Element Analysis	O	20	2	CSE7012-B
7	Structural Dynamics & Earthquake Engineering	O	20	2	CSE7010-B
7	Supply Chain Management and Production	O	20	2	ENB7008-B
7	Risk Assessment and Management	O	20	2	ENB7007-B

Students will be eligible for the award of MEng Degree if they have successfully completed at least 480 credits and achieved the award learning outcomes.

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

### Placement and/or Study Abroad

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

On successful completion of the ENG5002-Z, placement, students will be eligible for the award of University Diploma Industrial Studies.

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

For further information about study abroad opportunities please refer to <http://www.bradford.ac.uk/international/erasmus-and-international-exchanges/>

### 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, civil and structural 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 Professors and external guest speakers), but these will always be interactive and two-way. We

want to develop their 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 design projects, case studies, practical demonstrations, and provide lots of opportunities for them to design their own solutions. In each stage, students will work in a team to perform a design exercise that varies in the degree of complexity and challenge but appropriate to their stage. Several opportunities are offered for students to work alongside with researchers on externally funded research project and PhD projects.

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 **C**onceive potential solutions, **D**esign new-products, structures, processes or services, **I**mplement (or model) and test those designs, and **O**perate 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 use control and measuring techniques in a supportive and collaborative environment with their supervisors.

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 to 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 skills 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 their learning. All the modules will have some formative assessment and this may be in various forms including guidance, discussions or questioning from their 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 and class test. Nevertheless, many of the assessments will be tailored to the most efficient ways for assessing 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 the 'Design Project' work.

### Assessment Regulations

This Programme conforms to the standard University Undergraduate Regulations which are available at the link below

<http://www.bradford.ac.uk/aqpo/ordinances-and-regulations/>

To progress from stages 2 to 3 and 3 to 4 of 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

The University welcomes applications from all potential students and most important in the decision to offer a place is our assessment of a candidate's potential to benefit from their studies and of their ability to succeed on this particular programme. Consideration of applications will be based on a combination of formal academic qualifications and other relevant experience.

The **minimum** entry requirements for the programme are as follows:

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). On completion of a UCAS form students will be invited to the School for an Open Day where they will have the opportunity to meet staff, view the facilities and discuss "the Bradford experience" with current students. Further entry requirements are as below:

- To include 64 points from 2 A levels to inc. Maths minimum grade C (or possibly AS Maths + a science A level minimum grade C).
- GCSE English and Maths minimum grade C or grade 4.
- Minimum IELTS at 6.0 or the equivalent.

The UCAS **tariff** applicable may vary and is published here

<http://www.bradford.ac.uk/study/courses/info/civil-and-structural-engineering-meng-4-years>

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. We are continually reviewing and developing our practices and policies to make the University more inclusive, but if students are disabled we may need to make some adjustments to make sure that they are not disadvantaged. We would advise students to contact the programme leader before they apply to discuss these.

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

### **Recognition of Prior Learning**

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**

<b>Version Number</b>	<b>Brief description of Modification</b>	<b>Date of Approval (Faculty Board)</b>
1	Programme Specification written on new template	
2	Waivers	