UNIVERSITY of BRADFORD

**Faculty of Engineering and Informatics**

# MSc Advanced Civil and Structural Engineering Programme Specification

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| Academic Year: | 2020-21 |
| Degree Awarding Body: | University of Bradford |
| Final and interim award(s): | [Framework for Higher Education Qualifications (FHEQ) level 7]<br>MSc Advanced Civil and Structural Engineering<br>MSc Engineering (Civil and Structural)<br>Postgraduate Diploma Advanced Civil and Structural Engineering<br>Postgraduate Certificate Advanced Civil and Structural Engineering |
| Programme accredited by (if appropriate): | Joint Board of Moderators (JBM) |
| Programme duration: | 1 year full time<br>September intake (12 months)<br>January intake (12 months) |
| QAA Subject benchmark statement(s): | Engineering |
| Date last confirmed and/or minor modification approved by Faculty Board | March 2020; September 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

Civil engineering is a strategically important profession for both developed and developing countries. With creativity and technical skills, civil engineers plan, design construct, maintain and operate infrastructure facilities essential to modern life, ranging from

bridges and highways to water and wastewater treatment facilities and buildings. Civil engineering is a broad field that spans a number of branches including subjects such as Structural Engineering, Water Resources Engineering, Environmental Engineering, Transportation Engineering and Geotechnical Engineering. As countries develop, and their population's increase, and as environmental concerns mount, civil engineering skills will be increasingly needed throughout the world. Meeting the challenges of providing housing and buildings, infrastructure to control pollution, transportation links, drinking water and energy needs, urban redevelopment and community planning are few examples of the problems civil engineers solve. Civil engineering offers several career choices, ranging from design, construction, research, planning, teaching, to management. The branch of structural engineering is concerned with the structural design and analysis of buildings, bridges, and other structures. This involves calculating the stresses and forces that act upon or arise within a structure, and designing the structure to successfully resist those forces and stresses. Resistance to wind and seismic loadings, especially performance near resonant frequencies, which affect the overall stability of a structure are major design concerns. Other factors such as durability and cost are also considered. In addition to design of new buildings, structural engineers may design a seismic retrofit for an existing structure to mitigate undesirable performance during earthquakes. Most civil and structural engineers today deal with power plants, bridges, roads, railways, structures, water supply, irrigation, the natural environment, sewer, flood control, transportation and traffic. Civil and structural engineering aims to improve and maintain the built and natural environment with best use of resources to enhance the quality of life for present and future generations. They contribute with their knowledge to designing, building, maintaining, repair or refurbishing sustainable developments. Those entering the civil engineering field are increasingly required to continue their education long after bachelor's graduation and are required to increase their knowledge base to remain competitive. Thus this MSc programme at the University of Bradford is designed to provide advanced civil and structural engineering education to meet the aspirations of students' needs. The programme is designed in a way to address a balanced curriculum between advanced technical and design skills, and research skills with a strong sustainability thread. Optional modules are also included to offer students more choices and meet their interests and needs in civil and structural engineering. The programme is accredited by the Joint Board of Moderators (JBM) as meeting the requirements for Further Learning for a Chartered Engineer, and as a technical MSc for holders of an IEng degree.

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.

With reference to teaching and learning, the Faculty of Engineering and Informatics 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. It achieves this aim by:

Providing 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.

## 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 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. Students 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.

## Programme Aims

The aim of the MSc programme are to:

Provide students with the advanced theoretical knowledge, concepts and skills necessary for original thought and problem analysis related to civil and structural engineering.

Equip students with deepened academic and technical skills necessary to integrate their knowledge and understanding to solve a range of complex engineering problems.

Enable students to carry out independently, but under supervision, a specific research project in civil and structural engineering.

Provide those possessing an undergraduate degree, the Further Learning educational requirements (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/or the Institution of Highways and Transportation, and registration with the Engineering Council (UK) as a Chartered Engineer.

## Programme Learning Outcomes

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

LO1 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.

LO2 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.

LO3 Evidence advanced level knowledge and understanding of a wide range of engineering materials and components.

LO4 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.

LO5 Work effectively in a team in order to meet shared objectives.

LO6 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:

LO7 Evidence understanding and critical evaluation of concepts relevant to discipline including advanced structural design, geotechnics, construction management and water engineering, some from outside engineering, and apply them effectively (including in engineering projects).

LO8 Integrate engineering knowledge and insight to investigate new and emerging technologies, applying professional judgements to balance risks, cost, benefits, safety, reliability and environmental impact.

LO9 Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.

LO10 Use software packages in the advanced analysis, design, evaluation, and optimisation of complex engineering systems.

LO11 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.

LO12 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:

LO13 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

| FHEQ Level | Module Code | Module Title | Type | Credits | Semester | Sept Intake | Jan Intake |
|---|---|---|---|---|---|---|---|
| 7 | CSE7009-B | Advanced Geotechnics | C | 20 | 1 | Sept-Jan 2020-21 | Sept- Jan 2021-22 |
| 7 | CSE7015-B | Advanced Structural Analysis and Earthquake Engineering | O | 20 | 1 | Sept-Jan 2021-21 | Sept-Jan 2021-22 |

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|---|---|---|---|---|---|---|---|
| 7 | COS7006-B | Big Data Systems and Analytics | O | 20 | 1 | Sept-Jan 2020-21 | Sept- Jan 2021-22 |
| 7 | ENB7008-B | Supply Chain Management and Production | O | 20 | 1 | Sept-Jan 2020-21 | Sept- Jan 2021-22 |

| FHEQ Level | Module Code | Module Title | Type | Credits | Semester | Sept Intake | Jan Intake |
|---|---|---|---|---|---|---|---|
| 7 | CSE7014-B | Advanced Structural Design | C | 20 | 2 | Jan – May 2021 | Jan – May 2021 |
| 7 | CSE7013-B | Water and Waste Water Treatment | C | 20 | 2 | Jan – May 2021 | Jan – May 2021 |
| 7 | CSE7012-B | Computational Fluid Dynamics and Finite Element Methods | O | 20 | 2 | Jan – May 2021 | Jan – May 2021 |
| 7 | ENB7007-B | Risk Assessment and Management | O | 20 | 2 | Jan – May 2021 | Jan – May 2021 |
| 7 | CSE7008-B | Construction Management | O | 20 | 2 | Jan - May 2021 | Jan – May 2021 |

| FHEQ Level | Module Code | Module Title | Type | Credits | Semester | Sept Intake | Jan Intake |
|---|---|---|---|---|---|---|---|
| 7 | ENG7002-E | MSc Project | C | 60 | 1,2,3 | September 2020 – Sept 2021 | January 2021- January 2022 |

To be eligible for the award of Postgraduate Certificate at FHEQ level 7 students will have successfully completed 60 credits and achieved the award learning outcomes.

To be eligible for the award of Postgraduate Diploma at FHEQ level 7, students will have successfully completed 120 credits and achieved the award learning outcomes.

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

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

## 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, civil 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. Due to Covid-19, for many modules, the teaching and learning methods include a combination of online lectures/tutorials and seminars (synchronous or asynchronous), and workshop events etc.

Study with us will include formal lectures (including those from Visiting Professor and guest speakers), but these will always be interactive and two way. 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. The PG/Dip students will operate analytical instruments, 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. 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.

## 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 skills and knowledge. There are two forms of

assessment formative and summative assessments. Formative assessment 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 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. 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 project work.

## Assessment Regulations

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

To gain an accredited MSc 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 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 MSc will be awarded, MSc Engineering (Civil and Structural).

## 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 standard entry requirements for the programme are as follows:

In addition to satisfying the general admissions requirements of the University of Bradford, students must have a first degree in relevant discipline; normally a Second-class Honours degree or equivalent in Science, Engineering, or Technology. Candidates who do not fulfil the normal entry requirements but have extensive industrial experience in Civil and Structural Engineering are considered on an individual basis. Those applicants seeking to

use this MSc, accredited by the JBM, as Further Learning to satisfy the educational base requirements for chartership must also be in possession of an appropriate UG accredited degree.

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

| Version Number | Brief description of Modification | Date of Approval (Faculty Board) |
|---|---|---|
| 1 | New approved curriculum, waivers | April 2018 |
| 2 | Addition of curriculum for January entry | December 2018 |
| 3 | Additional core module | March 2019 |
| 4 | Changing delivery of ENB7008-B from Semester 2 to Semester 1<br>Changing the module COS7006-B from core to optional<br>Changing MSc project timeline for January entry students<br>Construction Management CSE7008-B will move from Semester 1 to Semester 2 and will become optional instead of core<br>Structural Dynamics and Earthquake Engineering CSE7010-B will be removed from the programme and replaced with the module Advanced Structural Analysis and Earthquake Engineering, to be offered as an optional module in Semester 1 | March 2020 |
| 5 | Specification reformatted and made accessible | December 2020 |