UNIVERSITY of BRADFORD

Faculty of Engineering and Informatics

BEng Chemical Engineering (with Integrated Foundation Year) Programme Specification

Academic Year	2020/2021
Degree Awarding Body	University of Bradford
Final and interim award(s) Framework for Higher Education Qualifications (FHEQ)	BEng (Honours) Chemical Engineering BEng Chemical Engineering [FHEQ level 6] Diploma of Higher Education (DipHE) Chemical Engineering [FHEQ level 5] Certificate of Higher Education (CertHE) Chemical Engineering [FHEQ level 4] Certificate of Engineering Foundation Studies [Qualifications and Credit Framework (QCF) /National Qualification and Credit Framework (NQF) Level 3]
Programme accredited by (if appropriate)	IChemE Accreditation currently being sought from IChemE
Programme duration	BEng: 4 years with integrated FY full-time 5 years with integrated FY full-time and placement year
UCAS code(s) / HECoS	100143 BEng 4 years with integrated FY 100143 BEng 5 years with integrated FY and placement year
QAA Subject benchmark statement(s)	Engineering
Date last confirmed and/or minor modification approved by Faculty Board	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

Chemical Engineering is fundamental to economic and social prosperity. It is the profession responsible for the creation of all material objects and systems necessary for modern life from concept to customer to decommissioning. The modern society relies on the work of Chemical Engineers who develop and design the processes that make the useful products for the society by efficient use and management of resources including oil and gas, water and energy while controlling health and safety procedures and protecting the environment.

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, which may include working towards Chartered Engineer (CEng) status. The BEng fully meets the exemplifying academic benchmark requirements for registration as an Incorporated Engineer (IEng). To achieve CEng status students will also need to complete accredited further learning at FHEQ Level 7 (such as a one-year accredited MSc) plus a period of postgraduate professional development in industry.

Studies 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. The course will provide students with essential tools based on the concept of sustainability and low carbon footprint for changing raw materials into useful products in a safe and cost-effective way. As a qualified Chemical Engineer students will understand how to alter the chemical, biochemical or physical state of a substance, to create everything from health care products (face creams, shampoo, perfume, drugs) to food (dairy products, cereals, agro-chemicals) and water (desalination for freshwater) to energy (petroleum to nuclear fuels). An excellent way to develop these skills is to undertake an industrial placement as an integral part of the degree studies.

The programme 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. IChemE accreditation ensures that the programme meets the highest international standards.

Designed for the next generation of engineers

This integrated programme has been designed as part of the CDIO educational framework for producing the next generation of engineers, the T-shaped professional with deep knowledge in a system/discipline plus broad transferrable competencies. This provides a learning experience that emphasises engineering fundamentals set within a context of Conceiving-Designing-Implementing-Operating (CDIO) real-world systems and products. The CDIO framework has been developed by universities across the globe and benefits from ongoing collaborative experience of engineers and educationalists. This means that student 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 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 programme to encourage and experience interdisciplinary working, to develop breadth as well as depth of skills and knowledge, and through this we believe that students will be ideally equipped to be successful and employable.

All students begin with the Engineering Foundation Year (Stage 0) that is designed to give students the necessary baseline knowledge and skills to continue their education in our Engineering undergraduate programmes.

Students begin their engineering journey with an interdisciplinary year to ensure 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, specific projects that they work on with students in their discipline, and a final project that will be an interdisciplinary project working with a range of students 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 polymers, coating, applied rheology and materials engineering (including the creation of complex components from powders, composites, and polymers). We draw our research strengths from the combined expertise of the IRC (Interdisciplinary Research Council) in Polymer Science and Technology, the Centre for Industrial Collaboration (CIC) in Polymer Engineering and the Engineering Materials Research Unit and this informs our undergraduate programmes. 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 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

Upon graduation students will be able to work as a (a) Projects Engineer, (b) Design Engineer, (c) Operations Engineer, or (d) Research and Development Engineer (R&D) in Chemical/Petroleum/Food and Pharmaceutical/Water Industries. Student will have the capacity for professional growth to continue the path towards Chartered Engineer (CEng) status. Students will develop high-level professional and interpersonal skills gained from learning through a team-based environment, and an education where they have spent 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, will be familiar with experimentation and systems thinking, and will have a solid understanding of the business and enterprise contexts.

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 becoming 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 students 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.

Students could pursue a research career. They will have highly developed research skills and their personal tutor can help them to identify postgraduate research opportunities here at Bradford.

Students may wish 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 significant 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 ability of an engineer to think clearly, logically, and ethically is widely appreciated by many other professions, and studying 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.

Accreditation aims to ensure that the BEng degree meets the highest international standards.

The University

The University of Bradford has four strategic objectives: excellence, sustainability, internationalisation, and equality and diversity. We believe in doing research and teaching to deliver career opportunities for our students as well as for economic development and job creation.

In the Faculty we strongly believe that our programmes subscribe to these four objectives through three key themes of the University's 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.

Academic staff at Bradford are active researchers in their fields of expertise, developing new knowledge and 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 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 holds the 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 accreditation for being a course student representative, by becoming a student ambassador, by helping with open days and applicant experience days, or by being a PAL leader. In the Peer Assisted learning Scheme (PAL) 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 and we recognise their contribution through 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 towards becoming professional Chemical 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 IChemE 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 UKSPEC requirements of an accredited programme.

Programme Learning Outcomes

To be eligible for the award of Certificate of Foundation Studies at QCF/NQF Level 3, students will be able to:

LO0.1 Demonstrate knowledge and understanding of mathematics, mechanics, physics, materials and chemistry to an appropriate standard to allow students to engage with an accredited engineering programme.

LO0.2 Develop knowledge and skills in the use of computers for word processing, report writing, data processing, power-point presentation, Computer Aided Design; numerical methods for simple modelling and analysing engineering problems relevant to their chosen specialism; selection and application of principles and data collection & manipulation methods to support problem solving; undertake and report on an investigation.

LO0.3 Demonstrate knowledge and skills in data management and presentation, IT and communication skills, systematic problem solving, lifelong learning, scientific method, teamwork, and personal management.

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

LO1.1 Select and apply physical principles to describe fundamental engineering processes.

LO1.2 Select and correctly apply quantitative methods to analyse the performance of engineering components systems.

LO1.3 Select and use appropriate and relevant materials, equipment, tools, processes, or products.

LO1.4 Apply simple computational techniques to simulate and visualise the solution to specified engineering problems.

LO1.5 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.

LO1.6 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:

LO2.1 Understand the essential concepts, principles, and theories of Chemical Engineering.

LO2.2 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.

LO2.3 Apply analytical and computational methods to solve and visualize problems in the engineering discipline and to implement appropriate action.

LO2.4 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.).

LO2.5 Apply relevant practical and laboratory skills to obtain accurate data to evaluate system performance and/or validate system models.

LO2.6 Plan and apply safe methods of construction and manufacture to semi-open projects, deriving solutions that consider technical, regulatory, and client requirements.

LO2.7 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:

LO3.1 Generate innovative designs for products, systems, components or processes to fulfil new needs.

LO3.2 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.

LO3.3 Select, apply and effectively integrate knowledge of other engineering disciplines to support study and evaluation of the engineering discipline.

LO3.4 Apply principles of organisation and management (project management, change management, health and 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:

LO3.5 Demonstrate knowledge and understanding of the concepts, principles, and theories underpinning Chemical Engineering.

LO3.6 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.

LO3.7 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.

LO3.8 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.

LO3.9 Use appropriate discipline software packages in the modelling, simulation, analysis, design, and critical performance evaluation of composite engineering systems in the discipline.

LO3.10 Correctly identify and use codes of practice and industry standards.

Curriculum Structure

A map of the curriculum that students will study is detailed in the tables below that show core (C) and optional (O) modules. Each year (or stage) of a programme comprises 2

semesters with 60 credits being studied in each semester. Some modules have teaching and assessment that occurs in both semesters.

Stage 0 [Level 3]

Module Code	Module Title	Type	Credits	Level	Study Period
ENM3001-B	Foundation Mathematics 1	C	20	3	1
ENM3002-B	Foundation Mathematics 2	C	20	3	2
MAE3001-B	Foundation Mechanics	C	20	3	1, 2
MAE3002-B	Foundation Physics	C	20	3	1, 2
MAE3003-B	Fundamentals of Materials	C	20	3	1, 2
ENB3001-B	Information & Communication Technology	C*	20	3	1, 2
ENB3002-B	Academic Reading and Writing	C*	20	3	1, 2

Important note: C*. For Home students ENB3001-B is compulsory. For Overseas students ENB3002-B is compulsory. However, subject to timetabling restrictions, Overseas students are permitted to attend ICT lectures but are not required to be assessed in this subject.

Mathematics, Mechanics, and Physics are studied to A2 level, and Fundamentals of Materials to AS level. There is a 20-credit module designed to introduce students to the use of Information and Communication Technologies within the context of the Engineering profession. The year features practical elements where students spend time in laboratories to conduct experiments on engineering applications. Students will be able to develop awareness of the breadth of opportunities and challenges posed by engineering and the exciting possibilities for their career development.

At the end of Stage 0 (level 3) students will be eligible to exit with the award of Certificate of Foundation Studies if they have successfully completed 120 Level 3 QCF/NQF credits and achieved the specified learning outcomes.

Stage 1 [Level 4]

Module Code	Module Title	Type	Credits	Level	Study period
CPE4001-B	Design, Build and Test (Chemical Engineering)	C	20	4	1, 2
ENM4004-B	Mathematical Methods and Applications	C	20	4	1, 2
ELE4013-B	Electronics and Mechanics	C	20	4	1, 2
ENG4007-B	Engineering Materials	C	20	4	1
ENG4008-B	Thermofluids 1	C	20	4	2
ENB4002-B	Computer Aided Engineering	C	20	4	1, 2

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	Study period
ENM5005-B	Further Mathematics and Statistics	C	20	5	1, 2

CPE5004-B	Mass Transfer Operations	C	20	5	1, 2
CPE5005-B	Reaction Engineering	C	20	5	1, 2
CHE5001-B	Chemistry for Engineers	C	20	5	1, 2
CPE5008-B	Transport Processes	C	20	5	1, 2
CPE5004-B	Engineering and Chemical Thermodynamics	C	20	5	1, 2

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	Study period
CPE6007-D	Chemical Engineering Design Project	C	40	6	1,2
CPE6008-B	Control Engineering	C	20	6	1
CPE6005-B	Process Design	C	20	6	1
ENB6009-B	Reliability and Safety Engineering	C	20	6	2
ENG6005-B	Sustainable Energy	O	20	6	2
ENB6010-B	Project Management and Six Sigma	O	20	6	2
CPE6006-B	Petroleum Engineering	O	20	6	2

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

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

Placement

This programme provides the option for students to undertake a work placement prior to their penultimate year. 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.

Learning, Teaching and Assessment Strategy

Stage 0: students will experience a wide range of teaching and learning environments. Concepts, principles and theories are typically explored in formal lectures, practised in tutorials, and demonstrated in laboratory classes. Practical skills are developed in laboratories. Cognitive and personal skills are developed in more open-ended problem solving and design exercises, often tackled by working in small groups supported by members of academic, technical, and library staff. Project work is used to bring various aspects of the programme together.

Typically, each module will involve students in 72 hours of scheduled contact except Mathematics for which students will have 96 hours of scheduled contact for each module. An expected weekly attendance commitment will be around 21 hours.

Stage 1 onwards: the teaching and learning strategy accounts for 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 (become independent learners) 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 and 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 Lecturers), that will be interactive and two way. We want you 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 use 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 to prepare students for the world of work, our curriculum has been developed using the CDIO framework. This means that our learning strategy is 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 and 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. At Levels 5 and 6 students will engage with practical work on civil and structural engineering in a purpose-built laboratory. Students will design equipment and procedures and use control and measuring techniques in a supportive and collaborative environment with their supervisors.

The University of Bradford is known for attracting students from a wide variety of backgrounds, experiences and countries, and encourages and supports women in engineering. Female staff and students are an integral part of the Faculty of Engineering and Informatics. The University's modus operandi, Making Knowledge Work, is embedded in the philosophy of this programme.

Assessment Strategy

To support our teaching and learning strategy (designed to prepare students for the world of work, academic research or entrepreneurship), our assessment methods incorporate a range of different methods designed to meet the needs of industry and accrediting bodies, as well as to prepare students for a potential research career.

Assessment is a key part of the learning process. It is only through challenging themselves to express what they have learned or to put it to practical use, that students can complete the learning journey and assess for themselves if they have understood what they have been taught and are able to apply and use the skills and knowledge.

We use two forms of assessment. Formative assessment provides an opportunity for our staff will give students feedback during their learning. This feedback is designed to help and guide learning. All modules have some formative assessment, and this may be in various forms including discussions and questioning from the supervisor, tests, practical activities, etc. Formative activities are crucial if students are to make best use of their learning experience and they are designed to prepare students for summative assessment. Summative assessment is how we grade the work on a module. Details of this assessment are available from the beginning of the module so that students can understand how the module grade will be determined.

A key method of assessment (common on all professional engineering degree programmes) is by formal written examination. 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 laboratory work linked to the taught modules. Methods of assessment for transferable skills are built into the structure of examinations, case studies, laboratory demonstrations, and project work.

Assessment Regulations

The Programme conforms to the standard University Assessment Regulations which are available at the link below: https://www.bradford.ac.uk/regulations/

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 72 UCAS points, a minimum of GCSE Maths grade B/grade 6 and GCSE English grade D/grade 3 (equivalents accepted) although having post GCSE Maths and/or Physics (A level) would be an advantage.

On completion of a UCAS form potential students will be invited to the School for an Experience Day when 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 the programme details are published at:

http://www.bradford.ac.uk/study/courses/info/engineering-with-foundation-year-beng

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

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, then they may wish to contact the Programme Leader before they apply.

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.

Minor Modification Schedule

Version No.	Brief Description of Modification	Date of Approval (Faculty Board)
2	Specification reformatted and made accessible	December 2020