

MSc Advanced Chemical and Petroleum Engineering Programme Specification

<https://www.bradford.ac.uk/courses/pg/advanced-chemical-and-petroleum-engineering/>

Academic Year: 2021/22

Degree Awarding Body: The University of Bradford

Target award [Framework for Higher Education Qualifications (FHEQ) Level 7]:

Degree of Master of Science in Advanced Chemical and Petroleum Engineering

Exit and interim awards [FHEQ Level 7]:

Degree of Master of Science in Engineering (Chemical); Postgraduate Diploma; Postgraduate Certificate.

Programme duration: 1 year full-time

Programme accredited by: IChemE – Institution of Chemical Engineers (target award only)

External benchmark: QAA Subject Benchmark Statement for Masters degrees in Engineering (2016, 2010)

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.

Minor Modification Schedule

1. March 2018: New curriculum
2. March 2019: CPE7013-B Oil and Gas Management module added as option
3. December 2020: Admissions text updated, specification reformatted and made accessible. Updated January intake details.
4. June 2021: Requirements for entry for non-chemical engineers. Inclusion of module (Process Design) for non-chemical Engineering entrants. Introduction, Admissions and Study Abroad text updated.

Introduction

Chemical Engineers develop and design the processes to make everything the modern society needs: from advanced polymeric materials (packaging, electrical goods, electronics, automotive, aircrafts) to 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). They do this by efficient use and management of resources including oil and gas, water and energy while controlling health and safety procedures and protecting the environment.

Chemical engineers are concerned with small and large-scale chemical and biochemical processes in which materials undergo change. In practice, this may mean anything from a relatively small batch production of a drug to the massive scale of equipment needed to turn seawater to freshwater, natural gas to agrochemicals etc. by applying advanced reaction and separation processes. The complexity of the oil and gas industry offers a wide variety of opportunities for career development in the petrochemical industries. Further, engineering new materials with advanced properties is at the heart of the new technological drive of this century. Electronic Polymers, Biomaterials, Nanocomposites, and

"Smart" Materials are examples of new material developments where the technological applications and impact on society are enormous.

The impact of Chemical Engineering in the 21st century is set out in the Chemical Engineering Matters report¹ which identifies Water, Energy, Food & Nutrition, Health & Wellbeing, as the four key areas where Chemical Engineering can make a positive impact on the quality of life and help produce a more sustainable future. The MSc in Advanced Chemical and Petroleum Engineering curriculum addresses aspects of these four challenge areas and the related topics of process design, optimisation, safety and risk management. This programme also addresses IChemE's recommendations for incorporating aspects of climate change and new digital technologies into chemical engineering curricula.

Study at MSc level at Bradford will be a foundation for life aimed at developing a deep understanding of advanced technical principles, analytical tools and competence in their application together with a wide range of management, personal and professional skills. The Programme will provide students with essential tools based on the concept of sustainability and maintaining a low carbon footprint for changing raw materials into useful products in a safe and cost-effective way.

This MSc is an industrially relevant programme designed with the aim of producing employable Master's graduates with problem-solving skills and the ability to critically apply their knowledge and make informed judgements. The curriculum helps students develop breadth and depth of advanced technical principles, advanced engineering practice whilst taking into consideration environmental, economic, social, sustainability and ethical issues associated with the operation of industrial processes.

The programme reflects the range of research strengths in chemical engineering at the University of Bradford, which include Chemical and Petrochemical Engineering, Polymer and Advanced Materials Engineering, Energy, Desalination Technologies, Water Treatment and Pharmaceutical Engineering. It is designed smartly and provides balanced in-depth exposures to help students find their career in these areas using research-led and research-engaged learning

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.

¹ <https://www.icheme.org/knowledge/policy/chemical-engineering-matters/> (3rd edition)

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 engage in enquiry-based projects allowing learning through research. The programmes of study include research with an emphasis on application, experiential learning and real-world engagement. This will make a major contribution to students' skill sets and enhance their personal attributes for 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 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 diverse needs of our businesses and communities.

The University of Bradford is well known for attracting students from a wide variety of backgrounds, experiences and countries. The University of Bradford encourages and supports women in engineering, and the Faculty is instrumental in organising events to celebrate occasions including International Women in Engineering Day (INWED), the UN International Day of Women and Girls in Science, and International Women's Day. We are members of WISE (<https://www.wisecampaign.org.uk/>) whose long-term vision is for gender balance in STEM, and we signpost students to networking events and specific upskilling opportunities offered via the organisation.

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

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

Students can gain here 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 experienced students support undergraduate students, especially those in stage 1. 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.

The Bradford Graduate

Upon completion of the Programme students will have the capacity for meaningful interdisciplinary interaction, leadership roles, and professional growth. The Faculty places emphasis on both teaching and research. We have particular research strengths in chemical and petrochemical engineering, polymers, energy, water, pharmaceutical engineering, coating and materials engineering. We have state of the art research facilities

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

Having completed the programme, students will be able to work as any of:

- a) Project Engineer
- b) Design Engineer
- c) Operations Engineer
- d) Research and Development Engineer (R&D) in Chemical/Petroleum/Polymer/Food and Pharmaceutical Industries.

Students will have the capacity, potential and opportunity for professional growth to continue the path to Chartered Engineer (CEng) status. The ability of an engineer to think clearly and logically is widely appreciated by many other professions and studies at Bradford may well be a stepping stone to many alternative careers other than Engineering – a real foundation for life and for a lifetime of learning.

Programme Aims

The aims of the MSc programme are:

- Equip students with the theoretical knowledge, concepts and skills necessary for original thought and problems analysis related to core chemical, petroleum, water, Food and Pharmaceutical engineering fields.
- Equip students with the organisational, practical and computational skills necessary to carry out research in chemical, petroleum, water, Food and Pharmaceutical engineering fields.
- Enable students to engage in research by carrying out, under expert supervision, a specific project in chemical/petroleum/ water/Food or Pharmaceutical engineering.
- Provide bridging information to non-specialists enabling them to extend their career opportunities.

Programme Learning Outcomes

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

- PLO1 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
- PLO2 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.

- PLO3 Evidence advanced level knowledge and understanding of a wide range of engineering materials and components.
- PLO4 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.
- PLO5 Work effectively in a team in order to meet shared objectives.
- PLO6 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:

- PLO7 Evidence critical evaluation of concepts relevant to discipline, some from outside engineering, and apply them effectively (including in engineering projects).
- PLO8 Integrate engineering knowledge and insight to investigate new and emerging technologies, applying professional judgements to balance risks, cost, benefits, safety, reliability and environmental impact.
- PLO9 Evidence self-direction, independent learning, and originality of thought to generate innovative designs for products, systems, components or processes to fulfil new needs.
- PLO10 Use appropriate software packages for advanced analysis, design, evaluation, and optimisation of complex engineering systems.
- PLO11 Apply skills in problem solving, communication, information retrieval, and 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.
- PLO12 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, and 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:

- PLO13 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 solve 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

The taught element is structured in the form of 20 credit modules over the two semesters forming the academic session. It is made up of a taught element of 120 credits (60 per Semester) and an individual research project element of 60 credits. The 60 credits MSc research project is carried out throughout the year alongside the taught component in Semesters 1 and 2 and on its own during Semester 3.

The curriculum may change, subject to the University's Programme approval, monitoring and review procedures, as improvements are made each year. More detail, including learning outcomes, is available for each module in the Module Handbooks.

Semester 1 (PG Certificate)

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	Desalination Technology	Core	20	Sem 1	CPE7002-B
7	Transport Phenomena	Core	20	Sem 1	CPE7011-B
7	Process Design	Core/Option	20	Sem 1	CPE7014-B
7	Big Data Systems and Analytics	Option	20	Sem 1	COS7006-B
7	Supply Chain Management and Production	Option	20	Sem 1	ENB7008-B

Please note: For students from a non-chemical engineering background, module CPE7014-B must be selected. Students will be eligible to exit with the FHEQ Level 7 award of **Postgraduate Certificate** if they have successfully completed 60 credits and achieved the award learning outcomes.

Semester 2 (PG Diploma)

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	Food and Pharmaceutical Processes Engineering	Core	20	Sem 2	CPE7004-B
7	Upstream Production and Refinery Operations	Core	20	Sem 2	CPE7007-B
7	Oil and Gas Management	Option	20	Sem 2	CPE7013-B
7	Polymer and Materials Engineering	Option	20	Sem 2	CPE7012-B
7	Risk Assessment and Management	Option	20	Sem 2	ENB7007-B
7	Water and Wastewater Treatment	Option	20	Sem 2	CSE7013-B

Students will be eligible to exit with the FHEQ Level 7 award of **Postgraduate Diploma** if they have successfully completed 120 credits and achieved the award learning outcomes.

Research Stage (Degree of Master)

FHEQ Level	Module Title	Module Type	Credits	Study Period	Module Code
7	MSc Project	Core	60	Academic Year	ENG7002-E

Students will be eligible for the FHEQ Level 7 award of **Degree of Master in Advanced Chemical and Petroleum Engineering** if they have successfully completed 180 credits, achieved the award learning outcomes and met the additional requirements set out in the Assessment Regulations.

Learning and Teaching Strategy

The teaching and learning strategies take 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.

We want students to become great engineers; that means great analysts 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, chemical 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 and invited 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 Conceive-Design-Implement-Operate (CDIO) framework. This means that our learning strategy will be to encourage students to work in teams to Conceive potential solutions, Design new products processes or services, Implement (or model) and test those designs, and Operate the product or solution. In line with the CDIO philosophy students will have numerous opportunities to be an active learner, to work as an engineer on real-world projects. Students will operate analytical instruments, under supervision, from Semester 2 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 and the students benefit greatly from this diversity. The University of Bradford encourages and supports women in engineering. 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 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 the skills and knowledge they have learned. There are two forms of assessment; formative and summative. Formative assessment provides an opportunity for our staff to give students feedback during their learning. This feedback is designed to help and guide students learning. All the modules will have some formative assessment delivered in various forms. These formative activities are important 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.

Each assessment is tailored to the most efficient way(s) for achieving the intended learning outcomes. For example, project work is assessed on the basis of the quality of the product or system produced as part of the project. Practical tests are used to assess practical skills and written reports are used to show the depth of understanding of concepts and ideas. Practical skills are often assessed via individual and group technical reports commensurate with associated laboratory work for given modules. The methods of assessment of transferable skills are built in the structure of the examinations, case studies, laboratory demonstrations and project work.

Assessment Regulations

Whilst this Programme conforms to the general principles set out in the standard University Taught Postgraduate Regulations which are available at the link <https://www.bradford.ac.uk/regulations/> the following exceptions apply:

- 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 otherwise complied with, then a non-accredited degree will be awarded with the title of MSc Engineering (Chemical).

Study Abroad

This programme is not eligible for Study Abroad Semester international opportunities. For details of post-study work opportunities and short summer programmes, visit the International Opportunities website: <https://www.brad.ac.uk/exchanges/current-students/>

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.

Academic

We specifically require that applicants to MSc Advanced Chemical and Petroleum Engineering who hold a Chemical Engineering undergraduate degree (e.g. Bachelor with Honours) do so with a 2:2 (lower second) classification, or above or equivalent.

Applicants without Chemical Engineering will need a 2:1 (upper second) classified undergraduate degree in Petroleum, Pharmaceutical, Food, Energy, Water and Nuclear engineering, or Applied Chemistry or Physics or equivalent.

Please note: These requirements are correct for the contemporary recruitment cycle and may be different when you are reading this document. The current tariff is published on the course website:

<https://www.bradford.ac.uk/courses/pg/advanced-chemical-and-petroleum-engineering/>

International

The standard postgraduate admission requirements for international students apply for English language and numeracy. Visit <https://www.bradford.ac.uk/international/country/> for details of accepted equivalent qualifications from your country.

Access and Recognition of Prior Learning

Applications are welcome from students with non-traditional qualifications, and/or significant personal/professional experience. For this programme, **at least 5 years working experience** in chemical/petroleum/food or pharmaceutical industries would be required. These applications will be assessed on an individual basis and by interview.

The University of Bradford has always welcomed applications from disabled students. To discuss adjustments or to find out more about support and access, you may wish to contact the Disability Service before you apply at: www.bradford.ac.uk/disability/before

Applications are particularly welcomed from returners to study (those aged 25+ at the start of the programme), armed forces families, carers and care leavers, estranged or orphaned learners, refugees and asylum seekers, and Romani or Traveller families.

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. For more details visit our RPL webpage at:

<https://www.bradford.ac.uk/teaching-quality/prior-learning/>