The University Of Sheffield.

Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

Programme Details

1. Programme title	Chemical Engineering
2. Programme code	CMBU006 / CPEU02
3. QAA FHEQ level	Honours - 6
4. Faculty	Engineering
5. School	Chemical, Materials and Biological Engineering
6. Other Schools providing credit bearing modules for the programme	Mathematical and Physical Sciences Electrical and Electronic Engineering
7. Accrediting Professional or Statutory Body	IChemE
8. Date of production/revision	March 2023

Awards	Type of award	Duration
9. Final award	BEng	3 years
10. Intermediate awards		

Programme Codes

11. JACS code(s) *Select between one and three codes from the [HESA website.](#)*	H800		
12. HECoS code(s) *Select between one and three codes from the [HECoS vocabulary.](#)*	100143		

Programme Delivery

13. Mode of study	Full-time
14. Mode of delivery	Face to face

15. Background to the programme and subject area

Chemical engineering is concerned with the application of science to the design, construction and operation of processes in which materials undergo changes. The applications of these changes are necessary for the production of commodities essential to our everyday life. These include food and drink, pharmaceuticals, fertilisers, man-made fibres, plastics, fuels and energy. These manufacturing activities require processes that provide the efficient and safe conversion of raw materials into useful products. This should be achieved at the lowest possible cost, with minimum energy consumption whilst ensuring safe operation and minimum impact on the environment. Chemical Engineers are involved in developing new processes, both chemical and biological, for synthesising new products and optimising the performance of existing process systems. Qualified Chemical Engineers can choose from a wide variety of career opportunities including plant management, research, commissioning, process safety, environmental protection, process control, consultancy or marketing and sales.

Students choosing to study this subject at the University of Sheffield are provided with a thorough understanding of chemical engineering by combining theoretical aspects of the discipline with hands-on practical experience. The programme also provides the first part of the academic qualifications for students wanting to enter the chemical engineering profession and progress to Chartered Engineer (CEng) status. All students are encouraged to become student members of the Institution of Chemical Engineers and/or the Energy Institute. Both professional bodies have active local branches which organise seminars and visits. Through these experiences, graduates are therefore well-equipped to meet the challenge of working within an ever-changing discipline and succeed in the wide range of career areas described above.

In addition to the clearly vocational orientation of the programme, students also benefit from the School's research activity, which informs its teaching. The School has four internationally leading research themes: Biological Engineering, Processes and Systems, Materials & Products and Circular Economy. The specialist subjects available in the 3rd year reflect the interests of members of staff in these groups.

Students should note that if they fail CMB315 (Process Design Project) they would normally be recommended for the award of an Ordinary Degree (i.e. without Honours).

Further information about the School of Chemical, Materials and Biological Engineering can be found on its web site at http://www.shef.ac.uk/cmbe.

16. Programme aims

The BEng in Chemical Engineering aims to:	
A1	provide access to an engineering degree to students from a range of academic and social backgrounds.
A2	deliver a coherent curriculum embedded in design and practice with an emphasis on critical thinking, problem solving, professionalism, ethics and sustainability.
A3	offer flexible learning environments and pathways to facilitate deep engagement.
A4	promote and facilitate industry involvement by focusing on both process and product engineering to develop industry ready practical graduates with hands on experience.

A5	produce graduates who are integrators, change agents and self-directed learners to lead multidisciplinary teams, and be at the forefront of innovation.
A6	provide exposure to niche research areas built on a strong core in engineering fundamentals.
A7	produce graduates capable of Engineering from molecules by applying systems level thinking at many length scales.
A8	foster safe and good laboratory practice.
A9	encourage students to think for themselves and develop a social awareness of the impact of chemical engineering on society.

17. Programme learning outcomes

Knowledge and understanding On successful completion of the programme, students will be able to demonstrate knowledge and understanding of:		
		Links to Aim(s)
K1	fundamental principles of engineering science relevant to chemical and biological engineering.	A1, A2
K2	mathematics necessary to apply engineering science to chemical and biological engineering.	A6, A7
K3	analytical and design methods used in chemical and biological engineering.	A6, A7
K4	use of information technology for analysis, design and management;	A3, A4
K5	operation of the chemical and biological engineering industry, including business practice and project management.	A4, A5, A8
K6	professional responsibility of chemical engineers and the influence of social, environmental, ethical, economic and commercial considerations on their activities.	A8, A9
Skills and other attributes (I for Intellectual Skills, P for Practical Skills, T for Transferable Skills) On successful completion of the programme, students will be able to:		
I1	use engineering science, mathematics and, where appropriate, information technology to analyse engineering problems.	A7
I2	analyse and interpret experimental and other numerical data.	A8
I3	produce designs in a professional manner, taking account of social, environmental, ethical and commercial considerations.	A2, A9
I4	carry out a health and safety risk assessment and devise a safe system of working.	A8
P1	use appropriate mathematical methods for modelling and analysing chemical and biological engineering problems.	A7
P2	use relevant test and measurement equipment.	A8

P3	design and conduct experimental laboratory work.	A8
P4	use chemical and biological engineering IT tools and programming.	A3, A6
P5	design systems, components or processes and test design ideas in the laboratory or through simulation.	A6, A8
P6	prepare technical reports and presentations.	A2, A7
P7	undertake the safe handling of chemical materials, taking into account their physical and chemical properties, including a risk assessment of any specific hazards associated with their use.	A8
T1	use information technology effectively.	A3, A6
T2	communicate effectively, orally and in writing.	A2, A3
T3	lead and collaborate with others in teams.	A5
T4	manage time, teams and projects efficiently.	A5
T5	find information and learn independently.	A2
T6	Develop employability skills.	A4

18. Learning and teaching methods

The main teaching, learning and assessment methods adopted for each learning outcome are shown below. In most cases a combination of methods is used. Emphasis is on 'learning by doing'. Knowledge and understanding are gained through a combination of lectures, tutorials, example classes, design classes, laboratory experience, open-ended problem solving and coursework assignments. Skills are acquired mainly through coursework and individual and group projects.

- **Lectures** – used to transmit information, explain theories and concepts, and illustrate methods of analysis or design. For most lecture courses tutorial sheets are provided to enable students to develop their understanding during private study.
- **Practical activities** – students undertake laboratory experiments, open-ended problem solving and computing tasks to gain practical skills.
- **Tutorials and example classes** – run for individuals, small groups or a whole class to help students with their understanding and to resolve problems in their programme materials.

The approach to teaching design encourages students to take a wide perspective on problems and to develop their powers of synthesis, analysis, creativity and judgement as well as clarity of thinking. Students are provided with the context and framework for the application of the scientific, technical and other knowledge which is taught elsewhere in the programme through the methods described above. The principal methods for design teaching are:

- **Design classes** – students work to solve design problems related to real chemical and biological engineering situations in order to learn design methods and to practice associated analytical techniques.
- **Design projects** – teams of 6-7 students tackle a chemical engineering problem by working through conceptual and detailed design stages.

In addition to planned teaching and learning activities, students are also expected to learn through the preparation of coursework assignments and other assessment activities which generally require students to seek additional information and work on their own, or in small groups, to develop understanding of the subject matter.

19. Assessment and feedback methods

Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:

Knowledge and understanding are primarily assessed in written examinations. However, in the later years further knowledge and understanding is gained through project work and assessed in written reports and oral presentations.

Written examinations – unseen examinations.

Coursework submission – designed to test knowledge and communication skills; these include design studies, computing assignments and laboratory reports.

Class tests and online tests – tests conducted in a lecture theatre or on the virtual learning portal during the main teaching periods to assess progress.

Oral presentations – most groups' projects include an oral presentation in which each group member plays a part.

Individual and group project reports – these include intermediate and final reports for the Design Project.

We will use a range of feedback mechanisms that we have designed and successfully utilised in the School. They include written and verbal, group and individual feedback from tutors; peer to peer feedback, self-reflection via keeping a skills journal, concept-check online quizzes and personal tutorials. All students receive a Feedback Handbook when they first arrive, which describes in depth the different types of feedback provided in the School. This handbook is available throughout their studies on the UG Community on Blackboard. For each module, a 'Module Assessment and Feedback' Form is provided at the beginning of the term on Blackboard, which clearly outlines feedback details and date for each assessment component. In addition, the School provides an 'Assessment and Feedback Overview' which summarises all assessment and feedback details per Level per Semester.

20. Programme structure and student development

The programme structure is modular and in each year students study modules worth a total of 120 credits.

The first two years (Levels 1 and 2) of the BEng programme are taught through a series of compulsory 10-20 credit modules and are shared across all undergraduate programmes, in order to accommodate transfers between this programme. This provides students with an opportunity to apply for a transfer of programme at the end of Level 2 (for further information about the MEng programmes, please refer to the separate programme specification).

At Levels 1 & 2, students also participate in a cross-faculty week-long group project: "Global Engineering Challenge" in Year 1 and "Engineering: You're Hired" in Year 2. These are an opportunity for students across the Faculty of Engineering to work together in multi-disciplinary teams, enabling them to develop a range of professional and technical competences, including awareness of the global context of their decisions, communication skills, cultural agility and enterprising problem solving. Neither of these group projects are credit bearing, but both are compulsory for progression to year 3. In addition, all students take a core 'CBE Skills for Employability' module, which has been developed as a programme level non-credit bearing module, designed to help students in planning their career development, and to equip them with the essential knowledge, know-how and practical skills needed to succeed in the recruitment process and be competitive in the job market.

At Level 3, the core curriculum includes a series of compulsory modules to the value of 45 credits plus a 45-credit design project, major feature of the final year, which involves working in a small, supervised group on the process design of a chemical plant. The remaining 30 credits are available for optional module choices.

The BEng degree (including a pass of the level 3 design project) is registered as meeting the core requirements for Chartered Engineer (via the Institution of Chemical Engineers). Graduates may take an MSc or equivalent education in suitable subjects to meet the full educational requirements for CEng, as an alternative to the MEng year, giving additional flexibility and choice of career options. The Engineering Applications component specified by the Engineering Council (the application of scientific and engineering principles to the solution of practical problems of engineering systems and processes) is embedded throughout the programme. Initially this is introduced during Levels 1 and 2 and includes dedicated design weeks and a week of practical activities along with visits to local chemical engineering industry. It is then continued through the Level 3 design project and requires both group and individual work.

Student development over the course of study:

Level 1 (1st year)

The first year of the programme aims to consolidate students' existing scientific knowledge of mathematics and science and also provide some relevant knowledge of other sciences to fill any gaps while at the same time introducing the basic principles of chemical engineering. Students will undertake practical experiments and will be able to present, interpret and evaluate data reliably. They will develop communication skills and teamwork through participation in design and tutorial exercises which will require them to have developed lines of argument and make sound judgements in accordance with basic theories and concepts of chemical engineering.

Level 2 (2nd year)

Over the following year, students will develop a more extensive knowledge and deeper understanding of the principal chemical engineering subjects, with an emphasis on real applications. Students will also extend their knowledge of computing and background information on other relevant engineering applications. They will further develop their practical skills and solve more difficult chemical engineering problems. Students will undertake more detailed design work in which some elements of professional practice are introduced.

Level 3 (3rd year)

The final year of the programme is aimed at broadening knowledge of the chemical process industries by introducing further topics together with more advanced treatment of the subjects covered during Level 2. Students will carry out a complex realistic design project requiring the application of the knowledge and understanding gained in earlier years, both of technical subjects and of professional issues. Students will work in self-directed groups, enhancing communication and team-working skills. Upon successful completion of Level 3, students will have developed and demonstrated achievement of the overall programme learning outcomes outlined in Section 17.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available online at http://www.sheffield.ac.uk/calendar/.

21. Criteria for admission to the programme

Detailed information regarding admission to programmes is available from the University's On-Line Prospectus at http://www.shef.ac.uk/courses/.

22. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Subject Benchmark Statements
https://www.qaa.ac.uk/quality-code/subject-benchmark-statements

Framework for Higher Education Qualifications (2014)
https://www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

University Strategic Plan
http://www.sheffield.ac.uk/strategicplan

23. Additional information

Further information is available in the School brochure "Undergraduate Courses" available from the School of Chemical, Materials and Biological Engineering or online at http://www.shef.ac.uk/cmbe/undergraduate.

This specification represents a concise statement about the main features of the programme and should be considered alongside other sources of information provided by the teaching School(s) and the University. In addition to programme specific information, further information about studying at The University of Sheffield can be accessed via our Student Services web site at http://www.shef.ac.uk/ssid.