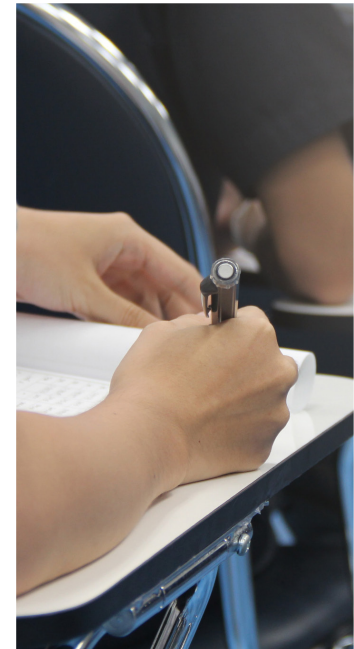
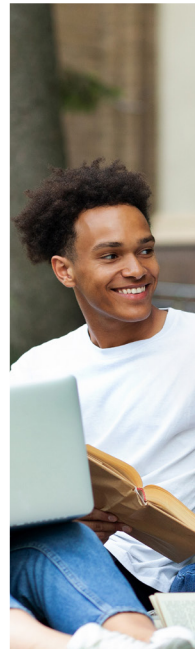


IChemE

Accreditation of chemical engineering programmes

A guide for education providers and assessors



Based on learning
outcomes

Preface

IChemE advances chemical engineering's contribution worldwide for the benefit of society. Through our conduct of higher education programme accreditation, we aim to recognise and share good practice in the education of chemical engineers. At the same time, we seek to promote development of the profession by encouraging innovation in chemical engineering programme design and delivery.

IChemE's accreditation guidelines derive from long experience in accrediting degree and diploma programmes across the world, against discipline-based criteria. Accreditation serves two purposes: (i) recognition of programmes against IChemE standards; and (ii) linkage to IChemE's suite of professional engineering registrations.

Through the strengths of our standards and quality of our processes, we are licensed by the UK's Engineering Council, a signatory of the International Engineering Alliance, to accredit higher education degrees and other qualifications against defined criteria set out in **UK-SPEC**. The accreditation process involves scrutiny of evidence provided by the higher education institution and a visit to ensure that the programmes comply with the guidelines in this document. IChemE accredited programmes are recognised through mutual recognition agreements worldwide.

This edition of the guide, first issued in October 2021, incorporates revisions to meet the requirements of the Fourth Edition of the Engineering Council's Accreditation of Higher Education Programmes (AHEP), released in August 2020. It also includes increased emphasis on sustainability, consistent with IChemE's stated position on climate change, and on increasing adoption of digital technologies across the chemical engineering profession and the industries it serves. Its publication follows an extensive consultation with assessors and higher-education institutions during 2021.

We would like to extend our sincere appreciation to the many people from industry and academia who have assisted in our worldwide accreditation activities, and who have helped in preparing this revision of the guidelines.

Application and supporting documents

All application and supporting documentation can be found at www.icheme.org/uni-accreditation-docs including: assessment questionnaires/report forms; credit analysis tools; safety, health and environment (SH&E) covering notes; SH&E checklist; appeals procedure; assessor code of conduct.

Information about fees for benchmarking, accreditation and reaccreditation can be found at www.icheme.org/uni-accreditation-fees

Document control

Version no.	Date issued	Changes
V4	May 2024	<ul style="list-style-type: none"> - Table added to section 4.6.2 to further clarify the Engineering Council's categories of accreditation. - Updated endorsement logos (the word 'internationally' has been removed from the design) - Previous 'Section 1.3 The international perspective' removed.
V3	February 2024	Updates to <i>Table 8. Documentation required from department three months before the visit</i> re evidence of learning outcomes actually achieved by students.
V2	February 2023	<p>New section added: 4.7 Termination of programmes.</p> <p>Plus updates/additions to:</p> <ul style="list-style-type: none"> Section 3.3 – to outline the scope of digital technologies. Section 4.1.5 – to reflect revised approach to (for example) 'double degrees' in Australia. Section 4.2.1 – on assessment of advanced learning outcomes. Section 5.5 – to make our position on clear on 'reasonable adjustments'. Section 6.10 – new information concerning 'virtual safety walkthroughs'. <p>Changed 'Education and Accreditation Forum (EAF)' to 'Education Subcommittee' throughout.</p>
V1	October 2021	Final revision to new version based on the Engineering Council's <i>Accreditation of Higher Education Programmes</i> handbook, released in August 2020.

Please note: when printed this becomes an uncontrolled document. See www.icheme.org/accreditation-guide for the latest version.

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1. Introduction

"What will the world look like in the future? The aim is for a more sustainable way of manufacturing the products and services we need to lead healthy, fulfilling and meaningful lives. But how do we get there from today? Chemical engineers play a pivotal role in how we live, working across every industry, right across the globe, linking sectors together to help address the UN's Sustainable Development Goals. Maintaining a vibrant and thriving profession is a critical part of our mission and supporting future chemical, biochemical and process engineers to develop their knowledge and skills is a key role for IChemE."

- www.icheme.org/discoverchemeng

Chemical engineering continues to evolve rapidly as a profession. Nowhere is the need to take account of change more important than in the education and academic formation of engineers. It is essential that new graduates have the skills to perform in an ever-wider variety of roles and industries. Moreover, they must not only be equipped to contribute quickly during their early careers, but also have a quality academic grounding in chemical engineering principles 'to last a lifetime' and to enable them to contribute to solving the challenges such as identified in *Engineering a Sustainable Future - the Chemical Engineering Challenge*.

Our aim, to recruit the brightest and most innovative people into the discipline of chemical engineering, challenges us to provide them with an education that will stimulate and develop their talents. Higher education degree and diploma programmes must communicate the relevance and excitement of our profession. We respond to this challenge with our accreditation activity, through which educators benefit from our knowledge of excellent global practice in chemical engineering education. We concentrate upon assessment of learning outcomes (ie what is learned by students) rather than programme content (ie what is taught to students).

These guidelines summarise what we require of an accredited degree or diploma programme, with the intention of leaving it to the university¹ to determine how the requirement is met².

¹ Please note that the term 'university' is used for convenience throughout these guidelines to represent all kinds of higher educational establishments including polytechnics and colleges. Likewise, the term 'department' is used generically for the academic unit responsible for delivering the programmes under review.

² Separate guidelines are available for accreditation of programmes underpinning recognition as a Professional Process Safety Engineer. For further information contact accreditation@icheme.org

1.1 The value of IChemE accreditation

IChemE accreditation provides benchmarking of academic programmes against high, internationally recognised standards. Institutions with IChemE accreditation have the option of applying for the EUR-ACE® label through the Engineering Council - the European quality label for engineering degree programmes. This is of increasing importance as the globalisation of engineering products and services demands greater confidence by employers in the skills and professionalism of the engineers they recruit.

Applicants with an accredited degree typically have an advantage when applying for professional registration as the accreditation demonstrates that the programme of study develops underpinning knowledge and understanding, thereby either partially or fully meeting Engineering Council IEng/CEng requirements.

A department with successfully accredited programmes:

- benefits from intensive professional consultation on the programmes;
- has demonstrated that their programmes are academically sound and industrially relevant;
- will be able to promote the accreditation status of its degree and diploma programmes publicly;
- benefits from academic exchange within the IChemE community of universities having accredited programmes;
- gains access to an international chemical engineering teaching community with opportunities for sharing good practice and progressing challenging issues;
- is eligible to participate in prestigious awards programmes such as those focusing on excellence in teaching and on design projects;
- will be able to offer students exchanges with other accredited departments knowing that the student experience will be of high quality and being able to ensure that such students' academic formation meets IChemE's requirements for professional qualification.

Graduates themselves strongly benefit from attending accredited programmes as accreditation links closely to professional qualification with IChemE (see [Section 2.2](#)).

Our aim is to help chemical engineers who acquire sufficient knowledge, understanding and skills to enable them to seek recognition either as an IChemE Chartered Member (MIChemE) and Chartered Engineer (CEng), the highest international qualification for professional chemical engineers, or as an Associate Member (AMIChemE) and Incorporated Engineer (IEng).

1.2 The IChemE accreditation process

IChemE accreditation is a high value, confidential, discipline-specific peer review by a small panel of experienced professional chemical engineers drawn from industry and academe. It is a joint enterprise in which the IChemE panel and the university department seek understanding through mutually respectful discussion of the available evidence. The process is intended to benefit the university, students, employers, IChemE and the wider public.

The appointed assessment panel undertakes an in-depth review of chemical engineering programmes against the criteria published in these guidelines. The panel reviews documentary material relating to the programmes and visits the department for discussions with staff and students. The assessors produce a confidential and written report. We will treat the report as confidential and will not distribute it for any other purpose. The report is made available to the department. Individual comments will be non-attributable in the report. We evaluate the report to decide the accreditation status of the programmes reviewed. A detailed statement of the General Data Protection Regulation (GDPR) provisions can be found in [Section 11.2](#).

IChemE's accreditation process has many unique strengths which departments value:

- it is a rigorous process that uses panels of three experienced and trained chemical engineering professionals from industry and academia to assess degree and diploma programmes. This provides greater depth and penetration of the teaching programmes than can be achieved by typical alternative pan-engineering accreditation processes;
- it is international in outlook and practice;

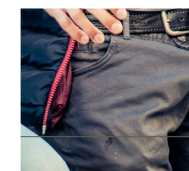
- it is recognised and respected worldwide. We have accredited programmes across the world for over 50 years and currently accredit over 200 programmes across 13 countries;
- it is modern and innovative. Concepts of sustainability and ethics, appreciation of the bio and digital interface, quality delivery of transferable skills etc are therefore expected;
- it is grounded in a philosophy of continuous improvement. We expect diversity of provision and seek to stimulate improvement in chemical engineering education by encouraging new and innovative approaches.

IChemE accreditation requirements and outcome standards are explained in [Sections 2–4](#) of these guidelines. Full details of the accreditation process are given in [Sections 5–9](#).

1.3 Equality, diversity and inclusion

IChemE is strongly committed to the principles of equality, diversity and inclusion. The future success of the profession and our organisation is critically dependent on our ability to ensure that chemical engineers come from all walks of life and that our membership is representative of broader society. In the UK, we are a signatory to the Science Council declaration on diversity, equality and inclusion and the Royal Academy of Engineering diversity concordat, which *“seeks to ensure that the profession properly reflects the society it serves and takes action to attract engineers from increasingly diverse backgrounds into professional membership and registration. In this way the profession can capitalise on their diversity of thought, innovation and creativity”*.

One route into professional membership and registration is through attainment of an accredited degree in chemical engineering. Therefore, we expect universities with accredited degrees to respect the principles of equality, diversity, and inclusion, aiming to provide equal opportunities for students from different backgrounds to enter their programmes, to succeed in their degree courses and to seek gainful employment.



2. Accreditation standards and the link to professional registration

2.1 Standards of accreditation award

IChemE accredits academic programmes to four 'standards'. Each standard is defined in terms of:

- a set of learning outcomes (Section 3);
- the level at which these learning outcomes are achieved (see appendices).

The standards are defined and linked to IChemE membership requirements as follows:

2.1.1 'M-Standard' – Programmes underpinning registration for Chartered Engineer (CEng):

A combination of first and second cycle degrees under the Bologna process.

- recognising integrated degrees of the highest international standards that provide both the solid academic foundation in chemical engineering of a first cycle degree at IChemE outcome Level B, and the advanced chemical engineering knowledge and skills of a second cycle degree at IChemE outcome Level F¹.

An IChemE-accredited qualification at M-Standard meets in full the academic requirements for Chartered Chemical Engineer.

2.1.2 'B-Standard' – Programmes underpinning registration for Incorporated Engineer (IEng):

A first cycle degree under the Bologna process.

- recognising first cycle degrees that provide a solid academic foundation in chemical engineering knowledge and skills at IChemE outcome Level B¹.

An IChemE-accredited qualification at B-Standard meets in full the academic requirements for Incorporated Engineer, and may be supplemented by an IChemE-accredited qualification at F-Standard to meet the academic requirements for Chartered Chemical Engineer.

2.1.3 'D-Standard' – Programmes underpinning registration for Engineering Technician (EngTech):

A higher education short cycle programme - within or linked to the first cycle under the Bologna process.

- recognising sub-degree programmes that provide a solid academic foundation in chemical engineering knowledge and skills at IChemE outcome Level D¹.

An IChemE-accredited qualification at D-Standard meets in full the academic requirements for Engineering Technician (EngTech), and may be supplemented by further learning to B-Standard to meet the academic requirements for Incorporated Engineer.

2.2 Professional recognition as a Chartered Engineer or Incorporated Engineer

Candidates applying for professional registration as a Chartered Engineer (CEng) or Incorporated Engineer (IEng) need to provide evidence of competency, through the application of knowledge and understanding, and adequate demonstration of professional experience².

- accredited degrees and diplomas provide graduates with a straightforward way of demonstrating their achievement of the required level of knowledge and understanding, otherwise known as academic formation. Accredited qualifications define the academic formation required for each level of professional membership; a candidate's actual formation may be attained in stages, which taken together match these qualifications.
- engineers who do not have IChemE-accredited qualifications will need to undergo a full review of academic formation as part of their application for professional registration.

Professional experience is gained in engineering practice, typically after obtaining the academic qualification. Progression between the registration categories is possible and encouraged.

¹ See [Appendix C](#) for the IChemE outcome level descriptors.

² Full guidance on IChemE membership and registration requirements can be found at www.icheme.org/membership. See also www.icheme.org/chartered

2.2.1 Chartered Engineer

The academic formation underpinning eligibility for Chartered membership and Chartered Engineer (CEng) registration is an IChemE-accredited M-Standard degree or equivalent in chemical engineering.

Graduates with an M-Standard degree will have met the formal educational requirements for Chartered membership in full (Path 1 in Table 1 below).

Graduates with a B-Standard degree will normally need to provide evidence of further learning to the equivalent of an M-Standard degree. This further learning can be achieved through completion of a relevant postgraduate (second cycle) qualification such as an MSc accredited at F-Standard (Path 2 in Table 1). The IChemE Individual Case Procedure (ICP) provides an alternative route to F-Standard (Path 3 in Table 1).

Graduates will also be required to demonstrate that they have acquired professional competency following a required and sufficient period of relevant training and experience (initial professional development) post-graduation.

Chartered Members (MIChemE) are entitled to register for Chartered Engineer (CEng) status within the jurisdiction of the UK Engineering Council, and for comparable titles elsewhere, such as Registered Professional Engineer of Queensland in Australia.

Table 1. Academic formation for Chartered Engineer (CEng)

Path	Qualification		
1	IChemE accredited M-Standard degree		
2	IChemE accredited B-Standard degree	+	IChemE accredited F-Standard degree
3	Other qualifications	+	Successful completion of Individual Case Procedure via academic qualifications and/or demonstrating required knowledge through technical experience

2.2.2 Incorporated Engineer

The academic formation underpinning eligibility for Incorporated Engineer is an IChemE-accredited B-Standard degree or equivalent in chemical engineering.

Graduates with a B-Standard degree will have met the formal educational requirements for Incorporated status in full (Path 1 in Table 2 below).

Graduates with a D-Standard qualification will normally need to provide evidence of further learning to the equivalent of a B-Standard degree (Path 2 in Table 2). This further learning can be achieved through completion of relevant additional academic studies or equivalent.

Graduates will also be required to demonstrate that they have acquired professional competency and commitment to high standards following a period of relevant training and experience (initial professional development) post-graduation. Associate Members (AMIChemE) are entitled to register for Incorporated Engineer (IEng) status within the jurisdiction of the UK Engineering Council and for comparable titles elsewhere, based upon comparative educational standards and professional experience.

Table 2. Academic formation for Incorporated Engineer (IEng)

Path	Qualification		
1	IChemE accredited B-Standard degree		
2	IChemE accredited D-Standard qualification	+	Additional academic modules or further learning to B-Standard assessed through Individual Case Procedure

2.3 Professional Process Safety Engineer

Guidance for the accreditation of F-Standard process safety programmes is available separately at www.icheme.org/university-accreditation-guidance

For further information contact accreditation@icheme.org



3. Accreditation based on learning outcomes

3.1 Introduction

IChemE's accreditation decision results from an evidence-based assessment of the learning outcomes delivered by the degree programme and the levels at which these are achieved.

We consider that the quality of a degree or diploma programme is fundamentally dependent on students having a high-quality learning experience which facilitates excellent attainment. This can only be evaluated through review of evidence of student achievement. We therefore believe that measurement of time spent (credit hours) on individual programme or module elements, while providing guidance regarding extent of taught content, is not a definitive measure of learning delivery. Likewise, we believe it can reasonably be expected that cohorts of high entry-standard may, given a stretching curriculum and a demanding, well-resourced teaching environment, be more likely to achieve higher levels of learning outcomes.

IChemE's accreditation philosophy therefore takes into account all factors that influence delivery of learning outcomes.

3.2 About learning outcomes

Learning outcomes define the capabilities of individuals obtaining a qualification. Programme designers typically express them in the form of outcome statements. A high-level outcome statement might be:

"Is able to solve open-ended chemical engineering problems, often on the basis of limited and possibly contradictory information".

Such an outcome statement can be supported by a cascade of lower-level statements specifying appropriate intellectual abilities, practical skills, general transferable skills etc. This approach provides an effective framework giving both guidance and flexibility to programme designers.

The learning outcomes of a chemical engineering programme will represent the important qualities that we expect the programme to develop in a student who will go on to practise as a chemical engineer. The high-level outcome statements inform the definition of individual module/programme objectives within the degree or diploma. More guidance on this is given later in this section to help those designing or accrediting programmes.

3.3 Scope of chemical engineering degree programmes

The learning outcomes specified in this guidance comprise a package which is distinctive to chemical engineering, and which can be regarded as a minimum necessary requirement for IChemE accreditation.

It is not practical for any one programme to achieve all the learning outcomes that every chemical engineer might conceivably need. However, an acceptable academic formation must prepare graduates for a range of employment roles.

Many degree and diploma programmes will broaden and deepen beyond the minimum requirements in many ways. These could be from within the chemical engineering discipline or through further studies in science or engineering, management, economics, languages or law, etc. The quantity of such study will depend on the interests and previous education of the students, as well as the length of the programme. Non-chemical engineering content is referred to as 'complementary subject material'.

Continuously evolving technology and industrial practices mean that higher education programmes cannot equip graduates with all the skills they will need to deploy over an entire career. There will thus always remain a need for continuing professional development (CPD) throughout an engineer's career. Degree and diploma programmes should lay the foundations on which further education, training and professional development can build.

Digital technologies are increasingly impacting how we do work and what we work on, and this change affects all of us. The profession is changing due to the widespread application of new technologies including, but not limited to, big data, machine learning, artificial intelligence, automation, process control, visualisation, and cyber security.

Likewise, the impact of using these new capabilities is leading to new digital ways of working. Examples include digital twins for process design, visualisation for remote assistance, big data for automatically detecting abnormalities and diagnosing causes.

3.4 Entry standards

High quality chemical engineering degree and diploma programmes are demanding on students. While the IChemE accreditation process places greatest emphasis on the outcomes of a programme of study, input standards to the programme invariably remain an important factor. We expect programme providers to maintain appropriate entry standards.

The early part of a chemical engineering programme requires an appropriate and satisfactory standard of knowledge in underpinning mathematics and sciences. We will therefore assess entry standards for the local education system against defined international norms (eg as measured by International Baccalaureate, Senior Secondary Certificate of Education, A-levels, etc) and will expect the standards for entry to accredited chemical engineering programmes to be at an appropriately high level.

For first degrees and diplomas, we expect prospective students to hold secondary schooling qualifications in underpinning mathematics and sciences above minimum threshold entry standards. Where these criteria are not adequately met, we may require that special measures are in place, such as a foundation year of preparatory study. Such a measure would not be subject to the accreditation review. In other cases, clear evidence of supplementary teaching within the programme will be required.

Many universities admit students directly to year two or later in a programme. Such arrangements are often through articulation agreements with other colleges and universities. Departments need to provide evidence that all students meet the overall programme outcomes, regardless of their point of entry, including the assessment of any prior learning.

Considerations comparable to those outlined above apply for entry to postgraduate programmes.

3.5 General learning outcomes

Students graduating from an accredited programme in chemical engineering at all levels must have the general abilities listed below:

Knowledge and understanding

They must be able to demonstrate their knowledge and understanding of essential facts, concepts, theories and principles of chemical engineering and its underpinning mathematics and sciences. They must have an appreciation of the wider engineering context. They must appreciate the social, environmental, legal, ethical, safety, economic and commercial considerations affecting the exercise of their engineering judgement.

Intellectual abilities

They must be able to apply appropriate quantitative science and engineering tools to the analysis of problems. They must be able to demonstrate creative and innovative ability in the synthesis of solutions and in formulating designs. They must be able to comprehend the 'broad picture' and thus work with an appropriate level of detail. They must be able to propose acceptable (safe, effective, ethical) solutions even when information is lacking.

Practical skills

They must possess relevant practical skills acquired through laboratory work, individual and group project work, in design, and use of software resources. Evidence of group working and of participation in a major substantive project is required.

Professional skills

They must have developed and demonstrated ability to integrate transferable professional skills (such as communications, time management, team working, interpersonal, effective use of IT and digital technologies including information retrieval skills) that will be of value in a wide range of situations.

3.6 Learning outcomes in a chemical engineering context

Programmes seeking IChemE accreditation must clearly deliver learning outcomes in each of the following broad areas of learning at the appropriate outcome level:

- underpinning mathematics, science and associated engineering;
- chemical engineering principles;
- chemical engineering practice;
- chemical engineering design;
- embedded learning.

The concepts of chemical engineering principles, practice, and design, and the detailed learning outcomes comprising them, are explained more fully in [Appendix A](#) (for outcome Levels B and F) and [Appendix B](#) (for outcome Level D). Broadly speaking, chemical engineering principles comprise the science and technology required for the processing (for example heating, cooling, mixing, separating, purifying, modifying the

physical structure of, and chemically reacting) substances; chemical engineering practice comprises the procedures, processes, standards, and methodologies of using this science and technology practically and safely; and chemical engineering design comprises the selection and sizing of equipment to perform a specific set of processing tasks to achieve a desired outcome.

The relationships between these learning areas, outcome levels and accreditation standards are shown in **Table 3**.

3.7 Interpretation of terms

Within each broad area of learning, it is expected that students will have achieved a number of specific outcomes in terms of 'knowledge', 'understanding', 'skills' and 'awareness'. Advanced, Level F, outcomes may be indicated by descriptors such as 'complex' or 'complexity'.

Consistency in the interpretation of these terms by both assessors and departments will be assisted by the following definitions¹ :

- **awareness** is a general familiarity;
- **knowledge** is information that can be recalled;
- **understanding** is the capacity to use concepts creatively, for example: in problem solving, in design, in explanations, and in diagnosis;
- **skills** are acquired and learned attributes that can be applied almost automatically;
- **complex** implies engineering problems, process or equipment which involve dealing simultaneously with a sizeable number of factors which interact and require deep understanding, including knowledge at the forefront of the discipline.

3.8 Outcome levels

IChemE defines descriptors for each outcome level in terms of Knowledge, Understanding, Skills and Competence, as shown in Table 3. There are three outcome levels based on European Qualifications Framework levels 5, 6 and 7². Each of the levels is defined by a set of descriptors for Knowledge, Understanding & Skills and Competence to be applied to the learning outcomes at that level (given in **Appendices A and B**). These correspond to the Levels D, B, and F, which will be referred to as 'foundational', 'core', and 'advanced' for short in **Table 3** on the next page.

¹ As in 'The Accreditation of HE Programmes' in **UK-SPEC** third edition 2014.

² See <https://ec.europa.eu/ploteus/en/content/descriptors-page>

Table 3. IChemE outcome level descriptors

IChemE Level Outcome	Level D (EQF level 5) 'Foundational'	Level B (EQF level 6) 'Core'	Level F (EQF level 7) 'Advanced'
Theoretical and/or factual knowledge	Comprehensive, specialised, factual and theoretical knowledge within chemical engineering and an awareness of the boundaries of that knowledge.	Advanced knowledge of chemical engineering, involving a critical understanding of theories and principles.	Highly specialised knowledge, some of which is at the forefront of knowledge in chemical engineering, as the basis for original thinking and/or research. Critical awareness of knowledge issues in chemical engineering and its interface with different fields.
Understanding and Skills <i>In this context, skill is described as:</i> <ul style="list-style-type: none"> ■ <i>cognitive (involving the use of logical, intuitive and creative thinking), and</i> ■ <i>practical (involving manual dexterity and the use of methods, materials, tools and instruments)</i> 	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems.	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in chemical engineering.	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields.
Competence <i>In this context, competence is described in terms of responsibility and autonomy.</i>	Exercise management and supervision in contexts of study or work activities where there is unpredictable change; review and develop performance of self and others.	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable study or work contexts.	Manage and transform study or work contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice.

Each of the broad outcomes in [Section 3.6](#) should be achieved at the level appropriate to the accreditation standard of programme, as shown in Table 4 below. Learning outcomes at Level B (and hence graduates from programmes accredited at B-Standard) meet the educational requirements for Incorporated Engineer (IEng). To meet the educational requirements to become a Chartered Engineer (CEng), Level F learning outcomes are required in addition to the Level B learning outcomes. An M-Standard degree delivers both Level B and Level F learning outcomes in a single integrated programme of study.

Table 4. Relationship between learning areas, outcome levels and accreditation standards

		Learning outcomes			Accreditation standards			
		Level D	Level B	Level F	D-Standard	B-Standard	F-Standard	M-Standard
Underpinning mathematics, science and associated engineering		✓	✓	✓	✓	✓	✓	✓
Foundational chemical engineering	Principles	✓	✓		✓	✓		✓
	Practice	✓	✓		✓	✓		✓
	Design	✓	✓		✓	✓		✓
Core chemical engineering	Principles		✓			✓		✓
	Practice		✓			✓		✓
	Design		✓			✓		✓
Advanced chemical engineering	Principles			✓			✓	✓
	Practice			✓			✓	✓
	Design			✓			✓	✓
Embedded learning		✓	✓	✓	✓	✓	✓	✓
Complementary subjects		✓	✓	✓	✓	✓	✓	✓

3.9 Complementary learning

IChemE expects students to also gain the benefits of a rounded education and allows programme designers to have the flexibility to allow students to follow additional beneficial programmes such as languages, management and policy related studies, history and culture.

These complementary studies are not formally assessed by IChemE, but rigour in their teaching and assessment is expected.



4. Design and assessment of programmes for accreditation

4.1 Guidance on duration and content of chemical engineering programmes

4.1.1 Introduction

Decisions on whether a programme is accredited, will be taken on the basis of evidence of achievement of learning outcomes against defined standards. This is regardless of whether the programme is full-time, part-time, industry-based, involves distance learning etc.

Although we seek to avoid prescription in these aspects, some broad guidance on content is useful for both departments and assessors. However, it should be stressed that the metrics on duration and content given within this section are for guidance. A significant difference from these metrics would not in itself preclude accreditation, but in such cases the department would be expected to justify the differences and provide compelling evidence that the required learning outcomes have been met.

In order to provide a common measure of content, and on the assumption that most programmes have a modular credit-based structure, it has been assumed that a typical year of full-time study comprises the equivalent of 60 credits. It is expected that departments will be able to convert their own measures of programme content to the IChemE credit basis. As a guide, one IChemE credit is equivalent to approximately 20 hours of student workload (combined teacher-led and independent study). In cases where there are difficulties in interpretation we will provide guidance.

We consider the incorporation of professional engineering approaches and attitudes, through direct contact between educators and students, to be a key component of an effective engineering education. The balance between direct contact and other study activities will vary according to the nature of the module and to local teaching and learning practices.

4.1.2 Minimum programme duration

An indication of the duration and academic credit is shown in Table 5 opposite. The indicated values apply to full-time study and for degree entrants meeting our baseline entry standards for underpinning mathematics and science (see Section 3.4). For part-

time or other modes of study, the values should be adjusted in proportion to the amount of study in each year.

Programme duration to a particular accreditation standard will depend on the level of attainment at entry in relation to the requirements of the chemical engineering curriculum. This will vary according to the local school and university education system. However, we stress that output standards achieved are more important than length of study.

Table 5. Indicative programme duration and credit for full-time study

Programme type	IChemE credits	Typical length of full-time study
D-Standard	120	two years
B-Standard	180	three years
M-Standard	240	four years
F-Standard	90	one extended year

4.1.3 Minimum programme content

IChemE specifies that learning outcomes must be delivered across the broad areas of learning defined in Section 3.6 and the supporting appendices.

In order to ensure that the learning outcomes are met adequately across the broad areas, we provide guidance on the minimum expected content for each area and for the programme as a whole. This content is specified in terms of minimum credits, as shown in Table 6.

Frequently, programmes or suites of programmes include various routes and options. These can take a wide variety of forms, including double degrees, joint honours degrees, programmes with specialisms, programmes with optional modules, and degree apprenticeships. In assessing compliance with the minimum requirements, we will look to ensure that the minimum is met for all possible variants which a student might select.

Some universities allow students with prior learning to join a degree programme at a stage later than the normal entry point. Where relevant, universities must provide us with evidence of how such prior learning is assessed as meeting IChemE learning outcomes.

4.1.4 Allocation of programme content to specific areas

IChemE's credit allocation process ensures that there is an appropriate balance between principles, practice and design, and that there is sufficient contact at an advanced level in integrated masters' degrees. Within the expected minimum of 85 IChemE credits in total for core chemical engineering, a detailed breakdown for each sub-area is not specified although it is particularly important that the learning outcomes for process safety (Appendix Sections A2.6 and B2.6) are met in full.

The allocation of the content of a degree programme to specific areas is, for some topics, a matter of judgement. For example:

- a) There is a possible overlap of content between 'Core Chemical Engineering', 'Chemical Engineering Practice' and 'Chemical Engineering Design Practice & Design Projects';
- b) There is a possible overlap of content within Core Chemical Engineering between 'Safety' and 'Sustainability, Economics and Ethics'.

We are generally content to leave this judgement to departments, subject only to clarity with respect to describing which specific areas are included within which headings. The use of minimum total content alongside specified minima for each category provides some latitude for allocation.

The credit analysis tool is available in the application documents at www.icheme.org/uni-accreditation-docs



Table 6. Learning outcome areas: minimum credit allocation guidance¹

Credit basis: 1 credit = 20h combined tutor-led and independent study

Accreditation standard	Minimum credit			
	M-Standard	B-Standard	F-Standard	D-Standard
Underpinning mathematics, science and associated engineering ^{2,3}	Appropriate	Appropriate	Appropriate	Appropriate
Foundation and Core chemical engineering principles ⁴	>85	115	>85	60
Foundation and Core chemical engineering practice ⁴	>10		>10	10
Foundation and Core chemical engineering design ⁴	>10		>10	10
Embedded learning ⁶	Sufficient	Sufficient	Sufficient	Sufficient
Advanced chemical engineering principles ^{3,4}	>20	60	>20	80
Advanced chemical engineering practice ⁴	>10		>10	
Advanced chemical engineering design ⁴	>5		>5	
Total minimum specified content	175	115	60	80
Complementary topics ⁷	Balance	Balance	Balance	Balance

Important notes:

1. Allocation: All credit counts are on an exclusive basis. Therefore, total content of whole programmes or modules cannot be accounted for twice nor appear under two categories of learning. If departments consider that it is appropriate for content of modules to be allocated across categories of learning, this is acceptable, provided full explanation of rationale is provided in the questionnaire (refer to [Page 2](#) for links to additional and supporting documents).
2. Underpinning mathematics, science and associated engineering: The appropriate amount of underpinning material will vary according to the entry achievement of students and the nature of the programme itself. In all cases, the underpinning material must enable students to understand and achieve all of the chemical engineering outcomes ([Section 3.6](#), [Appendix A1](#) and [B1](#)).
3. Mathematics and science at F-Level: It is expected that capabilities in mathematics and science at F-Level are primarily demonstrated through their application to advanced chemical engineering principles.
4. Credit totals: Note that the required minimum totals for Level B topics and for Advanced Chemical Engineering are in each case significantly greater than the sum of the component elements.
5. Prior learning: No specific prior learning is required for F-Standard courses. However, it should be understood that candidates require both a Level B and a Level F qualification to be eligible for Chartered status.

6. *Embedded learning:* – It is expected that modules throughout a programme include, illustrate and reinforce aspects of health and safety, sustainability, and ethics, along with general transferable skills, as set out in [Appendices A5](#) and [B5](#). It is expected that a wide variety of delivery methods are used throughout so that students acquire the range of interpersonal and management skills etc to equip them to the modern engineering workplace. No credits should be allocated to the embedded learning section.
7. *Complementary topics:* Complementary topics must not be included in the credit assessment ([Section 3.9](#)).
8. *Multiple programmes and options:* Where a choice is available to students, the 'worst' case should be evaluated ([Section 4.1.3](#)).

4.1.5 Curriculum flexibility and development

IChemE sees the purpose of a chemical engineering degree as being to equip students with the knowledge and skills needed to be an effective chemical engineer in process and related industries. We recognise chemical engineering as being a broad discipline, encompassing a range of scientific principles and engineering methodologies relevant to the processing of substances. However, the detailed requirements can vary both with time, as new technologies appear and older ones become obsolete, and with geography as different industries dominate in different locations. We therefore recognise the benefits of a diverse range of chemical engineering courses with different emphases taught by different institutions, and the need for courses to adapt and change.

Many courses now include material which, while not typically viewed as being within the traditional scope of a chemical engineering degree, extends the versatility of chemical engineering graduates and is valued by potential employers.

In the learning outcomes specified in the [appendices](#), we seek to balance the need to provide a clear common understanding of what students, and their subsequent employers, can reasonably expect from a chemical engineering degree, and a need to avoid being too prescriptive of detail. The required learning outcomes specified in the appendices are therefore broad and high-level, and we expect the choices of content made by individual universities to vary considerably. For example, courses with significant specialisation, such as biochemical engineering or chemical engineering for the nuclear industry, will focus many of their examples and projects on their target specialisms, yet still teach chemical engineering principles and skills applicable to a much broader range of applications. Likewise, the content of many courses (particularly at F-Level) will be influenced by the research expertise of the university department, but still meet the overall aims of a chemical engineering degree.

We also strongly encourage universities to seek input from industry in shaping their courses, for example by using industrial advisory boards.

We aim, through our Education Special Interest Group, to support universities as they develop their content to meet the changing needs of the chemical engineering profession, for example providing resources, webinars and workshops for sharing of best practice. This will include new topics introduced through changes to accreditation requirements (such as the introduction of security risk mitigation and digitalisation requirements in the 2021 guidelines revision).

4.2 Distinguishing features of accredited programmes

4.2.1 Distinguishing features of M-Standard programmes

Programmes accredited at M-Standard integrate the features of first and second cycle degrees. (M-Standard programmes go beyond B-Standard to provide a greater range and depth of specialist knowledge, within a research and industrial environment, as well as a broader and more general academic base. Graduates will therefore have an ability to apply their knowledge and skills to solving, from first principles, complex problems not typically encountered in a B-Standard programme. Such programmes should provide both a foundation for leadership and a wider appreciation of the economic, legal, social, ethical and environmental context of engineering.

Graduates from an M-Standard programme must achieve a systematic understanding of the learning outcomes in **Appendix A**, including the outcomes at Level B and the advanced outcomes at Level F. They must acquire a coherent and detailed knowledge of the subject, most of which is at, or informed by, the forefront of defined aspects

of chemical engineering. Crucially, graduates will have the ability to integrate their knowledge and understanding of mathematics; science; computer-based methods; design; digital technologies; the economic, legal, social, ethical and environmental context; and engineering practice to solve a substantial range of chemical engineering problems, some of them complex or novel. They will have acquired much of this ability through involvement in individual and group design work. Ideally some of this work would have industrial involvement or be practice-based.

The Level F advanced outcomes will be achieved through a combination of more technically complex topics, comprising principles, practice, and design, including at least some at the forefront of chemical engineering. Application to a broad range of fields of practice is expected, with a deep understanding of the limitations of methods, and critical evaluation of techniques and technologies. Courses on broader engineering or technology topics, provided not only for chemical engineering students but a more diverse range of engineers or scientists, can be included but should be relevant to the needs of a practising chemical engineer and preferably linked to the application of chemical engineering. In order to deliver sufficient advanced chemical engineering content in integrated M-Standard programmes, it is desirable and may be necessary to include some advanced content ahead of the final year of study. Material presented as

Level F for accreditation purposes should also be assessed at an advanced level, ie at ISCED L7 or EQF L7, regardless of the year of the programme in which it is taught.

M-Standard programmes may also include study of complementary subjects – particularly other sciences, technology, and engineering disciplines, or other non-chemical engineering subjects such as business or languages – provided there is sufficient chemical engineering content.

IChemE expects M-Standard degree programmes to have strong involvement and interaction with industry and to provide greater industry-relevant exposure of students than B-Standard programmes.

Ideally, features which distinguish the Level F part of the programme will be integrated throughout the latter years of the programme. Where appropriate, student progression to Level F should be conditional on a demonstration of good academic performance. There should be appropriate and clear criteria to ensure this.

These programmes should also include a substantial open-ended activity which stretches and develops students' problem solving and creative thinking capacities. Examples include:

- **research linked to the department's own postgraduate research programmes, or research undertaken at an industrial research laboratory/institute (this could be conducted as an interdisciplinary project);**
- **analysis of an industrial process, perhaps combining a period in industry with some analytical or theoretical work at the university;**
- **a theoretical project including a literature review with subsequent critical data analysis and advanced computer modelling.**

Many M-Standard programmes meet this requirement by including a research project in the final year, distinct from the earlier design project (or projects). Our experience is that most research projects contain some work which contributes to learning outcomes in advanced chemical engineering principles, but mainly to advanced chemical engineering practice. We are open to projects being treated differently in terms of credit allocation, but the university should be prepared to demonstrate that all projects meet those requirements, typically by showing that both the specification and assessment scheme do so.

4.2.2 Distinguishing features of B-Standard programmes

B-Standard degree programmes are also referred to as first cycle degrees. B-Standard programmes develop the ability to apply a thorough understanding of relevant science and mathematics to the analysis of chemical engineering problems and the design of technical solutions.

Graduates from B-Standard programmes must achieve a systematic understanding of the learning outcomes specified in **Appendix A** at IChemE Level B, including acquisition of coherent and detailed knowledge, much of which is at, or informed by, the forefront of defined aspects of chemical engineering. Crucially, they will have the ability to integrate their knowledge and understanding of mathematics; science; computer-based methods; design; the economic, legal, social, ethical and environmental context; and engineering practice to solve problems, some of a complex nature, in chemical engineering. They must have completed a satisfactory design portfolio, supported by individual and group project work. In addition, there may be study of complementary subjects – including other science/technology, or other non-chemical engineering subjects such as business or languages.

We make no specification regarding advanced chemical engineering content of these programmes and leaves provision and inclusion of any such advanced content entirely at the discretion of the programme designers.

4.2.3 Distinguishing features of F-Standard programmes (typically MSc)

F-Standard programmes (second cycle degrees, typically MSc) in chemical engineering either provide a deeper understanding of general chemical engineering or focus on a specific branch of the subject such as nuclear engineering or biochemical engineering. To be accredited as F-Standard, the programme must clearly demonstrate delivery of Level F advanced learning outcomes in **Appendix A**, beyond the attainments in a B-Standard chemical engineering degree.

The Level F advanced outcomes will be achieved through a combination of more technically complex topics, comprising principles, practice, and design, including at least some at the forefront of chemical engineering. Application to a broad range of fields of practice is expected, with a deep understanding of the limitations of methods, and critical evaluation of techniques and technologies. Courses on broader engineering or technology topics, provided not only for chemical engineering students but a more

diverse range of engineers or scientists, can be included but should be relevant to the needs of a practising chemical engineer and preferably linked to the application of chemical engineering. In addition, there may be study of complementary subjects – particularly other sciences, technology, and engineering disciplines, or other non-chemical engineering subjects such as business or languages.

4.2.4 Distinguishing features of D-Standard programmes

D-Standard programmes (eg Singapore Diploma and UK HND) have an emphasis on development and attainment of the know-how necessary to apply technology to chemical engineering problems and processes, and to maintain and manage current technology, sometimes within a multidisciplinary engineering environment.

Graduates from D-Standard programmes must achieve the learning outcomes at IChemE Level D, as described in **Appendix B**. The breadth and depth of underpinning scientific and mathematical knowledge, understanding and skills will be provided in the most appropriate manner to enable the application of engineering principles within existing technology to future engineering problems and processes. Graduates are likely to have acquired some of this ability through involvement in individual and/or group design projects.

Programmes will develop a knowledge and understanding of current engineering practice and processes, with less focus on analysis than in B-Standard programmes, for example:

- **greater exposure (where time allows) to 'related technologies' such as management and business issues, IT and its application;**
- **greater emphasis on aspects of plant operation, maintenance, reliability and process viability, capability and optimisation.**

Design will be a significant component, especially in integrating a range of knowledge and understanding to design products, systems and processes to meet defined needs using current technology. An example might be practical development of a major project which places emphasis on 'practical process improvement', ideally in conjunction with a local employer.

4.2.5 Courses requiring demonstration of prior learning

In most cases, all students will be required to meet all of the specified learning outcomes for the standard of accreditation within the scope of the course being accredited.

However, in a small number of cases, it is necessary for universities to require specific prior learning to ensure that all learning outcomes are reached, typically because the duration of a course is insufficient to deliver all of the required outcomes. There are two common instances of this:

1. Where some students are admitted directly to the second (or later) year of a first-degree course where some of the required learning outcomes are delivered in the first year.
2. Where a one-year postgraduate programme (such as an MSc in the UK) is used as a 'conversion course' seeking to enable graduates in cognate disciplines in science and engineering to reach B-Standard chemical engineering learning outcomes.

In such situations, it is essential that the university:

- has a clear definition of what prior learning is required for entry to the course; and
- has a clear process for assessing and documenting how each student meets that prior learning requirement.

In instances where different students may have dissimilar prior learning (such as postgraduate conversion courses with entrants from both science and engineering backgrounds), universities should consider how the differences in prior learning affect their taught content. For one-year 'conversion courses', it should also be noted that time is limited: universities offering such courses are therefore encouraged to focus on the specific learning outcomes required to deliver the B-Standard.

4.3 Taught delivery methods and departmental practice for student assessment

4.3.1 Delivery methods

Various methods can be used to deliver a programme satisfying the learning outcomes, depending on the style of teaching appropriate to the university and the students, the number of students taught and the varied nature of content. We encourage the use of diverse methods and innovation in teaching.

The choice of methods is at the discretion of the university. The methods used could include lectures; tutorials; laboratory and workshop sessions; problem-centred learning; distance learning; and computer-aided learning. In addition, programmes may incorporate industrial placements, or study at other universities at home or abroad.

Whilst much of the teaching will be done by university staff, the use of external lecturers and supervisors, including from industry, is encouraged, where these can supply knowledge and experience not otherwise readily available. Examples might be in the supervision of design work, the presentation of case studies, or in the lecturing of special topics. Where a course is reliant on significant external input, the university should take steps to ensure its quality and offer appropriate support (such as training in course development, delivery and management) to external providers.

4.3.2 Assessment

The purpose of assessment by a university is to confirm that individual students have attained the necessary learning outcomes, and that this attainment is at the appropriate level for the degree being awarded.

We do not prescribe any specific approach but expects the following:

- a variety of assessment methods, aligned with the intended learning outcomes, are used;
- explicit assessment of professional skills, including presentation skills, should form part of the overall assessment;
- robustly defined assessments with marking schemes based on clearly stated criteria, particularly for major projects;
- formal procedures exist for assessment, with a robust quality assurance process to ensure that outcome standards are consistent and fair. The procedures should include safeguards against academic misconduct (eg plagiarism and other forms of cheating);

- processes are in place to ensure that their assessment standards are robust and comparable with similar institutions;
- staff receive training in good assessment practice.

4.4 Evidence of achievement of learning outcomes

IChemE will look for evidence that students have attained the learning outcomes in each of the areas outlined in [Section 3](#).

Typical examples of direct evidence include:

- examination papers, together with model answers and marked scripts;
- project reports;
- laboratory reports;
- design project reports;
- industrial placement reports.

Typical examples of indirect evidence include:

- external examiner's reports;
- internal and external audits;
- quality assurance reports external to the department.

These documents are used solely for the purpose of accreditation and will not be distributed further, in line with the GDPR statement in [Section 11.2](#). Personal or confidential information, such as student's name, date of birth or address should be redacted from any of the documents submitted.

4.5 Learning periods away from the home university

Many programmes contain an assessed period of learning away from the home university – either in industry or at another university.

In cases where the assessed period away from the home university contributes to the

overall degree award, and hence to the learning outcomes relevant to accreditation, we will look for strong, clear evidence of:

- defined learning outcomes for the period away;
- suitability of the placement organisation;
- rigorous standards of supervision;
- rigorous assessment of the outcomes achieved by the student;
- quality assurance of the overall system of student placements.

Where the assessed period away is spent in an industrial environment, examples of evidence might include:

- project work or dissertations;
- presentations and posters;
- academic programmes/modules undertaken during the period away (distance learning);
- continuing professional development programmes.

Where the assessed period away is spent at another university, examples of evidence might include:

- programme of studies completed when at the partner university;
- examples of assessed project work and/or examination papers.

In each case it is expected that the students would re-enter the degree programme at a more advanced stage than when the period away began.

4.6 Compensation and condonement policy

4.6.1 Definitions

IChemE adopts the UK Engineering Council's definitions of compensation and condonement. Compensation is defined as *"the practice of allowing marginal failure (ie not more than 10% below the nominal pass mark) of one or more modules and awarding credit for them, often on the basis of good overall academic performance."*

Condonement is defined as: "The practice of allowing students to fail and not receive credit for one or more modules within a degree programme, yet still qualify for the award of the degree."

Many universities' examination board rules include some allowance for compensation or condonement of limited failure in one or more modules, where this is compensated by a stronger performance across the programme as a whole.

4.6.2 UK Engineering Council Policy

IChemE accredits academic programmes under licence from Engineering Council and are bound by Engineering Council's standards and regulations as outlined in AHEP and *Regulations for Registration*. Accredited programmes are listed in Engineering Council's course database. Engineering Council categorises accreditation as follows (see AHEP page 20):

Master's other than the integrated master's or Doctorate	Accredited by the IChemE on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as a Chartered Engineer. To hold accredited qualifications for CEng registration, candidates must also hold a CEng accredited bachelor's (Hons) undergraduate degree.
Integrated master's	Accredited by the IChemE on behalf of the Engineering Council for the purposes of fully meeting the academic requirement for registration as a Chartered Engineer.
Bachelor's (Hons)	Accredited by the IChemE on behalf of the Engineering Council for the purposes of fully meeting the academic requirement for registration as an Incorporated Engineer and partially meeting the academic requirement for registration as a Chartered Engineer. Candidates must hold a master's or doctorate accredited as further learning for CEng to hold accredited qualifications for CEng registration.

Bachelor's (with or without honours)	Accredited by the IChemE on behalf of the Engineering Council for the purposes of fully meeting the academic requirement for registration as an Incorporated Engineer.
Bachelor's top-up degrees (with or without honours)	Accredited by the IChemE on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as an Incorporated Engineer. To hold accredited qualifications for IEng registration candidates must also hold an accredited foundation degree or HND.
Foundation degrees	Accredited by the IChemE on behalf of the Engineering Council as meeting the requirements for Further Learning for registration as an Incorporated Engineer. To hold accredited qualifications for IEng registration candidates must also hold an accredited foundation degree or HND.

The UK Engineering Council's *Regulations for Registration* requires accrediting institutions to consider the awarding institution's regulations regarding progression. They may impose constraints on an accreditation decision as a result.

The key requirement is that all graduates of accredited engineering degree programmes have met all of the programme learning outcomes specified in the Engineering Council's Accreditation of Higher Education Programmes (AHEP) specification. This results in the following requirements:

1. Evidence that all AHEP learning outcomes are met by all variants of each programme must be provided before accreditation can be granted.
2. No condonement of modules delivering AHEP learning outcomes is allowed.
3. A maximum of 30 credits* (15 IChemE credits) in a bachelor's or integrated master's degree programme can be compensated, and a maximum of 20 credits (10 IChemE credits) in a master's degree other than the integrated master's degree.
4. Major individual and group-based project modules must not be compensated.
5. The minimum module mark for which compensation is allowed is 10% below the nominal module pass mark (or equivalent if a grade-based marking scheme is used).

* It should be noted that the IChemE credit value is equivalent to the European Credit Transfer System (ECTS) credit value. The Engineering Council guidance refers to the UK credit values. For information, two UK credits = 1 ECTS.

This policy will apply to all students joining the first year of an accredited degree programme from September 2022. There is no requirement or expectation that assessment regulations will be changed for students who enrolled on an accredited degree programme before this date. A phased implementation will be allowed whereby new accreditations must comply from the 2022 implementation date. Existing accreditations will be allowed to continue as they were but must align from the point of reaccreditation. For accreditation visits from September 2019 until September 2022 higher education institutions will have the option to either change their regulations to conform with the previous requirements and then change them again to conform to the new rules by September 2022, or to change their regulations straight away to comply with the new rules in advance of their enforcement.

Engineering Council guidance on compensation and condonement can be found at www.engc.org.uk/compensation

4.6.3 IChemE compensation and condonement policy

It must not be possible for any student to graduate without having successfully completed (in each of the IChemE learning outcomes categories) the minimum credits stipulated as the threshold for the level of accreditation awarded.

Where there are major group projects, it must not be possible for students to pass by virtue of the overall group mark; there must be individual components, which on aggregate all students must pass.

4.7 Termination of programmes

Universities are required to inform IChemE when they intend to discontinue programmes. It is expected that provision is made for all students on such programmes to complete their degrees and achieve all of the required learning outcomes, and IChemE may request evidence to demonstrate this. IChemE will update the Engineering Council register with the date at which the programme ceases to be awarded.

4.8 Resources

It is expected that appropriate human and physical resources will be in place to support the delivery of the programme.

A department running an accredited degree must employ a sufficient number of full-time academic staff, including professionally qualified chemical engineers, for students to have reasonable access to them for instruction and guidance.

The IChemE degree programme questionnaire seeks details of staff resources and laboratory, information and learning facilities. These will include the full-time equivalent (FTE) staff involved in the teaching programme and information on typical sizes of laboratory and design groups. An opportunity to meet staff and to view the facilities is included in the timetable for all accreditation visits. Information provided will be used for accreditation purposes only, in line with the GDPR statement in [Section 11.2](#).



5. Institutional culture and practice

5.1 The importance of institutional culture and practice

Chemical engineers work across a variety of industries: some will go on to be the leaders of major companies and institutions in those industries, while many others will hold positions of significant responsibility. Many of these industries have immense economic, social, and environmental impact and need to be managed ethically and responsibly.

Most contain significant hazards, with some being particularly acute, such that chemical engineers will be responsible for decisions on which the lives of others depend. More generally, chemical engineers, in their working lives, will be expected to demonstrate the highest standards of professional behaviour, and many professional institutions, including IChemE, have a code of conduct to which members are expected to adhere*.

While some national jurisdictions have strong expectations of the culture of their university sector, not all do: IChemE has a global role in encouraging all universities teaching chemical engineering to instil in their graduates the highest standards of professional culture. We therefore see it as being essential that institutions responsible for the education of chemical engineers not only provide their students with knowledge about how health and safety can be managed, how to measure and enhance sustainability, and what ethical principles should be adopted. The institutions should also aim to model attitudes and behaviours among their students which meet the highest expectations: as educators of professional leaders, universities are key agents of change in each of these areas.

This is not merely about policies, which are typically set at an institutional level. It requires individual departments within the institution to exemplify behaviours which are consistent with the material that it teaches – in health and safety practice, in sustainability practice, in how it deals with ethical challenges, and diversity and inclusion issues. And it is not solely about the institution's staff – it needs to engage the students so that they too increasingly exhibit the highest standards of professional behaviour.

A questionnaire on how the institution handles various aspects of its organisational culture is included as part of the submission for accreditation and forms an important part of the visit.

* IChemE's Code of Conduct can be found at www.icheme.org/codeofconduct

5.2 Health and safety culture and practice

In addition to formally taught process safety (**Appendices A2.6** and **B2.6**), it is important that students enrolled in accredited degree programmes develop professional attitudes to health and safety. The demonstration or otherwise of an effective safety culture within a department will form part of the IChemE assessment. In many countries, a written safety management system is a legal requirement, and all staff and students are expected to understand their roles and responsibilities in delivering it.

Evidence of an effective health and safety (H&S) culture includes:

- **leadership** – Head of Department and senior management take an active part in H&S;
- **visibility** – clear and relevant signage and information; good standards of housekeeping in laboratories;
- **behaviour** – staff, students and visitors behave in a careful, risk-averse manner; Personal Protective Equipment is available, and usage is enforced; there are systems for incident reporting, follow-up, feedback and improvement;
- **legislative compliance** – there is a sound understanding of, and compliance with, applicable SH&E legislation;
- **risk assessment and management** – Risk Assessment and Permit to Work systems are in place; those who use them are fully conversant with their roles and responsibilities.

IChemE's Safety Centre (www.icheme.org/isc) provides an extensive range of resources, many of them free of charge, including podcasts, webinars, and publications. A special membership class for universities gives access to items ranging from introductory-level material, suitable for general chemical engineering undergraduates, through to advanced material suitable for specialists. Education providers are particularly encouraged to take note of the following items:

- more detailed guidance on learning outcomes in process safety;
- a sample university laboratory process safety management system;
- a case study on a laboratory experiment.

5.3 Social responsibility and ethics culture and practice

We recognise that modern chemical engineering degrees need to include professional and engineering ethics as an integral component of the curriculum. Codes of conduct, an important part of engineering ethics, are the framework for professional behaviour. We, like other professional engineering institutions, have a code of conduct specific to the chemical engineering profession which our members are required to follow; comparable codes exist in other countries (eg Australia and Ireland), though these are usually more general to the engineering profession as a whole. We recognise that different codes of conduct have many common features and expect all accredited programmes to develop a strong ethos of professional behaviour and its implications.

To be consistent with this, institutions are expected to have fair and transparent processes for entry and recruitment, and for dealing with plagiarism, cheating, and disputes. We also encourage institutions to have outreach programmes to encourage young people from disadvantaged backgrounds to consider careers in chemical engineering and other professions.

5.4 Sustainability culture and practice

We first set out our position on climate change and sustainability in a statement in 2020¹, where we pledged to ensure that fundamental principles of sustainability, social responsibility and ethics are embedded in the education and training of chemical engineers. Chemical engineers have key skills in analysing and improving the sustainability of processes and products, and many have critical roles in industries that deliver them. Modern chemical engineering education must therefore include environmental sustainability as an integral component of the curriculum (as discussed in the learning outcomes) considering all forms of impact and detriments and the need to avoid them, in a sustainable way, locally and worldwide when developing or adapting processes, products and activities undertaken. Detriments include not only the technical aspects of challenges such as waste, climate change, economic and environmental damage but also the societal impacts highlighted by the majority of the United Nations' Sustainable Development Goals (SDGs)².

¹ www.icheme.org/climate-change

² www.un.org/sustainabledevelopment/sustainable-development-goals/

In addition, universities will be expected to demonstrate that they are seeking to improve their own operations to become more sustainable and protect their own local environment. Where possible, it is also expected that they will engage their students in relevant endeavours. Appropriate measures will include drives towards more efficient and minimal use of resources (such as paper, water, and energy), and reduction, recycling, and responsible management of waste.

5.5 Diversity and inclusion culture and practice

As highlighted in **Section 1.4**, we are strongly committed to the principles of equality, diversity and inclusion. We aim to enable students from different backgrounds to succeed in their chemical engineering education and seek gainful employment.

The Engineering Council's *Accreditation of Higher Engineering Programmes (AHEP)* requirements state that "*departments delivering accredited degrees are expected to promote equality, diversity and inclusion in line with applicable national regulatory frameworks, as well as embedding inclusive design within the curriculum where relevant.*"

While respecting local laws, we have the same expectation. Assessors will seek evidence of the measures that universities take to ensure that their processes treat all candidates, students and staff fairly, that they deal appropriately with anyone who discriminates against or intimidates fellow students and staff, and that they encourage all of their staff and students to adopt these principles.

IChemE encourages universities to make reasonable adjustments to their teaching and assessment processes to enable all candidates to participate fully in their degrees and have their abilities and achievements recognised.

5.6 Professional registration and lifelong learning

We consider that academic staff have a hugely important role in exemplifying professional behaviours to students. We therefore expect that a significant proportion of staff hold relevant professional level registration (or are engaged in the application process) with a recognised professional body (either for chemical engineering or their own cognate discipline). We encourage all universities to provide support to their staff in seeking such registration.

We expect all members to engage in a process of continuing professional development throughout their careers. We therefore expect universities to encourage and support staff with their own professional development and learning processes.



6. Overview of the accreditation process

6.1 Accreditation ethos

Our accreditation process is a cooperative activity intended to be of benefit to both the department and IChemE. Besides the accreditation assessment, departments benefit from an intensive professional consultation on their programmes and gain access to an international chemical engineering teaching community with opportunities for sharing good practice and progressing challenging issues. IChemE accreditation is a joint enterprise in which both parties seek the truth through mutually respectful discussion of the available evidence.

6.1.1 Confidentiality and document ownership

The accreditation process is confidential between IChemE and the university department. We will retain ownership of all reports produced but will make these available to departments in confidence and where appropriate. We will treat all data provided for accreditation solely for that purpose, as indicated in the GDPR statement in [Section 11.2](#).

6.2 Principal stages of accreditation

The IChemE accreditation process has the following principal stages:

- initial contact between the university department and IChemE;
- preparation by the department and submission to IChemE;
- appointment of assessors by IChemE;
- preparation and visit by the panel of assessors;
- report by the assessors to IChemE;
- decision by IChemE's Education Subcommittee;
- implementation of follow-up actions by the department.

A timeline for the process is given in Table 7 opposite, with further details in the sections which follow.

Table 7. Indicative timeline for accreditation

Time from visit		University department	IChemE assessors
Months	By -36	New programmes etc - initial contact with IChemE*.	(Re)training.
	By -24	New/revised programmes - design and implementation.	
	-24 to -3	Collect supporting documents Contacted by IChemE re visit dates.	Contacted by IChemE re visit dates.
	-3	Submit IChemE questionnaire and supporting documents. For non-UK accreditation, IChemE liaises with local engineering body as appropriate	Receive questionnaire and supporting documents.
	-3 to 0	Prepare for visit.	Study re-visit documents Pre-visit clarifications with department.
The visit (two days)			
Weeks	+3		Prepare and agree report.
	+8	Comment on draft report.	Lead assessor presents report for subcommittee decision.
	By +12		IChemE informs department of outcome.
	+12 onwards	Follow-up if required (meet conditions etc).	If required, review follow-up report etc.

*IChemE contact details are given at the end of this document.

6.3 Multiple campuses

In accordance with our Engineering Council Licence, when a university offers multiple versions of a programme in different locations, we must visit each location for which programme accreditation is sought, even where the programme is identical. An annual accreditation subscription will be applied, as in [Section 6.9](#) below, for each campus visited.

Universities with multiple campuses should contact us in good time to discuss the arrangements for the accreditation process. We will discuss with the university the programmes, locations and certificates for which accreditation is sought in order to confirm what model of accreditation is required. This may be:

- main campus and branch campus;
- a franchised programme;
- twinning arrangement (early parts of the programme delivered elsewhere);
- other.

Each campus should expect to pay a full accreditation fee.

6.3.1 Main branch and campus model

Most accredited universities follow the main campus and branch campus model, where the programmes at the two campuses are undifferentiated from each other with the same core curriculum and learning outcomes, and identical degree certificates are awarded with no indication of location.

For accreditation purposes, therefore, a branch campus programme cannot be accredited independently of the main campus programme. The most practical arrangement is for the main campus to be visited first, and branch campuses all to be visited as soon as practicable afterwards. The main campus visit will involve three assessors on a two-day visit in line with standard accreditation visits, with one-day visits involving two of the same assessors at the branch campus following shortly afterwards. If significant issues arise at the main campus, assessors should inform us as soon as possible to determine whether branch campus visits should be delayed.

A senior member of staff from the main campus should preferably be present (or available by web conference call) during branch campus visits to answer questions related to curriculum delivery, assessment and quality systems.

The programme learning outcomes defined by the main campus must be satisfied at the branch campus. The assessors are required to confirm that quality systems are in place to ensure that the programmes delivered at the branch campus meet our requirements and there is a robust assessment system that goes through the main campus systems and procedures, to ensure equivalence of outcomes.

The main campus is responsible for any potential short-comings at the branch campus and any significant short-comings could lead to the accreditation failing at all campuses.

6.3.2 Franchise arrangements

Another possible model is for a course developed and taught by one university to be licensed for use at another independent institution. In such circumstances, we will take a pragmatic view of exactly what needs to be assessed at each university within the arrangement. However, some general principles apply:

- it is preferable for the licensee university to be accredited in a single integrated process with the licensor university, following broadly the same arrangement as for a 'main and branch' campus scenario;
- assessment of each element of degree delivery (such as programme design and content, staffing, examination and assessment, and institutional culture) will be focused on whichever institution is responsible for that element. For example, if the programme being taught at the licensee university is exactly the same as that taught by the licensor, it should normally be necessary only to review it at the licensor university. However, the facilities for delivery should be reviewed at both;
- responsibility for assessment standards lies with whichever institution awards degrees. If a single, undifferentiated degree is awarded by the licensor university, then it must ensure that the required standards are met at all campuses, regardless of ownership, for any of its campuses to be accredited.

6.3.3 Other branch campus models

Where branch campuses operate largely independently of the main campus and are differentiated on the degree certificate, a full accreditation visit will normally be required at each branch campus, possibly with a different lead assessor and with separate reports. Where other operational models exist, please contact us to discuss how accreditation will be assessed.

6.4 Initial contact – new programmes

We will work with departments new to IChemE accreditation, to explore the best approach to accredited status. Where appropriate, this could include a preliminary 'benchmarking' assessment and/or the appointment of a mentor to help the department develop to meet the accreditation requirements.

All departments planning to introduce new programmes for accreditation are recommended to contact us at an early stage.

For further information, refer to the supporting documents found at www.icheme.org/uni-accreditation-docs

6.5 Initial contact – existing programmes

Where a programme is already accredited, we will contact the department in the penultimate year of accreditation with a view to arranging a visit during the last accredited year, in order to maintain continuity of accreditation. Where a department has several accredited programmes, we will do our best to align the periods of accreditation.

In exceptional circumstances (eg a major disruptive event), a department can apply in writing to extend the accreditation for a short period.

6.6 Preparation by the department

The department will need to make available documents of various kinds for review by the assessors. Since this includes work done by students, preparation of these documents

needs to be considered a long time (up to three years) ahead of the visit. Closer to the visit, the department will be asked to submit a completed questionnaire and other relevant documents. The questionnaire will be used solely for the accreditation process and handled in line with the GDPR statement in [Section 11.2](#).

Further details are given in [Section 7](#).

6.7 IChemE assessors and the visit

IChemE maintains a pool of trained assessors. A panel of three assessors comprising at least one academic and at least one industrial person will be selected from the pool. Where feasible, the panel will include members from outside the country of the department visited and with an understanding of the local education system. One member of the panel will be appointed as Lead Assessor. Occasionally, an observer may accompany the panel – often a potential addition to the pool or an IChemE staff member.

Where appropriate, it may be possible to combine our visit to coincide with another accrediting body. Further details of joint accreditations are given in [Section 10](#).

The assessor panel will receive the documents provided by the department to help them prepare the visit. The visit to the department will normally occupy two working days and, during the visit, assessors will wish to meet staff, representative students, recent graduates and, where feasible, industrial partners such as employers and advisory panel members.

Following the visit, the assessors will report their findings to us. The report, excluding the recommendations of the assessors, will be sent to the department for comment on any factual inaccuracies.

Further information on the appointment and role of the assessors is given in [Section 8](#).

6.8 The accreditation decision and subsequent actions

The completed accreditation report will be considered by IChemE's Education Subcommittee and a decision on whether to accredit will be made. The subcommittee will usually work through Virtual Accreditation Panels which usually meet

monthly for this purpose. The department will be notified of the outcome at the earliest opportunity, once the Engineering Council has accepted the accreditation to their database.

Following a successful accreditation, the department will receive a certificate of accreditation. Any conditions set by the Education Subcommittee must be met by the given date.

Further information on the decision and follow-up are given in [Section 9](#).

6.9 Accreditation costs and cost sharing

The costs of accreditation include the cost of administration and some of the direct costs of travel and subsistence for the accreditation assessors. We seek to share the direct costs with the universities undergoing assessment.

The international standard of accreditation is maintained through our use of a global pool of trained assessors. All assessors are volunteer members of IChemE, working on a pro bono basis, so no fees are payable. All assessment visits aim to include at least one assessor from outside of the region. Hence, the travel and subsistence costs incurred by the assessors undertaking a visit vary substantially, depending on both the geographic region and where the assessors are travelling from.

In order to provide a fair system of recovery of some direct costs of accreditation, we have a fixed subscription for university accreditation. The annual subscription is payable by each department that has accreditation and will cover all programmes accredited in one accreditation visit. There will be no additional charge for the assessors' travel and accommodation as this will all be covered by the annual accreditation subscription.

In order to meet full accreditation for programmes which are delivered at more than one campus, all campuses are required to have a separate accreditation visit. A separate annual accreditation subscription will be invoiced to each campus visited.

For departments without accredited programmes, or for new programmes, direct charges will, at our discretion, be made for benchmarking or other assessments.

For further information, refer to www.icheme.org/uni-accreditation-fees

6.10 Virtual accreditation visits

During the global COVID-19 pandemic, a series of 'virtual accreditation visits' were undertaken. These proved to deliver a very effective process for reviewing learning outcomes but could not replace the whole of a physical visit, which would typically include an assessment of the facilities and local culture and practice (as discussed in [Section 5](#)).

The Engineering Council changed its policy in 2021, in response to the positive experiences of virtual accreditation processes of many engineering institutions, to permit accreditation without a physical visit.

We will adopt the following risk-based approach:

1. A physical visit will normally be required for all new accreditations.
2. A physical visit will normally be required for re-accreditation if the previous visit highlighted concerns, or the previous accreditation process was wholly virtual.
3. A virtual process will normally be sufficient in other circumstances.

It is not envisaged that virtual visits will materially change the timeline or preparation required by universities as discussed in this document.

Virtual visits should also include a 'virtual safety walkthrough' of buildings, particularly laboratories, using a mobile telephone camera or similar device, to enable the assessors to gain an appreciation of the safety practices of the school or department. This should preferably be conducted when students are present and should be directed interactively by the assessors as would be the case for a physical visit. Where assessors have concerns, they may recommend that a satisfactory physical visit be carried out.

7. Preparation for accreditation

7.1 Preparing the submission documentation

Once contact has been established between IChemE and the department regarding possible accreditation, the department should in good time appoint a member of staff to be responsible for the whole process including the timely and comprehensive submission of documentation ahead of the visit. Early on, a provisional visit period will be agreed, and the visit date itself will be finalised somewhat later in the process, as set out in [Section 8.1](#).

In good time before a visit is to take place, the department should ensure that the necessary evidential documents are available. Since these will include examples of work completed by students (such as examination scripts and design projects), some of this preparation needs to be made in previous academic years. Examples of a range of performance (high, middle, threshold pass) need to be provided, together with a clear indication of the marking of such pieces of work. As an example (and where this is not already the practice), departments should consider requiring students to submit digital copies of major project reports, in order that these can be made available to accreditation assessors before the visit.

Document preparation needs to be rigorous and it is advised that sufficient time is made available for this activity. We require that document submissions are provided in digital form, are well-structured, easily navigable and usable, and can be accessed on commonly used digital platforms. It is preferable if assessors can download or transfer material so that they have access offline (eg whilst travelling). Where supporting documentation is available only from online systems with controlled access, such as a virtual learning environment (VLE), provision should be made for the assessor team to view such material. Assessors may sometimes request to make a record of curriculum or course content, not including personal data, for audit purposes.

The submission comprises a completed degree programme questionnaire and supporting documentation, as detailed in [Table 8](#) below. The complete set of documents should be provided to IChemE three months before the visit.

We will make the documents available to the assessor panel. After the assessors have received the advance documents, and prior to the visit, they may identify a need for further information. In such cases we will give the department as much notice as possible to provide this or, alternatively, make arrangements for this to be available for review during the assessors' visit. A copy of the submission as provided will be retained for audit

purposes, and the assessors may request screenshots or similarly auditable copies of online systems for accreditation records.

IChemE and the assessors will handle the documentation in compliance with GDPR: a detailed GDPR statement can be found in [Section 11.2](#).

Table 8. Documentation required from department three months before the visit

Category	Items required/description	Notes
Degree or diploma programme questionnaire	The degree or diploma programme questionnaire is a critical document and provides a structure for the department to collate all essential descriptive information on the degree programme(s) comprehensively for advance assessment by IChemE.	Refer to IChemE's separately available application documents* for the degree and diploma questionnaires.
Curriculum details	Programme structure – eg list of modules, showing year of delivery, credit value, options etc.	Where available, the programme handbook supplied to students may supply these details in a convenient form.
	Descriptors of all modules, showing learning outcomes, teaching methods (eg lectures, practicals, projects), methods of assessment, etc.	
	Briefs for major research/design projects including scope, assessment criteria (individual/group) and marking schedules.	
Staff details	Brief (one–two page) CVs of academic staff including qualifications, professional associations, outline of teaching areas, and expertise.	
Evidence of the learning outcomes actually achieved by students	Where relevant, evidence of how prior learning is assessed and recorded as meeting IChemE learning outcomes.	Evidence should be a representative cross-section (high, middle, threshold pass) and drawn from all parts of the degree programme for at least the last two cohorts (where available).
	Complete sets of examination question papers with marking schemes (past two years).	
	Three samples of assessed student work for major elements of each unit or module that contributes to the achievement of AHEP learning outcomes.	Evidence must be anonymised unless prior agreement from the individual is obtained and include, in all cases, markers' comments and marks.
	Major design project reports (three examples each).	
	Research and/or other (as appropriate) Level F project reports (three examples each).	Where backdating of accreditation is requested, evidence must cover the period of backdating.
	(Optional, as appropriate) External assessment.	
	(Optional, as appropriate) Industrial project reports.	

Important: in preparing the above documents, the department must ensure that it is clear which programmes are being assessed and, where there are several programmes, indicate details of multiple/parallel content. Details of each accredited award (degree name, title and mode of study) will be recorded on the UK Engineering Council database and will be used in assessing future applications from graduates for Chartered membership and employment. Hence, it is essential that the university documentation is consistent with the details as used on degree certificates.

* www.icheme.org/uni-accreditation-docs

7.2 Preparing the department for the visit

It is good practice for senior university staff to be briefed ahead of the visit. Likewise, department staff, representative recent graduates and students should also be briefed adequately to include the purpose, aims and possible outcomes from the assessment.

During the visit, key staff are expected to be readily available to meet the assessors. This includes programme leaders, advisors, laboratory managers, safety managers and others (eg senior management, library, QA or ICT staff) as deemed appropriate by the department.

7.3 Supporting the assessors' visit

The department should expect to provide additional supporting documentation for the assessors to examine in support of their assessment. Such material should be made available during the visit and must include:

- additional student materials to demonstrate learning outcomes achieved, such as marked examination scripts, laboratory reports, project reports; and
- evidence of academic quality assurance – eg external audit, academic review reports, External Examiner reports.

Further information might also include:

- management structure;
- industry involvement; and
- how sustainable development, ethics, safety etc are embedded in the programme.

A serviced meeting room should be prepared and made available to the assessors for their private reviews and deliberations. This room must have Wi-Fi and contain all supporting documentation provided to the assessors for their perusal. Where supporting documentation, such as risk assessments and safety data sheets, is available only from online systems with controlled access, provision should be made for the assessor team to view (and where necessary record) the relevant items.

8. IChemE assessors and the visit

8.1 Visit planning

Accreditation visits will include both a pre-meeting of the assessors on the evening before the visit and normally two full days at the university (see [Appendix C](#)), though visits to universities seeking first accreditation may possibly take longer.

Forward planning of the IChemE visit calendar is important in order to ensure that assessors and resources are available. At least 18 months before the visit is due, IChemE staff will negotiate with the department a target three-month period during which the visit will take place. Nearer the time, where possible at least one year ahead, we will liaise with the department to agree the month of the visit. Following this, the assessor panel will be identified. At least six to nine months before the visit, we will liaise with the department to finalise a mutually convenient date for the visit during term-time, with due regard to academic calendars and assessor availability. At this point they will also agree the structure of the visit, and initiate logistical arrangements such as timings, accommodation, travel etc.

This process allows the department time to prepare a comprehensive submission and to plan its own arrangements ([Section 7](#)). The preliminary documentation ([Section 7.1](#)) must be made available to us at least three months before the visit date.

IChemE staff will distribute the documentation supplied by the department to the assessors for review in advance of the visit and will liaise regarding any further materials or arrangements required prior to the visit.

IChemE and its assessors will use the data provide solely for the purposes of accreditation. Details can be found in the GDPR statement in [Section 11.2](#).

Refer to [Appendix C](#) for a typical visit schedule.

8.2 Selection of assessors

We maintain a pool of trained assessors who are all Chartered Chemical Engineers. The pool comprises both academics and industrialists who have current knowledge of the accreditation process and requirements. Assessors are appointed to the pool by nomination to, and decision of, the Education Subcommittee.

Assessment panels, each comprising three assessors including the lead assessor, are

approved by processes set by the subcommittee using the following criteria:

- all assessors will have received IChemE training;
- no more than one assessor should be without previous visit experience;
- panels will include assessors from our worldwide assessor pool with, where possible, one from outside the country of the university and one with understanding of the local education system;
- panels will always comprise at least one academic and at least one industrialist;
- panels will, if possible, include members with specialist expertise appropriate to the programmes being considered (eg biochemical engineering).

For re-accreditation visits we will, if appropriate and possible, strive to ensure that one assessor should have been a member of the panel for the previous visit.

Departments do not have the right to select or approve the membership of the assessor panel. Should there be exceptional circumstances that concern the department (for example a perceived conflict of interest with an assessor) then these concerns should be communicated in writing at the earliest possible opportunity to the senior IChemE staff member responsible for accreditation and the Chair of the Education Subcommittee.

8.3 The role of IChemE's assessors

Assessors act in a voluntary capacity on our behalf. They are required to work within the code of conduct for volunteer members on IChemE activities (see [accreditation supporting documents](#)) and to have undertaken IChemE training on their responsibilities under GDPR (see the detailed GDPR statement in [Section 11.2](#)).

The assessors' primary role is to seek evidence to verify that the target learning outcomes are being achieved by assessing the scope and depth of the examinations, projects, laboratory work and other learning activities completed by the students. The accreditation visit allows for time to view the resources that support this learning.

The general questions that underpin the work of the assessors include:

- are the entry qualification profiles of students satisfactory?
- are the learning outcomes clearly defined and are they appropriate?
- is the programme structure and content appropriate to deliver the learning outcomes?
- are the resources to support the delivery of the learning outcomes adequate?
- are the learning outcomes achieved to an appropriate level?

Assessors frequently request to see additional materials during their visit. Departments are respectfully requested to be prepared for, and accommodating of, reasonable requests.

At the end of the visit, assessors will give feedback on their principal findings, including recommendations for improvement. They are, however, instructed not to tell the department their recommendation on the accreditation outcome. The decision will be taken at the Education Subcommittee meeting at which the assessors' report (see Section 8.4 below) is discussed and moderated. While assessors are required to make recommendations to the subcommittee about the decision, these may be overridden on examination to maintain consistency with IChemE criteria and with other accreditation decisions.

During virtual accreditation processes, the assessors may request to record some meetings to ensure the accuracy of their report. This will only be done with the agreement of the department and all persons present, and the recordings will be deleted within three months of the accreditation process being complete and the final decision letter being sent to the university, or any appeal process being completed, whichever is later.

8.4 The assessors' report

The assessors prepare a written report to IChemE's Education Subcommittee. The report is expected to be submitted to us within three weeks of the visit.

8.4.1 Purpose of the report

The primary purpose of the assessors' report is to inform the Education Subcommittee of their findings and how learning outcomes have been met. The assessors' report includes a summary of general aspects of the visit, such as resources, safety culture and discussions with staff and students, which impact upon the delivery of those learning outcomes.

In addition, the assessors will:

- identify and commend strengths and good features within the programme(s);
- identify areas where there may be scope to improve the programme(s);
- propose recommendations to the subcommittee on the future accreditation status of the programme(s) reviewed.

8.4.2 Checking factual accuracy

We will send the assessors' report, excluding the assessors' accreditation recommendation, to the department for comments on its factual accuracy prior to final decision by the Education Subcommittee.

8.4.3 Confidentiality and ownership

At all stages, the assessors' report will remain confidential to and the property of IChemE and will be managed within the expectations of GDPR legislation as explained in [Section 11.2](#). The report is made available in confidence to departments for their information.

9. Accreditation outcomes

9.1 Accreditation decision process

The Education Subcommittee exists to maintain standards and consistency of decision-making for IChemE accreditation. The subcommittee usually meets four times per year and is comprised of experienced assessors who are collectively responsible for all decisions on accreditation. Potential conflicts of interest are declared at the start of each meeting and those concerned are normally required to leave the meeting during the relevant discussion.

The subcommittee will formally review the assessors' report, together with the accreditation recommendation of the assessor panel for final decision. They appoint from its membership a rapporteur for each accreditation visit. The rapporteur will raise (eg by email) and resolve as many issues as possible concerning the report with the lead assessor prior to the meeting, so that these can be noted with minimal need for further discussion. The meetings include video/audio links, so that an accreditation panel member (where possible the lead assessor) always be in attendance, in person or virtually, to contribute to the decision-making process. At the meeting, the visit report is introduced by the lead assessor (or other panel member) and the rapporteur clarifies and highlights their findings. The subcommittee resolves any outstanding issues by discussion with the assessor and decides the outcome, usually by consensus.

The subcommittee may ask the lead assessor to amend the report to clarify any ambiguities or other misleading statements. The report will be sent to the department for comment on any factual inaccuracies. Any significant changes arising from this and accepted by the assessors will be brought to the attention of the subcommittee. Where such changes may have a material effect on the outcome, further discussion will take place as above.

A Virtual Accreditation Panel, comprising at least five of the subcommittee's membership, will be appointed to decide accreditation outcomes. These panels meet monthly and operate in the same way as described above but with the additional step of ratification of their decision by correspondence or otherwise full discussion of the decision at an Education Subcommittee meeting.

Occasionally, further information or clarification may need to be sought before a final accreditation decision is made (normally at the subsequent meeting).

9.2 Accreditation outcomes

Decisions are based foremost on maintaining benchmark standards of academic formation. IChemE will seek to help departments, providing advice and counsel to support continuous improvement of their programmes. We also seek to commend and encourage the sharing of educational good practice amongst the community of accredited departments worldwide.

9.2.1 Available decisions

The Education Subcommittee will make one of the following possible decisions:

- **accredit/re-accredit the programme(s) without condition;**
- **accredit/re-accredit the programme(s) subject to conditions;**
 - such accreditations will be dependent upon the department meeting requirements set by IChemE following its review of the assessors' report. See 9.2.2 below.
- **to not accredit/re-accredit the programme(s);**
 - in this instance we will advise why the programme has failed to be accredited and will, upon request and where appropriate, advise the department on available assistance.

Refer to [Appendix D](#) for an indication of how accreditation decisions are reached.

9.2.2 Conditions

We may make accreditations subject to conditions. These are binding on the department and must be resolved within the indicated timeframe for accreditation to be maintained and valid.

Any conditions will be programme specific. Examples have included further report submissions, changes to programme modules, demonstration of stronger safety culture etc.

Fulfilling the conditions is the responsibility of the department. Reports on fulfilment must be made formally in writing for the Education Subcommittee's consideration and accreditation decision.

Reports on condition fulfilment may be sent to the original assessors for comment to advise the subcommittee. In some cases, a visit by an assessor may be required to confirm the action taken by the department.

9.2.3 Period of accreditation

Accreditation may be granted for a period up to a maximum of five years. New accreditations will not normally exceed three years.

Accreditation is effective from the date of entry of the first student cohort following the academic year that we visit. It is normally not possible for an accreditation award to be retrospective. However, accreditation may be backdated to allow cohorts already on the programme at the time it is accredited to benefit from the decision, provided that the work of that cohort of students has been reviewed as part of the accreditation exercise.

The period of accreditation may be reduced by the amount for any extension (see [Section 6.5](#)) granted to the previous accreditation.

Where conditions are made, the accreditation certificate will be to the end of the period set for them to be resolved. This is to allow the certificate to be displayed publicly without showing any conditions. Once the conditions have been met, a new certificate will be issued to reflect the full period of accreditation.

9.2.4 Recommendations to the department

In the majority of cases we seek to make recommendations to the department. These are not mandatory. However, they are offered in the spirit of providing help and sharing of good practice in chemical engineering education. Adoption by the department of these recommendations is encouraged and generally expected.

9.3 After the accreditation decision

Following an accreditation award, the department will be sent a decision letter

and, separately, a certificate to formally acknowledge the accredited status of the programme(s).

There will be ongoing contact between us and the department in terms of accreditation policy developments during the period of accreditation. Our qualifications department will liaise with the university department regarding policy changes, student services, membership and related activities.

9.4 Obligations and duties of departments

It is a general condition of accreditation that departments must inform us in a timely fashion of significant changes to the curriculum or resources that impact upon the delivery or nature of the accredited programme. Changes which must be notified include:

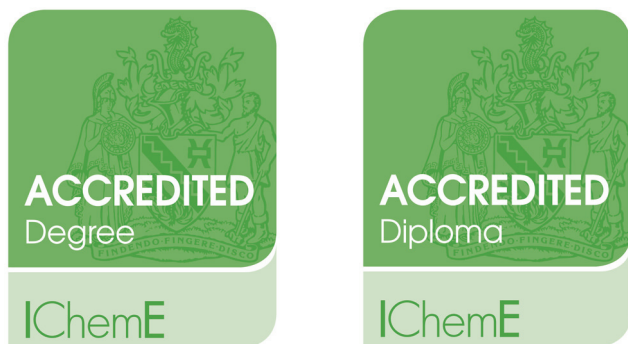
- changed learning outcomes;
- changed programme title;
- changed programme structure;
- loss of key staff which could affect the integrity of the programme;
- adverse impacts on resources, such as due to an upsurge in student numbers or the loss of staff or facilities.

Departments often need to make changes to a programme during the period of accreditation and we understand the need for this. Where the change is substantial, an interim accreditation visit may be required.

All departments with accredited programmes are encouraged to contribute to the development and implementation of accreditation policy and to share good practice in chemical engineering education. For example, we seek to identify senior and experienced academic staff from as wide a range of departments as possible, on an international basis, to join the pool of accreditation assessors. In addition, it is considered to be normal practice that the department, with our help, encourages uptake of IChemE student membership amongst the cohort. Further, the IChemE Education Special Interest Group (EdSIG) exists to share good practice and debate current issues in chemical engineering education. All chemical engineering departments are strongly encouraged to engage with EdSIG's numerous events and activities.

9.5 Endorsement logos

Our endorsement logos enable universities and other organisations to demonstrate IChemE approval. They are to be used only for the category accredited and must be used in compliance with the guidance provided with the logo. These logos will appear as an endorsement and can be used alongside the logo of the university on print and web material.



9.6 Appeals procedure

We maintain an appeals procedure for universities who wish to appeal against irregularities in the process of accreditation. Appeals against accreditation decisions will be considered by a panel appointed by the IChemE Qualifications Committee.

For further information, refer to the supporting documents found at www.icheme.org/uni-accreditation-docs

10. Working with other accrediting bodies

10.1 Introduction

We will normally agree to conduct an accreditation or benchmarking study by invitation of a university. Such invitations usually arise because of recognition of the distinct value of discipline-specific, in-depth peer review of chemical engineering teaching that we provide.

We completely respect the need for national-level accreditation systems and welcome the fact that agreements, such as the International Engineering Alliance's Washington Accord, provide confidence in the quality of university accreditation processes.

It is possible to combine an accreditation visit to coincide with another accrediting body. We have experience of visits to complement those of other national accrediting bodies either through joint visits or visits closely following the schedules of the national body. Examples include coordination with Engineers Australia, UK Engineering Accreditation Board and Institution of Professional Engineers New Zealand.

For further specific information on what is required from the university for a joint accreditation visit, please contact accreditation@icheme.org

10.2 Operational arrangements

Joint accreditation is at our discretion. It is essential that any department contemplating joint visits should discuss the options with us at the earliest possible opportunity to allow ample time for coordination between the organisations concerned.

IChemE staff and the Lead Assessor will liaise with representatives of the partner organisation(s) to optimise the arrangements, especially requirements for and use of documentation. The two organisations will similarly liaise over the visit schedule to ensure that each is able to satisfy its requirements, whilst minimising the need for separate meetings and events.

10.3 Decision-making for joint accreditations

We reserve the right to decide accreditation outcomes independently against the standards set out in these guidelines. However, for joint accreditations, the Lead Assessor will liaise with their counterpart(s) in the partner organisation(s) to align as far as possible the judgements made. Inevitably, there will be occasions where opinions cannot be aligned and details of these will be brought to the attention of the Education Subcommittee through the assessors' report.



11. Further information about the application

11.1 Applying for accreditation

Departments seeking new accreditation(s) can request this from us at any time. We will provide help and guidance at any stage and, in particular, encourage departments to seek informal advice and guidance at an early stage.

Departments that currently have accredited programmes will automatically receive a reminder from us well before the expiry date of the existing accreditation period, inviting the department to submit their programme(s) for re-accreditation.

Further information can be found in the supporting documents at www.icheme.org/uni-accreditation-docs

11.2 Data protection (GDPR)

The accreditation process is designed to comply with best practice in data protection, including legal requirements such as the General Data Protection Regulations in the European Union and the UK.

All documents submitted by the university are used for the purpose of accreditation and will not be distributed further, however, student's name, date of birth and address should not be on any of the documents submitted. Where this is unavoidable it is the university's responsibility that the subjects concerned have given approval.

The IChemE degree programme questionnaire seeks details of staff resources and laboratory, information and learning facilities. These will include the full-time equivalent (FTE) staff involved in the teaching programme and information on typical sizes of laboratory and design groups. We will not use, process, store or distribute the data obtained for the purpose of accreditation for any other purpose. Where staff and/or student names have to be included then it is the responsibility of the university to ensure that permission to include this information is given by the subject. It is the university's responsibility that the subjects concerned have given approval.

Encryption will be used where necessary to guarantee confidentiality and processing or distribution of reports for purposes other than accreditation is not permitted.

The assessors produce a confidential and anonymised written report. We will treat the report as confidential and shall not distribute it for any other purpose. The report is made

available to the department. Individual comments will be non-attributable in the report. Assessor confidentiality obligations include agreement to:

- only access data on password protected or encrypted devices;
- keep the confidential information secret and confidential by using a reasonable degree of care, and not less than the degree of care used by you in safeguarding your own confidential information;
- not use or exploit the confidential information in any way except for the purpose for which it was disclosed to you and only to the extent expressly permitted by IChemE;
- not disclose or make available any confidential information in whole or in part to any person; and
- acknowledge that all confidential information which belongs to IChemE remains the property of IChemE.

Documents will be retained for seven years. Assessors will delete records after the accreditation outcome has been notified to the university and any conditions placed on programmes have been met. We will send notification of when deletion must take place and assessors must confirm in writing that they have done this.

Appendix A: Learning outcomes at Levels B and F

A1 Underpinning mathematics, science (chemistry, physics, biology) and associated engineering disciplines

A1.1 Introduction

Students' knowledge and understanding of mathematics, science and associated engineering disciplines should be of appropriate depth and breadth to underpin their chemical engineering education, to enable appreciation of its scientific and engineering context, and to support their understanding of future developments. It is expected that this underpinning material should be taught in an engineering context and, where appropriate, a chemical engineering context.

The amount of underpinning mathematics and science will vary between programmes, particularly reflecting variations in entry qualifications and/or structure of the earlier year(s) of the programmes. Departments will need to provide evidence that students have achieved the levels in these topics to underpin all the other required learning outcomes in chemical engineering.

A1.2 Learning outcomes

The table opposite lists the expected learning outcomes from Level B and Level F programmes.

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ have a knowledge and understanding of mathematics necessary for the analysis of, and to support applications of, key chemical engineering principles and processes; ■ have a knowledge and understanding of basic mathematical models relevant to chemical engineering; ■ have a knowledge and understanding of scientific principles, namely the relevant aspects of physics, chemistry, biochemistry, biology and materials science, to enable the understanding of chemical engineering principles; ■ have knowledge of and understanding of the engineering use of materials, such as in the selection of materials of construction, corrosion protection, and design of novel products; ■ have a basic understanding of relevant principles from engineering disciplines commonly associated with chemical engineering. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ have a comprehensive knowledge and understanding of mathematics and scientific principles relevant to chemical engineering, demonstrated primarily through their ability to apply them to the solution of complex engineering problems.

A2 Chemical engineering principles

A2.1 Introduction

The learning outcomes in this area are based on the main principles and applications of chemical engineering. Students graduating from an accredited programme will:

- understand the principles of fluids and solids formation and processing;
- be proficient in applying these principles to problems involving fluid flow, heat transfer, mass transfer and reaction engineering;
- be able to apply the principles to the analysis of complex systems within a structured approach to safety, health and sustainability.

It is desirable that throughout the programme the students should gain an understanding of the broad range of applications of the principles and develop the ability to analyse, model quantitatively and synthesise at the appropriate scale. The applications should include:

- different types of process, including continuous and batch; chemical processes and bioprocesses;
- different time scales: short and long periods; steady and unsteady state;
- different physical scales: from molecular level to large scale continuous.

Students must acquire the knowledge and ability to handle broader implications of work as a chemical engineer. These include:

- sustainability aspects;
- process safety, health, environmental and other professional issues including ethics, risk, security, diversity, inclusion, societal, commercial and economic considerations etc.

The tables in the following sections are intended to give minimum indicative capabilities that all chemical engineering graduates are expected to possess. They are not intended to be exclusive or define the boundaries of chemical engineering.

A2.2 Fundamentals

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none">■ understand the principles of material and energy balances and be able to apply them to chemical engineering problems;■ understand the principles of momentum, heat and mass transfer and application to problems involving fluids and multiple phases;■ understand the thermodynamic and transport properties of fluids, solids and multiphase systems;■ understand the principles of equilibrium and chemical thermodynamics, and application to phase behaviour, to systems with chemical reaction and to processes with heat and work transfer;■ understand the principles of chemical and biochemical reaction and reactor engineering.	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none">■ be able to apply the same underlying principles to more complex problems, critically evaluating the limitations of assumptions of the approach taken.

A2.3 Mathematical modelling and quantitative methods

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ be familiar with the application and limitations of a range of modelling approaches including first-principles models, simple empirical correlations, and artificial intelligence approaches; ■ be competent in the use of numerical and computer methods, including commercial software for solving chemical engineering problems (detailed knowledge of computer coding is not required). 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ be able to select and adapt computational and analytical techniques to tackle complex problems; ■ recognise the limitations of standard commercial software for solving chemical engineering problems and identify requirements for more advanced techniques or specialist expertise.

A2.4 Process and product technology

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ understand the most widely used unit operations of separation and mixing; particle technology; equipment sizing and performance; biological systems; ■ understand and be able to use basic chemical principles to model the characteristics and performance of a range of typical mixing, separation and similar processing steps for fluids, particulates and multiphase systems; ■ understand the principles on which processing equipment operates to determine equipment size and performance of common items such as reactors, exchangers and columns; ■ understand and be able to quantify the effect of processing steps on the state of the material being processed, and its transformation to the end product in terms of its composition, morphology and functionality. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ be able to apply their knowledge of chemical engineering principles to complex and/or novel unit operations, process equipment, and substances with complex behaviour; ■ be able to apply their knowledge of these principles to complex problems with conflicting requirements.

A2.5 Systems

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ understand the principles of batch and continuous operation and criteria for process selection; ■ understand systems thinking, including the interdependence of elements of a complex system, being able to synthesise a conceptual multi-step process and apply analysis techniques to it; ■ understand system dynamics, being able to determine the dynamic response to changes in a process, design measurement and control functions, and determine its performance; ■ be able to apply digital techniques to solving chemical engineering problems; ■ understand the benefits and risks of digitalisation and adopt a holistic and proportionate approach to the mitigation of security risks using process, cyber and automation, and behavioural measures. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ understand how to combine and adapt different aspects of systems thinking to complex and novel processes.

A2.6 Process safety

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ be able to identify the principal hazard sources in chemical and related processes (including biological hazards); ■ understand the principles of safety and loss prevention, and their application to inherently safe design; ■ understand the principles of risk assessment and of safety management, and be able to apply techniques for the assessment and abatement of process and product hazards; ■ be able to apply systematic methods for identifying process hazards (eg HAZOP), and for assessing the range of consequences (eg impact on people, environmental reputation, financial, security); ■ be aware of specialist aspects of safety and environmental issues, such as noise, hazardous area classification, relief and blowdown, fault tree analysis; ■ have knowledge of the local legislative framework and how it is applied to the management of safety, health and environment in practice and in the workplace, from the perspectives of all involved, including operators, designers, contractors, researchers, visitors and the public. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ be able to apply the same principles with systems thinking to more complex problems; ■ have some understanding of the limits of available technology and of the potential of new and emerging technology.

A2.7 Sustainability and ethics

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ understand and be able to apply the principles of sustainability (environmental, social, economic) and the ability to apply techniques for analysing the interaction of process, product and plant with the environment and minimising adverse impacts. ■ be able to apply the principles of process, plant and project economics; ■ understand the need for high ethical and professional standards and understand how they are applied to issues facing engineers; ■ be able to adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion; ■ understand that: an effective ethics culture includes how sustainability, economics, health and safety, equality, diversity and inclusion and professionalism are informed by and influence the ethical reasoning and behaviour of the professional engineer. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ be able to apply principles of sustainability, economics and ethics to novel and complex situations with conflicting requirements.

A3 Chemical engineering practice

A3.1 Introduction

Chemical engineering practice is the practical application of chemical engineering skills, combining theory and experience, together with the use of other relevant knowledge and skills.

Graduates of accredited programmes must understand the ways in which chemical engineering knowledge can be applied in practice, such as in: operations and management; projects; providing services or consultancy; developing new technology.

Departments should demonstrate high standards of appreciation and practice of safety, health and environment (SH&E), ethics, sustainability, equality, diversity, and inclusion in their teaching and operations within laboratories, pilot plants and project work.

[Note that such areas of knowledge will be significantly developed after graduation, through learning and experience at work, and the expected level of attainment from an undergraduate programme will naturally be that of a fresh graduate, not that of an experienced engineer].

A3.2 Learning outcomes

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ understand the commercial, economic and social context of engineering processes; ■ be aware of the range of applications of chemical engineering and the roles of chemical engineers; ■ adopt an inclusive approach to engineering practice, recognising the responsibilities, benefits and importance of supporting equality, diversity and inclusion; ■ be aware of relevant legal requirements, codes or practice, and industry standards governing engineering activities, including personnel, health and safety, contracts, intellectual property rights, product safety and liability issues, and be aware that these may differ internationally; ■ understand and be able to apply knowledge of engineering management principles and techniques, including project and change management, and understand their limitations; ■ be aware of the concept and implications of 'professional' (Chartered) engineers and the role of Professional Engineering Institutions; ■ be aware of quality assurance issues and their application to continuous improvement; ■ be aware of the need to protect technology and information transfer securely ensuring both ethical and sustainability implications are considered; ■ have a knowledge and understanding of laboratory practice, and ability to operate bench (or larger) scale chemical engineering equipment; ■ be able to design, plan and undertake experimental or plant work and critically interpret, analyse and report on experimental data; ■ be able to find and apply, with judgement, information from technical literature and other sources. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ understand the limitations of current practice; ■ have a broad knowledge and critical awareness of developments at the forefront of chemical engineering; ■ have a critical awareness of the wider engineering discipline; ■ have undertaken research and/or development project work that provides opportunities for: application of research methods, including structured design of experimental work; originality and experience in dealing with uncertainty and new concepts and/or applications; ■ have communicated the outcomes of the project work in a professional manner that may include: thesis; publication; poster; presentation.

A4 Chemical engineering design

A4.1 Introduction

Chemical engineering design is the creation of a system, process, product or plant to meet an identified need.

Students need not only to understand the principles of design but must also display competence in applying those principles to doing their own design work. This requires them to bring together technical and other skills: they need to be able to define a problem, identify constraints, and employ creativity and innovation to find a solution. They must understand the concept of 'fitness for purpose' and the importance of delivery.

Chemical engineering design is the creation of a system, process, product, or plant to meet an identified need. Design is an essential component of all IChemE-accredited degrees and serves to:

- develop an integrated approach to chemical engineering;
- encourage the application of chemical engineering principles to problems of current and future industrial relevance including sustainable development, progress towards a more circular economy, safety, and environmental issues;
- encourage students to develop and demonstrate creative and critical powers by requiring choices and decisions to be made in areas of uncertainty;
- encourage students to take a broad view when confronted with complexity arising from the interaction and integration of the different parts of a process or system;
- encourage the development of transferable skills such as communication and team working;
- give students confidence in their ability to apply their technical knowledge to real problems.

We are keen to encourage innovation and diversity in design and to encourage a wide

range of applications, which might include:

- process design – synthesis of unit operations into a manufacturing process to meet a specification;
- process troubleshooting/debottlenecking – analysis of problems for an existing process for which the solutions require innovative process or equipment changes;
- equipment design – the design of specific and complex equipment items to deliver a process or product objective, eg extruder, distillation column, etc;
- product design;
- product troubleshooting – analysis of problems for an existing product for which innovative solutions are required;
- system design – where creativity, broad range thinking, and systems integration are needed to design a system to meet a specification, eg manufacturing supply chain, effluent handling system, transportation system, safety auditing system, recycling system, site utility system, product distribution system.

It is desirable that the learning outcomes for design are achieved throughout the programme: for example, by students accumulating a portfolio of design work as they progress through the programme. This approach will develop students' ability to handle a range of process, product and plant design problems, provide them with a wide variety of design experience, and will encourage integration of design-related aspects into the taught programme.

In order to meet the learning outcomes associated with the systems approach, the design portfolio must include a major design exercise which addresses the complexity issues arising from the interaction and integration of the different parts of a process or system. It is expected that this major project will be undertaken by teams of students and that this will contribute significantly to the development of the students' transferable skills such as communication and team working.

A separate document, available at www.icheme.org/uni-accreditation-docs provides a description of the elements of a full commercial design. While it is not expected that the design exercises in an academic programme would contain all elements discussed, it is

expected that they should cover feasibility, basic design, and detailed design aspects. The document provides a comprehensive list of design aspects which may be considered within design exercises.

While team-working in design and design projects is actively encouraged, we expect that the assessment methods will be effective in ensuring that each individual student, as well as the whole team, meets the required learning outcomes.

A4.2 Learning outcomes

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ understand the importance of identifying the objectives and context of the design in terms of: the business requirements; the technical requirements; sustainable development; safety, health and environmental issues; appreciation of public perception and concerns; ■ understand that design is an open-ended process, lacking a pre-determined solution, which requires: synthesis, innovation and creativity; choices on the basis of incomplete and contradictory information; decision making; working with constraints and multiple objectives; justification of the choices and decisions taken; ■ be able to deploy chemical engineering knowledge using rigorous calculation and results analysis to develop a design and with appropriate checks on feasibility and practicality; ■ be able to take a systems approach to design appreciating: complexity; interaction; integration; ■ be able to evaluate the effectiveness of their design, including its immediate and life cycle environmental impacts; ■ be able to work in a team and understand and manage the processes of: peer challenge; planning, prioritising and organising team activity; the discipline of mutual dependency; ■ be able to communicate effectively to: acquire input information; present the outcomes of the design clearly, concisely and with the appropriate amount of detail, including flowsheets and stream data; explain and defend chosen design options and decisions taken. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ have a comprehensive understanding of design processes and methodologies and an ability to apply and adapt them in unfamiliar situations; ■ be able to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies; ■ have the ability to generate an innovative design for processes, systems and products to fulfil new needs; ■ have achieved within the design project(s) some of the Level F outcomes in Section A2, such as: <ul style="list-style-type: none"> – detailed design of control systems based on process dynamics; – design and operation aspects of start-up and shut-down; – design of a process for a novel product or process for which data are unreliable or limited; – evaluation of financial and other risks.

A5 Embedded learning

A5.1 Introduction

Chemical engineers must develop general skills that will be of value in a wide range of business situations. These include development of abilities within problem solving, communication, effective working with others, effective use of IT, persuasive report writing, information retrieval, presentation skills, project planning, self-learning, performance improvement, awareness of the benefits of continuing professional development etc.

We expect degree programmes to be designed so that they provide the opportunity to acquire and develop these skills and will seek to ensure demonstration and commitment to this objective.

Chemical engineers must develop a range of general 'transferable' (or 'professional') skills. We expect degree programmes to be designed so that the opportunity to acquire and develop these skills, in different ways and at different levels, is embedded throughout the programme.

In order to encourage the embedding and integration of these skills throughout the programme, a minimum credit count is not specified. However, we expect that evidence will be provided to demonstrate where and how the learning outcomes are met.

Further details on learning outcomes can be found on the next page.

A5.2 Learning outcomes

Level B	Level F
<p>Students graduating from an accredited programme will:</p> <ul style="list-style-type: none"> ■ have developed a wide range of problem-solving skills; ■ have developed a range of effective communication skills including written reports and presentations; ■ recognise the importance of working inclusively and effectively with others from a diverse range of backgrounds and have acquired a range of experience in achieving this; ■ recognise the importance of leadership skills and have had some opportunity to acquire these; ■ be effective users of IT; ■ have awareness of the need to protect technology and information transfer securely ensuring both ethical and sustainability implications are considered; ■ recognise the importance of project planning and time management and have acquired a range of experience in achieving these; ■ be able to reflect on their own work and implement strategies for personal improvement and professional development; ■ be aware of the benefits of continuing professional development and of personal development planning. 	<p>Students graduating from an accredited programme will, building on the Level B learning outcomes:</p> <ul style="list-style-type: none"> ■ be able to handle uncertainty and complexity; ■ be able to familiarise themselves with the new and unknown; ■ be able to develop innovative approaches, addressing combinations of societal, business, and customer needs, while considering diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice, and industry standards; ■ have some understanding of the limits of available technology and of the potential of new and emerging technology; ■ be able to evaluate critically technical literature and other information sources; have the ability to evaluate the environmental and societal impact of solutions to complex problems across their entire life-cycle, minimising adverse impacts; ■ be able to evaluate critically their own effectiveness as an individual and as a member of a team and its performance; ■ be able to evaluate critically the communication approaches they use for a variety of audiences; ■ have a broader understanding of related subjects.

A6 Cultural learning

A6.1 Introduction

Section 5 of this document highlights the importance of the cultural development of chemical engineering students. This goes beyond the direct learning outcomes discussed above, extending to the behaviours they exhibit in their professional work. Shortcomings in these behaviours can be seriously detrimental to their effectiveness as engineers and their ultimate career outcomes.

Cultural learning is seen particularly in the approach of students to:

- health and safety;
- ethics;
- sustainability;
- diversity and inclusion.

Our experience is that student behaviour is influenced as much by exposure to a positive institutional culture as it is by the content of the programmes. Assessors will therefore, where possible, evaluate:

- the appropriateness of the university's policies in each of these areas;
- the attitude and level of adherence of the university's staff to these policies;
- the extent to which students are engaged in the policies.

A6.2 Specific learning outcomes in ethics

Ethics learning outcomes should be related to the four basic principles outlined by the Engineering Council and the Royal Academy of Engineering*:

- accuracy and rigour (including acting with competence; presenting and reviewing engineering competence; identifying and evaluating possible risks);

- honesty and integrity (including being aware of how one's own behaviour can affect others; preventing corrupt practices and professional misconduct; declaring conflicts of interest);
- respect for life, law and public good (including taking account of limited availability of human and natural resources; holding paramount the health and safety of others);
- responsible leadership (including being aware of the issues that engineering raises for society; promoting the public awareness of engineering benefits and impact).

Awareness of engineering ethics guides students in preparation for their professional lives and helps them to identify ethical issues and the practice in which they arise. Ethics also helps students to develop wider skills in communication, reasoning and reflection, and the professional attitude to carry forward into their working life.

A7 Complementary subjects

Accredited degree programmes may contain other subjects that are not directly related to chemical engineering, such as languages, business and management related studies, history and culture, etc. We recognise the benefits of a rounded education in effectively preparing graduates for their careers. Complementary subjects are not formally assessed, but rigour in their teaching and assessment is expected.

* Engineering Council and Royal Academy of Engineering, Statement of Ethical Principles, www.engc.org.uk/standards-guidance/guidance/statement-of-ethical-principles

Appendix B: Learning outcomes at Level D

B1 Underpinning mathematics, science (chemistry, physics, biology) and associated engineering

B1.1 Introduction

Students' knowledge and understanding of mathematics, science and associated engineering disciplines should be of appropriate depth and breadth to underpin their chemical engineering education, to enable appreciation of its scientific and engineering context, and to support their understanding of future developments. It is expected that this underpinning material should be taught in an engineering context and, where appropriate, a chemical engineering context.

The amount of underpinning mathematics and science will vary between programmes, particularly reflecting variations in entry qualifications and/or structure of the earlier year(s) of the programmes. Departments will need to provide evidence that students have achieved the levels in these topics to underpin all the other required learning outcomes in chemical engineering.

B1.2 Learning outcomes

Students graduating from an accredited programme will:

- have a knowledge and understanding of mathematics necessary to support applications of key chemical engineering principles and processes;
- be able to apply the basic mathematical models relevant to chemical engineering;
- have a knowledge and understanding of the core scientific principles, namely the relevant aspects of physics, chemistry, biochemistry, biology and materials science, to enable the understanding of chemical engineering principles;
- have a basic understanding of relevant elements from engineering disciplines commonly associated with chemical engineering, such as electrical power and motors; microelectronics; mechanics of pressure vessels; structural mechanics.

B2 Chemical engineering principles

B2.1 Introduction

The learning outcomes in this area will be based on the main principles and applications of chemical engineering. Students graduating from an accredited programme will:

- understand the principles of fluids and solids formation and processing;
- be capable of applying these principles to problems involving fluid flow, heat transfer, mass transfer and reaction engineering;
- be able to apply the principles to solve routine problems of broadly defined systems within a structured approach to safety, health and sustainability.

It is desirable that throughout the programme the students should gain experience of the broad range of applications of the principles and appreciate the importance of analysing and modelling systems. The applications should include:

- different types of process, including continuous and batch; chemical processes and bioprocesses;
- different time scales: short and long periods; steady and unsteady state;
- different physical scales: from molecular level to large scale continuous.

Students should have gained an insight into the requirement to handle broader implications of work as a chemical engineer. These include:

- sustainability aspects;
- process safety, health, environmental and other professional issues including ethics, risk, security, diversity, inclusion, societal, commercial and economic considerations.

B2.2 Fundamentals

Students graduating from an accredited programme will:

- understand the principles of material and energy balances and be able to apply to chemical engineering problems;

- understand the principles of momentum, heat and mass transfer, and apply them to routine problems involving fluids and multiple phases;
- understand the thermodynamic and transport properties of basic fluids, solids and multiphase systems;
- understand the principles of equilibrium and chemical thermodynamics, and apply them to basic phase behaviour, and to other basic systems with chemical reactions and to processes with heat and work transfer;
- understand and able to apply to routine problems the principles of chemical reaction, biochemical engineering and reactor engineering.

B2.3 Mathematical modelling and quantitative methods

Students graduating from an accredited programme will:

- understand and be able to apply routine tools for mathematical modelling;
- understand empirical correlation and other approximate methods;
- understand the use of numerical and computer methods, including commercial software for solving broadly defined chemical engineering problems (detailed knowledge of computer coding is not required).

B2.4 Process and product technology

Students graduating from an accredited programme will:

- understand the most widely used unit operations of separations and mixing; particle technology; equipment sizing and performance; biological systems;
- understand and be able to use basic chemical principles to model the characteristics and performance of a range of typical mixing, separation, and similar processing steps for fluids, particulates and multi-phase systems;
- understand the principles on which processing equipment operates to determine equipment size and performance of common items such as reactors, exchangers and columns;
- understand and be able to quantify the effect of processing steps on the

state of the material being processed, and its transformation to the end product in terms of its composition, morphology and functionality.

B2.5 Systems

Students graduating from an accredited programme will:

- understand the principles of batch and continuous operation and criteria for process selection;
- be able to integrate process steps into a sequence and apply basic analysis techniques such as balances (mass, energy);
- understand system dynamics, being able to determine response to basic changes in a process, design measurement and control functions;
- understand the use of systems thinking and modern digital tools and their application to broadly defined problems in chemical engineering;
- adopt a holistic and proportionate approach to the mitigation of security risks using process, cyber, automation, and behavioural measures.

B2.6 Process safety

Students graduating from an accredited programme will:

- identify and evaluate the principal hazard sources in chemical and related processes – including flammability, explosivity and toxicity, including biological hazards;
- understand the principles of safety and loss prevention, and their basic application to inherently safe design;
- identify and evaluate the principles of risk assessment and of safety management and be able to apply techniques for the assessment and mitigation of process and product hazards;
- understand the systematic methods for identifying process hazards (eg HAZOP), and of assessing the consequences (eg impact on people, environmental reputation, financial and security);

- identify and evaluate the specialist aspects of safety and environmental issues, such as noise, hazardous area classification, relief and blowdown, fault tree analysis;
- have a broad knowledge of the local legislative framework and its application to the management of safety, health and environment in practice and in the workplace, from the perspectives of all involved, including operators, designers, contractors, researchers, visitors and the public.

B2.7 Sustainability and ethics

Students graduating from an accredited programme will:

- understand, and be able to apply, the principles of sustainability (environmental, social, economic) and have an appreciation of techniques for analysing the interaction of process, product and plant with the environment and minimising adverse impacts;
- be aware of the principles of process, plant and project economics;
- identify ethical concerns and make reasoned ethical choices informed by professional codes of conduct;
- be able to adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.

B3 Chemical engineering practice

B3.1 Introduction

Chemical engineering practice is the practical application of chemical engineering skills, combining theory and experience, together with the use of other relevant knowledge and skills.

Graduates of accredited programmes must understand the ways in which chemical engineering knowledge can be applied in practice, such as in operations and management, projects, providing services or consultancy, and developing new

technology.

Departments should demonstrate high standards of appreciation and practice of safety, health and environment (SH&E), ethics, sustainability, and equality, diversity and inclusion in their teaching and operations within laboratories, pilot plants and project work.

Typical learning outcomes include: possession of practical and laboratory skills relevant to chemical engineering; knowledge of the characteristics of particular equipment, processes or products; the ability to deal with technical uncertainty; appreciation of the sources and value of technical literature; awareness of the nature of intellectual property; facility in the use of appropriate codes of practice and industry standards.

[Note that such areas of knowledge will be significantly developed after graduation, through learning and experience at work, and the expected level of attainment from an undergraduate programme will naturally be that of a fresh graduate, not that of an experienced engineer].

B3.2 Learning outcomes

Students graduating from an accredited programme will:

- be aware of the range of applications of chemical engineering and the roles of chemical engineers;
- be aware of the concept and implications of 'professional' (Chartered and Incorporated) engineers and the role of Professional Engineering Institutions;
- adopt an inclusive approach to engineering practice, recognising the responsibilities, benefits and importance of supporting equality, diversity and inclusion;
- be aware of the importance of codes of practice and industry standards and relevant legal codes such as intellectual property rights and have some experience in applying them;
- be aware of how chemical engineering interfaces with other engineering disciplines;

- recognise the need for quality management systems and continuous improvement in the context of broadly defined problems;
- be aware of need to protect technology and information transfer securely ensuring both ethical and sustainability issues are considered;
- apply knowledge of engineering management principles, commercial context and project management; use practical laboratory and workshop skills to operate bench- (or larger) scale chemical engineering equipment in the context of broadly defined problems;
- be able to undertake well-planned experimental work and to interpret, analyse and report on experimental data;
- be able to select and use, with judgement, information from technical literature and other sources of information to address broadly defined problems.

B4 Chemical engineering design practice and design projects

B4.1 Introduction

Chemical engineering design is the creation of a system, process, product or plant to meet an identified need.

Students must display competence in chemical engineering design, which requires bringing together technical and other skills, the ability to define a problem and identify constraints, and the employment of creativity and innovation. They must understand the concept of 'fitness for purpose' and the importance of delivery.

Departments should demonstrate high standards of appreciation of safety, health and environment (SH&E) within their teaching of design and related project work.

Chemical engineering design is the creation of a system, process, product, or plant to meet an identified need. Design is an essential component of all IChemE-accredited degrees and serves to:

- develop an integrated approach to chemical engineering;
- encourage the application of chemical engineering principles to problems of current and future industrial relevance including sustainable development, progress toward a more circular economy, safety, and environmental issues;
- encourage students to develop and demonstrate creative and critical powers by requiring choices and decisions to be made in areas of uncertainty;
- encourage students to take a broad view when confronted with complexity arising from the interaction and integration of the different parts of a process or system;
- encourage the development of transferable skills such as leadership, communication and teamworking;
- give students confidence in their ability to apply their technical knowledge to real problems.

We are keen to encourage innovation and diversity in design and to encourage a wide range of applications, which might include:

- process design – synthesis of unit operations into a manufacturing process to meet a specification;
- process troubleshooting/debottlenecking – analysis of problems for an existing process for which the solutions require innovative process or equipment changes;
- equipment design – the design of specific and complex equipment items to deliver a process or product objective, eg extruder, distillation column, etc;
- product design;
- product troubleshooting – analysis of problems for an existing product for which innovative solutions are required;
- system design – where creativity, broad range thinking, and systems integration are needed to design a system to meet a specification, eg manufacturing supply chain, effluent handling system, transportation system, safety auditing system, recycling system, site utility system, product distribution system.

It is desirable that the learning outcomes for design are achieved throughout the programme: for example, by students accumulating a portfolio of design work as they progress through the programme. This approach will develop students' ability to handle a range of process, product and plant design problems, provide them with a wide variety of design experience, and will encourage integration of design-related aspects into the taught programme.

In order to meet the learning outcomes associated with the systems approach, the design portfolio must include a major design exercise which addresses the complexity issues arising from the interaction and integration of the different parts of a process or system.

It is expected that this major project will be undertaken by teams of students and that this will contribute significantly to the development of the students' transferable skills such as leadership, communication and team working.

While team-working in design and design projects is actively encouraged, we expect that the assessment methods will be effective in ensuring that each individual student, as well as the whole team, meets the required learning outcomes.

B4.2 Learning outcomes

Students graduating from an accredited programme will:

- understand the importance of identifying the objectives and context of the design in terms of: the business requirements; the technical requirements; sustainable development; safety, health and environmental issues; appreciation of public perception and concerns;
- appreciate that design is an open-ended process, lacking a pre-determined solution, which requires: synthesis, innovation and creativity; choices on the basis of incomplete and contradictory information; decision making; working with constraints and multiple objectives; justification of the choices and decisions taken;
- be able to deploy chemical engineering knowledge using rigorous calculation and results analysis to develop a design and with appropriate checks on feasibility and practicality;
- be able to take a systems approach to design appreciating: complexity; interaction; integration;

- be able to evaluate the effectiveness of their design, including its immediate and life cycle environmental impacts;
- be able to select and apply appropriate materials, equipment, engineering technologies and processes to broadly defined problems;
- be able to work in a team and understand and manage the processes of: leadership, peer challenge; planning, prioritising and organising team activity; the discipline of mutual dependency;
- be able to communicate effectively to: acquire input information; present the outcomes of the design clearly, concisely and with the appropriate amount of detail, including flowsheets and stream data; explain and defend chosen design options and decisions taken.

B5 Embedded learning

B5.1 Introduction

Chemical engineers should develop general skills that will be of value in a wide range of business situations. These include development of abilities within problem solving, communication, effective working with others, effective use of IT, persuasive report writing, information retrieval, presentation skills, project operation, self-learning, performance improvement, awareness of the benefits of continuing professional development, etc.

We expect these programmes to be designed so that they provide the opportunity to acquire and develop these skills and will seek to ensure demonstration and commitment to this objective.

Chemical engineers should develop a range of general 'transferable' (or 'professional') skills. We expect these programmes to be designed so that the opportunity to acquire and develop these skills, in different ways and at different levels, is embedded throughout the programme.

In order to encourage the embedding and integration of these skills throughout the programme, a minimum credit count is not specified. However, we expect that evidence will be provided to demonstrate where and how the learning outcomes are met.

B5.2 Learning outcomes

Students graduating from an accredited programme will:

- have developed an appreciation of problem-solving skills;
- have developed effective communication skills including written reports and presentations for both technical and non-technical audiences;
- recognise the importance of working inclusively and effectively with others from a diverse range of backgrounds and have acquired a range of experience in achieving this;
- appreciate the importance of leadership skills and have had some opportunity to acquire these;
- be effective users of IT;
- have an awareness of the need to protect technology and information transfer securely ensuring both ethical and sustainability implications are considered;
- recognise the importance of project planning and time management and have acquired a range of experience in achieving these;
- apply knowledge of engineering management principles, commercial interest and project management;
- be able to reflect on their own work to generate strategies for personal improvement and professional development;
- plan and record self-learning and development as a foundation for lifelong learning/Continual Professional Development (CPD).

B6 Cultural learning

Section 5 of this document highlights the importance of the cultural development of chemical engineering students. This goes beyond the direct learning outcomes discussed above, extending to the behaviours they exhibit in their professional work. Shortcomings in these behaviours can be seriously detrimental to their effectiveness as engineers and their ultimate career outcomes.

Cultural learning is seen particularly in the approach of students to:

- health and safety;
- ethics;
- sustainability;
- diversity and inclusion.

Our experience is that student behaviour is influenced as much by exposure to a positive institutional culture. Assessors will therefore, where possible, evaluate:

- the appropriateness of the university's policies in each of these areas;
- the attitude and level of adherence of the university's staff to these policies;
- the extent to which students are engaged in the policies.

B6.1 Specific learning outcomes in ethics

Ethics learning outcomes should be related to the four basic principles outlined by the Engineering Council and the Royal Academy of Engineering:

- accuracy and rigour (including acting with competence; presenting and reviewing engineering competence; identifying and evaluating possible risks);
- honesty and integrity (including being aware of how one's own behaviour can affect others; preventing corrupt practices and professional misconduct; declaring conflicts of interest);
- respect for life, law and public good (including taking account of limited availability of human and natural resources; holding paramount the health and safety of others);
- responsible leadership (including being aware of the issues that engineering raises for society; promoting the public awareness of engineering benefits and impact).

Awareness of engineering ethics guides students in preparation for their professional lives and helps them to identify ethical issues and the practice in which they arise. Ethics also helps students to develop wider skills in communication, reasoning and reflection, and the professional attitude to carry forward into their working life.

B7 Complementary subjects

Accredited programmes may contain other subjects that are not directly related to chemical engineering, such as languages, business and management related studies, history and culture, etc. We recognise the benefits of a rounded education in effectively preparing graduates for their careers. Complementary subjects are not formally assessed, but rigour in their teaching and assessment is expected.



Appendix C: Typical schedule for an assessment visit

Day before visit

19:00 Pre-visit meeting of assessors.

Day one

- 08:45 Assessors arrive at the department.
- 09:00 Welcome to the department – introductions, orientation.
- 09:30 Meet with senior staff (as appropriate: Dean, Head of Department, Programme Directors etc) to discuss programme philosophy and future plans.
- 10:30 Meet with programme directors to discuss the degree programme questionnaire – entry standards and programme structure, curriculum, learning outcomes (to be continued after lunch).
- 12:00 Private panel discussion and review of materials.
- 13:00 Working lunch with academic staff.
- 14:00 Continued discussion of degree programme curriculum and specific learning outcomes.
- 15:00 Discuss design content of degree programme(s).
- 15:30 Informal coffee break, possibly including technical and support staff.
- 16:00 Discuss Level F (advanced) outcomes and other major projects.
- 16:30 Review day one with programme directors (an opportunity to guide the programme and materials required for day two).
- 17:00 Meet a representative group of students - including (if possible) some recent graduates – (no staff to be present).
- 18:00 Close of day one.

Day two

- 09:00 Visit teaching laboratories, computing facilities and other resources, eg library, project rooms etc.
- 11:00 Discuss cultural learning around health and safety, ethics, sustainability, and diversity and inclusion.
- 11:30 Private panel discussion/break.
- 12:00 Discuss achievement of embedded learning outcomes.
- 12:30 Discuss industrial/professional training.
- 13:00 Private panel lunch.
- 14:00 Discuss assessment and quality assurance aspects.
- 14:45 Private panel discussion.
- 15:45 Final review and discussion with head of department and programme directors.
- 16:30 Close.

Appendix D: Indicative criteria for accreditation decisions

For use by the Education Subcommittee

Present status	How well are IChemE requirements met? Learning outcomes, resources, quality assurance, safety culture etc.	Indicative decision*
Programme not accredited by IChemE	Fully met, or Substantially met with only insignificant or very minor deficiencies.	Accredit for up to three years. If the programme is a relatively minor variant of an existing IChemE-accredited programme, the period may be up to five years.
	Substantially met but with relatively minor deficiencies which are anticipated as straightforward to remedy.	Accredit with mandatory conditions and a time limit for these to be remedied (typically one or two years).
	Not met due to significant** and important deviations from IChemE requirements.	Cannot be accredited in its present form.
Programme accredited by IChemE and presented for re-accreditation	Fully met, or Substantially met with only insignificant or very minor deficiencies.	Accredit for up to five years.
	Substantially met but with relatively minor deficiencies which are anticipated as straightforward to remedy.	Accredit for up to five years with recommendations. The expectation is that these will usually be addressed within that timescale and reviewed at the next accreditation visit.
	Not met due to significant** and important deviations from IChemE requirements.	Where the problems were not previously evident, accredit with conditions and a time limit for these to be remedied (typically one or two years). Or, in exceptional cases, where problems are so great as to cast severe doubt on the capabilities of the graduates or otherwise to pose reputational risk to IChemE, immediate withdrawal of accreditation or other sanctions may be appropriate.
<p>*NB In all cases: indefinite conditions may also be imposed for issues which cannot be addressed by modification to the programme or its delivery, eg a particular pathway within a programme.</p> <p>IChemE may recommend non-mandatory actions referred to as recommendations. The expectation is that these will usually be addressed within the accreditation period and reviewed at the next accreditation visit.</p> <p>**Definition of 'significant' - examples include: shortfalls in health and safety culture; some learning outcomes below IChemE-defined standards; some learning outcomes a little below IChemE credit requirements.</p>		

Appendix E: Mapping of IChemE learning outcomes to Engineering Council learning outcomes

The tables below show the learning outcomes for meeting Engineering Council (EngC) requirements for Incorporated Engineer (IEng) and Chartered Engineer (CEng) registration. Full details of Engineering Council's *Accreditation of Higher Education Programmes V4.0 (AHEP 4)* learning outcomes can be found at www.engc.org.uk/ahep

Partial Incorporated Engineer (IEng)

Area of learning	EngC learning outcome	AHEP 4 - Partial IEng	IChemE mapping - Level D
Science, mathematics and engineering principles	F1	Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems.	B1.2 B2.1, B2.2, B2.3, B2.4, B2.5, B2.6 B4.2
Engineering analysis	F2	Analyse broadly-defined problems reaching substantiated conclusions.	B2.1, B2.2, B2.3, B2.4, B2.5, B2.6 B4.2
	F3	Use appropriate computational and analytical techniques to model broadly-defined problems.	B2.1, B2.2, B2.3, B2.4, B2.5, B2.6 B4.2
	F4	Select and use technical literature and other sources of information to address broadly-defined problems.	B3.1, B3.2
Design and innovation	F5	Design solutions for broadly-defined problems that meet a combination of user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal and environmental matters, codes of practice and industry standards.	B2.6, B2.7 B3.2 B4.1, B4.2
	F6	Apply a systematic approach to the solution of broadly-defined problems.	B2.5 B5.2
The engineer and society	F7	Evaluate the environmental and societal impact of solutions to broadly-defined problems.	B2.6, B2.7 B3.2 B4.1, B4.2
	F8	Identify ethical concerns and make reasoned ethical choices informed by professional codes of conduct.	B2.6, B2.7 B3.1, B3.2 B6.2
	F9	Identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity.	B2.6 B4.2
	F10	Adopt a holistic and proportionate approach to the mitigation of security risks.	B2.5

Partial Incorporated Engineer (IEng) continued

Area of learning	EngC learning outcome	AHEP 4 - Partial IEng	IChemE mapping - Level D
Engineering practices	F11	Recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.	B2.7 B3.1 B5.2
	F12	Use practical laboratory and workshop skills to investigate broadly-defined problems.	B3.1, B3.2
	F13	Select and apply appropriate materials, equipment, engineering technologies and processes.	B1.2 B2.2, B2.4 B4.2
	F14	Recognise the need for quality management systems and continuous improvement in the context of broadly-defined problems.	B3.2
	F15	Apply knowledge of engineering management principles, commercial context and project management.	B3.2 B5.2
	F16	Function effectively as an individual, and as a member or leader of a team.	B4.2 B5.2
	F17	Communicate effectively with technical and non-technical audiences.	B4.2 B5.2
	F18	Plan and record self-learning and development as the foundation for lifelong learning/CPD.	B5.2

Partial Chartered Engineer (CEng)

Area of learning	EngC learning outcome	AHEP 4 - Partial CEng	IChemE mapping - Level B*
Science, mathematics & engineering principles	C1	Apply knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems. Some of the knowledge will be at the forefront of the particular subject of study.	A1.2 A2.1, A2.2, A2.3, A2.4, A2.5, A2.6 A4.2
Engineering analysis	C2	Analyse complex problems to reach substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles.	A2.1, A2.2, A2.3, A2.5, A2.6 A4.2
	C3	Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed.	A2.1 A2.2 A2.3, A2.4 A2.5 A4.2
	C4	Select and evaluate technical literature and other sources of information to address complex problems	A3.2
Design and innovation	C5	Design solutions for complex problems that meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards	A2.6, A2.7 A3.2 A4.1, A4.2
	C6	Apply an integrated or systems approach to the solution of complex problems.	A2.5 A5.2
The engineer and society	C7	Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts	A2.6, A2.7
	C8	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.	A2.7 A3.2
	C9	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity.	A2.6
	C10	Adopt a holistic and proportionate approach to the mitigation of security risks.	A2.5
	C11	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.	A2.7 A3.1 A5.2

*Programmes accredited to B-Standard fully meet the requirements for Incorporated Engineer (IEng).

Partial Chartered Engineer (CEng) continued

Area of learning	EngC learning outcome	AHEP 4 - Partial CEng	IChemE mapping - Level B
Engineering practices	C12	Use practical laboratory and workshop skills to investigate complex problems.	A3.2
	C13	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.	A1.2 A2.4 A2.5
	C14	Discuss the role of quality management systems and continuous improvement in the context of complex problems.	A3.2
	C15	Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters including intellectual property rights.	A3.2
	C16	Function effectively as an individual, and as a member or leader of a team.	A4.2 A5.2
	C17	Communicate effectively on complex engineering matters with technical and non-technical audiences.	A4.2 A5.2
	C18	Plan and record self-learning and development as the foundation for lifelong learning/CPD.	A5.2

Chartered Engineer (CEng)

Area of learning	EngC learning outcome	AHEP 4 - CEng	IChemE mapping - M Level
Science, mathematics & engineering principles	M1	Apply a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems. Much of the knowledge will be at the forefront of the particular subject of study and informed by a critical awareness of new developments and the wider context of engineering.	A1.2 A2.1, A2.2, A2.3, A2.4, A2.5, A2.6 A4.2, A4.3
Engineering analysis	M2	Formulate and analyse complex problems to reach substantiated conclusions. This will involve evaluating available data using first principles of mathematics, statistics, natural science and engineering principles, and using engineering judgment to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed.	A2.2, A2.3, A2.5, A2.6 A4.2
	M3	Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.	A2.1 A2.2 A2.3, A2.4 A2.5 A4.2
	M4	Select and critically evaluate technical literature and other sources of information to solve complex problems.	A3.2
Design and innovation	M5	Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.	A2.6, A2.7 A3.2 A4.1, A4.2
	M6	Apply an integrated or systems approach to the solution of complex problems.	A2.5 A5.2
The engineer and society	M7	Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse impacts.	A2.6, A2.7
	M8	Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct.	A2.7 A3.2
	M9	Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity.	A2.6
	M10	Adopt a holistic and proportionate approach to the mitigation of security risks.	A2.5
	M11	Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion.	A2.7 A3.1 A5.2

Chartered Engineer (CEng) continued

Area of learning	EngC learning outcome	AHEP 4 - CEng	IChemE mapping - M Level
Engineering practices	M12	Use practical laboratory and workshop skills to investigate complex problems.	A3.2
	M13	Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations.	A1.2 A2.4, A2.5
	M14	Discuss the role of quality management systems and continuous improvement in the context of complex problems.	A3.2
	M15	Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters including intellectual property rights.	A3.2
	M16	Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.	A4.2 A5.2
	M17	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used.	A4.2 A5.2
	M18	Plan and record self-learning and development as the foundation for lifelong learning/CPD.	A5.2

Chartered Engineer (CEng) further learning

Area of learning	EngC learning outcome	AHEP 4 - CEng FL	IChemE mapping - F Level
Science, mathematics & engineering principles	M1	Apply a comprehensive knowledge of mathematics, statistics, natural science and engineering principles to the solution of complex problems. Much of the knowledge will be at the forefront of the particular subject of study and informed by a critical awareness of new developments and the wider context of engineering.	A1.2 A2.1, A2.2, A2.3, A2.4, A2.5, A2.6 A4.2, A4.3
Engineering analysis	M2	Formulate and analyse complex problems to reach substantiated conclusions. This will involve evaluating available data using first principles of mathematics, statistics, natural science and engineering principles, and using engineering judgment to work with information that may be uncertain or incomplete, discussing the limitations of the techniques employed.	A2.2, A2.3, A2.5, A2.6 A4.2
	M3	Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed.	A2.1, A2.2, A2.3, A2.4, A2.5 A4.2
	M4	Select and critically evaluate technical literature and other sources of information to solve complex problems.	A3.2
Design and innovation	M5	Design solutions for complex problems that evidence some originality and meet a combination of societal, user, business and customer needs as appropriate. This will involve consideration of applicable health & safety, diversity, inclusion, cultural, societal, environmental and commercial matters, codes of practice and industry standards.	A2.6, A2.7 A3.2 A4.1, A4.2
	M6	Learning outcome achieved at previous level of study.	
The engineer and society	M7	Evaluate the environmental and societal impact of solutions to complex problems (to include the entire life-cycle of a product or process) and minimise adverse impacts.	A2.6, A2.7
	M8	Learning outcome achieved at previous level of study.	
	M9	Learning outcome achieved at previous level of study.	
	M10	Learning outcome achieved at previous level of study.	
	M11	Learning outcome achieved at previous level of study.	

Chartered Engineer (CEng) further learning continued

Area of learning	EngC learning outcome	AHEP 4 - CEng FL	IChemE mapping - F Level
Engineering practices	M12	Learning outcome achieved at previous level of study.	
	M13	Learning outcome achieved at previous level of study.	
	M14	Learning outcome achieved at previous level of study.	
	M15	Learning outcome achieved at previous level of study.	
	M16	Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance.	A4.2 A5.2
	M17	Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used.	A4.2 A5.2
	M18	Learning outcome achieved at previous level of study.	

Appendix F: Glossary

See cross-referenced sections for further details. Where relevant, definitions have been adopted from the Engineering Council's *Accreditation of Higher Education Programmes*.

Term	Definition	Section
Academic formation	The educational process of obtaining the qualifications necessary for IChemE membership.	2.2
Accreditation	The process of peer review of an academic programme against IChemE's published learning outcomes, as described in these guidelines.	
Assessor	A person appointed by IChemE who is trained in assessing the suitability of a programme for accreditation.	8.2
Awareness	Learning outcome descriptor for general familiarity (with the subject material)	3.7
B-Standard	Accreditation level for first cycle degrees that provide a solid academic foundation in chemical engineering knowledge and skills at IChemE outcome Level B.	2.1
Bologna process	<p>A non-statutory inter-governmental agreement, creating a coherent and cohesive European Higher Education Area (EHEA) and a Framework for Qualifications of the European Higher Education Area (FQ-EHEA) comprising first, second and third cycle degrees. The EHEA is a means of promoting mutual recognition of qualifications, demonstrating transparency of systems and easing the mobility of staff and students across higher education in Europe. www.ehea.info.</p> <p>The UK has verified that its national frameworks for higher education qualifications in England, Wales and Northern Ireland and in Scotland are compatible with the FQ-EHEA: bachelor's and bachelor's (hons) degrees as first cycle, the Integrated MEng and master's degree as second cycle. Other jurisdictions have also adopted or recognise the general principles of the Bologna process.</p> <p>www.engc.org.uk/international-activity/european-recognition/the-bologna-declaration/</p>	
Chartered Chemical Engineer	Professional title awarded to IChemE Chartered Members (MIChemE). See www.icheme.org/chartered	2.2
Chemical engineering principles	The theory and knowledge underlying chemical engineering, such as fluid flow behaviour, conservation of mass, energy and momentum, and thermodynamics.	A2, B2
Chemical engineering practice	The practical application of chemical engineering skills, combining theory and experience, together with the use of other relevant knowledge and skills.	A3, B3
Chemical engineering design	The creation of a system, process, product or plant to meet an identified need. Design problems will normally not have a single correct answer and require creativity, judgement and compromise.	A4, B4

Term	Definition	Section
Compensation	The system by which, in some assessment schemes, it is possible for students to compensate for poor performance in one module by achieving better marks in other modules.	4.6
Complementary learning	Substantial topics in a programme which are additional to the IChemE accreditation learning outcomes.	3.9
Complex	Learning outcome descriptor for engineering problems, processes or equipment which involve dealing simultaneously with a sizeable number of factors which interact and require deep understanding, including knowledge at the forefront of the discipline.	3.7
Condition (of accreditation)	Where continued accreditation is dependent upon the department meeting requirements set by IChemE. Conditions are binding on the department and must be resolved within the indicated timeframe for accreditation to be maintained and valid.	9.2.2
Content	The material taught in a programme, as opposed to the learning outcomes achieved. In order to ensure that all required learning outcomes are met, IChemE provides guidance on the minimum expected content for each area and for the programme as a whole, specified in terms of minimum credits.	4.1
Credit	A measure of the content of a programme. One credit is equivalent to approximately 20 hours student workload (combined tutor-led and independent study).	4.1
Department	The term 'department' is used for convenience throughout these guidelines for the academic unit (ie department, school, faculty etc) responsible for delivering the programmes under review.	
Diversity	The recognition of difference, and acknowledgment of the benefit of having a range of perspectives in decision-making and the workforce being representative of the organisation's customers.	5.5
D-Standard	Accreditation level for sub-degree programmes that provide a solid academic foundation in chemical engineering knowledge and skills with learning outcomes at IChemE Level D.	2.1
Education Subcommittee	IChemE's subcommittee with delegated decision-making authority for all matters relating to the accreditation of university programmes.	
Embedded learning	Learning which is developed in the context of other activities (eg ethics and safety culture developed in the context of general practical working).	4.2, A5, B5
Evidence	Auditable material supporting the accreditation application, for example samples of marked student work, information on programme structure, academic quality review reports etc.	7.1

Term	Definition	Section
First cycle	A programme at level 6 in the European Qualifications Framework (EQF) – see https://ec.europa.eu/ploteus/content/descriptors-page	
F-Standard	Accreditation level for postgraduate degrees of the highest international standards that provide advanced chemical engineering knowledge and skills at IChemE outcome Level F.	2.1
Inclusion	Inclusion is where people's differences are valued and used to enable everyone to thrive at work. An inclusive working environment is one in which everyone feels that they belong without having to conform, that their contribution matters and they are able to perform to their full potential, no matter their background, identity or circumstances. An inclusive workplace has fair policies and practices in place and enables a diverse range of people to work together effectively.	5.5
Incorporated Engineer	Professional registration available to individuals who meet the required standard of competence and commitment. See www.icheme.org/ieng	2.2
Integrated programme	A programme which integrates outcome Levels B and F into a single award.	4.2.1
Knowledge	Learning outcome descriptor for information that can be recalled.	3.7
Learning outcome	Also known as programme outcomes or programme learning outcomes. A statement of achievement expected of a graduate from an accredited programme.	3
M-Standard	Accreditation standard for integrated degrees of the highest international standards that provide both the solid academic foundation in chemical engineering of a first cycle degree and the advanced chemical engineering knowledge and skills of a second cycle degree, at IChemE outcome levels B and F.	2.1
Programme	A set of courses of study that leads to the award of a degree or other higher education qualification.	
Qualification	The award made as a result of successful completion of a programme of study.	2.1
Questionnaire	The proforma used by IChemE to collect data about programmes to be assessed for accreditation.	
Resources	The staff, facilities, and learning materials supporting a programme of study.	4.7
Second cycle	A programme at level 7 in the European Qualifications Framework (EQF) – see https://ec.europa.eu/ploteus/content/descriptors-page	

Term	Definition	Section
Skills	Learning outcome descriptor for acquired and learned attributes that can be applied almost automatically.	3.7
Understanding	Learning outcome descriptor for the capacity to use concepts creatively, for example: in problem solving; in design; in explanations and in diagnosis.	3.7
University	The term 'university' is used for convenience throughout these guidelines to represent all kinds of higher educational establishment including universities, polytechnics and colleges.	

Getting help

IChemE specialist staff will be happy to offer advice on any aspect of the accreditation process.

We recognise that each application is unique and will be pleased to help departments achieve ambitions for recognition of their degree programmes. Questions on accreditation are best directed by email to accreditation@icheme.org

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