About this Statement

This document is a QAA Subject Benchmark Statement for Engineering that defines what can be expected of a graduate in the subject, in terms of what they might know, do and understand at the end of their studies. Subject Benchmark Statements also describe the nature and characteristics of awards in a particular subject or area. Subject Benchmark Statements are published in QAA's capacity as a membership organisation on behalf of the higher education sector. A summary of the Statement is also available on the QAA website. There is a separate Subject Benchmark Statement for Computing.

Key changes from the previous Subject Benchmark Statement include:

- a revised structure for the Statement which includes the introduction of cross-cutting themes of:
  - equality, diversity and inclusion
  - education for sustainable development
  - employability, entrepreneurship and enterprise education
- a comprehensive review updating the context and purposes of Engineering, including course design and content in order to inform and underpin the revised benchmark standards.

How can I use this document?

Subject Benchmark Statements are often used by higher education providers in the design and development of new courses in the relevant subject, as they provide a framework for specifying intended learning outcomes in an academic or vocational discipline. They are also used as a reference point when reviewing or revalidating degree courses. They may be used by external examiners in considering whether the design of a course and the threshold standards of achievement are comparable with other higher education providers. They also provide professional, statutory and regulatory bodies (PSRBs) with the academic standards expected of students.

Subject Benchmark Statements provide general guidance for understanding the learning outcomes associated with a course but are not intended to represent a national curriculum in a subject or to prescribe set approaches to teaching, learning or assessment. Instead, they allow for flexibility and innovation in course design within a framework agreed by the subject community.

You may want to read this document if you are:

- involved in the design, delivery and review of courses in engineering
- a prospective student thinking about undertaking a course in engineering
- an employer, to find out about the knowledge and skills generally expected of engineering graduates.

Relationship to legislation

The responsibility for academic standards lies with the higher education provider which awards the degree. Higher education providers are responsible for meeting the requirements of legislation and any other regulatory requirements placed upon them by their relevant funding and regulatory bodies. This Statement does not interpret legislation, nor does it incorporate statutory or regulatory requirements.

The regulatory status of the Statement will differ with regard to the educational jurisdictions of the UK. In England, Subject Benchmark Statements are not sector-recognised standards.
as set out under the Office for Students’ regulatory framework. However, they are specified as a key reference point, as appropriate, for academic standards in Wales under Quality Assessment Framework for Wales and in Scotland as part of the Quality Enhancement Framework. Subject Benchmark Statements are part of the current quality requirements in Northern Ireland. Because the Statement describes outcomes and attributes expected at the threshold standard of achievement in a UK-wide context, many higher education providers will use them as an enhancement tool for course design and approval, and for subsequent monitoring and review, in addition to helping demonstrate the security of academic standards.

**Additional sector reference points**

Higher education providers are likely to consider other reference points in addition to this Statement in designing, delivering and reviewing courses. These may include requirements set out by PSRBs and industry or employer expectations. QAA has also published Advice and Guidance to support the Quality Code which will be helpful when using this Statement, for example, in course design, learning and teaching, external expertise and monitoring and evaluation.

Explanations of unfamiliar terms used in this Subject Benchmark Statement can be found in QAA’s Glossary. Sources of information about other requirements and examples of guidance and good practice are signposted within the Statement where appropriate.
1  Context and purpose of an Engineering degree

What is Engineering?

1.1  Engineers seek to create, develop and apply technology, processes and systems which enhance the lives of people and protect them from harm. The word ‘engine’ stems from a triad of ingenuity, artfulness and creativity and the engineers of today require each of these skills alongside scientific and mathematical principles to work as part of a complex techno-socio system of innovation. A core aspect of the engineering mind is the ability and desire to put things together, to design things that work and to design things that work better.

1.2  Engineering innovation is central to delivering equitable and sustainable solutions to the most pressing global challenges. Sustainable solutions are not merely about the environment, but also addressing social and economic concerns at all levels in order to create a more robust and resilient world. Particular emphasis has been placed within this Statement on the ways in which engineers can meet the challenges defined in the UN Sustainable Development Goals together with the global challenges of cybersecurity, infrastructure, manufacturing, mobility and energy. Engineers of the future must be adaptable to new and emerging challenges as these arise and, as such, the engineering curriculum continues to evolve.

Engineering degree courses

1.3  Engineering is a very broad subject covering many diverse disciplines. Within each discipline there are numerous specialisations. This Statement refers to courses of study in engineering delivered by universities and other higher education providers. The courses include:

- a bachelor’s degree with honours (often denoted as BEng (Hons)) in an engineering discipline
- an integrated master’s degree (often denoted as MEng) in an engineering discipline
- a postgraduate taught master’s degree (often denoted as MSc) in an engineering discipline or specialisation.

1.4  Many other courses of study in engineering exist. Apprenticeships tend to have a more applied focus and are often linked with work experience: more information about apprenticeships can be found at Characteristics Statement: Higher Education in Apprenticeships and engineering apprenticeships can be found at Engineering Council. Foundation degrees are usually designed and delivered by a higher education provider in collaboration with industry or business partners. This type of degree combines academic learning with work-based skills. A foundation degree is a higher education qualification at Level 5 on the FHEQ. Students with a foundation degree may progress to higher apprenticeships or the final year of a bachelor’s degree, often known as a top-up degree. More information about foundation degrees can be found on the QAA website.

1.5  A bachelor’s degree with honours is a first cycle qualification in the overarching Qualifications Frameworks in the European Higher Education Area. It usually includes study equivalent to at least three full-time academic years (four in Scotland), of which study is equivalent to at least 90 credits at FHEQ Level 6 or SCQF Level 10. A bachelor’s degree that does not have honours also exists but is not as common as a bachelor's degree with honours. A bachelor’s degree that does not have honours includes an ordinary degree or a pass degree; these degrees consist of a smaller volume of credit and so meet the qualification descriptor in part at Level 6 or SCQF Level 10 but not in full. In everyday usage, the ‘honours’ or ‘ordinary’ part of the degree title is often omitted and both are simply referred to as bachelor’s or BEng. This can lead to confusion, and providers should resolve
such confusion through stipulating what is meant by various titles in their course information to prospective students and employers.

1.6 The integrated master’s (MEng) course of study is designed as an integrated whole from entry to completion, although some of the earlier parts may be delivered in common with a parallel bachelor’s degree with honours. It is a first and second cycle qualification. MEng degrees meet the expectations of the qualifications descriptor for master's degrees in The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies, with the additional period of study at the lower level meeting the expectations of the bachelor’s degree with honours descriptors. This generally includes study equivalent to at least four full-time academic years (five in Scotland), of which the equivalent of at least one full-time academic year (120 credits) is at FHEQ Level 7 or SCQF Level 11. Progression to MEng courses is subject to performance criteria that indicate likely progression to the more demanding outcomes expected for the award of a master's degree. Transfer between courses leading to bachelor's degrees with honours and MEng courses is usually possible within a higher education provider subject to students meeting certain academic requirements. MEng degrees are compatible with the completion of the second cycle within the Framework for Qualifications of the European Higher Education Area (QF-EHEA).

1.7 Although students typically graduate with a specialism in a single area, there are an increasing number of general and multidisciplinary BEng and MEng degree courses. These may combine different disciplines of engineering or have a component with a non-engineering subject.

1.8 Master's degrees in Engineering other than integrated master’s (typically MSc degrees) vary significantly in nature and purpose. Master’s degrees are second cycle qualifications within the QF-EHEA. With reference to the QAA characteristics statement on master's degrees, this includes:

- research master's degrees (often denoted as MRes), aiming to prepare students for the next stage in a research career
- specialised master's, providing students with opportunities to study in greater depth particular aspects or applications of a broader discipline
- professional and practice-based master's, including those that may attract entrants from a diverse range of undergraduate qualifications.

Characteristics of an Engineering degree

1.9 Degrees cover mathematical and scientific fundamentals together with the application of these fundamentals through design and/or realisation of products and systems. During an Engineering degree, students typically acquire knowledge, understanding and skills across five areas:

- science, mathematics and engineering principles
- engineering analysis, including use of computational tools and techniques
- design, creativity and innovation, including applying an integrated or systems approach
- engineering and society, incorporating sustainability, ethics, risk, security and equity, diversity and inclusion
- engineering practice, including teamwork, project management and use of practical equipment.

1.10 As students progress through an Engineering degree, depending on the nature of their course, they will either develop skills to solve broadly defined, single-domain problems, or develop skills to solve progressively more complex, integrated, socio-economical and
technological systems. Typically, broadly-defined problems involve making appropriate assumptions and balancing needs of different requirements to achieve a goal. Such problems can be solved by the application of engineering science and learned analysis techniques. Complex problems, on the other hand, have no obvious, known or optimum solutions and may involve wide-ranging or conflicting technical issues and/or user needs that must be addressed through creativity and innovative application of engineering science and skills. Learners will need to be exposed to problems at an early stage in their course of study so that they have sufficient opportunities to develop their knowledge, confidence and skills.

1.11 Where appropriate, structured design tools and methods may need to be applied to understand, investigate, analyse and solve problems posed within an engineering course. Engineering learning is therefore supported by practical activities. The amount and type of practical work varies by higher education provider and discipline. Typical practical activities normally include characteristics such as creativity, experimentation, imagination, curiosity and collaboration. These may or may not include elements of physical activity.

1.12 Graduate engineers possess skills which are attractive to a wide range of employers and, as a result, they are highly sought after.

Equality, diversity and inclusion

1.13 Better engineering solutions emerge when the diversity of engineers is representative of the societies in which they operate and a key challenge exists to diversify engineering to meet the rapidly growing demand for skills. In particular, the ability to design equitable solutions which meet the needs of people across the globe is a priority. This requires understanding and inclusion of the people within the societies that are served, or indeed under-served, by engineering.

1.14 The promotion of equality, diversity and inclusion (EDI) is a core expectation for professional engineers and a key competency for accredited engineering courses. Inclusive practice is embedded throughout this Statement, with particular reference to course design in paragraphs 2.4 and approaches to inclusive learning and assessment in paragraphs 3.6 and 3.14.

1.15 Engineering curricula in the UK have been developed within an Anglo-centric context and this cultural influence shapes how engineering projects are conceived and developed. It is valuable therefore to consider how different cultural traditions can shape engineering design approaches. In particular, for courses that include projects focused on design of solutions for developing or international contexts, it is vital that students thoroughly understand the technical and non-technical environment in which the solution will operate and ensure that cultural and user perspectives are included.

Accessibility

1.16 Accessibility supports the promotion and implementation of EDI. Engineering solutions can transform lives and directly facilitate accessibility and remove barriers in society. Therefore, accessibility should be considered in terms of both access to engineering education and within curricula. As noted in paragraph 3.13, this entails the use of flexible approaches to learning teaching and assessment.

1.17 Accessibility should be treated as a standard part of engineering curricula, particularly in design, ensuring solutions remove barriers to access and facilitate inclusion. In addition, curricula should be designed with accessibility in mind, meeting statutory requirements as a minimum.
Furthermore, creating educational environments with accessibility as a primary concern can enable disabled students to study engineering when without such consideration, they would be unable to do so. Accessibility considerations should remove barriers to engagement and should extend beyond practical initiatives (such as access to laboratory and workshop environments) and also address hidden disabilities to ensure individuals or groups are not disadvantaged.

**Sustainability**

Engineering courses should inspire students in their journey to become more sustainable engineers by equipping them with the knowledge and skills to evaluate the environmental and societal impact of solutions. Reference to the [UN Sustainable Development Goals](https://www.un.org/sustainabledevelopment) to inform curriculum design, pedagogy and assessment is encouraged. This includes the importance of digital accessibility and the promotion of resilience, adaptability and problem-solving. Engineering and sustainable development are closely linked, and the role of engineers is critical in building a sustainable future.

Education for Sustainable Development (ESD) supports the development of subject-specific knowledge and skills to promote sustainable development for the challenges of today and the future. Education for Sustainable Development is an integral part of enhancing the quality of higher education and it stimulates Engineering students to make informed decisions and responsible actions towards more sustainable solutions for greener societies. The [Education for Sustainable Development Guidance](https://www.un.org/sustainabledevelopment) outlines pedagogic approaches for implementation in UK higher education institutions.

**Ethics**

Engineers should carry out their work in accordance with the ethical principles of the profession. A [revised statement](https://www.engr.ac.uk) on these principles was jointly produced in 2017 by the Engineering Council and Royal Academy of Engineering and covers the principles of honesty and integrity, respect for life, law, the environment and public good, accuracy and rigour, and leadership and communication. Engineers should develop a comprehension of the ethical issues inherent in engineering through their course of study together with the ability to make judgements and justify ethical choices. To support the teaching of ethics within Engineering curricula, an Engineering Ethics Toolkit has been produced by the Engineering Professors Council and can be consulted for advice and guidance on how to embed and assess ethics within the curriculum. The [toolkit](https://www.engr.ac.uk) includes a suite of case studies for use in engineering education.

**Safety and security**

Engineering degree courses should support students in developing a holistic approach to security and safety throughout their course of study. This requires an understanding of human behaviour, experience of risk monitoring and management approaches and the knowledge and skills to carry out specification and testing of these system qualities. They should understand the specific threats posed from negative agents in the light of increased automation and autonomy of systems.

The development of complex systems is made more challenging due to the unpredictability of behaviour and interactions, and the rapidly evolving risk climate posed by political, socio-economic and environmental change. The impact of failure on systems and the influence of human behaviour are challenging to model, yet it is essential to consider how people may act and interact with systems to ensure success. There are specific risks associated with safety and security which must be explicitly included in engineering design approaches – these are typically labelled as non-functional system attributes (or system
qualities) and include reliability, resilience, performance and useability. Non-compliance with such requirements can result in system failure and there are often legal obligations to meet regulatory requirements.

1.24 The Engineering X initiative from the Royal Academy of Engineering presents case-studies and reports for the development of safer complex systems which can be used to support teaching.

Industry and entrepreneurship

1.25 The section below should be read in conjunction with Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers (QAA, 2018).

1.26 Students undertaking an Engineering degree can expect industrial involvement in their course and this can occur in a number of ways. For example, students may receive guest lectures from people working in industry or they might work on industrially linked projects. Many higher education providers will have a formal industry advisory board comprising industrialists and this is considered good practice.

1.27 Some students take part in placements and internships which can be integrated into their degree course. Students who elect to take a formal industrial placement should receive continued support from their institution to ensure educational as well as financial benefit.

Professional accreditation of Engineering degrees

1.28 Engineers practice in a variety of professions; some of their roles require professional registration with a licensed engineering institution, while for many others registration is desirable. The academic course of study must meet specific requirements and standards if it is to contribute towards the student’s professional registration and the course must undergo periodic accreditation. The accreditation length awarded is usually no more than five years. Readers are referred to the Engineering Council’s Accreditation of Higher Education Programmes (AHEP) for more details.

1.29 Engineering accreditation in the UK is a rigorous peer-review process undertaken by one or more professional engineering institutions (PEIs) under license from the Engineering Council. Accreditation is applied to individual courses, not departments. Part of the process of accreditation is to ensure that specific educational courses, delivered at a specific site or sites, provide some, or all, of the underpinning knowledge and understanding for eventual professional registration in a particular category (such as CEng). This requires reviewing degree courses to ensure that all graduates satisfy the prescribed learning outcomes by viewing assessments, facilities for being taught the discipline, staffing and other factors. The standard expected for all learning outcomes is the minimum threshold level. Accredited degree courses also have to meet stringent requirements with regard to progression. The reason for this is to reduce the likelihood that degree graduates have gaps in their education which would make them unfit to practice the profession.

1.30 Engineering courses, however, are not required to be accredited. There are a range of reasons why this may be the case: new degree courses may not be accredited until the first students have completed a full cycle from entry to the final year. For this reason, accreditation can be backdated to include students who started studying before accreditation was gained.

Some degree courses are not designed to meet all of the Engineering Council’s learning outcomes. While these degrees are not intended to hold accreditation, they broadly follow the same study areas of accredited degrees. Non-accredited
provision may still be informed by the Expectations and practices set out in the UK Quality Code; mapping to threshold standards contained in this Statement.

Some institutions have degree regulations that allow students to fail more credit than the minimum levels defined by the Engineering Council. In this case a non-accredited degree may be awarded. The non-accredited degree will have a different title to distinguish it from the accredited degree.
2 Distinctive features of Engineering degrees

Curriculum design

2.1 Engineering degrees are designed to equip graduates with integrated knowledge, skills and judgement which will enable them to begin a professional career in the engineering sector. Engineering degrees usually have some industrial involvement in their design and delivery.

2.2 Engineering is a sector that works with and across multiple other technical and non-technical disciplines and within a variety of contexts. The design of an engineering degree prepares graduates to apply systems thinking to engineering products and processes, equipping them to unpick and predict system-level interactions that move beyond technical considerations to encompass economic, political, legal, social, environmental and ethical considerations. The curriculum should support engineers in analysing and mitigating the risks posed to a system (especially those concerned with safety and security). In doing so, Engineering graduates are equipped to optimise designs to prevent failure, reduce bias and be effective advocates for social and environmental justice.

2.3 The following course design features can develop Engineering graduates for the challenges of the future.

- For students to achieve a rounded competence in Engineering, the expectation is that they have significant exposure to practical work, including hands-on laboratory and project work. Experiential learning can help students to understand concepts, and gain an appreciation of the logistics and health, safety and well-being aspects of practical engineering.
- Students should be given sufficient opportunities to develop mathematic and scientific literacies relevant to their discipline or specialisation.
- A balance of individual and facilitated group project work can help students develop those competencies in self-directed learning, teamwork and leadership that are required for graduate-level work. Students at higher FHEQ/FQHEIS levels are expected to be increasingly autonomous learners and require less facilitation in groupwork.
- Engineering is a rapidly evolving sector with engineering innovation regularly resulting in new products and processes. Course design benefits from course review mechanisms to ensure that content and skills keep pace with sector developments.
- The curriculum typically includes both design and research-led projects informed by industrial and societal needs. These should incorporate aspects of inclusive and accessible design and practice and students should develop the ability to meet a combination of economic, social and environmental needs together with knowledge of their professional responsibilities as engineers.
- Uncertainty and competing factors are often an inherent part of engineering problem-definition and solving, and therefore an Engineering degree provides graduates with an ability to manage compromise. Students at higher FHEQ/FQHEIS levels are expected to be able to handle progressively more complex scenarios with an increasing amount of conflicting and/or missing information, and use critical reasoning to make rational, effective and justified decisions. This approach can benefit from being applied beyond design modules in order to help students gain familiarity with working with complexity.
- The promotion and use of ethical principles, codes and national frameworks support inclusive practices. A strong foundation in ethical principles and decision making can aid engineers in exploring and assessing options leading to improved
engineering outcomes, better environmental outcomes and a more inclusive society.

- The ability to evaluate the lifecycle and environmental impact of engineering decisions is necessary in designing within the global context of climate change. Alongside the understanding of low-carbon and clean technologies, students should also be able to evaluate the impact of exploitation of resources.

- Engineering courses within the UK attract a significant number of overseas students and students from the UK have the opportunity to work across the world and with international teams. Students should therefore possess cultural competencies to prepare them for working within a global sector.

2.4 Students can be significantly impacted by the way courses are structured, delivered and assessed. Understanding these potential impacts and how best to address them can be achieved through the use of inclusive education approaches. Such an inclusive culture within Engineering courses requires nurturing, ongoing re-evaluation and an evidence-informed approach. Measures to promote an inclusive engineering community include:

- student-centred course design that facilitates an inclusive culture in which individual differences are recognised as a strength and incorporated, enabling all individuals to be successful
- course design that promotes belonging and ensure equitable experiences for all students, including accommodations, and should not disadvantage any students
- embedding opportunities to increase awareness and understanding of all aspects of EDI, including equity, justice and human rights, through knowledge and experience
- building in key EDI elements for supporting collaboration and facilitating self-reflection and an understanding of others in order to appreciate a wide range of personal identities.

Progression

2.5 Over the course of a bachelor’s degree (FHEQ Level 6; FQHEIS Level 10) an Engineering student will progress from one level of study to the next, in line with the regulations and processes for each institution. However, it is expected that each level would see the attainment of certain levels of knowledge, expertise and experience that build towards the final achievement of meeting the threshold-level subject-specific and generic skills listed in this Statement. Upon graduation from an undergraduate degree, it would be expected that a student who had achieved a second-class degree or higher would be capable of, and equipped for, undertaking postgraduate study in engineering or an associated subject.

2.6 In a standard three-year undergraduate honours degree course, students may exit earlier and be eligible for a Certificate of Higher Education, a Diploma of Higher Education, or an honours degree depending upon the levels of study completed to a satisfactory standard. In Scotland, bachelor’s degrees with honours are typically designed to include four years of study, which relates to the structure of Scottish primary and secondary education. For students following part-time routes, their study time would be the equivalent of the three or four-year degree.

2.7 Over the course of an integrated master’s degree (FHEQ Level 7; FQHEIS Level 11) an Engineering student will progress from one level of study to the next, in line with the regulations and processes for each institution. However, it is expected that each year would see the attainment of certain levels of knowledge, expertise and experience that build towards the final achievement of meeting the threshold-level subject-specific and generic skills listed in this Statement. Integrated master’s courses often have more stringent progression requirements than BEng(hons) degrees, and students who do not meet the
progression requirement may be transferred onto a corresponding bachelor’s degree. Upon graduation from an integrated master’s degree, it would be expected that a student who had achieved a third-class degree or higher would be capable of, and equipped for, undertaking postgraduate study in Engineering or an associated subject.

2.8 In a standard four-year integrated master’s degree course, students may exit earlier and be eligible for a Certificate of Higher Education, a Diploma of Higher Education, or a bachelor’s degree with or without honours, depending upon the levels of study completed to a satisfactory standard. Scottish integrated master’s degree courses are typically designed to include five years of study, which relates to the structure of Scottish primary and secondary education. For students following part-time routes, their study time would be the equivalent of the four or five-year degree.

2.9 General and multidisciplinary undergraduate honours degrees will achieve core elements of the specific and generic skills for Engineering, and will add others according to the subjects covered in joint courses. Additionally, they may explore the overlap between their two subject areas, creating further opportunities for interdisciplinary study.

2.10 An Engineering degree is awarded as a result of a student demonstrating that they have met the learning outcomes of the course and the higher education provider regulations governing the award of degrees. An accredited degree is awarded when a student has also demonstrated the learning outcomes required by the applicable Accreditation of Higher Education Programmes (AHEP) regulations and any additional requirements for their discipline prescribed by their professional engineering institution. The overlay of these AHEP requirements may mean that students registered on an accredited degree course are required to meet these more challenging requirements until such time as the attainment of an accredited degree is no longer possible for the student. At which time, the standard higher education provider regulations will be applied.

**Partnership**

2.11 Engineering degree courses exist in a rapidly changing sector. Higher education providers need to therefore stay up to date with contemporary industry needs through active partnerships with industry. Engineering industry advisory boards provide an essential input into the design of Engineering courses. These boards can provide valuable insight into the knowledge, skills and experience that would be valuable in their industry and provide insight into sector innovation and contemporary skill needs.

2.12 The benefits of strong industrial relations include:

- advice on course content and structure to meet the sector’s needs at graduate level
- active learning exercises based on workplace activities
- work placements for students
- site visits
- industry guest lectures
- mentoring and employability advice.

2.13 An industry-informed Engineering degree can help students to socialise into the expectations and norms of the engineering sector and prepare them for employment in industry. This partnership works both ways. For example, the Intergovernmental Panel on Climate Change (IPCC) cites the need to radically change industrial norms in order to meet the challenge of climate crisis. Therefore, while graduates need to be socialised into the sector in order to function effectively, industry can also benefit from students being equipped to challenge industry norms where practice is harmful to ambitions for net zero in 2050 - or other sustainability considerations.
2.14 There is a partnership between Engineering and the broader society that the sector serves. Partnerships with community groups impacted by engineering products and processes may help students to understand the needs of beneficiaries, as can taking human and community-centred approaches to design. Such approaches should explicitly consider EDI and ethical implications in serving the whole of society.

2.15 Students are co-creators of their educational experiences, and Engineering courses benefit from a partnership approach to learning and teaching. This can be achieved through regular dialogue with students and student representation on course management committees. Working with students as partners, and engaging in student-led initiatives, helps to develop deeper skills in graduates as well as improving learning and teaching experiences and outcomes. Courses can benefit from supporting a community of learners and facilitating peer relationships, through engagement with student-led societies and extracurricular events.

2.16 Partnerships include relevant PSRBs, and the Engineering Council is the regulatory body for the UK engineering profession. The Engineering Council sets and maintains internationally recognised standards of professional competence and commitment, and standards for degrees and other qualifications recognised on behalf of the profession. The Engineering Council grants licences to professional engineering institutions, allowing them to assess candidates for inclusion on the national register of professional engineering and technicians. Many professional engineering institutions are also licensed to accredit degrees and other educational programmes.

2.17 Within the UK there are many organisations that provide resources and networking opportunities to develop and share best practice in Engineering education:

- the Royal Academy of Engineering (RAEng) is a charitable organisation and national academy supporting a community of Engineering professionals; it offers a range of support to Engineering courses, including visiting professorships and industry and academic exchanges
- the Engineering Professor’s Council represents Engineering academics and conducts research in areas including admissions, skills and innovation
- the UK and Ireland Engineering Education Research Network and the European Engineering Education Society (SEFI) provide conferences and networking opportunities for individuals engaged in Engineering education research
- there are over 35 professional engineering institutions (PEIs) of various sizes, each specialising in various areas of engineering. Many are engaged in education outreach and welcome student members.

Monitoring and review

2.18 A major feature of academic quality assurance and enhancement at a higher education provider is having in place monitoring and regular review processes for the courses it delivers. Degree-awarding bodies routinely collect and analyse information and undertake periodic course review according to their own needs. They draw on a range of external reference points, including this Statement, to ensure that their provision aligns with sector norms. Monitoring and evaluation is a periodic assessment of a course, conducted internally or with the support of external independent evaluators. Evaluation uses information from both current and historic monitoring to develop an understanding of student achievement or inform future course planning.

2.19 Externality is an essential component of the quality assurance system in the UK. Higher education providers will use external reviewers as part of periodic review to gain an external perspective on any proposed changes and ensure threshold standards are
achieved and content is appropriate for the subject. In particular, the periodic review of Engineering degrees should also draw in the expertise of industrial partners to ensure the currency of curriculum.

2.20 The external examination system currently in use across the UK higher education sector also helps to ensure consistency in the way academic standards are secured by degree-awarding bodies. Typically, external examiners will be asked to comment on the types, principles and purposes of assessments being offered to students. They will consider the types of modules on offer to students, the academic standards and quality of the assessments being set, the outcomes of a cohort and how these compare to similar provision offered within other UK higher education providers. External examiners are asked to produce a report each year and make recommendations for changes to modules and assessments, where appropriate. Subject Benchmark Statements, such as this one for Engineering, can play an important role in supporting external examiners in advising on whether threshold standards are being met in a specific subject area.

2.21 In the UK, most established Engineering degrees are accredited. This process is periodically undertaken by a professional engineering institution, licensed by the Engineering Council, to review appropriate degree courses to judge whether or not they meet the defined standards set by the Engineering Council (for example, the Accreditation of Higher Education Programmes, AHEP). Accreditation therefore provides all stakeholders with assurance that an accredited degree meets the standards set by the engineering profession. Accredited status is most commonly applied to BEng, BEng(Hons) and master’s degrees (MEng and MSc). The Engineering Council maintains a publicly available database of all current and previously accredited Engineering degree courses. Accreditation itself does not constrain Engineering courses in terms of their delivery methods.
3 Content design and delivery

Content

3.1 Engineering degree courses are wide ranging and diverse in nature. Engineers are, by their very nature, professional problem-solvers who are able to apply their knowledge and skills to a wide range of applications. Consequently, the content of their courses cannot be easily prescribed.

3.2 The aim of all Engineering courses is to prepare the learner with the academic tools, practical skills, mindset and the ethical framework needed to become a practicing engineer.

3.3 The practical component of any Engineering course is of particular significance as this distinguishes it from other applied sciences. It is not enough to be able to theorise how to solve a problem in an engineering context; the degree course needs to include opportunities for the learner to demonstrate their ability to make this work in practice. Thus, the practical components of an Engineering course can range from the build-and-test of a programming solution through to the build-and-test of a physical construction.

3.4 There is some flexibility within all Engineering degrees for higher education providers to develop specialist content and skills relevant to their local and institutional context. Higher education providers seeking accreditation should ensure that the learning outcomes are consistent with what is required by the relevant professional engineering institution and the Engineering Council. Engineering degrees have the flexibility to offer non-specialist content, from subjects beyond engineering (language, humanities and so on) which can enhance a course of study, help students to gain interdisciplinary insights and offer more choice for course personalisation.

Teaching and learning

3.5 There is a holistic approach to the design of the curriculum. The methods of teaching and learning are constructed so that the learning activities and tasks are aligned with intended learning outcomes.

3.6 Existing Engineering courses deploy a diverse range of teaching and learning methods to enhance and reinforce the student learning experience. This diversity of practice is a strength of the subject of Engineering. Whichever methods are employed, strategies for teaching and learning deliver opportunities for the achievement of the learning outcomes, demonstrate the attainment of learning outcomes, and recognise the range of student backgrounds and diversity in their learning styles. The methods of delivery and the design of the curriculum are updated on a regular basis in response to generic and subject-specific developments, considering educational research, changes in national policy, industrial practice and the needs of employers.

3.7 Curriculum design is informed by relevant examples of current developments, reflecting appropriate research, scholarship and industrial practice, and an understanding of the potential destination of graduates. Accredited degree courses must also satisfy the requirements of AHEP.

3.8 For students on a bachelor’s degree course to achieve a satisfactory understanding of Engineering, the expectation is that they have significant exposure to hands-on laboratory work and substantial individual and group project work. The curriculum includes both design, development and research-led projects, which develop in graduates both independence of thought and the ability to work effectively in a team. Teaching and learning needs to be
placed within the context of social, ethical, legal, environmentally sustainable and economic factors relevant to Engineering. The enhanced employer links that Degree Apprenticeships contain enable institutions to develop extensive innovation in teaching, learning and assessment processes across higher education institutions. This can lead to transformative developments, as employers and educators increasingly collaborate to deliver effective work-based learning and improved strategies to support widening participation in curriculum design.

3.9 Teaching and learning methods within an integrated master’s degree course not only includes those in a bachelor's degree with honours but also goes further through the deepening of technical understanding, sustainability and design. There is additional emphasis on team/group working and communication, together with an increase in the use of industrially relevant applications of engineering analysis and an enhanced capability for independent learning. Case studies, design work and projects alongside industrial visits are generally utilised more extensively, especially towards the end of the course when they build upon earlier learning. The inclusion of such elements within the design of MEng courses prepares students for subsequent leading roles in technical and/or managerial activities.

3.10 Teaching and learning for other master’s qualifications (typically MSc degrees) depends to a large extent on the focus of the course, but may include increased specialisation, breadth or depth of material. There are expectations that master’s students will be increasingly self-reliant and self-directing, particularly during the later stages of their course.

3.11 Master’s degrees often attract students who have not studied for their first degree within the UK higher education system. The learning outcomes they achieve do not always align with those of students from the UK system and this difference should be taken into account in the design of individual courses.

3.12 Embedding employability and ways by which graduates can be prepared for life beyond academia are priorities for all interested parties within Engineering. Effectively embedding employability both in the curriculum and within extracurricular provision is key.

3.13 Flexibility of delivery can improve accessibility to learning for a diverse community. A mix of synchronous and asynchronous delivery can be beneficial for learners who may face barriers in attending a physical classroom.

Assessment

3.14 As stated in the FHEQ/FQHEIS, assessment procedures should not allow for the award of a qualification when learning outcomes have not been achieved.

- All students graduating with Engineering degrees will be able to demonstrate that they have achieved the necessary output standards for the degree that they have been awarded. The higher education provider publishes course objectives and outcomes, and sets robust assessment standards and procedures to assess whether a graduate achieves the expected learning outcomes of the course.
- Assessment will focus on student learning and enable students to demonstrate their full range of abilities, both theoretical and practical. All assessments will directly align to the learning outcomes and emphasise deep learning. The higher education provider will offer a range of assessment methods that are accessible to all students and should also make reasonable adjustments for disabled students.
- A diversity of innovative assessment methods is encouraged and assessments can be carried out in person or remotely using appropriate digital technology. Flexibility of assessment can improve accessibility to learning for a diverse community.
Assessment design beyond traditional exams can allow students to showcase different strengths across the curriculum. Assessment methods in Engineering may include, but are not limited to:
- examinations (both open-book and closed-book)
- laboratory and project reports
- case studies
- literature reviews
- dissertations
- verbal and/or non-verbal presentations and examinations
- peer and self-assessment
- work-integrated assessments.

- Formative assessment will also be used for the enhancement of learning, particularly to support blended applications.
- The aims and requirements for each assessment should be clearly defined through using transparent marking criteria, and relevant feedback should be provided for all students in a timely manner. Assessment should be designed to ensure the highest possible standards while also preventing opportunities for academic misconduct - such as plagiarism and contract cheating. Policies and procedures published by the higher education providers for safeguarding academic integrity should also be actively promoted and applied consistently.
- Students should be given opportunities to demonstrate their skills through collaborative group work in addition to individual assessments. The fair assessment of groupwork is fundamental to supporting an inclusive curriculum. Consideration should be given to assessing the ability to work in a group (not just the academic output), including student actions within the group environment that promotes inclusivity while recognising the needs of disabled learners. Another priority involves peer assessment, including individual self-reflection about the ability to work effectively in a group when meeting learning outcomes.
- Authentic assessment, which will equip students for employment, is encouraged through considering communication methods, the assessment of technical skills, and cultural competences.

3.15 Accredited Engineering degrees are subject to strictly imposed limits on failure and marginal failure. These are more stringent than the standard credit recognition of most providers. Typically, students will have to pass most, or in some cases all, modules on the course in order to achieve an accredited degree.
# Benchmark standards

## Introduction

4.1 This Subject Benchmark Statement sets out the minimum threshold standards that a student will have demonstrated when they are awarded

- a bachelor’s degree with honours (often denoted BEng (Hons)) in an Engineering discipline;
- an integrated master’s degree (often denoted MEng) in an Engineering discipline or
- a postgraduate taught master’s degree (often denoted MSc) in an Engineering discipline.

4.2 Demonstrating these standards over time will show that a student has achieved the range of knowledge, understanding and skills expected of graduates in Engineering.

4.3 The vast majority of students will perform significantly better than the minimum threshold standards. Each higher education provider has its own method of determining what appropriate evidence of this achievement will be required.

4.4 The benchmark standards are defined relative to the appropriate FHEQ Level 6 or 7 (FQHEIS Level 10 or 11) specification and associated descriptors. As such, their application to an individual course is necessarily contextual. Many Engineering degrees are accredited by UK professional engineering institutions acting under license from the Engineering Council (see section 1 for more details). For degrees that are accredited, professional competency standards will apply.

## Minimum threshold standards

4.5 For the purposes of this Statement, the professional competencies set out in the relevant edition of Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence, published by the Engineering Council, should be interpreted as the minimum threshold standards for accredited courses.

## Undergraduate benchmark standards

4.6 For bachelor’s degrees with honours, refer to Annex D: Outcome classification descriptions for FHEQ Level 6 and FQHEIS Level 10 degrees. This Annex sets out common descriptions of the four main degree outcome classifications for bachelor’s degrees with honours classifications 1st, 2.1, 2.2 and 3rd.

4.7 Integrated master’s (MEng) degrees include the outcomes of bachelor’s degrees with honours and go beyond them to provide a greater range and depth of specialist knowledge - often within a research and industrial environment, as well as a broader and more general academic base.

4.8 It should be particularly noted that document Annex D: Outcome classification descriptions for FHEQ Level 6 and FQHEIS Level 10 degrees sets out expectations in relation to professional competencies that students at all classifications will have ‘adhered to the appropriate rules and/or conventions set by regulators or the industry’, and that they will have ‘demonstrated achievement of professional competence when assessed against the requirements of a PSRB’. However, as discussed in section 1, it is perfectly valid for provision not to be accredited for a variety of reasons, and so this formal assessment may not take place.
Bachelor's degree with honours

Threshold level (3rd class degree)

4.9 With regard to undergraduate courses, students graduating with a bachelor's degree with honours in Engineering must demonstrate at least a threshold-level of attainment across all outcome categories. Threshold-level attainment typically maps onto that associated with a 3rd class honours. Criteria for achievement at threshold level will be in line with the higher education provider’s common or generic marking schemes for undergraduate courses and the sector-recognised standards that are in use in each of the nations of the UK. If the course is accredited, the threshold will also be determined by the relevant professional engineering institution(s).

On graduating with a BEng honours degree in Engineering, graduates will have demonstrated:

- **Knowledge and understanding**: a coherent knowledge and understanding of their engineering discipline and its practical application.
- **Problem solving**: the ability to identify complex engineering problems, select the appropriate tools and go on to create safe, secure and sustainable solutions designed to meet defined needs.
- **Analysis**: the skill to select and apply quantitative and computational analysis techniques recognising the limitations of the methods employed.
- **Delivery/skills/practice**: creativity, innovation, teamworking and communication.
- **Values and principles**: an appreciation of professional and commercial engineering practice, ethics and global social responsibility.

Typical level

4.10 Criteria for achievement above threshold level at 2:1 and 2:2 will be in line with the higher education provider’s common or generic marking schemes for undergraduate courses and the sector-recognised standards that are in use in each of the nations of the UK.

Excellent level

4.11 Criteria for excellent (1st class achievement) will be in line with the higher education provider’s common or generic marking schemes for undergraduate courses and the sector-recognised standards that are in use in each of the nations of the UK.

Integrated master’s degree

Threshold level (3rd class degree)

4.12 With regard to undergraduate courses, students graduating with an integrated master’s degree in Engineering must demonstrate at least a threshold-level of attainment across all outcome categories. Threshold-level attainment typically maps onto that associated with a 3rd class honours. Criteria for achievement at threshold level will be in line with the higher education provider’s common or generic marking schemes for integrated master’s courses. If the course is accredited the threshold will also be determined by the relevant professional engineering institution(s).

On graduating with an MEng degree in Engineering, graduates will have demonstrated:

- **Knowledge and understanding**: a broad and coherent knowledge and understanding of their engineering discipline and its practical application.
• **Problem solving**: the ability to identify complex engineering problems, select the appropriate tools and go on to create safe, secure and sustainable solutions designed to meet defined needs.

• **Analysis**: the skill to select and apply quantitative and computational analysis techniques in the absence of complete data, discussing the limitations of the methods employed.

• **Delivery/skills/practice**: creativity, innovation, effective teamworking, leadership and communication.

• **Values and principles**: an appreciation of professional and commercial engineering practice, ethics and global social responsibility.

**Typical level (2.2 or 2.1)**

4.13 Criteria for achievement above threshold level at 2:1 and 2:2 will be in line with the higher education provider's common or generic marking schemes for integrated master’s courses.

**Excellent level (1st class)**

4.14 Criteria for excellent (1st class achievement) will be in line with the higher education provider's common or generic marking schemes for integrated master's courses.

**Postgraduate master’s degrees benchmark standards**

4.15 Students graduating with a postgraduate master’s degree in Engineering must demonstrate at least a threshold level of attainment across all relevant course outcome categories. Attainment at a threshold level usually maps onto that associated with a pass award.

**Threshold level (pass degree)**

4.16 With regard to postgraduate courses, students graduating with a master’s degree in Engineering must demonstrate at least a threshold-level of attainment across all relevant outcome categories. Threshold-level attainment typically maps onto that associated with a pass degree. Criteria for achievement at threshold level will be in line with the higher education provider's common or generic marking schemes for integrated master’s courses. If the course is accredited the threshold will also be determined by the relevant professional engineering institution(s).

On graduating with an MSc in Engineering, graduates will have demonstrated:

• **Knowledge and understanding**: a coherent knowledge and understanding of their engineering discipline or specialisation.

• **Problem-solving**: the ability to identify complex engineering problems, select the appropriate tools and go on to create safe, secure and sustainable solutions designed to meet defined needs.

• **Analysis**: the skill to select and apply quantitative and computational analysis techniques in the absence of complete data, discussing the limitations of the methods employed.

• **Delivery/skills/practice**: creativity, innovation, research, effective teamworking, leadership and communication.

• **Values and principles**: an appreciation of professional and commercial engineering practice, ethics and global social responsibility.
Typical level (merit)

4.17 Criteria for merit achievement above threshold level will be in line with the higher education provider's common or generic marking schemes for master's courses.

Excellent level (distinction)

4.18 Criteria for excellent level (distinction) will be in line with the higher education provider's common or generic marking schemes for master's courses.
5 List of references and further resources

Engineering Council

The Accreditation of Higher Education Programmes (AHEP): www.engc.org.uk/ahep

Glossary of terms: www.engc.org.uk/glossary-faqs/glossary


AQAH apprenticeships: www.engc.org.uk/aqah

List of current and previously accredited courses: www.engc.org.uk/education-skills/course-search/recognised-course-search


QAA

Characteristic Statement: Master’s Degrees www.qaa.ac.uk/docs/qaa/quality-code/master's-degree-characteristics-statement.pdf


The Frameworks for Higher Education Qualifications of UK Degree-Awarding Bodies www.qaa.ac.uk/docs/qaa/quality-code/qualifications-frameworks.pdf

Annex D: Outcome classification descriptions for FHEQ Level 6 and FQHEIS Level 10 degrees www.qaa.ac.uk/docs/qaa/quality-code/annex-d-outcome-classification-descriptions-for-fheq-level-6-and-fqheis-level-10-degrees.pdf

Education for Sustainable Development (ESD) Guidance Advance HE and QAA’s Education for Sustainable Development (ESD) Guidance

Enterprise and Entrepreneurship Education: Guidance for UK Higher Education Providers www.qaa.ac.uk/quality-code/education-for-sustainable-development

Others

Engineering Professors Council, Engineering Ethics toolkit https://epc.ac.uk/resources/toolkit/ethics-toolkit

Royal Academy of Engineering, Engineering X https://engineeringx.raeng.org.uk

6 Membership of the Advisory Group

Membership of the Advisory Group for the Subject Benchmark Statement for Engineering 2022

- Professor Alistair Greig (Chair)
- Dr Vaibhav Gandhi (Deputy Chair)
- Professor Claire Lucas (Deputy Chair)
- Prof Gill Cooke
- Dr Timothy John Coole
- Catherine Elliott
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Membership of the review group for the Subject Benchmark Statement for Engineering (2019)

The fourth edition, published in 2019, was revised by QAA to align the content with the revised UK Quality Code for Higher Education, published in 2018. Proposed revisions were checked and verified by the Chair of the Subject Benchmark Statement for Engineering review group from 2015.

- Professor Kel Fidler (Chair)
- Dr Alison Felce

Fellow of the Royal Academy of Engineering, formerly Vice-Chancellor and Chief Executive of Northumbria University and Chairman of the Engineering Council

QAA

Membership of the review group for the Subject Benchmark Statement for Engineering (2015)

Details provided below are as published in the third edition of the Subject Benchmark Statement.

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Engineering Council
Employer representatives
Nicola Price
Rolls Royce
Dr Mike Cook
Buro Happold Ltd and Royal Academy of Engineering
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* (resigned due to ill health)