AHEP 4
OUTPUT STANDARDS AND LEVELS OF REGISTRATION.

The following defining characteristics are common to those presented in AHEP and AAQA for IEng and CEng recognition:

Foundation degrees and equivalent qualifications accredited as partially meeting IEng registration (ISCED/EQF Level 5) will have an emphasis on the applications of current and developing technology. An individual who has completed a Foundation degree or equivalent qualification must achieve the prescribed learning outcomes and will possess a coherent body of knowledge including mathematics, natural science and engineering principles, and a proven ability to apply that knowledge to analyse and solve broadly defined problems using established principles and techniques. With an appreciation of professional engineering practice and ethics, graduates will be able to apply their knowledge and skills to new situations.

Bachelors degrees and Bachelors (Honours) degrees accredited for the purpose of IEng registration (ISCED/EQF Level 6) will have an emphasis on applications of current and developing technology. Graduates from accredited Bachelors or Bachelors (Honours) degree programmes must achieve the prescribed learning outcomes (below) and will possess a coherent body of knowledge including mathematics, natural science and engineering principles, and a proven ability to apply that knowledge to analyse and solve broadly-defined problems using established principles and techniques. Some of the knowledge will be informed by current developments in the subject of study. With an appreciation of professional engineering practice and ethics, graduates will be commercially aware and able to apply their knowledge and skills to design and deliver products, systems, and processes to meet defined needs using current technology.

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 programmes accredited for CEng. 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.

Bachelors (Honours) degrees accredited as partially meeting the educational requirement for CEng (ISCED/EQF Level 6) have an emphasis on developing solutions to engineering problems using new or existing technologies, through innovation, creativity, and change. Graduates from a Bachelors (Honours) degree must achieve the prescribed learning outcomes (below) and will possess a coherent body of knowledge including mathematics, natural science and engineering principles, and a proven ability to apply that knowledge to analyse and solve complex problems. Some of the knowledge will be at the forefront of the subject of study. Graduates will be able to select and apply quantitative and computational analysis techniques, recognising the limitations of the methods employed. With an appreciation of professional engineering practice and ethics, graduates will be commercially aware and able to apply their knowledge and skills to design and deliver new products or services to meet defined needs using new or existing technologies

They are likely to have acquired some of this ability through involvement in individual and/or group design projects.

Masters degrees (other than the Integrated Masters) accredited as further learning to Masters Level (ISCED/EQF Level 7) for the purposes of registration with the Engineering Council vary in nature. Some offer the chance to study in greater depth particular aspects or applications of a broader discipline in which the graduate holds an Honours degree at Bachelors level. Others bring together different engineering disciplines or subdisciplines in the study of a particular topic, or engineering application, while a further category may be truly multidisciplinary.

These programmes should provide a foundation for leadership and innovative engineering practice. Graduates from an Integrated Masters degree other than the

Integrated Masters must achieve the prescribed learning outcomes (below) and will possess a broad and coherent body of knowledge including mathematics, natural science and engineering principles, and a proven ability to apply that knowledge to analyse and solve complex problems. Much of the knowledge will be at the forefront of the subject of study. Graduates will be able to select and apply quantitative and computational analysis techniques in the absence of complete data, discussing the limitations of the methods employed. With an appreciation of professional engineering practice and ethics, graduates will be commercially aware and able to apply their knowledge and skills to design, deliver and evaluate innovative new products or services to meet defined needs using new or existing technologies.

They will have acquired much of this ability through individual and/or group projects. Ideally some of these projects would have industrial involvement or be practice-based

Integrated Masters (MEng) degrees accredited for CEng (ISCED/EQF Level 7) registration will have an emphasis on developing solutions to problems using new or existing technologies, through innovation, creativity and change. The Integrated Masters will go beyond the outcomes of accredited Bachelors (Honours) degrees to provide a greater range and depth of specialist knowledge, within an authentic environment, as well as a broader and more general academic base.

These programmes should provide a foundation for leadership and innovative engineering practice. Graduates from an Integrated Masters degree must achieve the prescribed learning outcomes (below) and will possess a broad and coherent body of knowledge including mathematics, natural science and engineering principles, and a proven ability to apply that knowledge to analyse and solve complex problems. Much of the knowledge will be at the forefront of the subject of study. Graduates will be able to select and apply quantitative and computational analysis techniques in the absence of complete data, discussing the limitations of the methods employed. With an appreciation of professional engineering practice and ethics, graduates will be commercially aware and able to apply their knowledge and skills to design, deliver and evaluate innovative new products or services to meet defined needs using new or existing technologies.

They will have acquired much of this ability through involvement in individual and group design projects. Ideally some of these projects would have industrial involvement or be practice-based.

Notes:

- Full-time bachelor's degrees accredited for CEng and bachelor's degrees accredited for IEng are normally three-years in duration and are made up of 360 credits. Full-time integrated master's degrees accredited for CEng, i.e., accredited MEng degrees, are normally four-years in duration and 480 credits. It is recognised that degrees in Scotland are normally one year longer than the equivalent degree in England, Wales, and Northern Ireland. In addition, the Institution encourages the use of part-time, sandwich and distance learning degrees of an extended duration.
- MScs are normally 180 credits, and it is expected that at least 70% of the modules must be above Bachelors level.

Interpretation

In the tables below the following terms are used with the meanings stated:

Well-defined problems involve several factors, but with few of these exerting conflicting constraints, and can be solved through the standardised application of engineering science	**Broadly defined problems involve a variety of factors which may impose conflicting constraints, but can be solved by the application of engineering science and well-proven analysis techniques.**	**Complex problems have no obvious solution and may involve wide-ranging or conflicting technical issues and/or user needs that can be addressed through creativity and the resourceful application of engineering science.**
Knowledge is information that can be recalled.	**Skills are acquired and learned attributes that can be applied almost automatically**	**Awareness is general familiarity, albeit bounded by the needs of the specific discipline.**

DEGREE LEARNING OUTCOMES.

Graduates from accredited programmes must achieve the following five broad areas of learning and the corresponding learning outcomes.

- These learning outcomes are **threshold standards** and should be interpreted in the context of a particular disciplinary or multidisciplinary engineering practice, **and the stipulated threshold ISCED/EQF level of study**.
- **An individual who has completed an approved or accredited programme must meet all the identified learning outcomes**, however student learning hours are likely to vary between the five key areas of learning.
- It is recognised that an accredited programme may develop learning outcome(s) beyond the threshold level, however such additional learning is not prescribed or required for academic accreditation.
- The Engineering Council defines security as 'the state of relative freedom from threat or harm caused by deliberate, unwanted, hostile or malicious acts. It operates on a number of levels ranging from national security issues to countering crime'. See the guidance note at: www.engc.org.uk/security

The tables below show the learning outcomes that need to be achieved in each of the five areas in order for a particular degree to be accredited for a certain level of professional registration.

Incorporated Engineer (IEng)			**Chartered Engineer (CEng)**		
Foundation degrees, Higher National Diplomas and equivalent qualifications and apprenticeships accredited or approved as fully meeting the academic requirement for EngTech registration and partially meeting the academic requirement for IEng registration	**Bachelors Top-up degrees and Equivalent qualifications and apprenticeships accredited or approved as meeting the requirement for further learning for IEng registration**	**Bachelors degrees and Bachelors (Honours) and Equivalent qualifications and apprenticeships accredited or approved as fully meeting the academic requirement for IEng registration**	**Bachelors (Honours) degrees and equivalent qualifications and apprenticeships accredited or approved as fully meeting the academic requirement for IEng registration and partially meeting the academic requirement for CEng registration**	**Masters degrees other than the Integrated Masters and Doctoral programmes and equivalent Qualifications and apprenticeships accredited or approved as meeting the requirement for further learning for CEng registration**	**Integrated Masters degrees and equivalent qualifications and apprenticeships accredited or approved as fully meeting the academic requirement for CEng registration**

Science and mathematics						
The study of engineering requires a substantial grounding in engineering principles, science and mathematics commensurate with the level of study.						
On successful completion of an accredited or approved programme, an individual will be able to:						
Science, mathematics and engineering principles	F1. Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems (ISCED L5/EQF L5)	B1. Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems. Some of the knowledge will be informed by current developments in the subject of study (ISCED L6/EQF L6)	B1. Apply knowledge of mathematics, statistics, natural science and engineering principles to broadly-defined problems. Some of the knowledge will be informed by current developments in the subject of study (ISCED L6/EQF L6)	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 (ISCED L6/EQF L6)	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 (ISCED L7/EQF L7)	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 (ISCED L7/EQF L7)
Engineering analysis						
Engineering analysis involves the application of engineering concepts and tools to analyse, model and solve problems. At higher levels of study engineers will work with information that may be uncertain or incomplete						
On successful completion of an accredited or approved programme, an individual will be able to:						

Problem analysis	F2. Analyse broadly-defined problems reaching substantiated conclusions (ISCED L5/EQF L4/5)	B2. Analyse broadly-defined problems reaching substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles (ISCED L6/EQF L6)	B2. Analyse broadly-defined problems reaching substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles (ISCED L6/EQF L6)	C2. Analyse complex problems to reach substantiated conclusions using first principles of mathematics, statistics, natural science and engineering principles (ISCED L6/EQF L6)	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 (ISCED L7/EQF L7)	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 (ISCED L7/EQF L7)

Analytical tools and techniques	F3. Use appropriate computational and analytical techniques to model broadly-defined problems (ISCED L5/EQF L5)	B3. Select and apply appropriate computational and analytical techniques to model broadly-defined problems, recognising the limitations of the techniques employed (ISCED L6/EQF L6)	B3. Select and apply appropriate computational and analytical techniques to model broadly-defined problems, recognising the limitations of the techniques employed (ISCED L6/EQF L6)	C3. Select and apply appropriate computational and analytical techniques to model complex problems, recognising the limitations of the techniques employed (ISCED L6/EQF L6)	M3. Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed (ISCED L7/EQF L7)	M3. Select and apply appropriate computational and analytical techniques to model complex problems, discussing the limitations of the techniques employed (ISCED L7/EQF L7)
Technical literature	F4. Select and use technical literature and other sources of information to address broadly-defined problems (ISCED L5/EQF L5)	B4. Select and evaluate technical literature and other sources of information to address broadly-defined problems (ISCED L5/EQF L5)	B4. Select and evaluate technical literature and other sources of information to address broadly-defined problems (ISCED L5/EQF L5)	C4. Select and evaluate technical literature and other sources of information to address complex problems (ISCED L6/EQF L6)	M4. Select and critically evaluate technical literature and other sources of information to solve complex problems (ISCED L7/EQF L7)	M4. Select and critically evaluate technical literature and other sources of information to solve complex problems (ISCED L7/EQF L7)
Design and innovation						
Design is the creation and development of an economically viable product, process or system to meet a defined need. It involves significant technical and intellectual challenges commensurate with the level of study.						
On successful completion of an accredited or approved programme, an individual will be able to:						

Design	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 (ISCED L5/EQF L5)	B5. Design solutions for broadly-defined 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 (ISCED L5/EQF L5)	B5. Design solutions for broadly-defined 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 (ISCED L5/EQF L5)	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 (ISCED L6/EQF L6)	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 (ISCED L7/EQF L7)	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 (ISCED L7/EQF L7)
Integrated/ systems approach	F6. Apply a systematic approach to the solution of broadly-defined problems (ISCED L5/EQF L5)	B6. Apply an integrated or systems approach to the solution of broadly-defined problems (ISCED L6/EQF L6)	B6. Apply an integrated or systems approach to the solution of broadly-defined problems (ISCED L6/EQF L6)	C6. Apply an integrated or systems approach to the solution of complex problems (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M6. Apply an integrated or systems approach to the solution of complex problems (ISCED L6/EQF L6)
The engineer and society						

Engineering activity can have a significant societal impact and Engineers must operate in a responsible and ethical manner, recognise the importance of diversity, and help ensure that the benefits of innovation and progress are shared equitably and do not compromise the natural environment or deplete natural resources to the detriment of future generations.						
On successful completion of an accredited or approved programme, an individual will be able to:						
Sustainability	F7. Evaluate the environmental and societal impact of solutions to broadly-defined problems (ISCED L5/EQF L5)	*Learning outcome achieved at previous level of study*	B7. Evaluate the environmental and societal impact of solutions to broadly-defined problems (ISCED L5/EQF L5)	C7. Evaluate the environmental and societal impact of solutions to complex problems and minimise adverse impacts (ISCED L6/EQF L6)	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 (ISCED L7/EQF L7)	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 (ISCED L7/EQF L7)
Ethics	F8. Identify ethical concerns and make reasoned ethical choices informed by professional codes of conduct (ISCED L5/EQF L5)	B8. Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct (ISCED L6/EQF L6)	B8. Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct (ISCED L6/EQF L6)	C8. Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M8. Identify and analyse ethical concerns and make reasoned ethical choices informed by professional codes of conduct (ISCED L6/EQF L6)

Risk	F9. Identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity (ISCED L5/EQF L5)	B9. Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity (ISCED L6/EQF L6)	B9. Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity (ISCED L6/EQF L6)	C9. Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M9. Use a risk management process to identify, evaluate and mitigate risks (the effects of uncertainty) associated with a particular project or activity (ISCED L6/EQF L6)
Security	F10. Adopt a holistic and proportionate approach to the mitigation of security risks (ISCED L3/EQF L4)	*Learning outcome achieved at previous level of study*	B10. Adopt a holistic and proportionate approach to the mitigation of security risks (ISCED L3/EQF L4)	C10. Adopt a holistic and proportionate approach to the mitigation of security risks (ISCED L3/EQF L4)	*Learning outcome achieved at previous level of study*	M10. Adopt a holistic and proportionate approach to the mitigation of security risks (ISCED L3/EQF L4)
Equality, diversity and inclusion	F11. Recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion (ISCED L5/EQF L5)	*Learning outcome achieved at previous level of study*	B11. Recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion (ISCED L5/EQF L5)	C11. Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M11. Adopt an inclusive approach to engineering practice and recognise the responsibilities, benefits and importance of supporting equality, diversity and inclusion (ISCED L6/EQF L6)
Engineering practice						

The practical application of engineering concepts and tools, engineering and project management, teamwork and communication skills. Engineers also require a sound grasp of the commercial context of their work, specifically the ways an organisation creates, delivers and captures value in economic, social, cultural or other contexts.						
On successful completion of an accredited or approved programme, an individual will be able to:						
Practical and workshop skills	F12. Use practical laboratory and workshop skills to investigate broadly-defined problems (ISCED L5/EQF L5)	*Learning outcome achieved at previous level of study*	B12. Use practical laboratory and workshop skills to investigate broadly-defined problems (ISCED L5/EQF L5)	C12. Use practical laboratory and workshop skills to investigate complex problems (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M12. Use practical laboratory and workshop skills to investigate complex problems (ISCED L6/EQF L6)
Materials, equipment, technologies and processes	F13. Select and apply appropriate materials, equipment, engineering technologies and processes (ISCED L5/EQF L5)	*Learning outcome achieved at previous level of study*	B13. Select and apply appropriate materials, equipment, engineering technologies and processes (ISCED L5/EQF L5)	C13. Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M13. Select and apply appropriate materials, equipment, engineering technologies and processes, recognising their limitations (ISCED L6/EQF L6)
Quality management	F14. Recognise the need for quality management systems and continuous improvement in the context of broadly-defined problems	*Learning outcome achieved at previous level of study*	B14. Recognise the need for quality management systems and continuous improvement in the context of broadly-defined problems	C14. Discuss the role of quality management systems and continuous improvement in the context of complex problems (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M14. Discuss the role of quality management systems and continuous improvement in the context of complex problems (ISCED L6/EQF L6)

	(ISCED L5/EQF L5)		(ISCED L5/EQF L5)			
Engineering and project management	F15. Apply knowledge of engineering management principles, commercial context and project management (ISCED L5/EQF L5)	B15. Apply knowledge of engineering management principles, commercial context, project management and relevant legal matters (ISCED L6/EQF L6)	B15. Apply knowledge of engineering management principles, commercial context, project management and relevant legal matters (ISCED L6/EQF L6)	C15. Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters including intellectual property rights (ISCED L6/EQF L6)	*Learning outcome achieved at previous level of study*	M15. Apply knowledge of engineering management principles, commercial context, project and change management, and relevant legal matters including intellectual property rights (ISCED L6/EQF L6)
Teamwork	F16. Function effectively as an individual, and as a member or leader of a team (ISCED L5/EQF L5)	*Learning outcome achieved at previous level of study*	B16. Function effectively as an individual, and as a member or leader of a team (ISCED L5/EQF L5)	C16. Function effectively as an individual, and as a member or leader of a team (ISCED L5/EQF L5)	M16. Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance (ISCED L7/EQF L7)	M16. Function effectively as an individual, and as a member or leader of a team. Evaluate effectiveness of own and team performance (ISCED L7/EQF L7)

Communication	F17. Communicate effectively with technical and non-technical audiences (ISCED L3/EQF L4)	*Learning outcome achieved at previous level of study*	B17. Communicate effectively with technical and non-technical audiences (ISCED L3/EQF L4)	C17. Communicate effectively on complex engineering matters with technical and non-technical audiences (ISCED L6/EQF L6)	M17. Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used (ISCED L7/EQF L7)	M17. Communicate effectively on complex engineering matters with technical and non-technical audiences, evaluating the effectiveness of the methods used (ISCED L7/EQF L7)
Lifelong learning	F18. Plan and record self-learning and development as the foundation for lifelong learning/CPD (ISCED L3/EQF L4)	*Learning outcome achieved at previous level of study*	B18. Plan and record self-learning and development as the foundation for lifelong learning/CPD (ISCED L3/EQF L4)	C18. Plan and record self-learning and development as the foundation for lifelong learning/CPD (ISCED L3/EQF L4)	*Learning outcome achieved at previous level of study*	M18. Plan and record self-learning and development as the foundation for lifelong learning/CPD (ISCED L3/EQF L4)