# **Further Learning Report - Introduction**

If you are advised that the Further Learning Report (FLR) option for CEng is available to you, you may use this to demonstrate further learning to an accredited Master’s level in order to satisfy the CEng academic benchmark and progress to Professional Review.

# **What is an accredited qualification?**

Accredited engineering and technology programmes provide the exemplifying levels of understanding, knowledge and skills for professional competence.

The six key areas of learning within accredited degree programmes are:

* Science and mathematics
* Engineering analysis
* Design
* Economic, legal, social, ethical and environmental context
* Engineering practice
* Additional general skills

In general, accredited MEng programmes are characterised by the requirement for deeper and broader technical and non-technical knowledge than that covered in a BEng (Hons) programme, plus additional project work and a wider appreciation of the economic, social and environmental context of engineering.

# **How to demonstrate that your learning meets the academic benchmark for CEng**

You should complete the table below which lists the MEng learning outcomes of accredited courses and identify, with supporting evidence as an Appendix, how your learning meets each of the criteria.

As the comparison is an academic one, the evidence supplied by you in the FLR must exhibit suitable rigour and measurability through recognised assessment processes. The requirement can be met either through conventional qualifications or examinations, or through work-based assessment based on verifiable and certified achievements.

# **Interpretation**

Within the below table, the following terms are used with the meanings stated:

* **Understanding** is the capacity to use concepts creatively, for example, in problem solving, design, explanations and diagnosis
* **Knowledge** is information that can be recalled
* **Know-how** is the ability to apply learned knowledge and skills to perform operations intuitively, efficiently and correctly
* **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
* **Complex** implies engineering problems, artefacts or systems that involve dealing simultaneously with a sizeable number of factors that interact and require deep understanding, including knowledge at the forefront of the discipline, to analyse or deal with

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| **Science and Mathematics**Engineering is underpinned by science and mathematics, and other associated disciplines, as defined by the relevant professional engineering institution(s). Graduates will need the following knowledge, understanding and abilities: |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| A comprehensive knowledge and understanding of the scientific principles and methodology necessary to underpin their education in their engineering discipline, and an understanding and know-how of the scientific principles of related disciplines, to enable appreciation of the scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies |  |  |
| Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply mathematical and statistical methods, tools and notations proficiently in the analysis and solution of engineering problems |  |  |
| Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline and the ability to evaluate them critically and to apply them effectively |  |  |
| Awareness of developing technologies related to own specialisation |  |  |
| A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations |  |  |
| Understanding of concepts from a range of areas, including some outside engineering, and the ability to evaluate them critically and to apply them effectively in engineering projects |  |  |

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| **Engineering Analysis**Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. Graduates will need:  |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes |  |  |
| Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques |  |  |
| Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and implement appropriate action |  |  |
| Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems |  |  |
| Ability to use fundamental knowledge to investigate new and emerging technologies |  |  |
| Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems |  |  |

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| **Design**Design at this level 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 and can be used to integrate all engineering understanding, knowledge and skills to the solution of real and complex problems. Graduates will therefore need the knowledge, understanding and skills to: |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics |  |  |
| Investigate and define the problem, identifying any constraints including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards |  |  |
| 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 |  |  |
| Apply advanced problem-solving skills, technical knowledge and understanding, to establish rigorous and creative solutions that are fit for purpose for all aspects of the problem including production, operation, maintenance and disposal |  |  |
| Plan and manage the design process, including cost drivers, and evaluate outcomes  |  |  |
| Communicate their work to technical and non-technical audiences |  |  |
| Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations |  |  |
| Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs |  |  |

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| **Economic, Legal, Social, Ethical and Environmental Context** Engineering activity can have impacts on the environment, on commerce, on society and on individuals. Graduates therefore need the skills to manage their activities and to be aware of the various legal and ethical constraints under which they are expected to operate, including:  |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| Understanding of the need for a high level of professional and ethical conduct in engineering, a knowledge of professional codes of conduct and how ethical dilemmas can arise |  |  |
| Knowledge and understanding of the commercial, economic and social context of engineering processes |  |  |
| Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering objectives, their limitations, and how they may be applied appropriately |  |  |
| Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate |  |  |
| Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues, and an awareness that these may differ internationally |  |  |
| Knowledge and understanding of risk issues, including health and safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk |  |  |
| Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction |  |  |

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| **Engineering Practice**This is the practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills. This can include: |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| Understanding of contexts in which engineering knowledge can be applied (for example operations and management, application and development of technology, etc.) |  |  |
| Knowledge of characteristics of particular equipment, processes or products, with extensive knowledge and understanding of a wide range of engineering materials and components |  |  |
| Ability to apply relevant practical and laboratory skills |  |  |
| Understanding of the use of technical literature andother information sources |  |  |
| Knowledge of relevant legal and contractual issues |  |  |
| Understanding of appropriate codes of practice and industry standards |  |  |
| Awareness of quality issues and their application to continuous improvement |  |  |
| Ability to work with technical uncertainty |  |  |
| A thorough understanding of current practice and its limitations, and some appreciation of likely new developments |  |  |
| Ability to apply engineering techniques taking account of a range of commercial and industrial constraints |  |  |
| Understanding of different roles within an engineering team and the ability to exercise initiative and personal responsibility, which may be as a team member or leader |  |  |

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| **Additional General Skills**Graduates must have developed transferable skills, additional to those set out in the other learning outcomes, that will be of value in a wide range of situations, including the ability to:  |
| **MEng Learning Outcomes** | **Formal Learning** | **Learning in the workplace** |
| Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities |  |  |
| Plan self-learning and improve performance, as the foundation for lifelong learning/CPD |  |  |
| Monitor and adjust a personal programme of work on an ongoing basis  |  |  |
| Exercise initiative and personal responsibility, which may be as a team member or leader |  |  |