IET Academic Accreditation

Guidance on how to meet the Learning Outcome requirements for Accreditation

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Contents

About this document

This document describes key aspects of the accreditation process undertaken by the IET. It is important to note that it should be read in conjunction with UK-SPEC [1] and "The Accreditation of Higher Education programmes" [2].

Professional Registration of Engineers in the UK

Professional Registration of Engineers in the UK is controlled and regulated by Engineering Council UK, who publish the requirements in the "United Kingdom Standard for Professional Engineering Competence" (UK-SPEC) [1] This defines the threshold standards of competence and commitment required of Chartered Engineers, Incorporated Engineers and Engineering Technicians.

These requirements cover all engineering disciplines, and so are generic in nature, requiring interpretation within the context of individual subject areas.

UK-SPEC requires an engineer to satisfy both academic and experiential requirements.

> In respect of the academic requirements, for IEng and CEng, Engineering Council UK supports the accreditation of HEI programmes, which means that any student graduating from an accredited programme, with a 3rd class Honours or above, automatically satisfies the academic requirements of UK-SPEC. Engineering Council UK publishes guidance "The Accreditation of Higher Education programmes" (AHEP) which sets out the criteria for all accredited programmes [2].
>
> In respect of experiential requirements, Engineering Council UK supports the accreditation of company based programmes of training, though no specific guidance is published.

Engineering Council UK does not administer the process of assessing the competence of individuals seeking professional registration, or accrediting HEI programmes, but delegates these roles to professional institutions, including the IET. Engineering Council UK audits the processes and procedures adopted within these institutions, to ensure that the guidance is being followed correctly, with appropriate interpretation in respect the needs of different engineering disciplines, and that standards are maintained.

Under UK-SPEC the decision to accredit a degree programme, as satisfying the academic requirements for CEng or IEng registration, is made on the basis of the programme delivering and assessing learning outcomes (demonstrating competence), as specified in "The Accreditation of Higher Education Programmes (AHEP)" [2].

The accreditation of Higher Education programmes

The generic requirements of AHEP, and the need to interpret the requirements of different subjects presents a real challenge to HEIs and the accrediting institutions. Publishing detailed interpretations by subject area, could be seen as being helpful, but it risks being seen as prescriptive, stifling innovation (content and delivery) and would potentially encourage a uniform educational offering across all HEIs. This would not meet the needs of the country and has been resisted by the IET.

The IET accredits the following types of programmes:

- BEng/BSc as fully satisfying the educational requirements for IEng registration, or as partially satisfying the educational requirements for CEng registration. Note that ECUK stipulates that a programme deemed as partially satisfying the educational requirements for CEng registration is deemed to fully meet the educational requirements for IEng registration
- MEng as fully satisfying the educational requirements for CEng registration.
- MSc as partially satisfying the educational requirements for CEng registration, as further learning, with the expectation that students on the course will already hold an appropriately accredited BEng degree (or overseas equivalent).

Other equivalent degree titles are also considered on a case by case basis.

The following characteristics, and distinctiveness between the competence of Chartered and Incorporated Engineers as articulated in AHEP, should be evident in the aims and learning outcomes of each programme:

- Chartered Engineers develop solutions to engineering problems using new or existing technologies, through innovation, creativity and change and/or they may have technical accountability for complex systems with significant levels of risk.

  Chartered Engineers are able to demonstrate:

  - The theoretical knowledge to solve problems in new technologies and develop new analytical techniques
  - Successful application of the knowledge to deliver innovative products and services and/or take technical responsibility for complex engineering systems
  - Accountability for project, finance and personnel management and managing trade-offs between technical and socio-economic factors
  - Skill sets necessary to develop other technical staff
  - Effective interpersonal skills in communicating technical matters.

- Incorporated Engineers maintain and manage applications of current and developing technology, and may undertake engineering design, development, manufacture, construction and operation.

  Incorporated Engineers are able to demonstrate:

  - The theoretical knowledge to solve problems in developed technologies using well proven analytical techniques
  - Successful application of their knowledge to deliver engineering projects or services using established technologies and methods

- Responsibility for project and financial planning and management together with some responsibility for leading and developing other professional staff
- Effective interpersonal skills in communicating technical matters
- Commitment to professional engineering values.

Guidance on how to meet the AHEP accreditation requirements

When the IET look to accredit a HEI programme, it undertakes a holistic review of:

1. Programme Title

   The programme title must be seen as an intrinsic driver of the aims and learning outcomes, and thereby the curricula.

2. Programme Description

   The HEI should provide a statement defining the subject matter of the degree programme especially noting any particular flavour, specialism or approach that it incorporates.

   The accreditation panel will be selected to have knowledge of the subject area, and so can make a judgment on what would constitute a coherent and appropriate offering under the given programme title.

   Suites of degree programmes that are very similar should be listed under programme title and then, under programme description, the basis of and justification for the derivative programmes should be made.

3. Aims and Learning Outcomes

   The aims of a programme should articulate the global aspiration of the programme such as future careers and skills of its graduates.

   The learning outcomes are the means by which the aims will be achieved. These do not need to be fully described but rather the core elements highlighted.

   They can be considered to be the “high level” competencies the HEI is looking to develop in their students. It is unlikely that two programmes from different HEIs, even with the same title, will aim to produce graduates with exactly the same attributes and so the accreditation panel wants to understand the “nature” of the programme. What is distinctive? This defines what the programme is all about.

   Crucially, the aims and learning outcomes of the course should link clearly to Learning Outcomes, at the appropriate level (CEng or IEng). It will be expected that the Aims and Learning Outcomes for a MEng course will be different for those of a BEng course. Similarly the Aims and Learning Outcomes for a BEng aimed at those seeking only IEng registration will be different from those for a BEng aimed at partial CEng level.

4. Structure and Coherence of the Programme

   The programme must contain a coherent collection of modules/units which the HEI is able to justify as appropriate to delivering the stated aims and learning outcomes under the “banner” of the programme title.

   There should be an appropriate balance of lectures, coursework, laboratory work etc.

The IET will be looking in the programme specification, module/unit specifications, coursework, exam papers and elsewhere, for evidence of:

- Appropriate grounding in underpinning mathematics and science.
- Analytical skills
- Practical skills
- A design thread through the programme

5. Content and Level of the modules/units

All modules/units should:

- have up to date, relevant content, built on appropriate fundamental knowledge (including mathematics and analytical skills), identified through pre-requisite modules (where relevant)
- be delivered at the appropriate level
- have clearly defined and auditable learning outcomes linked to the programme aims and learning outcomes

The IET will also be looking at facilities and staffing to ensure that the content of the module/unit can be delivered effectively.

6. Mapping of the content to AHEP Learning Outcomes (LOs)

One of the primary tasks of the accreditation process is to verify that the aims and learning outcomes of a degree programme are consistent with the standards expected of a professional engineer. This task reduces to one of mapping and auditing the declared learning outcomes for the programme against AHEP requirements and thereby ensuring that all academic requirements of a Chartered or Incorporated Engineer are developed in the graduate.

In preparing for accreditation, departments will need to provide a commentary explaining how this mapping is achieved as well as supplying evidence which demonstrates convincingly that graduates from the programme have achieved the desired learning outcomes at the appropriate level.

The above approach is undertaken on a programme by programme basis. Very often HEIs offer a range of programmes with different titles but which have a substantial amount of commonality in either mode of delivery or with some specialization, for example a subset of optional modules/units. In such cases the HEI should make the commonality and differences clear to the accreditation panel. Key elements in such situations would be the programme titles and its distinctive aims and learning outcomes, and these should be highlighted. This could be addressed by including this information in the submission outlining departmental philosophy and aspirations.

It is important to understand that the accreditation process is evidence based. The accreditation panel will be looking at not only what is delivered but also the ability of the HEI to deliver in terms of staff expertise, facilities, and cohorts of students. Further the HEI and departmental processes will be reviewed, relating to programme changes, marking, degree awards etc, with a view to ensuring the integrity of the accredited programme.

Summary

Following an accreditation visit a report will be prepared highlighting the strengths and weaknesses of the programme and, where necessary, identifying any action points that will need to be addressed before accreditation can be confirmed.

The appropriateness of the programme will be judged against the following criteria:

- **The title of degree programme:** Does the curriculum justify the title? A statement defining the subject matter of the degree programme especially noting any particular flavour, specialism or approach that it incorporates should be provided.

- **Aims of the programme:** State here the global aspiration of the programme in terms of skill sets and future careers of its graduates.

- **Learning Outcomes:** Provide a list of learning outcomes of the programme i.e. the means by which the aims will be achieved.

- **Modules:** It is important to demonstrate how the individual modules **mainly** satisfy the delivery of the learning outcomes. The Panel will look for evidence that claimed learning outcomes are delivered by individual modules.

The learning outcomes matrix is regarded by the IET Panel as a key pointer towards evidence that the programme will be accreditable at the appropriate level.

Guidance on meeting specific learning outcomes

The remainder of this document gives guidance on the learning outcomes that a degree course will need in order to be accredited by the IET at the chosen level. It does not attempt to prescribe specific topics which should be covered in a degree course.

The learning outcomes described in this document are a direct copy of those contained in edition 3 of The Accreditation of Higher Education Programmes (AHEP). The IET has added short codes against each of the statements in an attempt to make it clear, at a glance, the categories and the differences between the levels of accreditation and to make the difference clear within ADAMs (the IET's online Accreditation Database and Management System). The codes have been allocated to learning outcomes as follows:

SM	Science and Mathematics
EA	Engineering Analysis
D	Design
ET	Economic, Legal, Social, Ethical and Environmental Context
EP	Engineering Practice

Postfix 'i'	Indicates that this learning outcome is for partial or full IEng accreditation
Postfix 'p'	Indicates that the learning outcome is for partial CEng accreditation
Postfix 'm'	Indicates that the learning outcome is for full CEng accreditation. Usually for Integrated Masters (MEng) programmes.
Postfix 'fl'	Indicates that the learning outcomes is for partial CEng further learning accreditation. Usually for MSc or equivalent Masters programmes

Science and Mathematics

IEng

Engineering is underpinned by science and mathematics, and other associated disciplines, as defined by the relevant professional engineering institution(s). Graduates will need:

SM1i	*Knowledge and understanding of the scientific principles underpinning relevant current technologies, and their evolution*
SM2i	*Knowledge and understanding of mathematics and an awareness of statistical methods necessary to support application of key engineering principles*

These learning outcomes are normally integrated into programmes suitable for accreditation at IEng level i.e. mathematics and statistical methods underpinning the science and engineering curriculum. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at IEng level will contain most, if not all of the following elements:

1) Unseen examination questions and/or coursework, which allow students to demonstrate that they have met SM1i and SM2i.

2) Laboratory work to meet the requirements of the particular engineering discipline, which involves:
   - experiments and demonstrations of the relevant scientific principles, to achieve SM1i,
   - use of current technologies in laboratory experiments to arrive to SM1i,
   - statistical processing and presenting of data to achieve SM2i.

Partial CEng

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:

SM1p	*Knowledge and understanding of scientific principles and methodology necessary to underpin their education in their engineering discipline, to enable appreciation of its scientific and engineering context, and to support their understanding of relevant historical, current and future developments and technologies.*
SM2p	*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.*
SM3p	*Ability to apply and integrate knowledge and understanding of other engineering disciplines to support study of their own engineering discipline.*

In order to demonstrate that the LOs can be met, it will be expected that programmes suitable for accreditation at partial CEng level will contain most, if not all of the following elements:

1) Unseen examination questions and/or coursework, which use knowledge and understanding of mathematics and sciences to undertake:
   - analysis and modelling of science or engineering problems relevant to the discipline to achieve SM1p and SM2p,
   - synthesis to offer solutions to engineering problems relevant to the discipline to achieve SM3p.

2) Laboratory work to meet the requirements of the particular engineering discipline, which involves:
   - critical analysis of how theoretical solutions are arrived at, to achieve SM1p,
   - proficient analysis and presentation of data using relevant statistical methods and tools, to achieve SM2p.

3) A substantial individual project (typically the equivalent to one-quarter of a study year) which involves the student going through the process of applying and integrating their knowledge of a range of engineering disciplines i.e. the process of engineering problem analysis to synthesize a solution in order to demonstrate that she/he has met SM1p, SM2p and SM3p.

Integrated Masters – full CEng

Graduates will need the following knowledge, understanding and abilities:

SM1m	*A comprehensive knowledge and understanding of 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.*
SM2m	*Knowledge and understanding of mathematical and statistical methods necessary to underpin their education in their engineering discipline and to enable them to apply a range of mathematical and statistical methods, tools and notations proficiently and critically in the analysis and solution of engineering problems.*
SM3m	*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.*
SM4m	*Awareness of developing technologies related to own specialisation.*
SM5m	*A comprehensive knowledge and understanding of mathematical and computational models relevant to the engineering discipline, and an appreciation of their limitations.*
SM6m	*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.*

In order to demonstrate that the LOs can be met, it will be expected that programmes suitable for accreditation at full CEng level will contain most, if not all of the following elements:

1) A range of substantial coursework/examination question examples, which require:
   - advanced integration of a comprehensive range of underpinning principles and developing technologies, relevant to the discipline, to propose solutions to science or engineering problems and achieve SM1m, SM3m and SM4m.
   - proficient use of mathematical methods and tools, to present solutions, whilst appreciating their limitations to achieve SM2m, SM4m and SM5m.

2) A substantial individual project (typically the equivalent to one-quarter of a study year) which involves the student going through the process of applying and integrating their knowledge of a range of engineering disciplines i.e. the process of engineering problem analysis to synthesize the solution in order to demonstrate that he/she has met SM2m to SM5m.

3) A substantial group project (typically the equivalent to one-quarter of a study year), which involves the student making design choices as part of a team, where their work has to relate to those of others, to produce a common goal whilst involving the group going through the process of applying and integrating their knowledge of a range of engineering disciplines i.e. the process of engineering problem analysis to synthesize the solution, which also takes into account concepts and factors that are external to the discipline influencing the solution, to demonstrate that they have additionally met SM6m.

MSc / MRes

Engineering is underpinned by science and mathematics, and other associated disciplines, as defined by the relevant professional engineering institution(s). The main science and mathematical abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will therefore need additionally:

SM1fl	*A comprehensive understanding of the relevant scientific principles of the specialisation.*
SM2fl	*A critical awareness of current problems and/or new insights most of which is at, or informed by, the forefront of the specialisation.*
SM3fl	*Understanding of concepts relevant to the discipline, some from outside engineering, and the ability to evaluate them critically and to apply them effectively, including in engineering projects.*

In order to demonstrate that the LOs can be met, it will be expected that programmes suitable for accreditation at MSc level will contain most if not all of the following elements:

1) A range of substantial coursework/examination question examples, which require:
   - advanced integration of a comprehensive range of the underpinning principles with the developing technologies, relevant to the discipline, to propose advanced solutions, to achieve SM1fl,
   - well-informed, insightful analysis of state-of-the-art developments in the relevant discipline, demonstrating the ability to critically appraise the emerging technologies and solutions, to achieve SM2fl.

2) A substantial project (typically the equivalent to one-third of the overall programme of study), which involves the student going through the process of applying and integrating their knowledge of a range of engineering disciplines i.e. the process of engineering problem analysis to synthesize the solution, which also takes into account concepts and factors influencing the solution that are external to the discipline, in order to demonstrate that they have additionally met SM3fl.

Engineering Analysis

IEng

Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. Graduates will need:

EA1i	*Ability to monitor, interpret and apply the results of analysis and modelling in order to bring about continuous improvement.*
EA2i	*Ability to apply quantitative methods in order to understand the performance of systems and components.*
EA3i	*Ability to use the results of engineering analysis to solve engineering problems and to recommend appropriate action.*
EA4i	*Ability to apply an integrated or systems approach to engineering problems through know-how of the relevant technologies and their application.*

These learning outcomes are normally integrated into programmes suitable for accreditation at IEng level. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at IEng level will contain most, if not all of the following elements:

1) Unseen examination questions and/or coursework, which allow students to demonstrate that they have met EA1i and EA2i.
2) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant scientific principles (EA1i, EA2i)
3) An individual project which involves the student using engineering analysis. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EA1i, EA2i, EA3i and EA4i.

Partial CEng

Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. Graduates will need:

EA1p	*Understanding of engineering principles and the ability to apply them to analyse key engineering processes.*
EA2p	*Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques.*
EA3p	*Ability to apply quantitative and computational methods in order to solve engineering problems and to implement appropriate action.*
EA4p	*Understanding of, and the ability to apply, an integrated or systems approach to solving engineering problems.*

These learning outcomes are normally integrated into programmes suitable for accreditation at Partial CEng level. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at Partial CEng level will contain most, if not all of the following elements:

1) Unseen examination questions and/or coursework, which allow students to demonstrate that they have met EA1p and EA2p.

2) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant scientific principles (EA1p, EA2p)
3) An individual project which involves the student using engineering analysis. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EA1p, EA2p, EA3p and EA4p.

Integrated Masters - Full CEng

Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. Graduates will need:

EA1m	*Understanding of engineering principles and the ability to apply them to undertake critical analysis of key engineering processes.*
EA2m	*Ability to identify, classify and describe the performance of systems and components through the use of analytical methods and modelling techniques.*
EA3m	*Ability to apply quantitative and computational methods, using alternative approaches and understanding their limitations, in order to solve engineering problems and to implement appropriate action.*
EA4m	*Understanding of, and the ability to apply, an integrated or systems approach to solving complex engineering problems.*
EA5m	*Ability to use fundamental knowledge to investigate new and emerging technologies.*
EA6m	*Ability to extract and evaluate pertinent data and to apply engineering analysis techniques in the solution of unfamiliar problems.*

These learning outcomes are normally integrated into programmes suitable for accreditation at Full CEng level. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at Full CEng level will contain most, if not all of the following elements:

1) Unseen examination questions and/or coursework, which allow students to demonstrate that they have met EA1m, EA2m and EA6m.

2) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant scientific principles (EA1m, EA2m, EA5m, EA6m)

3) An individual project which involves the student using engineering analysis. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EA1m, EA2m, EA3m, EA4m, EA5m and EA6m.

4) A group project which involves the student using engineering analysis which will demonstrate completion of all the EAm LOs in a team context.

MSc / MRes

Engineering analysis involves the application of engineering concepts and tools to the solution of engineering problems. The main engineering analysis abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will therefore need additionally:

EA1fl	*Ability both to apply appropriate engineering analysis methods for solving complex problems in engineering and to assess their limitations.*
EA2fl	*Ability to use fundamental knowledge to investigate new and emerging technologies.*
EA3fl	*Ability to collect and analyse research data and to use appropriate engineering analysis tools in tackling unfamiliar problems, such as those with uncertain or incomplete data or specifications, by the appropriate innovation, use or adaptation of engineering analytical methods.*

These learning outcomes are normally integrated into programmes suitable for accreditation at MSc level. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at MSc level will contain most, if not all of the following elements:

1) An individual project which involves the student using engineering analysis. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EA1fl, EA2fl, and EA3fl.

Design

At all levels, the IET would expect to see *Design* included from the beginning of a programme and will look for evidence of a design thread running throughout the course.

IEng

Design at this level is the creation and development of an economically viable product, process or system to meet a defined need. It involves technical and intellectual challenges and can be used to integrate all engineering understanding, knowledge and skills to the solution of real problems. Graduates will need the knowledge, understanding and skills to:

D1i	*Be aware of business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics.*
D2i	*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.*
D3i	*Work with information that may be incomplete or uncertain and be aware that this may affect the design.*
D4i	*Apply problem-solving skills, technical knowledge and understanding to create or adapt design solutions that are fit for purpose including operation, maintenance, reliability etc.*
D5i	*Manage the design process, including cost drivers, and evaluate outcomes.*
D6i	*Communicate their work to technical and non-technical audiences.*

In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at IEng level will contain most if not all of the following elements:

1) An individual project which involves the student being **guided** through the process of making design choices. These choices will need to be made in the context of D1i and D2i. Normally the project would be assessed by a combination of a formal report and a presentation (D6i) and would demonstrate completion of D3i, D4i and D5i. Other elements of assessment, such as a poster display, can be used to further demonstrate the meeting of D6i.

2) Laboratory work which involves some choices in how solutions are arrived at (D3i and D4i).

3) Open-ended examination questions (D2i and D4i)

4) Coursework which allow students to demonstrate that they have met D2i and D4i.

Partial CEng

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:

D1p	*Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and Aesthetics.*
D2p	*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.*
D3p	*Work with information that may be incomplete or uncertain and quantify the effect of this on the design.*
D4p	*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.*
D5p	*Plan and manage the design process, including cost drivers, and evaluate Outcomes.*
D6p	*Communicate their work to technical and non-technical audiences.*

In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at Partial CEng level will contain most if not all of the following elements:

1) A substantial individual project (typically taking the equivalent of one-quarter of a study year) which involves the student going through the process of **making design choices**. These choices will need to be made in the context of D1p and D2p. Normally the project would be assessed by a combination of a formal report and a presentation (D6p) and would demonstrate completion of D3p, D4p and D5p. Other elements of assessment, such as a poster display, can be used to further demonstrate the meeting of D6p.

2) Laboratory work which involves some choices in how solutions are arrived at (D3p and D4p).

3) Open-ended examination questions (D2p and D4p).

4) Coursework which allow students to demonstrate that they have met D2p and D4p.

Integrated Masters – full CEng

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:

D1m	*Understand and evaluate business, customer and user needs, including considerations such as the wider engineering context, public perception and aesthetics.*
D2m	*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.*
D3m	*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.*
D4m	*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.*
D5m	*Plan and manage the design process, including cost drivers, and evaluate outcomes.*
D6m	*Communicate their work to technical and non-technical audiences.*
D7m	*Demonstrate wide knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations.*
D8m	*Demonstrate the ability to generate an innovative design for products, systems, components or processes to fulfil new needs.*

In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at Full CEng level will contain most if not all of the following elements:

1) A substantial individual project (typically taking the time equivalent to one-quarter of a study year) which involves the student going through the process of making creative design choices. These choices will need to be made in the context of D1m and D2m. Normally the project would be assessed by a combination of a formal report and a presentation (D6m) and would demonstrate completion of D3m, D4m, D5m, D7m and D8m. Other elements of assessment, such as a poster display, can be used to further demonstrate the meeting of D6m.

2) A substantial group project (typically taking the time equivalent to one-quarter of a study year) which involves the student making creative design choices as part of a team, where their work has to relate to those of others, to produce a common goal (D1m, D2m, D3m, D4m, D5m, D7m and D8m). Normally this would be assessed by the production of a group report, with some element detailing the individual contributions, in combination with a presentation (D6m).

3) Laboratory work which involves some choices in how solutions are arrived at (D3m and D4m).

4) Open-ended examination questions (D2m and D4m).
5) Coursework which allow students to demonstrate that they have met D2m and D4m.

MSc / MRes

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. The main design abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will need additionally:

D1fl	*Knowledge, understanding and skills to work with information that may be incomplete or uncertain, quantify the effect of this on the design and, where appropriate, use theory or experimental research to mitigate deficiencies.*
D2fl	*Knowledge and comprehensive understanding of design processes and methodologies and the ability to apply and adapt them in unfamiliar situations.*
D3fl	*Ability to generate an innovative design for products, systems, components or processes to fulfil new needs.*

In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at MSc level will contain most if not all of the following elements:

1) A substantial individual project (typically taking the time equivalent to one-third of a calendar year) which involves the student going through the process of making design choices. These choices will need to be made in the context of D1fl and D2fl. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of D3fl.

2) Laboratory work which involves some choices in how solutions are arrived at (D1fl and D3fl).

3) Open-ended examination questions (D1fl,D2fl and D3fl).

4) Coursework which allow students to demonstrate that they have met D1fl, D2fl and D3fl.

Economic, legal, social, ethical and environmental context

IEng

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:

ET1i	*Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct*
ET2i	*Knowledge and understanding of the commercial, economic and social context of engineering processes*
ET3i	*Knowledge of management techniques that may be used to achieve engineering* learning outcomes
ET4i	*Understanding of the requirement for engineering activities to promote sustainable development,*
ET5i	*Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues,*
ET6i	*Awareness of risk issues, including health & safety, environmental and commercial risk.*

It is vital that the importance of these LOs is appreciated and understood. In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at IEng level will contain most if not all of the following elements:

1) An individual project which involves the student considering his/her work in the context of Economic, Legal, Social, Ethical and Environmental concerns (all ETi LOs).

2) Coursework which requires the student to consider these factors as part of a problem relevant to the specific engineering discipline (all ETi LOs).

Partial CEng

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:

ET1p	*Understanding of the need for a high level of professional and ethical conduct in engineering and a knowledge of professional codes of conduct,*
ET2p	*Knowledge and understanding of the commercial, economic and social context of engineering processes,*
ET3p	*Knowledge and understanding of management techniques, including project management, that may be used to achieve engineering* learning outcomes*,*
ET4p	*Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate,*
ET5p	*Awareness of relevant legal requirements governing engineering activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues,*
ET6p	*Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, and of risk assessment and risk management techniques.*

It is vital that the importance of these LOs is appreciated and understood. In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at Partial CEng level will contain most if not all of the following elements:

1) An individual project which involves the student considering his/her work in the context of Economic, Legal, Social, Ethical and Environmental concerns (all ET LOs).

2) Coursework which requires the student to consider these factors as part of a problem relevant to the specific engineering discipline (all ET LOs).

Integrated Masters – Full CEng

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:

ET1m	*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,*
ET2m	*Knowledge and understanding of the commercial, economic and social context of engineering processes,*
ET3m	*Knowledge and understanding of management techniques, including project and change management, that may be used to achieve engineering* learning outcomes*, their limitations and how they may be applied appropriately,*
ET4m	*Understanding of the requirement for engineering activities to promote sustainable development and ability to apply quantitative techniques where appropriate,*
ET5m	*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,*
ET6m	*Knowledge and understanding of risk issues, including health & safety, environmental and commercial risk, risk assessment and risk management techniques and an ability to evaluate commercial risk,*
ET7m	*Understanding of the key drivers for business success, including innovation, calculated commercial risks and customer satisfaction.*

It is vital that the importance of these LOs is appreciated and understood. In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at Full CEng level will contain most if not all of the following elements:

1) An individual project which involves the student considering his/her work in the context of Economic, Legal, Social, Ethical and Environmental concerns (all ETm LOs).

2) A Group project which involves the student considering his/her work in the context of Economic, Legal, Social, Ethical and Environmental concerns (all ETm LOs).

3) Coursework which requires the student to consider these factors as part of a problem relevant to the specific engineering discipline (all ETm LOs).

MSc / MRes

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:

ET1fl	*Awareness of the need for a high level of professional and ethical conduct in engineering,*
ET2fl	*Awareness that engineers need to take account of the commercial and social contexts in which they operate,*
ET3fl	*Knowledge and understanding of management and business practices, their limitations, and how these may be applied in the context of the particular specialisation,*
ET4fl	*Awareness that engineering activities should promote sustainable development and ability to apply quantitative techniques where appropriate,*
ET5fl	*Awareness of relevant regulatory requirements governing engineering activities in the context of the particular specialisation,*
ET6fl	*Awareness of and ability to make general evaluations of risk issues in the context of the particular specialisation, including health & safety, environmental and commercial risk.*

It is vital that the importance of these LOs is appreciated and understood. In order to demonstrate that these LOs can be met it will be expected that programmes suitable for accreditation at MSc level will contain most if not all of the following elements:

1) An individual project which involves the student considering his/her work in the context of Economic, Legal, Social, Ethical and Environmental concerns (all ETfl LOs).

2) Coursework which requires the student to consider these factors as part of a problem relevant to the specific engineering discipline (all ETfl LOs).

Engineering practice

IEng

This is the practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills. This can include:

EP1i	*Knowledge of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc)*
EP2i	*Understanding of and ability to use relevant materials, equipment, tools, processes, or products*
EP3i	*Knowledge and understanding of workshop and laboratory practice*
EP4i	*Ability to use and apply information from technical literature*
EP5i	*Ability to use appropriate codes of practice and industry standards*
EP6i	*Awareness of quality issues and their application to continuous improvement*
EP7i	*Awareness of team roles and the ability to work as a member of an engineering team*

These learning outcomes are expected to be fully integrated into programmes suitable for accreditation at IEng level. It is also expected that they will be carefully designed to meet the requirements and reflect the practices, tools and materials of the particular engineering discipline of the programme. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at IEng level will contain most, if not all of the following elements:

1) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant engineering practice (EP1i, EP2i, EP3i and EP4i).

2) Coursework relevant to the particular engineering discipline which is carried out in teams (EP7i).

3) An individual project. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EP1i, EP4i, EP5i and EP6i.

Partial CEng

This is the practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills. This can include:

EP1p	*Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc)*
EP2p	*Knowledge of characteristics of particular materials, equipment, processes, or products*
EP3p	*Ability to apply relevant practical and laboratory skills*
EP4p	*Understanding of the use of technical literature and other information sources*
EP5p	*Knowledge of relevant legal and contractual issues*
EP6p	*Understanding of appropriate codes of practice and industry standards*
EP7p	*Awareness of quality issues and their application to continuous improvement*
EP8p	*Ability to work with technical uncertainty*
EP9p	*Understanding of, and the ability to work in, different roles within an engineering team.*

These learning outcomes are expected to be fully integrated into programmes suitable for accreditation at Partial CEng level. It is also expected that they will be carefully designed to meet the requirements and reflect the practices, tools and materials of the particular engineering discipline of the programme. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at Partial CEng level will contain most, if not all of the following elements:

1) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant engineering practice (EP1p, EP2p, EP3p and EP4p).

2) Coursework relevant to the particular engineering discipline which is carried out in teams (EP9p).

3) An individual project. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EP1p, EP4p, EP5p, EP6p, EP7p and EP8p.

Integrated Masters - full CEng

This is the practical application of engineering skills, combining theory and experience, and use of other relevant knowledge and skills. This can include:

EP1m	*Understanding of contexts in which engineering knowledge can be applied (eg operations and management, application and development of technology, etc) with extensive knowledge and understanding of a wide range of engineering*
EP2m	*Knowledge of characteristics of particular equipment, processes, or products, materials and components;*
EP3m	*Ability to apply relevant practical and laboratory skills.*
EP4m	*Understanding of the use of technical literature and other information sources*
EP5m	*Knowledge of relevant legal and contractual issues*
EP6m	*Understanding of appropriate codes of practice and industry standards*
EP7m	*Awareness of quality issues and their application to continuous improvement*
EP8m	*Ability to work with technical uncertainty*
EP9m	*A thorough understanding of current practice and its limitations, and some appreciation of likely new developments*
EP10m	*Ability to apply engineering techniques taking account of a range of commercial and industrial constraints*
EP11m	*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.*

These learning outcomes are expected to be fully integrated into programmes suitable for accreditation at Full CEng level. It is also expected that they will be carefully designed to meet the requirements and reflect the practices, tools and materials of the particular engineering discipline of the programme. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at Full CEng level will contain most, if not all of the following elements:

1) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant engineering practice (EP1m, EP2m, EP3m and EP4m).

2) Coursework relevant to the particular engineering discipline which is carried out in teams (EP11m).

3) An individual project. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EP1m, EP4m, EP5m, EP6m, EP7m, EP8m, EP9m and EP10m.

4) A group project which would allow the student to demonstrate completion of EP11m.

MSc / MRes

The main engineering practice abilities will have been developed in an accredited engineering undergraduate programme. Masters graduates will need to demonstrate application of these abilities where appropriate and additional engineering skills which can include:

EP1fl	*Advanced level knowledge and understanding of a wide range of engineering materials and components*
EP2fl	*A thorough understanding of current practice and its limitations, and some appreciation of likely new developments*
EP3fl	*Ability to apply engineering techniques, taking account of a range of commercial and industrial constraints*
EP4fl	*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*

These learning outcomes are expected to be fully integrated into programmes suitable for accreditation at MSc level. It is also expected that they will be carefully designed to meet the requirements and reflect the practices, tools and materials of the particular engineering discipline of the programme. In order to demonstrate that these LOs can be met, it will be expected that programmes suitable for accreditation at MSc level will contain most, if not all of the following elements:

1) Laboratory work to meet the requirements of the particular engineering discipline, which involve experiments and demonstrations of the relevant engineering practice (EP1fl, EP2fl and EP3fl).

2) Coursework relevant to the particular engineering discipline which is carried out in teams (EP4fl).

3) An individual project. Normally the project would be assessed by a combination of a formal report and a presentation and would demonstrate completion of EP2fl and EP3fl.

References

[1] The UK Standard for Professional Engineering Competence (UK Spec) can be obtained from: http://www.engc.org.uk/ukspec.aspx

[2] The Accreditation of Higher Education Programmes can be obtained from: http://www.engc.org.uk/accreditation.aspx