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AWARD STANDARDS - **ENGINEERING**

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Award Standards - Engineering

FOREWORD

The Qualifications (Education & Training) Act 1999 required the Higher Education and Training Awards Council to determine standards of knowledge, skill or competence to be acquired by learners "before a higher education and training award may be made". These standards are based on the level indicators and award-type descriptors of the National Framework of Qualifications (NFQ, Appendix 2).

Standards for certain broad fields of learning were developed for awards at level 6 to level 9 on the NFQ. These standards represent an elaboration of the generic descriptors of the Framework. They should facilitate experts in particular fields of learning to create the link between their programmes' intended learning outcomes and the NFQ. These standards are not programme specifications. It is through these, however, that the relationship between a programme, its component parts and the NFQ should be evident. The standards are a reference point and a point of comparison against which individual programmes may be justified.

They are intended to provide general guidance for articulating the learning outcomes associated with a particular field of learning. In designing programmes, providers must take cognisance of the standards for specific fields of learning where they generally relate to the programme being developed. It is, however, recognised that there is a significant growth in multi-disciplinary/inter-disciplinary programmes; there are emerging fields of learning; and in addition, within each field there is the vast spectrum of programmes possible, which range from highly practical to very theoretical.

In this context, it is not possible to have a standard, or multiple standards, that cater for the complete range of programmes possible. It is therefore expected that the standards for specific fields of learning will be used as reference points for the design of programmes.

In drafting the standards every effort has been made to ensure that they will provide for flexibility and variety in the design of programmes and therefore encourage innovation within an overall agreed framework. It is not expected that all programmes will include every learning outcome identified in a standard. It is, however, expected that many programmes will include learning outcomes that are not included in the relevant standard. When designing a programme, each learning outcome in the standard should be considered. Where departure from these is necessary, it should be justified in the context of the specific orientation of the programme and other facts pertaining to it. Each programme provider should be able to demonstrate how the design and content of its own programmes has been informed by the standard.

The level descriptors of the Framework, the award type descriptors and consequently the standards for the specific fields of learning are divided into three different types of learning outcomes - knowledge, skill and competence.

These strands are further subdivided (sub-strands). Each strand/sub-strand is important. The relative weighting of each strand in a programme will vary from programme to programme. The weighting will be determined by many factors, including for example, the practical nature of a programme, or otherwise. Each strand/sub-strand should be addressed appropriately in every programme. Where a programme is multi-disciplinary or inter-disciplinary in nature, the use of more than one standard may be necessary. In such cases, the scope, depth and balance of concepts and application should not result in the neglect of either the theoretical, or applied, at the expense of the other.

These standards were originally determined by the Higher Education and Training Awards Council in August 2005 and reissued with a new foreword by QQI in July 2014. They are QQI awards standards under section 84 (10) of the Qualifications (Education and Training) Act 2012.

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Knowledge				
	Level 6	**Level 7**	**Level 8**	**Level 9**
	The graduate should be able to demonstrate:	The graduate should be able to demonstrate:	The graduate should be able to demonstrate:	The graduate should be able to demonstrate:
Knowledge-Breadth	*Specialised knowledge of a broad area*	*Specialised knowledge across a variety of areas*	*An understanding of the theory, concepts and methods pertaining to a field (or fields) of learning*	*A systematic understanding of knowledge, at, or informed by, the forefront of a field of learning*
Mathematics	Has knowledge of routine mathematical methods, for well- defined engineering problems, essential to the particular subfield of engineering.	Has knowledge of the underlying theory essential to the mathematics used for common engineering problems in the particular sub-field of engineering.	Has knowledge and understanding of a range of mathematical methods and the underlying theory relevant in the particular sub-field of engineering.	Has comprehensive knowledge and understanding of a wide range of mathematical methods and the underlying theory, relevant to complex engineering problems in the particular sub-field of engineering.
Science	Has knowledge of scientific principles pertaining to the understanding of well-defined engineering problems.	Has knowledge of the fundamental principles of science appropriate to the particular sub-field of engineering.	Has comprehensive understanding of the fundamental principles of appropriate scientific knowledge and the extent of their applicability to engineering problems.	Has a comprehensive knowledge and understanding of scientific principles as applied in the particular specialisation.
Information Technology	Can identify appropriate ICT as it applies to solving well-defined engineering problems. Can specify appropriate ICT for communication purposes.	Has knowledge and understanding of the role of ICT for engineering. Has sufficient knowledge and understanding of ICT to adopt it to solve common engineering problems.	Has knowledge and understanding of the role of ICT and its application to the particular sub-field of engineering. Has sufficient knowledge and understanding of ICT to adopt it to solve complex engineering problems.	Has sufficient knowledge and understanding of ICT to adopt it to solve ill-defined problems in the particular sub-field of engineering.
Design and Development	Has knowledge of the basic elements of the design process and its role in engineering. Can explain the relationship between core engineering topics and the technical design requirements for well-defined engineering problems.	Has knowledge of the essential elements of the design process and design methodologies relevant to common engineering problems in the particular subfield of engineering.	Has knowledge and understanding of the essential elements of the design process and methodologies relevant to complex engineering problems in their particular subfield of engineering.	Has a wide knowledge and comprehensive understanding of the design process and methodologies relevant to ill-defined complex engineering problems.
Business Context	Has basic knowledge of management and business in the context of well-defined industrial practices.	Has basic knowledge and understanding of management and business in the context of common industrial practice.	Has knowledge of management and business in the context of complex industrial practices and in the context of technological innovations and change. Understands the different operational and managerial structures in companies and the context of employment legislation, trade unions and public and private bodies.	Understands the economic implications of engineering in the particular sub-field of engineering. Understands the elements of project management necessary to define and complete a project in a specified time-frame.
Engineering Practice	Has basic knowledge of current engineering practice and procedures in the context of routine engineering work, in the specific sub-field of engineering, including the need for codes of practice and health and safety regulations.	Has knowledge of specific codes of practice in common engineering problems, including the role of design factors. Has knowledge of the codes of practice relating to hazards and operational safety. Understands the need for operational safety by design and good working practices.	Has knowledge of current engineering practice at project and management levels.	Understands the key parameters and the technical, economic, environmental and social issues which pertain to the particular sub-field of engineering.
Knowledge-Kind	*Some theoretical concepts and abstract thinking, with significant underpinning theory*	*Recognition of limitations of current knowledge and familiarity with sources of new knowledge; integration of concepts across a variety of areas*	*Detailed knowledge and understanding in one or more specialised areas, some of it at the current boundaries of the field(s)*	*A critical awareness of current problems and/or new insights, generally informed by the forefront of a field of learning*
Mathematics	Understand how basic mathematical techniques/ concepts apply to the particular sub-field of engineering. Has knowledge of mathematical concepts that enable the development of abstract thinking.	Understands the advantages and limitations of specific mathematical formulae and techniques used in the solution of common engineering problems. Can demonstrate core mathematical knowledge to solve common engineering problems in the particular sub-field of engineering.	Understands and appreciates the advantages, limitations, inherent assumptions and the range of applicability of specific mathematical formulae and techniques and mathematical solutions to engineering problems.	Is aware of the latest mathematical techniques and their limitations and applicability to the solution of ill-defined engineering problems in the particular subfield of engineering.

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Science	Has knowledge of scientific concepts that enable and develop abstract thinking.	Has knowledge of relevant scientific concepts that enable and develop abstract thinking. Understands the relationship between scientific principles and the particular subfield of engineering. Understands the limitations of scientific techniques used in the solution of common engineering problems.	Understands the advantages, limitations, inherent assumptions and the range of applicability of specific scientific principles, together with their potential for development.	Has comprehensive knowledge and understanding of the principles of developing scientifically based models of engineering systems and the approaches taken in incorporating a range of scientific principles into engineering projects.
Information Technology	Has practical knowledge and understands the basic concepts of the information and communication technologies relevant to the particular sub-field of engineering. Understands the fundamental concepts behind industry standard hardware and software systems and techniques as they apply to well-defined engineering situations.	Understands the basic concepts, advantages and limitations of the core technologies relevant to the particular sub-field of engineering. Understands the capabilities and limitations of computer based methods for solving common engineering problems.	Is sufficiently aware of the concepts behind and the capabilities of ICT as they apply in the particular sub-field of engineering. Understands the fundamental concepts and the advantages and limitations of the core technologies relevant to the particular subfield of engineering.	Has knowledge and understanding of ICT required to solve ill-defined complex problems in the sub-field of engineering.
Design and Development	Can explain the relationship between core engineering topics and the technical design requirements for well-defined engineering problems. Can understand the underlying concepts of basic design techniques.	Can explain the relationship between core engineering topics and the technical design requirements for common engineering problems. Has basic knowledge of the characteristics of commonly occurring engineering materials and components and the characteristics of design methodologies.	Has knowledge and understanding of a wide range of engineering topics and related areas of management sufficient to prepare project specifications and to overcome impediments to good design solutions to complex engineering problems.	Has a fundamental understanding of the context and range of complex engineering problems necessary to specify, plan and implement projects. Is aware of the latest/newest design methodologies and their advantages and limitations.
Business Context	Understands and can describe the role of the technician engineer in industry and business. Understands the importance of communication skills in a business context.	Understands the role of the engineering technologist in industry and business and the interpersonal skills required. Understands management issues and company structures. Understands the role and relationships in the supply chain of products, processes and engineering projects.	Understands the role of the graduate engineer in industry and business. Has sufficient knowledge of human resources management necessary to function at the engineering graduate level. Has knowledge of intellectual property issues. Understands the importance of the engineer's role in society and the need for the highest ethical standards of practice.	Understands and can justify the cost implications and commercial potential for engineering projects. Understands the relationship between the role of engineering and other disciplines.
Engineering Practice	Has an awareness of the current operational practice and expectations of working within a well-defined field of engineering, including codes of practice, the assessment of hazards, operational, health and safety and environmental issues.	Understands the operational practice and roles of individuals in the particular sub-field of engineering, including codes of practice, the assessment of hazards, operational safety and environmental issues.	Understands the role of the technician, engineering technologist and a graduate engineer in engineering practice. Has knowledge of management structures and techniques necessary to function at the engineering graduate level. Appreciates the importance of quality in engineering. Understands the importance of the engineer's role in society and the need for the highest ethical and professional standards of practice.	Understands how new insights in engineering can be transferred into practical engineering applications.

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Know-How & Skill-Range	*Demonstrate comprehensive range of specialised skills and tools*	*Demonstrate specialised technical, creative or conceptual skills and tools across an area of study*	*Demonstrate mastery of a complex and specialised area of skills and tools; use and modify advanced skills and tools to conduct closely guided research, professional or advanced technical activity*	*Demonstrate a range of standard and specialised research or equivalent tools and techniques of enquiry*
Mathematics	Can apply appropriate mathematical techniques to solve well-defined problems in the particular sub-field of engineering and present the solution in an appropriate form. Can present given data through a range of standard forms. Can specify and formulate routine mathematical methods pertaining to the understanding of well-defined engineering problems.	Can select and apply appropriate mathematical techniques to solve common engineering problems in the particular subfield and present the solution in an appropriate form. Can manipulate and sort given data through a range of standard forms. Can derive mathematical formulae fundamental to the discipline. Can specify and formulate routine mathematical methods pertaining to the understanding of common engineering problems.	Can select and apply appropriate mathematical techniques to solve complex engineering problems in the particular subfield and present the solution in an appropriate form. Can derive mathematical formulae fundamental to the discipline. Can generate/extrapolate new data sets from a given data set. Can select and manipulate appropriate mathematical methods from a standard range to solve a particular problem.	Can identify and develop appropriate mathematical methods and apply them to new and ill-defined complex engineering problems. Can derive and apply solutions from this knowledge. Can create models by deriving appropriate equations and formula and by specifying boundary conditions and underlying assumptions. Can incorporate aspects of engineering outside of their own specialisation into projects.
Science	Can apply and specify appropriate scientific techniques to solve well-defined engineering problems, in the particular subfield of engineering, and present the solution in an appropriate form. Can demonstrate core scientific knowledge in the solution of well-defined engineering problems. Can use test and measurement instrumentation appropriate to the particular sub-field of engineering.	Can apply and specify appropriate scientific techniques to solve common engineering problems, in the particular sub-field of engineering. Can conduct a well-described laboratory experiment and draw limited conclusions. Can collect and interpret data with reference to a range of scientific principles relevant to common engineering problems and draw conclusions. Can model and analyse simple engineering systems, processes and products using scientific principles.	Can apply and specify scientific principles to solving unfamiliar and complex engineering problems, in the particular sub-field of engineering. Can select and derive scientific solutions to model complex engineering problems, having regard for their limitations, inherent assumptions and range of applicability. Can analyse multi-variate and multiparameter problems.	Can be innovative in the use of scientific principles in solving ill-defined engineering problems. Can use scientific principles in the analysis and modelling of engineering systems, processes and products.
Information Technology	Can use industry standard software tools to gather data, solve well-defined engineering problems and display the result. Has basic familiarity with common IT tools, such as word processor, spreadsheets, the web and e-mail.	Can use computer-based engineering tools to solve common engineering problems and display the result. Can understand the principles of the operation of the technologies that are core to the particular sub-field of engineering.	Can select and use an appropriate technology to meet a stated need. Can specify ICT appropriate for complex engineering projects. Has an ability to specify the technical performance requirements and develop tools to solve engineering problems.	Can demonstrate mastery of the technologies relevant to the particular subfield of engineering. Can select, modify and use appropriate technologies to solve complex engineering problems. Can specify the technical performance requirements and develop soft and hard tools to solve complex engineering problems.
Design and Development	Can use industry standard tools and techniques to produce contributions to the design and/or development process for well-defined engineering problems.	Can design a system, component or process using routine design techniques.	Can manage and apply the design process in complex engineering situations. Can identify, classify and describe engineering systems. Can take into consideration environmental issues when developing a design.	Can apply knowledge and understanding of the design process in ill-defined, complex engineering situations. Can use engineering principles to design and develop new engineering systems. Can engage in the creative and innovative development of engineering technology and continuous improvement systems.
Business Context	Can produce acceptable presentations of well-defined technical and business information in a variety of ways.	Can make acceptable presentations to peers and supervisors. Can communicate effectively with the engineering community and society in general.	Can analyse and present the ethical issues associated with a particular situation related to the particular sub-field of engineering. Can incorporate business considerations into design solutions.	Can manage ill-defined complex projects and act as an expert on specific areas of technology and engineering.

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Engineering Practice	Can operate engineering equipment safely in order to solve well-defined engineering problems. Can manufacture and test simple engineering components, products and systems and contribute as part of a team to manufacture and test more complex components, products and systems.	Can develop a project plan, identifying the resource requirements and the timescales involved. Can use a sound evidence-based approach to problem solving and contribute to continuous improvement. Can operate and apply core technologies competently. Can select and introduce new technologies.	Can define a project and manage a planned implementation of a design, utilising the resources necessary, within a realistic time scale. Can analyse problems and make observations on performance and communicate recommendations to other technical and non-technical personnel. Can perform a management role in an engineering context. Can undertake appropriate research in order to develop engineering solutions, or to advance the state of knowledge.	Can identify, formulate, analyse and solve engineering problems. Can maintain and extend a sound theoretical approach in enabling the introduction and exploitation of new and advancing technology and other relevant developments. Can manage and conduct complex engineering projects in the particular subfield of engineering.
Know-How & Skill-Selectivity	*Formulate responses to well-defined abstract problems*	*Exercise appropriate judgement in planning, design, technical and/or supervisory functions related to products, services, operations or processes*	*Exercise appropriate judgement in a number of complex planning, design, technical and/or management functions related to products, services, operations or processes, including resourcing*	*Select from complex and advanced skills across a field of learning; develop new skills to a high level, including novel and emerging techniques*
Mathematics	Can select appropriate mathematical techniques and assess the accuracy of proposed mathematical solutions to well-defined engineering problems in the particular sub-field. Can formulate a basic engineering problem in simple mathematical notation.	Can select an appropriate mathematical/analytical/ numerical method from a standard range to solve a particular problem. Can assess the accuracy of proposed mathematical solutions to common engineering problems.	Can manipulate given data in alternative forms to create a deeper understanding and to develop realistic models of the behaviour of complex engineering situations.	Can research and use new methods required for novel situations. Can identify inconsistencies in data and detect misleading impressions from data.
Science	For well-defined engineering problems the graduate should be able to: 1. select and use appropriate scientific principles to produce routine solutions to familiar engineering problems; 2. estimate errors/accuracy of measurement; 3. collect data, identify trends, and present the data in graphical, tabular or text format; 4. identify problems and causes thereof and propose appropriate solutions.	For common engineering problems the graduate should be able to: 1. select and use appropriate scientific principles to produce routine solutions; 2. estimate errors/accuracy of measurement; 3. collect data, identify trends, and select appropriate methods to represent findings in a logical and clear manner; 4. identify problems and causes thereof and propose appropriate solutions.	For complex engineering problems the graduate should be able to: 1. select and use appropriate scientific principles to produce solutions to non-routine problems; 2. estimate errors/accuracy of measurement; 3. design experiments, collect data, identify trends, and present the data in graphical, tabular, or text format; 4. identify problems and causes thereof and propose appropriate solutions; 5. select and conduct appropriate experimental procedures from a standard range in order to generate appropriate data.	Can model and analyse complex engineering systems, processes and products using scientific principles and recognise the limitations of such analysis.
Information Technology	Can integrate and apply core technologies to solve well-defined engineering problems. Can utilise a range of common IT tools for communication purposes.	Can use industry standard software and techniques to manipulate, represent and disseminate engineering data.	Can design, select, modify, manage and use an appropriate technology to solve complex engineering problems. Can develop models of engineering systems using industry-standard software tools.	Can specify the technical requirements of, and develop software tools and numerical packages and manage the resources required to solve ill-defined complex engineering problems.

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Design and Development	Can select design methodologies and execute a design modification to meet a specified requirement for well-defined engineering problems. Can apply basic standards when using design tools. Can understand the underlying concepts of design tool features and basic design techniques.	Can select design methodologies and execute and produce a design modification for an existing system, component or process to meet a specified requirement of a common engineering system. Can undertake routine practical or simulation testing of a design and report and comment on the results. Can develop a new solution from an existing one.	Has the ability to develop a new solution from an initial idea. Can identify, classify and describe complex engineering systems. Can contribute to the design and development of solutions to complex engineering problems. Can specify and manage the generation of a range of design solutions and contribute to their analysis, selection and implementation for complex engineering problems. Can prepare project specifications and overcome impediments to good design solutions Can estimate technical risks.	Can undertake analysis of the design and justify decisions throughout a particular design process. Can demonstrate innovation in the design and creation of new systems, components or processes. Can implement design solutions and manage the design process for ill-defined engineering problems.
Business Context	Has the ability to communicate well-defined technical matters effectively to other technical personnel. Can identify, organise and use resources effectively to complete tasks, with consideration for cost, quality, safety and environmental impact for well-defined engineering problems.	Can estimate cost of familiar engineering works. Can present simple budget requirements for common engineering projects. Can work to national, EU and other international standards.	Can evaluate commercial risks. Can select an appropriate form and delivery for a given audience. Can apply appropriate management techniques in the execution of engineering projects. Can conduct financial analysis and feasibility studies of engineering projects, including making proposals for alternative solutions.	Can prepare budget submissions and justify costs for ill-defined complex engineering situations, in a format understandable to engineers and non-engineers. Can prepare clear project proposals and funding submissions for specific projects related to solving ill-defined complex engineering problems.
Engineering Practice	For well-defined engineering problems can: 1. apply codes of practice and industry regulations; 2. select and apply appropriate instrumentation and methodologies; 3. identify and solve technical problems in the particular sub-field of engineering; 4. apply environmental health and safety regulations.	Can solve common engineering problems through systematic analysis and design methods. Can maintain and extend a sound theoretical approach to the application of technology in engineering practice. Can identify, review and select techniques, procedures and methods to undertake common engineering tasks.	Can develop manage and promote safe systems and working practices. Can apply appropriate management techniques in the execution of complex engineering projects. Can apply fundamental principles to real engineering problems. Can maintain and extend a sound theoretical approach to the application of technology in engineering practice. Can apply engineering principles and materials in unfamiliar situations. Can prepare and present project reports, which include data collections, analysis and critical discussion of the outcome.	Can create and manage novel engineering solutions for real life ill-defined complex engineering problems.

Competence-Context	*Act in a range of varied and specific contexts involving creative and nonroutine activities; transfer and apply theoretical concepts and/or technical or creative skills to a range of contexts*	*Utilise diagnostic and creative skills in a range of functions in a wide variety of contexts*	*Use advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for all related decision making; transfer and apply diagnostic and creative skills in a range of contexts*	*Act in a wide and often unpredictable variety of professional levels and illdefined contexts*
	In the context of well-defined engineering situations can: 1. apply appropriate mathematical and scientific formulae and techniques to the solution of well-defined engineering problems; 2. assist with the design process through implementing and developing a system component or process to meet specified needs; 3. apply techniques understood by experts in the particular sub-field of engineering; 4. work in a safe, ethical and environmentally sound manner; 5. understand the wider social, political, business and economic context within which engineering operates.	In the context of common engineering situations can: 1. select and apply appropriate mathematical and scientific formulae and techniques to develop engineering solutions to practical problems; 2. design, manufacture, maintain and evaluate basic engineering components, products and systems, using soft and/or hard technologies; 3. assist with the design process through implementing and developing a system component or process to meet specified needs; 4. conduct a pre-specified engineering project within a specified time-frame; 5. work in a safe, ethical and environmentally sound manner; 6. use an evidence-based approach to problem solving.	In the context of complex engineering situations can: 1. implement a design solution within a specified time frame, taking account of safety, ethical, environmental and risk assessment issues; 2. manage the planning and budgeting of tasks and resources; and manage continuous quality improvement, including development and training of personnel; 3. recognise the need for research in order to develop new engineering solutions, or advance the state of knowledge; 4. present project reports which include data collections, analysis and critical discussion of the outcome.	In the context of ill-defined complex engineering situations can: 1. adapt existing and new engineering techniques for novel and unfamiliar situations; 2. take account of risk assessment and social and environmental impacts in setting constraints on design; 3. identify potential projects and opportunities; conduct appropriate research and undertake the design and development of engineering solutions; 4. achieve continuous improvement through quality management and plan for effective project implementation.
Competence-Role	*Exercise substantial personal autonomy and often take responsibility for the work of others and/or for allocation of resources; form, and function within, multiple complex and heterogeneous groups*	*Accept accountability for determining and achieving personal and/or group outcomes; take significant or supervisory responsibility for the work of others in defined areas of work*	*Act effectively under guidance in a peer relationship with qualified practitioners; lead multiple, complex and heterogeneous groups*	*Take significant responsibility for the work of individuals and groups; lead and initiate activity*
	Can work effectively as an individual or as part of a team. Can accept and exercise personal responsibility and allocate and supervise technical and other tasks. Can develop a personal plan of work to meet a deadline and identify the main external constraints. Can work under guidance within allocated responsibility. Can demonstrate an understanding of the need for high ethical standards in the practice of engineering, including the responsibilities of the engineering profession towards people and the environment. Can work effectively with colleagues, clients, suppliers and the public. Can communicate engineering problems, ideas and findings to other technically qualified personnel.	Has an awareness of the responsibilities of an engineering technologist and the associated ethical responsibilities, together with the impact of engineering practices in a global and social context. Can apply current engineering technologies, in the particular sub-field of engineering, in a responsible manner. Can exercise independent technical judgement and work with significant autonomy within allocated responsibility. Can plan for effective project implementation and manage the organisation of tasks, people and resources. Can accept responsibility for the work of self and others.	In the context of complex engineering situations can: 1. manage teams and develop staff to meet changing technical and managerial needs, taking cognisance of ethical responsibilities; 2. behave professionally and is aware of the responsibilities associated with working in and contributing to a multi-disciplinary team.	In the context of ill-defined complex engineering situations can: 1. lead teams and develop staff to meet changing technical and managerial needs; 2. lead the improvement of relevant engineering systems and processes incorporating /suggesting the latest technologies and procedures; 3. plan, budget, organise, direct and control tasks, people and resources; 4. communicate with, work with and manage non-technical personnel in the execution of projects; 5. initiate, plan and manage new project proposals; 6. lead the improvement of relevant engineering systems and processes

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Competence-Learning to Learn	*Learn to evaluate own learning and identify needs within a structured learning environment; assist others in identifying learning needs*	*Take initiative to identify and address learning needs and interact effectively in a learning group*	*Learn to act in variable and unfamiliar learning contexts; learn to manage learning tasks independently, professionally and ethically*	*Learn to self-evaluate and take responsibility for continuing academic/professional development*
	Demonstrates the capacity to undertake lifelong learning. Has an ability to pursue continuing professional development, including opportunities offered by their institution, employers etc, to ensure competence in the particular sub-field of engineering and at the level of future intended practice. Can, under guidance, identify gaps in personal knowledge, understanding and skills and identify appropriate means of gaining these attributes.	Undertake continuing professional development necessary to maintain and enhance competence in own area of practice. Can identify gaps in personal knowledge, understanding and skills and identify appropriate means of gaining these attributes.	Can identify gaps in personal knowledge, understanding and skills and identify appropriate means to gain these attributes. Can initiate and formulate independent research into gaps/ deficits in knowledge and understanding.	Can publish own work in peer-reviewed journals and present own work. Can identify knowledge gaps and source and undertake self-learning to fill the gaps. Can explain a problem, or a lack of understanding.
Competence-Insight	*Express an internalised, personal world view, reflecting engagement with others*	*Express an internalised, personal world view, manifesting solidarity with others*	*Express a comprehensive, internalised, personal world view, manifesting solidarity with others*	*Scrutinise and reflect on social norms and relationships and act to change them*
	Can form a view of the role of engineers in society. Understands the wider social, political, business and economic context within which engineering operates. Recognises the impact of changes in the economy on the profession. Recognises the limitations of own knowledge, understanding and skills and knows when to draw on the higher level knowledge, understanding and skills of others in solving engineering problems.	Can contribute to the development of the role of the engineering technologist in society. Understands the wider social, political, business and economic contest within which engineering operates. Understands the impact and management of change in the economy on the profession.	Can form a view and contribute to the development of the role of engineers in society. Can appreciate the limitations of own knowledge, skills and competence.	Can identify and articulate the key parameters and issues of a problem. Can critically comment on the technical, economic, environmental and social implications of own work and work of others.

APPENDIX 1

National Framework of Qualifications - Grid of Level Indicators

	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Level 9	Level 10
Knowledge - Breadth	Elementary knowledge	Knowledge that is narrow in range	Knowledge moderately broad in range	Broad range of knowledge	Broad range of knowledge	Specialised knowledge of a broad area	Specialised knowledge across a variety of areas	An understanding of the theory, concepts and methods pertaining to a field (or fields) of learning	A systematic understanding of knowledge, at, or informed by, the forefront of a field of learning	A systematic acquisition and understanding of a substantial body of knowledge which is at the forefront of a field of learning
Knowledge -Kind	Demonstrable by recognition or recall	Concrete in reference and basic in comprehension	Mainly concrete in reference and with some comprehension of relationship between knowledge elements	Mainly concrete in reference and with some elements of abstraction or theory	Some theoretical concepts and abstract thinking, with significant depth in some areas	Some theoretical concepts and abstract thinking, with significant underpinning theory	Recognition of limitations of current knowledge and familiarity with sources of new knowledge; integration of concepts across a variety of areas	Detailed knowledge and understanding in one or more specialised areas, some of it at the current boundaries of the field(s)	A critical awareness of current problems and/or new insights, generally informed by the forefront of a field of learning	The creation and interpretation of new knowledge, through original research, or other advanced scholarship, of a quality to satisfy review by peers
Know-how and skill - Range	Demonstrate basic practical skills, and carry out directed activity using basic tools	Demonstrate limited range of basic practical skills, including the use of relevant tools	Demonstrate a limited range of practical and cognitive skills and tools	Demonstrate a moderate range of practical and cognitive skills and tools	Demonstrate a broad range of specialised skills and tools	Demonstrate comprehensive range of specialised skills and tools	Demonstrate specialised technical, creative or conceptual skills and tools across an area of study	Demonstrate mastery of a complex and specialised area of skills and tools; use and modify advanced skills and tools to conduct closely guided research, professional or advanced technical activity	Demonstrate a range of standard and specialised research or equivalent tools and techniques of enquiry	Demonstrate a significant range of the principal skills, techniques, tools, practices and/or materials which are associated with a field of learning; develop new skills, techniques, tools, practices and/or materials
Know-how and skill - Selectivity	Perform processes that are repetitive and predictable	Perform a sequence of routine tasks given clear direction	Select from a limited range of varied procedures and apply known solutions to a limited range of predictable problems	Select from a range of procedures and apply known solutions to a variety of predictable problems	Evaluate and use information to plan and develop investigative strategies and to determine solutions to varied unfamiliar problems	Formulate responses to well-defined abstract problems	Exercise appropriate judgement in planning, design, technical and/ or supervisory functions related to products, services, operations or processes	Exercise appropriate judgement in a number of complex planning, design, technical and/or management functions related to products, services, operations or processes, including resourcing	Select from complex and advanced skills across a field of learning; develop new skills to a high level, including novel and emerging techniques	Respond to abstract problems that expand and redefine existing procedural knowledge
Competence - Context	Act in closely defined and highly structured contexts	Act in a limited range of predictable and structured contexts	Act within a limited range of contexts	Act in familiar and unfamiliar contexts	Act in a range of varied and specific contexts, taking responsibility for the nature and quality of outputs; identify and apply skill and knowledge to a wide variety of contexts	Act in a range of varied and specific contexts involving creative and non-routine activities; transfer and apply theoretical concepts and/or technical or creative skills to a range of contexts	Utilise diagnostic and creative skills in a range of functions in a wide variety of contexts	display mastery Use advanced skills to conduct research, or advanced technical or professional activity, accepting accountability for all related decision making; transfer and apply diagnostic and creative skills in a range of contexts	Act in a wide and often unpredictable variety of professional levels and ill defined contexts	Exercise personal responsibility and largely autonomous initiative in complex and unpredictable situations, in professional or equivalent contexts
Competence – Role	Act in a limited range of roles	Act in a range of roles under direction	Act under direction with limited autonomy; function within familiar, homogeneous groups	Act with considerable amount of responsibility and autonomy	Exercise some initiative and independence in carrying out defined activities; join and function within multiple, complex and heterogeneous groups	Exercise substantial personal autonomy and often take responsiblity for the work of others and/or for the allocation of resources; form, and function within, multiple, complex and heterogeneous groups	Accept accountability for determining and achieving personal and/ or group outcomes; take significant or supervisory responsibility for the work of others in defined areas of work	Act effectively under guidance in a peer relationship with qualified practitioners; lead multiple, complex and heterogeneous groups	Take significant responsibility for the work of individuals and groups; lead and initiate activity	Communicate results of research and innovation to peers; engage in critical dialogue; lead and originate complex social processes
Competence – Learning to Learn	Learn to sequence learning tasks; learn to access and use a range of learning resources	Learn to learn in a disciplined manner in a well-structured and supervised environment	Learn to learn within a managed environment	Learn to take responsibility for own learning within a supervised environment	Learn to take responsibility for own learning within a managed environment	Learn to evaluate own learning and identify needs within a structured learning environment; assist others in identifying learning needs	Take initiative to identify and address learning needs and interact effectively in a learning group	Learn to act in variable and unfamiliar learning contexts; learn to manage learning tasks independently, professionally and ethically	Learn to self-evaluate and take responsibility for continuing academic/professional development	Learn to critique the broader implications of applying knowledge to particular contexts
Competence – Insight	Begin to demonstrate awareness of independent role for self	Demonstrate awareness of independent role for self	Assume limited responsibility for consistency of self-understanding and behaviour	Assume partial responsibility for consistency of self-understanding and behaviour	Assume full responsibility for consistency of self-understanding and behaviour	Express an internalised, personal world view, reflecting engagement with others	Express an internalised, personal world view, manifesting solidarity with others	Express a comprehensive, internalised, personal world view manifesting solidarity with others	Scrutinise and reflect on social norms and relationships and act to change them	Scrutinise and reflect on social norms and relationships and lead action to change them

Note: The outcomes at each level include those of all the lower levels in the same sub-strand

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