

Output Standards for approved qualifications and apprenticeships

Interpretation

Within this handbook, the following terms are used with the meanings stated:

- **Understanding** is the capacity to use concepts creatively, for example, in problem solving, design, explanations and diagnosis
- **Knowledge** is information that can be recalled
- **Know-how** is the ability to apply learned knowledge and skills to perform operations intuitively, efficiently and correctly
- **Skills** are acquired and learned attributes that can be applied almost automatically
- **Awareness** is general familiarity, albeit bounded by the needs of the specific discipline

Underpinning knowledge and understanding requirements

For qualifications and apprenticeships, the six key areas of learning are as follows:

A Science and mathematics	
Engineering is underpinned by science and mathematics, and other associated disciplines, as defined by the relevant professional engineering institution(s). Technicians will need:	
LO A1	A descriptive, formula-based knowledge and understanding of the scientific principles underpinning relevant current technologies
LO A2	Knowledge and understanding of relevant mathematics, including numerical and data analysis, that is necessary to support the application of technical and practical skills
B Engineering analysis	
Engineering analysis involves the application of engineering concepts and tools to the solution of engineering or ICT problems. Technicians will need:	
LO B1	To understand the limitations of standard tests and measurements relevant to their field of activity
LO B2	Know-how to use the results of engineering analysis for the purpose of developing solutions to well-defined engineering or ICT problems
LO B3	To apply appropriate solutions to well-defined engineering or ICT problems using methods specific to their field of activity
C Design	
Design at this level involves the awareness of an economically viable product, process or system to meet a defined need. Technicians will need:	
LO C1	Awareness of business, customer, and user needs
LO C2	Awareness of constraints on the design process including environmental and sustainability limitations; ethical, health, safety, security and risk issues; intellectual property; codes of practice and standards
LO C3	Knowledge that supports design for the purpose of developing solutions to well-defined engineering or ICT problems
LO C4	Know-how to contribute to the design and/or the design process

LO C5	Know-how to communicate their work to technical and non-technical audiences
D Economic, legal, social, ethical and environmental context	
Engineering or ICT activity can have impacts on the environment, on commerce, on society and on individuals. Technicians 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:	
LO D1	Understanding the need for a high level of professional and ethical conduct in engineering or ICT and a knowledge of professional codes of conduct
LO D2	Knowledge of the commercial, economic and social context of the engineering or ICT processes
LO D3	Understanding the requirement for engineering or ICT activities to promote sustainable development
LO D4	Awareness of relevant legal requirements governing engineering or ICT activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
LO D5	Awareness of risk issues, including health & safety and environmental risk
E Engineering practice	
This is the practical application of engineering or ICT knowledge and skills. This can include:	
LO E1	Know-how to use relevant materials, equipment, tools, processes, or products
LO E2	Knowledge of procedures and practices for industry standard operations and processes
LO E3	Know-how to use and apply information from technical literature
LO E4	Know-how to use appropriate codes of practice and industry standards
LO E5	Awareness of quality issues and the potential for continuous improvement
LO E6	Awareness of team roles and the ability to work as a member of an engineering or ICT team
F Additional general skills	
Technicians must have developed transferable skills, additional to those set out in the other learning outcomes, and that will be of value in a wide range of situations, including the ability to:	
LO F1	Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
LO F2	Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
LO F3	Plan and carry out a personal programme of work
LO F4	Exercise personal responsibility, as an individual or as a team member