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:

**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:

- A descriptive, formula-based knowledge and understanding of the scientific principles underpinning relevant current technologies
- Knowledge and understanding of relevant mathematics, including numerical and data analysis, that is necessary to support the application of technical and practical skills

**Engineering analysis**

Engineering analysis involves the application of engineering concepts and tools to the solution of engineering or ICT problems.

Technicians will need:

- To understand the limitations of standard tests and measurements relevant to their field of activity
- Know-how to use the results of engineering analysis for the purpose of developing solutions to well-defined engineering or ICT problems
- To apply appropriate solutions to well-defined engineering or ICT problems using methods specific to their field of activity
**Design**
Design at this level involves the awareness of an economically viable product, process or system to meet a defined need.

Technicians will need:
- Awareness of business, customer, and user needs
- 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
- Knowledge that supports design for the purpose of developing solutions to well-defined engineering or ICT problems
- Know-how to contribute to the design and/or the design process
- Know-how to communicate their work to technical and non-technical audiences

**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:
- Understanding the need for a high level of professional and ethical conduct in engineering or ICT and a knowledge of professional codes of conduct
- Knowledge of the commercial, economic and social context of the engineering or ICT processes
- Understanding the requirement for engineering or ICT activities to promote sustainable development
- Awareness of relevant legal requirements governing engineering or ICT activities, including personnel, health & safety, contracts, intellectual property rights, product safety and liability issues
- Awareness of risk issues, including health & safety and environmental risk

**Engineering practice**
This is the practical application of engineering or ICT knowledge and skills. This can include:
- Know-how to use relevant materials, equipment, tools, processes, or products
- Knowledge of procedures and practices for industry standard operations and processes
- Know-how to use and apply information from technical literature
- Know-how to use appropriate codes of practice and industry standards
- Awareness of quality issues and the potential for continuous improvement
- Awareness of team roles and the ability to work as a member of an engineering or ICT team

**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:
- Apply their skills in problem solving, communication, information retrieval, working with others and the effective use of general IT facilities
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
- Plan and carry out a personal programme of work
- Exercise personal responsibility, as an individual or as a team member