



National 4  
Course  
Specification



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# National 4 Engineering Science Course Specification (C723 74)

**Valid from August 2013**

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Please refer to the note of changes at the end of this Course Specification for details of changes from previous version (where applicable).

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## Course outline

**Course title:** Engineering Science (National 4)

**SCQF:** level 4 (24 SCQF credit points)

**Course code:** C723 74

### Mandatory Units

**H23A 74 Engineering Contexts and Challenges (National 4) 6 SCQF credit points**

Or

**H6NT 74 Engineering Contexts and Challenges with a Scottish Context (National 4)\* 6 SCQF credit points**

and

**H23B 74 Electronics and Control (National 4) 6 SCQF credit points**

and

**H23D 74 Mechanisms and Structures (National 4) 6 SCQF credit points**

and

### Added Value Unit

**H23E 74 Engineering Science Assignment (National 4) 6 SCQF credit points**

This Course includes six SCQF credit points for the assessment of added value in the Added Value Unit. Further information on this Unit is provided in the Assessment section.

\*Scottish Studies Award contributing Unit: This Course Specification should be read in conjunction with the relevant Scottish Studies Unit Specification on the [Scottish Studies Award web page](#).

## Recommended entry

Entry to this Course is at the discretion of the centre. However, learners would normally be expected to have attained the skills and knowledge required by the following or by equivalent qualifications and/or experience:

- ◆ Design and Technology (National 3) Course or relevant component Units

In terms of prior learning and experience, relevant experiences and outcomes may also provide an appropriate basis for doing this Course. Further information on relevant experiences and outcomes is given in the *Course Support Notes*.

## **Progression**

This Course or its Units may provide progression to:

- ◆ other SQA qualifications in Engineering Science or related areas
- ◆ further study, employment and/or training

Further details are provided in the *Course Support Notes*.

## **Equality and inclusion**

This Course Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the *Course Support Notes*.

## **Rationale**

All new and revised National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.

In this Course, and its component Units, there will be an emphasis on skills development and the application of those skills. Assessment approaches will be proportionate, fit for purpose and will promote best practice, enabling learners to achieve the highest standards they can.

This Course provides learners with opportunities to continue to acquire and develop the attributes and capabilities of the four capacities, as well as skills for learning, skills for life and skills for work.

All Courses provide opportunities for learners to develop breadth, challenge and application, but the focus and balance of the assessment will be appropriate for the subject area.

## **Relationship between the Course and Curriculum for Excellence values, purposes and principles**

Engineering is a broad area of human endeavour which brings together elements of technology, science and mathematics, and applies these to real world challenges. The Course therefore provides an excellent opportunity for making links across learning in the senior phase.

The Course encourages learners to become successful, responsible and creative in their use of technologies and to continue to acquire and develop the attributes and capabilities of the four capacities, including: creativity, flexibility and adaptability; enthusiasm and a willingness to learn; perseverance, independence and resilience; responsibility and reliability; and confidence and enterprise.

The Course provides progression mainly from craft, design, engineering and graphics experiences and outcomes. It also builds on some science experiences and outcomes, prior learning in mathematics and numeracy, and aspects of technological developments in society.

## **Purpose and aims of the Course**

Engineering is vital to everyday life; it shapes the world in which we live and its future. Engineers play key roles in meeting the needs of society in fields which include climate change, medicine, IT and transport.

Our society needs more engineers, and more young people with an informed view of engineering. The Course provides a broad introduction to engineering. Because of its focus on developing transferable skills, it will be of value to many learners, and particularly beneficial to learners considering a career in engineering, or one of its many branches.

The aims of the Course are to enable learners to:

- ◆ apply knowledge and understanding of basic engineering facts and ideas
- ◆ understand the relationships between engineering, mathematics and science
- ◆ apply skills in analysis, design, construction and evaluation to a range of straightforward engineering problems
- ◆ communicate engineering concepts clearly and concisely using appropriate terminology
- ◆ develop an understanding of the role and impact of engineering in changing and influencing our environment and society

The Course develops a number of pervasive and integrative themes, including the systems approach, energy and sustainability. These are used to explore varied engineering systems through simulation, practical projects and investigative tasks in a range of contexts.

Courses in Engineering Science and in Physics (and other pure sciences) are designed to be complementary; a combination of this Course and a pure science Course will provide a very strong foundation for further study in engineering or the sciences.

### **Information about typical learners who might do the Course**

The Course is designed for learners who have a general interest in engineering, as well as those considering further study or a career in engineering and related disciplines. It provides sufficient breadth, flexibility and choice to meet the needs of all learners.

Learners will develop an understanding of the far-reaching impact of engineering on our society and of the central role of engineers as designers and problem solvers, able to conceive, design, implement and operate complex systems. They will also develop a range of transferable skills for learning, life and work, opening up a wide range of career and study opportunities, and enabling learners to develop as global citizens who can contribute effectively to their communities, society and the world.

On completing the Course, learners will have developed skills in analysis and problem solving, engineering design, the use of equipment and materials, and evaluation.

Course activities also provide opportunities to enhance generic and transferable skills in planning and organising, working independently and in teams, critical thinking and decision making, research, communication and self- and peer-evaluation, in a technological context.

# Course structure and conditions of award

## Course structure

The Course enables learners to develop a range of technological skills, including skills in analysis and problem solving, design skills, skills in the use of equipment and materials, and skills in evaluating products and systems.

The Course also enables learners to develop knowledge and understanding of key engineering concepts and processes, and the ability to apply these to a variety of problems; and an awareness of the impact of engineering on society and the environment.

These skills, knowledge and awareness are developed through a range of contexts within the broad discipline of engineering, including mechanical, structural, pneumatic and electronic systems.

The Course has four mandatory Units including the Added Value Unit. The first three Units listed below are designed to provide progression to the corresponding Units at National 5.

Units are statements of standards for assessment and not programmes of learning and teaching. They can be delivered in a number of ways.

### **Engineering Contexts and Challenges (National 4)**

This Unit provides a broad context for the Course. It introduces engineering concepts by exploring a range of engineered objects, and straightforward engineering problems and solutions. This Unit also allows the learner to explore some existing and emerging technologies and challenges, and to consider implications relating to the environment, sustainable development, and, economic and social issues.

### **Electronics and Control (National 4)**

This Unit explores a range of key concepts and devices used in analogue and digital electronic control systems. Skills in problem solving are developed through simulation, practical projects and investigative tasks in a range of contexts.

### **Mechanisms and Structures (National 4)**

This Unit develops a basic understanding of simple mechanisms and structures. Skills in problem solving are developed through simulation, practical projects and investigative tasks in a range of contexts.

### **Added Value Unit: Engineering Science Assignment (National 4)**

This Unit requires the learner to apply and integrate skills and knowledge from the other Units to solve an appropriately challenging engineering problem.

## Conditions of award

To gain the award of the Course, learners must pass all of the required Units, including the Added Value Unit. The required Units are shown in the Course outline section.

National 4 Courses are not graded.

## Skills, knowledge and understanding

Full skills, knowledge and understanding for the Course are given in the *Added Value Unit Specification*. A broad overview of the mandatory subject skills, knowledge and understanding that will be assessed in the Course is given in this section. This includes:

- ◆ analysing, with guidance, straightforward engineering problems
- ◆ designing, developing, simulating, building and testing, with guidance, solutions to straightforward engineering problems in a range of contexts
- ◆ investigating, with guidance, some existing and emerging technologies
- ◆ communicating basic engineering facts and ideas clearly and concisely using appropriate terminology
- ◆ awareness of the main branches of engineering: electrical, mechanical, civil and chemical
- ◆ basic knowledge of the wide role and impact of engineering on society and the environment
- ◆ basic knowledge of the workings of a range of simple engineered objects
- ◆ knowledge of key facts and ideas related to electronic and microcontroller-based control systems, and their application
- ◆ knowledge of key facts and ideas related to mechanical, structural and pneumatic systems, and their application
- ◆ basic knowledge of the relevance of energy, efficiency and sustainability to straightforward engineering problems and solutions
- ◆ applying engineering knowledge and skills in a range of straightforward contexts

Skills, knowledge and understanding to be included in the Course will be appropriate to the SCQF level of the Course. The SCQF level descriptors give further information on characteristics and expected performance at each SCQF level ([www.sqa.org.uk/scqf](http://www.sqa.org.uk/scqf)).

# Assessment

Further information about assessment for the Course is included in the *Course Support Notes*.

## Unit assessment

All Units are internally assessed against the requirements shown in the Unit Specification.

They can be assessed on an individual Unit basis or by using other approaches which combine the assessment for more than one Unit.

They will be assessed on a pass/fail basis within centres. SQA will provide rigorous external quality assurance, including external verification, to ensure assessment judgments are consistent and meet national standards.

The assessment of the Units in this Course will be as follows.

### **Engineering Contexts and Challenges (National 4)**

For this Unit, learners will be required to provide evidence of:

- ◆ technological skills in a range of contexts and challenges
- ◆ knowledge of engineering contexts and challenges
- ◆ awareness of the impact of engineering on society and the environment

### **Electronics and Control (National 4)**

For this Unit, learners will be required to provide evidence of:

- ◆ skills in developing analogue electronic control systems
- ◆ skills in developing digital electronic control systems

### **Mechanisms and Structures (National 4)**

For this Unit, learners will be required to provide evidence of:

- ◆ knowledge of simple mechanisms and structures
- ◆ skills in developing mechanical and structural solutions



## Added Value Unit

Courses from National 4 to Advanced Higher include assessment of [added value](#)<sup>1</sup>. At National 4, added value will be assessed in an Added Value Unit. The Added Value Unit will address the key purposes and aims of the Course as defined in the Course Rationale. It will do this by addressing one or more of breadth, challenge or application.

In the Engineering Science (National 4) Course, the Added Value Unit will focus on challenge and application.

The learner will draw on and apply the skills and knowledge they have learned during the Course. These will be assessed through an [assignment](#)<sup>2</sup> which involves application of skills and knowledge from the other Units to solve an appropriately challenging engineering problem.

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<sup>1</sup> Definitions can be found here: [www.sqa.org.uk/sqa/58409.html](http://www.sqa.org.uk/sqa/58409.html)

<sup>2</sup> Definitions can be found here: [www.sqa.org.uk/sqa/58409.html](http://www.sqa.org.uk/sqa/58409.html)

# Development of skills for learning, skills for life and skills for work

It is expected that learners will also develop broad, generic skills through this Course. The skills that learners will be expected to improve on and develop through the Course are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Course where there are appropriate opportunities.

## **2 Numeracy**

- 2.1 Number processes
- 2.3 Information handling

## **4 Employability, enterprise and citizenship**

- 4.2 Information and communication technology (ICT)

## **5 Thinking skills**

- 5.2 Understanding
- 5.3 Applying

Amplification of these skills is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills will be appropriate to the level of the Course. Further information on building in skills for learning, skills for life and skills for work for the Course is given in the *Course Support Notes*.

## Administrative information

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**Published:** September 2014 (version 1.1)

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### History of changes to National Course Specification

Course details	Version	Description of change	Authorised by	Date
	1.1	Scottish Studies Award Unit contributing information added. No other changes made to document content	Qualifications Manager	September 2014

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Note: You are advised to check SQA's website ([www.sqa.org.uk](http://www.sqa.org.uk)) to ensure you are using the most up-to-date version of the Course Specification.

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