



Higher
Course
Specification



Higher Engineering Science Course Specification (C723 76)

Valid from August 2014

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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: Higher Engineering Science

SCQF: level 6 (24 SCQF credit points)

Course code: C723 76

Mandatory Units

H23A 76 Engineering Contexts and Challenges (Higher) 6 SCQF credit points

Or

H6NT 76 Engineering Contexts and Challenges with a Scottish Context (Higher)* 6 SCQF credit points

and

H23B 76 Electronics and Control (Higher) 6 SCQF credit points

and

H23D 76 Mechanisms and Structures (Higher) 6 SCQF credit points

and

Course assessment 6 SCQF credit points

This Course includes six SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course. Further information on the Course assessment 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, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- ◆ Engineering Science (National 5) Course

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* and the *Course Assessment Specification*.

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 from the Engineering Science (National 5) Course.

Purposes 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 and challenging exploration of 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:

- ◆ extend and apply knowledge and understanding of key engineering concepts, principles and practice

- ◆ understand the relationships between engineering, mathematics and science
- ◆ apply analysis, design, construction and evaluation to a range of engineering problems with some complex features
- ◆ communicate engineering concepts clearly and concisely, using appropriate terminology
- ◆ develop a greater 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 all learners who can respond to a level of challenge including, but not limited to, 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 a deeper understanding of the central role of engineers as designers and problem solvers, able to conceive, design, implement and control complex systems, and the far-reaching impact of engineering on our society and the environment. They will also continue to develop a range of transferable skills for learning, skills for life and skills for work, opening up a wide range of career and study opportunities, and enabling them to develop as global citizens who can contribute effectively to their communities, society and the world.

On completing the Course, learners will have developed greater 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 and extend 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 and extend 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 and electronic systems.

As well as the Course assessment, the Course includes three mandatory Units. Each of these Units is designed to provide progression to related Units at Advanced Higher.

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 (Higher)

This Unit provides a broad context for the Course. It contributes to developing a deep understanding of engineering concepts by exploring a range of engineering problems with some complex features, and their solutions. This Unit 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 (Higher)

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

Mechanisms and Structures (Higher)

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

Conditions of award

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. The required Units are shown in the Course outline section. Course assessment will provide the basis for grading attainment in the Course award.

Skills, knowledge and understanding

Further information on the assessment of the skills, knowledge and understanding for the Course is given in the *Course Assessment 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 covers:

- ◆ analysing engineering problems with some complex features
- ◆ designing, developing, simulating, building, testing and evaluating solutions to engineering problems in a range of contexts
- ◆ investigating and evaluating existing and emerging technologies
- ◆ communicating engineering concepts clearly and concisely, using appropriate terminology
- ◆ knowledge and understanding of the many types of engineering
- ◆ knowledge and understanding of the wide role and impact of engineering on society and the environment
- ◆ knowledge and understanding of the workings of a range of engineered objects
- ◆ knowledge and understanding of key concepts related to electronic and microcontroller-based systems, and their application
- ◆ knowledge and understanding of key concepts related to mechanical, structural and pneumatic systems, and their application
- ◆ knowledge and understanding of the relevance of energy, efficiency and sustainability to engineering problems and solutions
- ◆ applying engineering knowledge, understanding and skills in a range of 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).

Assessment

Information about assessment for the Course is included in the *Course Assessment Specification*, which provides full details including advice on how a learner's overall attainment for the Course will be determined.

Unit assessment

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

They can be assessed on a Unit-by-Unit basis or by combined assessment.

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 (Higher)

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

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

Electronics and Control (Higher)

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 (Higher)

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

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

Exemplification of possible assessment approaches for these Units is provided in the *National Assessment Resource*.

Course assessment

Courses from National 4 to Advanced Higher include assessment of [added value](#)¹. At National 5, Higher and Advanced Higher, the added value will be assessed in the Course assessment. The added value for the Course must 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 this Course, added value will focus on breadth, challenge and application.

¹ Definitions can be found here: www.sqa.org.uk/sqa/45528.html

The learner will draw on and apply the skills, knowledge and understanding they have developed during the Course. These will be assessed through a combination of an [assignment](#)² and a [question paper](#)³.

The Engineering Science assignment adds value by requiring challenge and application. Learners will apply knowledge and skills from the Units to solve an appropriately challenging engineering problem.

The question paper introduces breadth to the assessment. It requires depth of understanding and application of knowledge from the Units.

² Definitions can be found here: www.sqa.org.uk/sqa/45528.html

³ See link above for definitions.

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

It is expected that learners will 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

- 5.3 Applying
- 5.4 Analysing and evaluating

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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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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