



Higher Engineering Science — draft Course rationale and summary

May 2011



This edition: May 2011, draft version 1.0

Published by the Scottish Qualifications Authority
The Optima Building, 58 Robertson Street, Glasgow G2 8DQ
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www.sqa.org.uk

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Course rationale

Background

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 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 Engineering Science (National 5).

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 today and for the future, 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 any branch of 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 increasingly complex engineering problems
- ◆ 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 information, control, 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 operate complex systems, and of 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.

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.

This Course or its components may provide progression to:

- ◆ Advanced Higher Engineering Science
- ◆ National Certificate Group Awards (NCGAs) in a range of engineering disciplines
- ◆ employment, apprenticeships and/or training in engineering and related fields

and ultimately, for some, to:

- ◆ a range of engineering-related Higher National Certificates (HNCs) and Higher National Diplomas (HNDs)
- ◆ degrees in Engineering and related disciplines
- ◆ careers in engineering

Course summary

Course title: Higher Engineering Science

SCQF level 6 (24 SCQF credit points)

Course outline

Mandatory Units

Engineering: Contexts and Challenges (Higher)	(6 SCQF credit points)
Electrical and Electronic Systems (Higher)	(6 SCQF credit points)
Mechanical Systems (Higher)	(6 SCQF credit points)

Course assessment

(6 SCQF credit points)

This Course includes six SCQF credit points for 40 additional programmed hours to allow 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.

Course structure and conditions of award

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, electrical and electronic systems.

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

Each of the component Units of the Course is designed to provide progression from the corresponding Unit at National 5, and to the corresponding Unit at Advanced Higher.

Engineering: Contexts and Challenges (Higher)

This Unit provides a broad context for the Course. Its purposes are to develop a deeper understanding of engineering and its role and impact in changing and influencing our environment and society. It continues to develop an understanding of engineering concepts by exploring a range of increasingly complex engineering problems and 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 ethical, economic and cultural issues.

Electrical and Electronic Systems (Higher)

This Unit explores an appropriate range of key concepts and devices used in electrical and electronic 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. This provides learners with a growing understanding of electrical and electronic engineering.

Mechanical Systems (Higher)

This Unit explores an appropriate range of key concepts involving mechanical systems, such as gears and pulleys, pneumatics, materials, forces, energy and efficiency. Skills in problem-solving and evaluating are developed through simulation, practical projects and investigative tasks in a range of contexts. This provides learners with a growing understanding of mechanical engineering.

To gain the award of the Course, the learner must pass all 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.

Assessment

Information about assessment standards for the Course will be included in the *Course Assessment Specification*, which will provide 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 Unit specifications.

They will be assessed pass/fail within centres.

SQA will provide rigorous external quality assurance, including external verification, to ensure assessment judgements are consistent and meet national standards.

Exemplification of possible assessment approaches for these Units will be 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 and application.

In the Higher Engineering Science Course, added value will focus on:

- ◆ breadth
- ◆ challenge
- ◆ application

Learners will draw on, extend and apply the skills and knowledge they have developed during the Course. These will be assessed through a combination of a [project](#)² and a [question paper](#)³.

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

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

² See link above for definition.

³ See link above for definition.

successful learner, confident individual, responsible citizen, effective contributor

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

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