



Advanced Higher Engineering Science — draft Course rationale and summary



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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 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 independent learners, 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 Higher Engineering Science.

Purpose and aims of the Course

Engineering is a core STEM subject, and is vital to everyday life — socially, technologically and economically; 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 or further study in any branch of engineering.

The purpose of the Course is to build on the knowledge and understanding and practical skills developed by the candidate in the Higher Engineering Science Course, and to provide a useful bridge towards further study of engineering in higher education. This is achieved by a Course which consolidates and extends learning, provides opportunity for independent and investigative work, while encouraging teamwork, and requires candidates to undertake and report on a significant engineering project.

The aims of the Course are to enable learners to:

- ◆ extend and apply knowledge and understanding of key engineering concepts, principles and practice through independent learning
- ◆ understand and apply the relationships between engineering, mathematics and science
- ◆ develop skills in investigation and research in an engineering context

- ◆ analyse, design, construct and evaluate solutions to complex engineering problems
- ◆ communicate advanced engineering concepts clearly and concisely, using appropriate terminology
- ◆ develop an informed understanding of the role and impact of engineering in changing and influencing our environment and society, including ethical implications

The Course develops a number of pervasive and integrative themes, including information, control, the systems approach, energy and sustainability. These are applied to 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, a Mathematics 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, especially those considering further study or a career in engineering and related disciplines. It provides sufficient 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 strong 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 engineering contexts.

This Course or its components may provide progression to:

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

Course summary

Course title: Advanced Higher Engineering Science

SCQF level 7 (32 SCQF credit points)

Course outline

Mandatory Units

Electronics and Control (Advanced Higher)	8 SCQF credit points
Mechanisms and Structures (Advanced Higher)	8 SCQF credit points
Engineering Project Management (Advanced Higher)	8 SCQF credit points

Course assessment

8 SCQF credit points

This Course includes 8 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

Course structure

The Course enables learners to develop and extend a range of engineering skills, including skills in analysis and problem solving, application of mathematical processes, design skills, and skills in evaluating products and systems.

The Course also enables learners to develop and extend knowledge and understanding of advanced engineering concepts and processes, 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.

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

Electronics and Control (Advanced Higher)

This Unit explores a range of key concepts and devices related to electronic control systems. Mathematical techniques and skills in problem solving and evaluating are developed through simulation and practical projects. Learners will choose and investigate an aspect of engineering related to electronics and control, and apply this in practical situations.

Mechanisms and Structures (Advanced Higher)

This Unit develops a deepening mathematical 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. Learners will choose and investigate an aspect of engineering related to mechanisms or structures, and apply this in practical situations.

Engineering Project Management (Advanced Higher)

In this Unit, learners will develop knowledge and skills of project management as it applies to an engineering project. Learners will investigate an industrial engineering project, and consider its environmental, societal and ethical impact.

Learners will develop a project brief, carry out research in relation to the brief, and develop a design to meet the brief. The design may be carried forward, implemented and evaluated as part of the Course assessment.

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.

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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.

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 and application.

In the Advanced 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 specify, plan, construct, test, evaluate and report on a solution to a significant and

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

² 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

appropriately challenging engineering problem. This project may be an individual or group project, and may involve partnerships with industry or further or higher education.

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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