

Route map through learning, teaching and assessment

Course: Engineering Science

Level: Higher

This route map is intended to assist staff in planning and delivering the overall vision for Curriculum for Excellence. It has been developed to signpost the relevant support materials available to assist staff in the planning of learning, teaching and assessment of Higher Engineering Science.

The vision for the new qualifications is to create assessment opportunities that follow and support learning and teaching. This follows the principles laid out in *Building the Curriculum 5* and makes assessment a natural part of learning and teaching.

Education Scotland has published support materials to help staff develop programmes of learning drawn from three sources: course materials commissioned by Education Scotland, other support materials produced by staff seconded to Education Scotland and course materials provided by staff through their education authorities. Further materials will be added as they become available.

These support materials, which are neither prescriptive nor exhaustive, provide suggestions on approaches to learning and teaching that will promote development of the necessary knowledge, understanding and skills for Higher Engineering Science. Staff are encouraged to draw on these materials, and existing materials, to develop their own programmes of learning which are appropriate to the needs of learners within their own context.

The link to Education Scotland's support materials can be found below together with a number of other subject-specific links staff may find helpful as they develop **programmes of learning** for Higher Engineering Science. These links are followed by a sequential list of the key guidelines, advice and support for the Higher Engineering Science **qualification**. This information is intended to support staff in deciding the most appropriate ways to generate evidence and assess learners.

Useful links for learning and teaching Higher Engineering Science

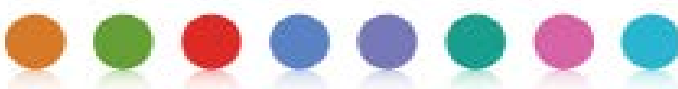
Education Scotland NQ course materials (Glow login and password required)

A wide range of learning and teaching resources to help staff develop programmes of learning.

<http://www.educationscotland.gov.uk/nqcoursematerials/subjects/engineeringscience/coursematerials.asp>

SQA course and unit support notes providing advice and guidance on learning and teaching

http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_Higher_Technologies_EngineeringScience.pdf



Key Curriculum for Excellence support

A quick guide to finding vital information about Curriculum for Excellence under the following headings:

- the latest guidance, updates and plans for embedding Curriculum for Excellence
- information on assessment
- information on the new qualifications.

<http://www.educationscotland.gov.uk/keycfesupport/index.asp>

National Assessment Resource (login and password required)

Materials that inform planning for learning, teaching, moderation and assessment.

<https://www.narscotland.org.uk/>

Higher Engineering Science course content

Higher Engineering Science consists of three units and a coursework assessment. The three units are:

Engineering Contexts and Challenge

http://www.sqa.org.uk/files_ccc/CfE_Unit_H_EngineeringScience_EngineeringContextsandChallenges.pdf

There is a full package of unit assessment support available on the SQA Secure website for this mandatory unit. The package includes unit assessments for both combined approaches, and also unit-by-unit approaches.

Electronics and Control

http://www.sqa.org.uk/files_ccc/CfE_Unit_H_EngineeringScience_ElectronicsandControl.pdf

There is a full package of unit assessment support available on the SQA Secure website for this mandatory unit. The package includes unit assessments for both combined approaches, and also unit-by-unit approaches.

Mechanisms and Structures

http://www.sqa.org.uk/files_ccc/CfE_Unit_H_EngineeringScience_MechanismsandStructures.pdf

There is a full package of unit assessment support available on the SQA Secure website for this mandatory unit. The package includes unit assessments for both combined approaches, and also unit-by-unit approaches.

Course Assessment

http://www.sqa.org.uk/files_ccc/CfEAssessmentOverviewHigherEngSci.pdf

Unit assessment

Units are mandatory when taken as part of the full Higher Engineering Science course but they can be standalone also. Unit support notes follow on from the course support notes.

http://www.sqa.org.uk/files_ccc/CfE_CourseUnitSupportNotes_Higher_Technologies_EngineeringScience.pdf

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.

Requirements for the coursework assessment

The assessment of the units in this course will be as follows.

Engineering Contexts and Challenges

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

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

For this unit learners will be required to provide evidence of:

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

External assessment

The external course assessment comprises a question paper and an assignment, worth a total of 150 marks.

Component 1 – Question paper (90 marks, 60% of the overall marks for the course assessment)

The purpose of the question paper is to assess breadth of knowledge from across the units, depth of understanding, and application of this knowledge and understanding to answer appropriately challenging questions.

Approximately 20–30% of the marks will be awarded for questions related to engineering contexts and challenges.

Approximately 30–40% of the marks will be awarded for questions related to electronics and control.

Approximately 30–40% of the marks will be awarded for questions related to mechanisms and structures.

Question will sample within topics, so that each question paper will have some marks related to each of the following:

- the systems approach
- energy and efficiency
- engineering roles and disciplines
- impacts of engineering
- analogue electronic control systems
- digital electronic control systems
- drive systems
- pneumatics
- structures and forces
- materials.

Approximately 30–40% of the marks will be awarded for application and manipulation of formulae to solve context-based numerical engineering problems.

A data booklet containing relevant data and formulae will be provided for use by the learner.

The question paper has two sections:

Section 1 will have 20 marks, and will consist of short answer questions. This section will give learners an opportunity to demonstrate breadth of knowledge from across the topics specified in the further mandatory information on course coverage section of the course assessment specification.

Section 2 will have 70 marks, and will consist of structured questions. This section will give learners an opportunity to demonstrate application of knowledge and understanding to answer appropriately challenging context-based questions by drawing on and applying knowledge from the table provided in the Further mandatory information on course coverage section of the course assessment specification.

Component 2 – Assignment (60 marks, 40% of the overall marks for the course assessment)

The purpose of the assignment is to assess practical application of knowledge and skills from the units to develop a solution to an appropriately challenging engineering problem. It will assess learners' skills in analysing a problem, designing a solution to the problem, simulating or constructing a solution to the problem, and testing and reporting on that solution.

Time will be required for:

- preparation for the assignment, which could include considering exemplar assignments and practising required skills
- carrying out the stages of the assignment, with staff guidance and support
- assessing the process and completed solution.

The assignment should clearly demonstrate application of knowledge and skills, at an appropriate level, related to mechanisms, structures, electronics and control (as defined in the Further mandatory information on course coverage section of the course assessment specification).

Guidelines for the assignment will include questions, tasks and prompts that will lead learners through the task in clear stages.

Marks will be awarded for:

- analysing the problem
- designing a solution
- constructing/simulating a solution
- testing the solution
- reporting on the solution.

Evidence should include:

- the completed solution
- a record of progress through the assignment (such as an informal electronic log or diary maintained by the learner)
- a short report on the testing of the solution (in written, electronic and/or oral form).

Verification

The verification process is intended to be supportive and not onerous. Internal verification is the process of ensuring that standards are applied uniformly and consistently within a school in line with national standards. External verification is the process of ensuring that national standards are maintained consistently across all schools. Information on quality assurance can be found at <http://www.sqa.org.uk/sqa/58448.html>.

The following links will also support staff when preparing evidence for verification purposes, including prior verification, as well as internal and external verification:

http://www.sqa.org.uk/files_ccc/Prior%20Verification%20Centre%20Guidance%20FINAL.pdf

http://www.sqa.org.uk/sqa/files_ccc/InternalVerificationGuideforSQAcentres.pdf

http://www.sqa.org.uk/sqa/files_ccc/Evidence_required_for_verificationevents.pdf
http://www.sqa.org.uk/sqa/files_ccc/SQA_Evidence_retention_requirements_A3_table.pdf

Key messages from verification will be put up on the SQA website.

Results services

http://www.sqa.org.uk/sqa/files_ccc/FA6669_SQA_Results_Services_A5_8pp_brochure_web.pdf
<http://www.sqa.org.uk/sqa/65427.html>

SQA offer two services to replace the appeals process:

- Exceptional Circumstances Consideration Service (details to be provided to SQA within ten days of the learner sitting the external assessment)
- Post-results Service – this consists of a clerical check and/or a marking review if the centre has concerns about the results of an individual or group.