National 4 Unit Specification

Engineering Science Assignment (National 4)

SCQF: level 4 (6 SCQF credit points)

Unit code: H23E 74

Unit outline

This is the Added Value Unit in the Engineering Science (National 4) Course. The general aim of this Unit is to enable the learner to provide evidence of added value for the Engineering Science (National 4) Course through the successful completion of an assignment which will allow the learner to demonstrate challenge and application.

Learners who complete this Unit will be able to:

1 Develop, with guidance, an engineering solution which will draw on and apply skills and knowledge of mechanisms, structures and electronic control systems

This Unit is a mandatory Unit of the Engineering Science (National 4) Course and is also available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Course Support Notes*, which provide advice and guidance on delivery and assessment approaches. Exemplification of the standards in this Unit is given in *Unit Assessment Support*.

Recommended entry

Entry to this Unit is at the discretion of centre. It is recommended that the learner should be in the process of completing, or have completed, the Units of the Engineering Science (National 4) Course:

- Engineering Contexts and Challenges (National 4)
- Mechanisms and Structures (National 4)
- Electronics and Control (National 4)

Equality and inclusion

This Unit 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.*

Standards

Outcomes and assessment standards

Outcome 1

The learner will:

1 Develop, with guidance, an engineering solution which will draw on and apply skills and knowledge of mechanisms, structures and electronic control systems by:

1.1 Analysing a straightforward problem
1.2 Designing a solution to the problem
1.3 Simulating or constructing a solution to the problem
1.4 Testing and reporting on the solution to the problem

Evidence Requirements for the Unit

This Unit will be assessed through controlled assessment which meets the Evidence Requirements below.

Evidence for this Unit will be generated through an assignment in which the learner will draw on and apply skills and knowledge related to mechanisms, structures and electronic control systems.

The assignment 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.

The assignment is:

- set by centres within the SQA guidelines described below
- conducted under some supervision and control

Evidence will be internally marked by centre staff in line with SQA guidelines.

All assessment is subject to quality assurance SQA.

Setting the assessment
The assignment will be set by centres within the following guidelines:

- The specification for the assignment will be agreed between the learner and the teacher/lecturer.
- The assignment will be a meaningful and appropriately challenging task, which should clearly demonstrate application of knowledge and skills, at an appropriate level, from both the Mechanisms and Structures Unit and the Electronics and Control Unit (as defined in the 'Further mandatory information on Course coverage' section of this document).
- The teacher/lecturer will provide overall guidelines for the assignment and a list of questions/tasks/prompts which will lead learners through the assignment in clear stages.

Conducting the assessment

The assignment will be conducted under some supervision and control. This will take the form of the following:

- The assignment will be carried out under supervised open book conditions.
- The teacher/lecturer may also give learners some support and guidance, as appropriate to National 4 level, to help them progress through each stage of the assignment. The amount of support provided should be reflected in the assessment judgement.

Judging the evidence

Evidence will be internally marked and verified by centre staff in line with SQA guidelines.

All assessment is subject to quality assurance by SQA.

Evidence should include:

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

Re-assessment

In relation to Unit assessment, SQA's guidance on re-assessment for Units applies.

Further information is provided in the exemplification of assessment in *Unit Assessment Support*. Advice and guidance on possible approaches to assessment is provided in the *Course Support Notes.*

Assessment standard thresholds

If a candidate successfully meets the requirements of the specified number of Assessment Standards they will be judged to have passed the Unit overall and no further re-assessment will be required.

The specific requirements for this Unit is as follows:

- 3 out of 4 Assessment Standards must be achieved.

It should be noted that there will still be the requirement for candidates to be given the opportunity to meet all Assessment Standards. The above threshold has been put in place to reduce the volume of re-assessment where that is required.

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

Please refer to the *Course Specification* for information about skills for learning, skills for life and skills for work.

Further mandatory information on Course coverage for the Engineering Science (National 4) Course

The following gives details of mandatory skills, knowledge and understanding for the Engineering Science (National 4) Course. Assessment of this Added Value Unit will involve selecting appropriate skills, knowledge and understanding from those listed below, in line with the Evidence Requirements above. This list of skills, knowledge and understanding also provides the basis for the assessment of all the Units in the Course:

Course themes	
The systems approach	simple system and sub-system diagrams, showing inputs and outputs systems analysis of an environmental control system systems analysis of a renewable energy device working of simple engineered objects
Energy and efficiency	the law of conservation of energy energy transfers, losses and transformations in a system, involving kinetic, potential, electrical and heat energy calculations involving efficiency, work done and power, using: $E_w = Fd$ $P=E/t$, Efficiency $\eta = E_{out}/E_{in} = P_{out}/P_{in}$
Calculations	substituting values into given formulae to obtain answers

Engineering Contexts and Challenges	
Engineering roles and disciplines	applications of civil, mechanical, electrical and chemical engineering roles of engineers in designing, implementing, testing and controlling systems
Impacts of engineering	social, economic and environmental benefits of engineering impacts of a renewable energy project on the environment and community contribution of engineering to tackling climate change

Electronics and Control	
Analogue electronic control systems	symbols, and simple description of function of: battery; switch; resistor; variable resistor; LDR; thermistor, LED; diode; motor; lamp; ammeter and voltmeter concept of voltage, current and resistance measurement of resistance, voltage and current using a meter explanation of the operation of a fixed voltage divider

	use of a fixed voltage divider to generate a signal use of resistors in electronic systems for component protection
Digital electronic control systems	Description of AND, OR and NOT gates using truth tables. use of correct symbols (start, stop, input, output, branch, loop) to construct flowcharts showing solutions to simple control programs

Mechanisms and Structures	
Drive systems	examples of motion in mechanical systems — rotary, reciprocating, oscillating and linear belt drives and chain drives purpose of a tensioner the use and effects of friction in simple drive systems crank and slider, cam and follower, rack and pinion appropriate British Standard symbols
Pneumatics	use of fluid (air) to produce linear movement in single and double acting cylinders standard pneumatic symbols, eg mains air, pilot air, exhaust, tee piece, single and double acting cylinders, 3/2 valve, shuttle valve and actuators (push button, roller, roller trip, plunger, lever, solenoid, spring return and pilot) logic control of pneumatic circuits including OR and AND control circuits relationship between force, pressure and area in single acting cylinders
Structures and forces	effects of a force concurrent forces, equilibrium use of triangle of forces and free body diagrams
Materials	compression, tension, shearing and bending properties of materials

Administrative information

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Superclass: XA

History of changes to National Unit Specification

Version	Description of change	Authorised by	Date
1.1	Assessment standard thresholds updated	Qualifications Manager	September 2018