# Higher National Unit specification

## General information

**Unit title:** Engineering Software Applications (SCQF level 8)

**Unit code:** H948 35

**Superclass:** CH

**Publication date:** May 2015

**Source:** Scottish Qualifications Authority

**Version:** 01

## Unit purpose

This Unit is designed to provide learners with the skills to develop, apply and understand software models to solve engineering problems. It is intended for learners wishing to work in an engineering environment. These skills can be applied in a design or an analytical context within engineering.

## Outcomes

On successful completion of the Unit the learner will be able to:

1 Use spreadsheet software to develop and present analytical solutions to engineering problems.
2 Use industry recognised engineering analysis and simulation software to model the operating characteristics of engineering systems.
3 Use industry recognised CAD software model creation tools to prepare solid and surface models for export to analysis software.

## Credit points and level

1 Higher National Unit credit at SCQF level 8: (8 SCQF credit points at SCQF level 8)

## Higher National Unit Specification: General information (cont)

**Unit title:** Engineering Software Applications (SCQF level 8)

## Recommended entry to the Unit

Entry is at the discretion of the centre. However, learners would benefit from having knowledge and skills in basic Information Technology and Mathematics at SCQF level 7.

## Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the Support Notes for this Unit specification.

There is no automatic certification of Core Skills or Core Skill components in this Unit.

## Context for delivery

If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

## 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.

Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

## Higher National Unit specification: Statement of standards

## Unit title: Engineering Software Applications (SCQF level 8)

Acceptable performance in this Unit will be the satisfactory achievement of the standards set out in this part of the Unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

## Outcome 1

Use spreadsheet software to develop and present analytical solutions to engineering problems.

### Knowledge and/or Skills

- Spreadsheet functions
- Cell and condition formatting
- Advanced spreadsheet features
- Charts and graphs

## Outcome 2

Use industry recognised engineering analysis and simulation software to model the operating characteristics of engineering systems.

### Knowledge and/or Skills

- Load and sorting of data
- Calculation of data sets
- Graphical representation of results
- Fundamentals of graphical data flow modelling

## Outcome 3

Use industry recognised CAD software model creation tools to prepare solid and surface models for export to analysis software.

### Knowledge and/or Skills

- Advanced 3D model creation tools
- Solids and surfaces creation and modification
- Model assembly and rendering
- Analysis preparation

## Higher National Unit specification: Statement of standards (cont)

## Unit title: Engineering Software Applications (SCQF level 8)

### Evidence Requirements for this Unit

Evidence for this Unit must be generated using appropriate software, on a computer or workstation and under open-book conditions.

**Outcome 1**

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- apply general spreadsheet functions — SUM; ROUND; AVERAGE; IF statements to a spreadsheet.
- apply cell and conditional formatting to a spreadsheet.
- apply advanced spreadsheet functions to a spreadsheet — Vlookup and pivot tables.
- apply custom macros to a spreadsheet.
- produce an appropriate chart or graph to represent data sets and solutions.

**Outcome 2**

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

Construct a program that should:

- load a data set into the software.
- sort the data set within the software.
- apply appropriate formula to the data set within the software.
- produce results from the data set within the software.
- generate an appropriate graph or chart from the solutions within the software.

For graphical data flow modelling the learner should:

- be able to modify an existing systems parameters and understand the implications.
- produce a basic data flow model.

The assessment for Outcome 2 should be carried out under open-book supervised conditions. Learners may bring one sheet of A4 paper with their own notes into the exam with them.

## Higher National Unit specification: Statement of standards (cont)

**Unit title:** Engineering Software Applications (SCQF level 8)

## Outcome 3

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- produce at least two individual solids that utilise a minimum of six creation/modification tools.
- produce at least one complex surface generated geometry.
- produce a fully constrained assembly using the parts they have already produced.
- produce a rendering of the final assembly.
- prepare one solid part for analysis.

## Higher National Unit Support Notes

## Unit title: Engineering Software Applications (SCQF level 8)

Unit Support Notes are offered as guidance and are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

## Guidance on the content and context for this Unit

This Unit is designed to provide learners with the skills to develop, apply and understand software models to solve engineering problems. Learners will also gain experience in design aspects within an engineering context.

**Outcome 1**

- Apply general spreadsheet functions to individual cells or over a range of cells. Multiple functions can be applied to single cells:
  - SUM
  - ROUND
  - AVERAGE
  - IF — multiple IF statements may be used within the same cell

- Apply cell and conditional formatting to a spreadsheet:
  - apply colour based condition
  - apple text format condition
  - create a custom rule condition

- Apply advanced spreadsheet functions:
  - simple use of Vlookup
  - IF condition Vlookup
  - two-dimensional pivot table
  - sort and filter within a pivot table

- Apply custom macros to a spreadsheet:
  - simple command button macros
  - IF THEN macro commands

- Produce an appropriate chart or graph to represent data sets and solutions:
  - insert bar and line graphs
  - multiple data sets on the same graph

## Higher National Unit Support Notes (cont)

## Unit title: Engineering Software Applications (SCQF level 8)

**Outcome 2**

- Load a data set into the software:
  - import data from a text file that can be loaded into the software

- Sort the data set within the software:
  - sort the loaded data into rows or columns as appropriate

- Apply appropriate formula to the data set within the software:
  - linier equations
  - basic non-linear equations
  - loop functions
  - matrix addition, subtraction, multiplication, inverse and transposition

- Produce results from the data set within the software:
  - show individual solutions
  - show range of solutions

- Generate an appropriate graph or chart from the solutions within the software:
  - graph production with multiple data sets
  - label axis and change data point visualisation

For graphical data flow modelling the learner should:

- be able to modify an existing systems parameters and understand the implications:
  - alter multiple parameters within an existing systems
  - understand the effect of the modifications

- produce a basic model that simulates a part of an engineering system:
  - use basic function blocks — step, ramp, sine wave, gain, constant, sum, scope

**Outcome 3**

- Produce at least two individual solids that utilises a minimum of six creation/modification tools:
  - use pad tool (or equivalent)
  - use pocket tool (or equivalent)
  - use shaft tool (or equivalent)
  - use groove tool (or equivalent)
  - use chamfer tool (or equivalent)
  - use fillet tool (or equivalent)

- Produce at least one complex surface generated geometry:
  - use multi section surface tool (or equivalent)
  - use combined curves tool (or equivalent)
  - use blend tool (or equivalent)
  - use fill tool (or equivalent)

- Produce a fully constrained assembly using the parts they have already produced:
  - use fix component tool (or equivalent)
  - use coincidence tool (or equivalent)
  - use offset tool (or equivalent)
  - use contact tool (or equivalent)
  - use angle tool (or equivalent)

- Produce a rendering of the final assembly:
  - use appropriate settings to produce a rendered image file of the final assembly

- Prepare one solid part for analysis in a static case:
  - set component materials and properties
  - set component restraints
  - apply a reasonable mesh size to the component
  - set force conditions
  - set acceleration condition
  - set temperature conditions

By using more advanced spreadsheet functions learners will improve their ability to solve engineering problems using spreadsheets. They will also achieve a good understanding on how to write a program using a high-level technical programming language to solve engineering based problems. Learners will acquire skills in 3D CAD design with solids and surfaces.

## Guidance on approaches to delivery of this Unit

It is logical to deliver this Unit sequentially by Outcome as the mathematical and computational operational requirements for Outcome 1 provide a good basis for Outcome 2.

Delivery is at the discretion of the centre, however it is anticipated that traditional hands on tutorial approaches will be supplemented by either paper or online notes. This Unit also provides an excellent opportunity to use video media examples and tutorials specific to the application software available, which will allow learners to further develop skills in integration and exchanged information/data of various software. Other methods may be used in a bid to further enhance the learning experience. It would be advantageous to have the ability to allow learners access to software out with normal class time in an effort to maximise the learner's familiarity to the software.

## Higher National Unit Support Notes (cont)

## Unit title: Engineering Software Applications (SCQF level 8)

## Guidance on approaches to assessment of this Unit

Evidence can be generated using different types of assessment. The following are suggestions only. There may be other methods that would be more suitable to learners.

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

The assessment for Outcomes 1 and 2 should be carried out under open-book conditions.

The assessment for Outcome 1 could be completed out with class time and could involve the learner producing a spreadsheet to solve an engineering based problem, covering all Evidence Requirements. The spreadsheet may utilise custom macros that have already been produced by the learner in class.

The assessment for Outcome 2 could focus on the program construction and solution. Outcome 2 assessment should be completed by the learners under supervised open-book conditions. Learners may bring one sheet of A4 paper with their own notes into the exam with them. It is recommended that the assessment last no more than 2 hours.

The assessment for Outcome 3 could also be completed out with class time. A 3D model specification could be produced by the lecturer and given to the learners to produce in the software. The model could consist of three parts and be assembled, post-processed for analysis and exported to selected engineering application software.

All assessments for this Unit must be completed using appropriate software and on a computer or workstation.

## Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this Unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at **www.sqa.org.uk/e-assessment**.

## Higher National Unit Support Notes (cont)

**Unit title:** Engineering Software Applications (SCQF level 8)

## Opportunities for developing Core and other essential skills

Learners will have the opportunities to develop the Core Skill of *Numeracy* (Using Number and Using Graphical Information), *Information and Communication Technology (ICT)* (Accessing Information and Providing/Creating Information) and *Problem Solving* (Planning and Organising) at SCQF level 5. This could be achieved through loading data, applying engineering and mathematical formula which is then presented in graphical form.

## History of changes to Unit

| Version | Description of change | Date |
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## General information for learners

## Unit title: Engineering Software Applications (SCQF level 8)

This section will help you decide whether this is the Unit for you by explaining what the Unit is about, what you should know or be able to do before you start, what you will need to do during the Unit and opportunities for further learning and employment.

This Unit is designed to enable you to acquire a knowledge and understanding of software used to solve problems in an engineering context.

On successful completion of the Unit the learner will be able to:

1 Use spreadsheet software to develop and present analytical solutions to engineering problems.
2 Use industry recognised engineering analysis and simulation software to model the operating characteristics of engineering systems.
3 Use industry recognised CAD software model creation tools to prepare solid and surface models for export to analysis software.

You will be assessed on all of the Knowledge and/or Skills contained in the three Outcomes and to complete Unit successfully you will have to achieve a satisfactory level of performance in the assessment event/s.

You will have the opportunities to develop the Core Skill of *Numeracy* (Using Number and Using Graphical Information), *Information and Communication Technology (ICT)* (Accessing Information and Providing/Creating Information) and aspects of *Problem Solving* (Planning and Organising) at SCQF level 5. This could be achieved through loading data, applying engineering and mathematical formula which is then presented in graphical form.

The Unit may be of particular interest if you are interested the computational aspect of engineering. Especially if you are interested in undertaking design or analysis within engineering.