

SQA Advanced Unit Specification

General information for centres

Unit title: Computer Applications for Civil Engineering

Unit code: HR4Y 48

Unit purpose: This Unit is designed to provide the candidate with the knowledge, understanding and skills necessary to use computer applications for civil engineering projects.

On completion of the Unit the candidate should be able to:

- 1 Describe the use of computers in civil engineering projects.
- 2 Produce a presentation on information and communication technology as used within the civil engineering industry.
- 3 Use a technical software package to input, edit, save and report on data.
- 4 Use planning software to input data, analyse results and produce a report.

Credit points and level: 1 SQA Credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from National 1 to Doctorates.*

Recommended prior knowledge and skills: It would be an advantage for candidates to have a basic understanding and knowledge of civil engineering design and planning.

Core Skills: There are opportunities to develop the Core Skill(s) of Communication, Numeracy, IT, Problem Solving, Working with Others in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

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.

Assessment: It is possible to assess candidates either on an individual Outcome basis, or by combinations of outcomes. The assessment papers should be composed of the appropriate combination of exercises, reports, short answer, and restricted response questions. Assessments should be conducted under supervised, controlled conditions. Sufficient time should be allowed within the teaching and learning process to allow assessments to be carried out. It should be noted

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that candidates must achieve all minimum evidence specified for each Outcome in order to pass the Unit.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

An exemplar instrument of assessment and marking guidelines have been produced to provide examples of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 8.

SQA Advanced Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, knowledge and/or skills, and evidence requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Throughout the Unit emphasis will be placed on the application of Health and Safety and Sustainability. Safe working practices should be looked at in accordance with correct safety codes of practice and regulations. Sustainability should include reference to criteria affecting sustainability, impact of not implementing sustainability on the environment and the legislation promoting sustainability.

Outcome 1

Describe the use of computers in civil engineering projects

Knowledge and/or skills

- ◆ Available computer technology
- ◆ Available computer applications
- ◆ Computer systems and software

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ identify computer hardware and peripherals and explain their use on civil engineering projects
- ◆ describe computer software used in civil engineering and give examples of their use
- ◆ describe the factors affecting the choice of computer hardware and software for a civil engineering project including health and safety considerations

In any assessment for this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment guidelines

Assessment should be conducted under closed book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Questions used to elicit candidate evidence should take the form of an appropriate balance of short answer, restricted and extended response questions.

Outcome 2

Produce a presentation on information and communication technology as used within the civil engineering industry

Knowledge and/or skills

- ◆ Internet
- ◆ Email
- ◆ Presentations
- ◆ Video Conferencing

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ explain the benefits and uses of the internet within the civil engineering sector of the construction industry
- ◆ use email software to send receive and store messages and explain the need for task management when dealing with email
- ◆ prepare a presentation on a civil engineering topic using a technical software package
- ◆ describe the practical use of video conferencing within the civil engineering industry

Evidence for the knowledge and/or skills for this Outcome will be provided on a sample basis. In any assessment of this Outcome a minimum of **three out of four** knowledge and/or skills items should be sampled. In order to ensure that candidates will not foresee what items they will be questioned on, a different sample of knowledge/skill items is required each time the Outcome is assessed. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment guidelines

Assessment should be conducted under open book conditions with internet access.

Questions used to elicit candidate evidence should take the form of an appropriate balance of practical exercises, restricted and extended response questions.

Outcome 3

Use a technical software package to input, edit and report on data

Knowledge and/or skills

- ◆ Data input
- ◆ Results analysis and data editing
- ◆ Report production

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Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ use software to input data for analysis
- ◆ use software to show results of analysis, edit data and compare results
- ◆ produce a printed report showing the results of the analysis

In any assessment for this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment guidelines

Assessment should be undertaken in open book conditions such that notes and handouts are permitted to be available during the assessment.

A combination of formative and summative assessment in the form of practical exercises should be used to elicit candidate evidence that knowledge and/or skills requirements have been met.

Outcome 4

Use planning software to input data, analyse results and produce a report

Knowledge and/or skills

- ◆ Data input
- ◆ Results analysis
- ◆ Report production

Evidence Requirements

Candidates will need to provide evidence to demonstrate their knowledge and/or skills by showing that they can:

- ◆ use civil engineering planning software to input data for analysis
- ◆ use software to analyse data, show results of analysis, modify data and compare results
- ◆ produce a printed report showing the results of the analysis

In any assessment for this Outcome **all** knowledge and/or skills items should be included. Candidates must provide a satisfactory response to all three items.

Evidence should be generated through assessment undertaken in controlled, supervised conditions.

Assessment guidelines

Assessment should be undertaken in open book conditions.

A combination of formative and summative assessment in the form of practical exercises should be used to elicit candidate evidence that knowledge and/or skills requirements have been met.

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Administrative Information

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SQA Advanced Unit specification: support notes

Unit title: Computer Applications for Civil Engineering

This part of the Unit specification is offered as guidance. The support notes 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 provides the candidate with the basic knowledge, understanding and skills necessary to use computer applications on civil engineering projects.

The opportunity to provide evidence of the achievement of a range of key skills will feature strongly in both formative and summative assessments. An integrative approach to assessment is to be encouraged both within the unit and with other units within the programme area of study.

Suitable computer software packages could be used in the areas of communication, measurement, structural analysis and design, estimating, planning, hydraulics and hydrology, surveying, and highways and traffic engineering.

It is preferable that common commercially available software packages be used, however, 'Freeware' could also be used.

Recommended time allocations to each outcome are given as guidance towards the depth of treatment which might be applied to each topic. This guidance has been used in the design of the assessment exemplar material provided with the Unit.

Corresponding to outcomes 1 to 4:

1 Use of computers in civil engineering projects (10 hours)

Computer technology: develop knowledge and understanding of computers, tablets, printers, plotters, scanners, digital cameras, networks, modems, data storage and retrieval devices, and videoconference suites.

Computer applications: structural analysis and design, drawing, geotechnical engineering, environmental engineering, hydraulics and hydrology, highways and traffic management, surveying, estimating, planning, administration, and communication.

Choosing systems and software: factors effecting choice between stand-alone, laptop, tablet, or networked computer; wireless technology; memory capacity and backup; computer drives; screen size; VDU and work station health and safety considerations; economy in printing and/or plotting; software suitability, cost, training, availability and support; and peripherals.

2 Use information and communication technology (12 hours)

Internet: internet providers, use of web browser software, construction industry web sites, civil engineering web sites, company web sites, technical web sites, links, projects, html documents, copyright, pictures, setting up a web site, viruses, worms, spy ware.

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Email: use of software, create a new message, attachments, address book, send and receive, task management, creating a file structure for storage of emails, blocking SPAM.

Presentations: candidates should be able to understand and use software to create, edit, save and give a presentation on a civil engineering topic, including use of hyperlinks, animation and sound

Video Conferencing: It's use within the construction industry, benefits, technology, VC suite layout, limitations in use, presenting data in an appropriate format.

3 Use technical software package to input, edit, save and report on data (9 hours)

Input data: candidates should have a clear understanding of how the software package operates, create a file, and input data correctly, change views, use formulas, save file, record output.

Analyse results and edit data: view results in appropriate format, input revised data and compare outputs, use edit, insert and format commands, save file under new name.

Use data to produce a report: use data and outputs to create a graphical report with project, title, date and author fields, in correct format, use print and page setup commands.

4 Use planning software (9 hours)

Input data: candidates should have a clear understanding of how the software package operates; create a project file, calendar, and input planning data into the correct fields (project start date, activity, duration, logic links).

Analyse results: view results in tabular and graphical form (Gantt Chart), check end date, identify critical path, examine float, modify data, change activity order and check revised end date and critical path.

Produce report: view data in bar chart, network diagram and tabular form, print results in an appropriate format identifying project, activity, duration, start date, end date and critical path.

Guidance on the delivery and assessment of this Unit

Since it is important that candidates have a sound understanding of the principles that underpin the design and planning of a construction project prior to undertaking learning Outcomes 3 and 4, this Unit should follow on after design and planning units within the course of study.

Learning Outcome 1 could be taught within a normal classroom environment and assessed using a combination of restricted and extended response questions. The remaining assessments will require access to internet, email, presentation, spreadsheet, design and planning software. Some examples of such software include: Internet Explorer Browser, Outlook Express, PowerPoint, Excel, Fastrack, and MS Project.

Outcome 2 involves a series of formative assessments, which could be combined to contribute to the summative assessment submitted as evidence by candidates. The presentation could be on the use of ICT in civil engineering projects, which would cover all of the knowledge/skills and evidence requirements for this learning outcome. Candidates could be orally assessed with printed submissions of their presentations in an appropriate format.

Learning Outcomes 3 and 4 involve candidates using commercially available software packages to input, analyse, alter and print out data. The choice of software is at the discretion of the centre.

Learning outcome 3 is ideally suited to either Excel or design software. If Excel is used the candidates could carry out a cost analysis for a project and use the software to produce graphical outputs to an appropriate format. To this end the learning outcome could be integrated with a construction management or estimating unit. If a design software package is used the learning outcome could be combined with a design unit which requires a particular form of analysis (eg a steel beam design).

It is recommended that evidence for learning outcomes is achieved through well-planned course work, assignments and projects. Assessment may be formative and summative and both may feature as part of the process. Although assessments must be focused on the individual achievement of each candidate, group work and role-play activities may contribute to the assessment. Integrative assignments and project work will help to link this unit with other related units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme. In designing the assessment instrument/s, opportunities should be taken to generate appropriate evidence to contribute to the assessment of Core Skills units.

The volume of evidence required for each assessment should take into account the overall number of assessments being contemplated within this unit and the design of the overall teaching programme.

Where available, evidence from the workplace can also be incorporated to enhance the learning outcomes, provided that this evidence is appropriate and authenticated as the students over work.

Opportunities for developing Core Skills

The following grid provides a general guide to opportunities for the development of Core Skills in this Unit. Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Signposting Guide.

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Core Skill	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5
1 Communication					
Reading	3	3	3	3	
Writing	3	3	3	3	
Oral					
2 Numeracy					
Using Number			3	3	
Using Graphical Information			3	3	
3 IT					
Using Information Technology	3	3	3	3	
4 Problem Solving					
Critical Thinking	3	3	3	3	
Planning and Organising		3			
Reviewing and Evaluating	3	3	3	3	
5 Working with Others		3			

Open learning

Given that appropriate materials exist this unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that assessment/s were conducted under controlled, supervised conditions.

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.

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Evidence that you can satisfy the knowledge and skill elements of this unit will be obtained by assessment in controlled, supervised conditions.