

SQA Advanced Unit Specification

General information for centres

Unit title: CAD for Civil Engineering

Unit code: HR52 47

Unit purpose: This Unit is designed to develop 2-dimensional and basic 3-dimensional Computer Aided Draughting (CAD) drawing skills.

On completion of this Unit, the candidate will be able to:

- 1 Work in different drawing environments.
- 2 Create, edit save and print 2D orthographic drawings to a given specification using the CAD package.
- 3 Create, save and print a 2D Pictorial drawing to a given specification using the CAD package.

Credit points and level: 1 SQA Credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*).

**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: Access to this Unit is at the discretion of the centre. However, it would be an advantage for candidates to have a basic knowledge and understanding of computers and technical drawing and have successfully completed the CAD 2D I Unit.

Core Skills: There are opportunities to develop the Core Skills of Numeracy (Using Graphical Information) and Information Technology 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.

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Assessment: The intention for the assessment of all Outcomes in this Unit is that they be combined together into a single practical assessment. A single assessment may be given in whole or in parts at the discretion of the lecturer under controlled, supervised conditions over an 8-hour period. However, individual assessments of 1 to 3 hours each may be given at the discretion of the centre.

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

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SQA Advanced Unit specification: statement of standards

Unit title: CAD for Civil Engineering

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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 approach 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

Work in different drawing environments

Knowledge and/or skills

- ◆ World Co-ordinate System (WCS)
- ◆ User Co-ordinate System (UCS)
- ◆ 2D UCS origin point
- ◆ 2D UCS axis rotation
- ◆ named UCS
- ◆ multiple viewports within the Model environment
- ◆ creation of objects within the Model environment for presentation in the Layout/Paper environment
- ◆ Layout tab operations
- ◆ single and multiple viewports within the Layout/Paper environment
- ◆ positioning and scaling objects within the Layout/Paper environment

Outcome 2

Create, edit, save and print 2D Orthographic drawings to a given specification using the CAD package

Knowledge and/or skills

- ◆ Modification and use of line types
- ◆ Polylines (PLINE) and curves (SPLINE)
- ◆ Extended use of layers
- ◆ Modification and use of dimension styles
- ◆ Modification and use of text styles
- ◆ Editing and use of Hatch patterns

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- ◆ Generation of block library
- ◆ Generation of different scaled layouts for printing on specified paper sizes

Outcome 3

Create, save and print a 2D Pictorial drawings to a given specification using the CAD package

Knowledge and/or skills

- ◆ Snap grid set to Isometric mode
- ◆ Isometric planes
- ◆ Circles in Isometric mode
- ◆ Text and dimensions for Isometric objects
- ◆ Pictorial drawings
- ◆ Print/plot the completed drawing

Evidence Requirements for the Unit

The candidate will be required to demonstrate his/her knowledge and/or skills in Outcomes 1 2 and 3 with the production of practical and graphical evidence.

In any assessment of these Outcomes the candidate will be required to:

- ◆ manipulate the User Co-ordinate System (UCS) by performing at least **two** UCS operations
- ◆ create and manipulate Viewports within both the Model and Layout/Paper environments of the CAD package
- ◆ create and manipulate Layout tabs within the Layout/Paper environment
- ◆ carry out creation of a pictorial drawing file of **one** type, eg Isometric, Perspective or Planometric will also be created
- ◆ present all files within the Layout/Paper environment, scaled, saved and printed to a given specification

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

Graphical evidence will be in the form of CAD application drawing files presented as

Assessment guidelines for the Unit

Assessment will be under open-book conditions and as such candidates **will be allowed** to bring any textbooks or notes to the assessment or use the Help system available within the application software.

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Administrative Information

| | |
|-----------------------------|---------------------------|
| Unit code: | HR52 47 |
| Unit title: | CAD for Civil Engineering |
| Superclass category: | VF |
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SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of SQA Advanced Qualifications.

FURTHER INFORMATION: Call SQA's Customer Contact Centre on 44 (0) 141 500 5030 or 0345 279 1000. Alternatively, complete our Centre Feedback Form.

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SQA Advanced Unit specification: support notes

Unit title: CAD 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 is a mandatory Unit of the SQA Advanced Certificates in Structural Engineering and Civil Engineering and the SQA Advanced Diploma in Civil Engineering but may be delivered on a standalone basis or as an option to another Group Award. 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.

This Unit has been written in order to allow candidates to develop fundamental knowledge, understanding and skills in creation and manipulation of the User Co-ordinate System (UCS) within the 2D environment, creation and manipulation of Viewports within both the Model and Layout/Paper environments of the CAD package and creation and manipulation of Layout tabs within the Layout/Paper environment; creation of grouped standard parts which contain attribute information, saving them as external drawing files to a standard parts library and then reinserting them into a drawing file and linking them as externally referenced drawing files; extraction of attribute information, importing the extraction data into an external program, creation of a table to be imported and linked back to the drawing file; creation of Pictorial drawing files, such as Isometric, Perspective or Planometric, presenting objects within the Layout/Paper environment; and scaling, saving and printing the completed drawings to a given specification.

These skills are essential to creation of more advanced 2D drawings within any discipline, eg general arrangement drawings, detailed drawings, illustration drawings, etc. There is one other Unit in the group entitled CAD 2D I, which covers fundamental drawing setup commands and object creation and editing commands. The two Units have been developed as an integrated suite of Units to meet most 2D CAD requirements and can be used in awards as necessary and where appropriate.

In designing this Unit a range of topics have been included which lecturers are expected to cover. Recommendations are given below as to how much time should be spent on each Outcome. This has been done to help lecturers decide what depth of treatment should be given to the topics attached to each of the Outcomes. While it is not mandatory for a centre to use this list of topics, it is strongly recommended that it do so to ensure continuity of teaching and learning across the Units.

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Outcome 1

Work in different drawing environments. (8 hours)

The following topics are specific in nature but should be put into context by reference to the CAD software application package being used at the Centre:

Manipulate the User Co-ordinate System (UCS):

- ◆ Understand the difference between the World Coordinate System (WCS) and the User Co-ordinate System (UCS)
- ◆ Display the UCS Icon
- ◆ Display the UCS Icon at the origin point
- ◆ Change the UCS origin point
- ◆ Rotate the UCS origin point
- ◆ Save and name the UCS
- ◆ Recall a saved UCS

Transition between the Model and Layout/Paper environments:

- ◆ Understand the difference between the Model and Layout/Paper environments
- ◆ Toggle between the Model and Layout/Paper environments
- ◆ Create multiple Viewports in both the Model and Layout/Paper environments
- ◆ Create non-rectangular Viewports in the Layout/Paper environment
- ◆ Toggle between Viewports in both the Model and Layout/Paper environments
- ◆ Toggle between the Model and Paper environments within the Layout tab
- ◆ Create Layout tabs with and from template files
- ◆ Create, name, copy and move Layout tabs in the Layout/Paper environment
- ◆ Present objects within a Layout/Paper environment Viewport
- ◆ Control the visibility of objects within Viewports using Layer control, pan, move and zoom commands
- ◆ Align objects between various viewports using the MVSETUP command
- ◆ Lock the display of individual Layout Viewports

Outcome 2

Create, save and print a 2D Orthographic drawing to a given specification using the CAD package. (22 hours)

The following topics are specific in nature but should be put into context by reference to the CAD software application package being used at the Centre:

Create library blocks:

- ◆ Create drawings of standard blocks
- ◆ Use the Block and Wblock commands to create standard blocks within a standard block library

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Initiate a new drawing:

- ◆ Initiate a new drawing using a Standard Template file, which contains a border and title box in the Layout/Paper environment
- ◆ Save the drawing to a given location with a new name as a drawing file

Create new drawings:

- ◆ Use the Xref Manager to link drawings into a master drawing, eg Illustration drawings and Sectional drawings
- ◆ Edit referenced drawings to see the effect in the master drawing
- ◆ Unload, reload, and bind original drawings within the master drawing
- ◆ Control the path of linked drawings
- ◆ Use layer control to control the visibility of referenced objects
- ◆ Modify and use line types
- ◆ Modify and use dimension styles
- ◆ Edit and use Hatch patterns
- ◆ Use the PLINE and SLINE to generate curves

Setting out and Printing:

- ◆ Use of Layouts
- ◆ Viewports within Layouts
- ◆ Zoom command to Scale to an appropriate scale within a Viewport
- ◆ MVSETUP to align objects within viewports
- ◆ A hard copy of the specified drawing is produced to a given scale appropriate to the paper specified.

Outcome 3

Create, save and print a 2D Pictorial drawing to a given specification using the CAD package.
(10 Hours)

The following topics are specific in nature but should be put into context by reference to the CAD software application package being used at the Centre:

Isometric Drawing Concepts:

- ◆ Set the Isoplane Grid mode within the CAD package
- ◆ Toggle between the various planes to control drawing of objects
- ◆ Use the CAD system Isoplane capability to create Isocircles
- ◆ Use the CAD system Isoplane capability to create Isometric views based on the Orthographic information given
- ◆ Add text and dimensions to the Isometric objects

Demonstrate other Pictorial drawings types:

- ◆ Perspective drawings
- ◆ Planometric drawings
- ◆ Cabinet/Cavalier drawings

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Unit Assessment

Outcomes 1 to 3 should be assessed on a continuous basis as the Unit is taught.

Guidance on the delivery and assessment of this Unit

As this Unit provides more advanced CAD skills, which requires continual use to obtain proficiency, it is recommended that the Unit be delivered towards the start or middle of an award so that it may be used with other Unit requirements.

Where this Unit is incorporated into other Group Awards it is recommended that it be delivered in the context of the specific occupational area(s) that the award is designed to cover, ie architectural drawings with Built Environment courses.

Details on approaches to assessment are given under Evidence Requirements and Assessment guidelines under each Outcome in the SQA Advanced Unit specification: Statement of Standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

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.

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

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Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. The candidate would require access to a PC with the appropriate CAD software installed. With regard to assessment, arrangements would need to be made by the centre to ensure the sufficiency and authenticity of candidate evidence under controlled conditions. Candidates should also be made aware of the time commitment to assessment. Outcome evidence may be presented as an electronic drawing file if creation of a printed version is not possible.

For further information and advice, please refer to the SQA guide *Assessment and Quality Assurance of Open and Distance Learning* (SQA, February 2001 - publication code A1030).

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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General information for candidates

Unit title: CAD for Civil Engineering

At the end of this Unit you should be able to:

- 1 Work in different drawing environments.
- 2 Create, edit save and print 2D orthographic drawings to a given specification using the CAD package.
- 3 Create, save and print a 2D Pictorial drawings to a given specification using the CAD package.

This Unit has been designed to help the candidate to develop knowledge, understanding and additional skills in the use of Computer Aided Design application software for the creation of two-dimensional drawings. From the use of Template files to creation of standard part libraries with attached attribute information; to Orthographic drawings which insert the standard parts directly into the main drawing or linking them as externally referenced drawings, Pictorial drawings, Illustration drawings and Sectional drawings; to final printing of layout sheets, this Unit will provide a sound basis for future CAD Units and for use within a chosen award group, such as Built Environment, Architectural, Mechanical or Civil Engineering award groups.

Candidates, through a series of practice exercises and drawing tutorials, will logically progress through more advanced CAD commands in producing 2D fully working drawings to a given specification.

Formal assessments for this Unit are based on the candidate's competence in producing drawings to a given specification via practical assignments using CAD system commands effectively and efficiently.