

SQA Advanced Unit Specification

General information for centres

Unit title: Design of Building Structures

Unit code: HR3R 47

Unit purpose: This Unit is designed to enable the candidate to develop a knowledge and understanding of basic structural design concepts and elements. In addition, the candidate will develop competence in recognising structural elements and structural behaviour.

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

- 1 Recognise and illustrate basic structural concepts.
- 2 Understand the effects of loading on individual structural elements.
- 3 Explain and illustrate the effects of loading on structures.

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: It would be an advantage for candidates to have a basic knowledge and understanding of the principles of structural theory as well as basic knowledge and understanding of construction technology (structures). This may be evidenced by possession of an appropriate Higher or SQA Advanced Unit.

Core Skills: There are opportunities to develop the Core Skill of Numeracy, 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 Outcomes basis or combinations of Outcomes. It should be noted that candidates must achieve all minimum evidence specified for each Outcome in order to pass this Unit.

Much of the evidence could arise from tasks set by the tutor to elicit appropriate graphical responses that meet the Evidence Requirements demanded by the Outcomes. Outcome 2 shall be assessed by a

SQA Advanced Unit Specification

closed-book objective test. This assessment should be conducted under supervised, controlled conditions. It should be noted that candidates must achieve all the minimum Evidence Requirements specified for each Outcome in order to pass this 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

It is the responsibility of the centre to satisfy themselves that the portfolio of evidence submitted for assessment is entirely original and solely the respective student's work.

An exemplar instrument of assessment and marking guidelines has 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 7.

SQA Advanced Unit Specification

SQA Advanced Unit specification: statement of standards

Unit title: Design of Building Structures

Unit code: HR3R 47

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 where appropriate on the application of Health & Safety and Sustainability. Safe working practises should be looked at in accordance with current safety codes of practise 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

Recognise and illustrate basic structural concepts

Knowledge and/or skills

- ◆ basic structural forms
- ◆ basic structural concepts

Evidence Requirements

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

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

- ◆ draw diagrams to illustrate structural forms

Assessment guidelines

Evidence for the knowledge and/or skills for this Outcome will be provided by the production of diagrams produced to illustrate a variety of structural forms.

Outcome 2

Understand the effects of loading on individual structural elements

Knowledge and/or skills

- ◆ tension, compression, torsion, strain, stress, bending, shear
- ◆ freehand sketching of structural elements
- ◆ concepts of stability, equilibrium, dead loads and live loads

SQA Advanced Unit Specification

Evidence Requirements

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

- ◆ describe and explain the effects of loading on structural members
- ◆ describe and explain the concept of stability and equilibrium

Assessment guidelines

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 **two out of three** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to 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 the Evidence Requirements.

The candidates will undertake a multi-choice test.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Assessment should be conducted under closed-book conditions.

Outcome 3

Explain and illustrate the effects of loading on structures

Knowledge and/or skills

- ◆ static and dynamic loading of structures
- ◆ purposes of wind bracing and shear walls
- ◆ properties and behaviour of structural materials

Evidence Requirements

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

- ◆ illustrate and explain the effects of loading on structures

Assessment guidelines

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 **two out of three** knowledge and/or skills items should be sampled. In order to ensure that candidates will not be able to 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 the Evidence Requirements, this must be provided by oral/written evidence.

Evidence for the knowledge and/or skills for this Outcome will be provided by the production of diagrams produced by the student to illustrate structural behaviour.

SQA Advanced Unit Specification

Administrative information

Unit code:	HR3R 47
Unit title:	Design of Building Structures
Superclass category:	TD
Date of publication:	August 2017
Version:	01
Source:	SQA

History of changes

Version	Description of change	Date

© Scottish Qualifications Authority 2005, 2017

This publication may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if reproduced in part, the source is acknowledged.

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](#).

SQA Advanced Unit Specification

SQA Advanced Unit specification: support notes

Unit title: Design of Building Structures

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 has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

- 1 Recognise and illustrate basic structural concepts.
- 2 Understand the effects of loading on individual structural elements.
- 3 Explain and illustrate the effects of loading on structures.

This Unit is at SCQF level 7 and has been developed as part of the new SQA Advanced Certificate and SQA Advanced Diploma Built Environment awards.

The list of topics is given below. Lecturers are advised to study this list of topics in conjunction with the assessment exemplar pack so that they can get a clear indication of the standard of achievement expected of candidates in this Unit.

Topics to be covered in the teaching of the Unit.

Dead loads, live loads and dynamic loads. **(Time: 2 hours)**

Thermal expansion and its effect on building structures. **(Time: 3 hours)**

Uneven settlement of framed structures. **(Time: 2 hours)**

Stress and strain. Compression and tension. Uneven loading of columns. Point loads and uniformly distributed loads. Cantilevers and bending in beams. Continually supported beams and simply supported beams. **(Time: 6 hours)**

Elastic behaviour and plastic failure. **(Time: 3 hours)**

Equilibrium and statics. **(Time: 3 hours)**

Arches and domes. Lintels and columns. **(Time: 3 hours)**

Bending and shear. **(Time 3: hours)**

Rectilinear building frames, portal frames, wind bracing, shear walls. **(Time: 3 hours)**

Properties of structural materials. Ductility, self weight, resistance to deformation, compressive strength, brittle materials, economic shape of structural elements. **(Time: 12 hours)**

SQA Advanced Unit Specification

Guidance on the delivery and assessment of this Unit

The formal assessments for this Unit may consist of the assessment of individual Outcomes. The assessments will be graphical illustrations for Outcomes 1 and 3 and a multiple choice test paper for Outcome 2.

Assessments will generally not involve calculation exercises.

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 student, 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.

Group work may contribute to the assessment. However, planning would be required by the centre 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.

Opportunities for developing Core Skills

Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Sign Posting Guide. The grid below is indicative of the opportunities for Core Skills development within this Unit.

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 IT					
Using Information Technology					
4 Problem Solving					
Critical Thinking	3	3	3		
Planning and Organising					
Reviewing and Evaluating					
5 Working with Others					

Open learning

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. Arrangement would be required to be

SQA Advanced Unit Specification

put in place to ensure that the assessment, which is required to be as two events, was conducted under controlled, supervised conditions.

For information on normal open learning arrangements, please refer to SQA guide Assessment and Quality Assurance of Open and Distance Learning (SQA 2000)

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.

SQA Advanced Unit Specification

General information for candidates

Unit title: Design of Building Structures

This Unit has been designed to allow you to develop knowledge and understanding of:

- ◆ basic structural concepts
- ◆ the effects of loading on individual structural elements
- ◆ the effects of loads on structures