

## **SQA Advanced Unit specification**

### **General information**

**Unit title:** CAD: Prototyping (SCQF level 8)

**Unit code:** HV21 48

**Superclass:** CH

**Publication date:** November 2017

**Source:** Scottish Qualifications Authority

**Version:** 01

### **Unit purpose**

This Unit is designed to enable the learner to develop a knowledge and understanding of the role of prototyping in the design process. In addition, the learner will develop competence in the processes involved in development of prototypes. Learners will also gain knowledge in the use of Rapid Prototyping in an industrial context.

### **Outcomes**

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

- 1 Compare Rapid Prototyping Techniques.
- 2 Develop and evaluate concept designs.
- 3 Create a physical model/prototype.
- 4 Create a computerised 3D model in preparation for Rapid Prototyping.

### **Credit points and level**

2 SQA Credits at SCQF level 8: (16 SCQF credit points at SCQF level 8)

### **Recommended entry to the Unit**

While entry to this Unit will be at the discretion of the centre, it is recommended that learners possess a basic knowledge and understanding of design. This may be evidenced by the possession of the following SQA Advanced Units: HR3L 47 *CAD: 2D I*, HV1T 48 *CAD: 3D Animation*, HV1K 47 *CAD: 3D Surface and Solid Modelling*, HV1Y 48 *CAD: Manufacturing* and/or a Higher in Graphical Communication or Craft and Design (or equivalent).

## **SQA Advanced Unit Specification**

### **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](http://www.sqa.org.uk/assessmentarrangements).

## **SQA Advanced Unit specification: Statement of standards**

### **Unit title: CAD: Prototyping (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**

Compare Rapid Prototyping Techniques.

##### **Knowledge and/or Skills**

- ◆ Rapid Prototyping techniques
- ◆ Secondary research techniques
- ◆ Rapid Prototyping file types

#### **Outcome 2**

Develop and evaluate concept designs.

##### **Knowledge and/or Skills**

- ◆ Client design brief
- ◆ Illustrative techniques
- ◆ Concept development
- ◆ Concept evaluation
- ◆ Adopting a solution

#### **Outcome 3**

Create a physical model/prototype.

##### **Knowledge and/or Skills**

- ◆ Safe workshop or studio practices
- ◆ Equipment and materials
- ◆ Production techniques
- ◆ Prototyping
- ◆ Functionality testing
- ◆ Assembly trialling
- ◆ Aesthetics

## **SQA Advanced Unit Specification**

### **Outcome 4**

Create a computerised 3D prototype in preparation for Rapid Prototyping.

#### **Knowledge and/or Skills**

- ◆ 3D computerised modelling techniques
- ◆ Functionality simulation
- ◆ Assembly trialling

#### **Evidence Requirements for this Unit**

##### **Outcome 1**

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

- ◆ carry out secondary research to compare at least two Rapid Prototyping file types.
- ◆ compare a minimum of three Rapid Prototyping techniques.

This is an open-book assessment. The evidence should be presented in a conventional report format, with all sources referenced in a conventional manner. A timeline should be negotiated for submission.

##### **Outcome 2**

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

- ◆ produce three illustrated concept development responses to a given design brief which interprets the client/s requirements, is presented using appropriate illustrative techniques and contains referenced sources to demonstrate influencing factors in the developments.
- ◆ evaluate each of the concepts and provide a rationale for the adoption of one solution.

##### **Outcome 3**

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

- ◆ select materials suitable for the creation of a physical prototype for a chosen concept design.
- ◆ satisfy the tutor that they can follow safe working practices in the workshop or studio environment when using equipment and materials to carry out production techniques.
- ◆ create a physical prototype from the concept design and demonstrate assembly and functionality of the prototype through testing and trialling.
- ◆ explain three contributory factors which influence the aesthetics of the prototype.

Learners must demonstrate safe working practices before attempting to produce any physical prototypes unsupervised.

## **SQA Advanced Unit Specification**

### **Outcome 4**

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

- ◆ produce a 3D computerised prototype assembly and print a hardcopy drawing showing the prototype in multi view format.
- ◆ produce an animated functional simulation of the assembly.
- ◆ save an electronic copy of the simulation.

### SQA Advanced Unit Support Notes

**Unit title:** CAD: Prototyping (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 80 hours.

#### **Guidance on the content and context for this Unit**

This Unit may form part of a group award or be completed as a free-standing Unit.

This Unit has been written in order to allow learners to develop knowledge, understanding and skills in the following areas: Rapid Prototyping techniques, development and evaluation of concept designs, creation of physical prototypes and the creation of computerised 3D models in preparation for Rapid Prototyping.

Outcome 1 should be delivered through lectures and demonstrations with visits to organisations with RP facilities. Rapid Prototyping techniques could include Selective Laser Sintering (SLS), Laminated Object Manufacturing (LOM), Fused Deposition Modelling (FDM), Solid Ground Curing (SGC), Stereolithography (SLA) 3D Printing (3DP) and any other evolving technique. Secondary research techniques should be practised to allow the learner to be confident in these techniques prior to engaging in the research necessary for the assessment task.

For Outcomes 2, 3 and 4 learning should be through practical application and the creation of 2D images and both physical and computer generated 3D prototypes.

#### **Guidance on approaches to delivery of this Unit**

It is intended that this Unit be presented at all times using the specialist application CAD software available at the centre. Appropriate technical and support material should be available to the learner.

In delivery of this Unit, learners should be provided with the opportunity to gain as much 'hands on' experience as possible. Each learner should have access to a PC with CAD software installed.

#### **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.

All Outcomes could be assessed by individual assessment events however the use of one design brief could allow for an integrated approach to assessment for Outcomes 2, 3 and 4.

### Assessment Guidelines

#### Outcome 1

The assessment for this Outcome should take the form of a single event where the learner is given a research task and a submission date for evidence negotiated. Adequate time should be built into the assessment to allow the learner to carry out the necessary research tasks and complete the Evidence Requirements. A suggested word count of 1,000 words or equivalent should be sufficient to complete the task.

#### Outcome 2

The assessment for this Outcome could be undertaken as a separate event or could be combined with Outcomes 3 and 4 to provide one holistic assessment if one client brief is carried across each of these three Outcomes.

#### Outcome 3

The assessment for this Outcome could be undertaken as a separate event or could be combined with Outcomes 2 and 4 to provide one holistic assessment if one client brief is carried across each of these three Outcomes. If an integrated approach were the chosen assessment task, the developed and evaluated concept produced for Outcome 1 could be used here. It is recommended that centres develop checklists to support the recording of safe workshop practices.

#### Outcome 4

The assessment for this Outcome could be undertaken as a separate event or could be combined with Outcomes 2 and 3 to provide one holistic assessment if one client brief is carried across each of these three Outcomes. If an integrated approach were the chosen assessment task, the developed and evaluated concept produced for Outcome 2 and 3 could be used here.

### 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](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills of *Communication, Information and Communication Technology (ICT)*, and the components Planning and Organising and Reviewing and Evaluating of the Core Skill *Problem Solving* at SCQF level 6, and the component 'Using Graphical Information' of the Core Skill of *Numeracy* at SCQF level 5 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

## History of changes to Unit

Version	Description of change	Date

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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](#).



### General information for learners

#### Unit title: CAD: Prototyping (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 was developed for the SQA Advanced Diploma in Computer Aided Draughting and Design.

This Unit has been written in order to allow you to develop knowledge, understanding and skills in the following areas: Rapid Prototyping (RP) techniques, development and evaluation of concept designs, creation of physical prototypes and the creation of computerised 3D models in preparation for Rapid Prototyping.

Outcome 1 should be delivered through lectures and demonstrations with you being involved in visits to organisations with RP facilities. Secondary research techniques will be practised so you can become confident in these techniques prior to engaging in the research necessary for the assessment task. For Outcomes 2, 3 and 4 learning should be through practical application and the creation of 2D images and both physical and computer generated 3D prototypes.

In addition, you will develop competence in the processes involved in developing prototypes and knowledge of the use of *Rapid Prototyping* in an industrial context and you will develop practical skills enabling you to create part and assembly drawings.

In the Unit's first Outcome, you will gain knowledge and skills in various different Rapid Prototyping techniques. In Outcome 2 you will learn about the development and evaluation of concept designs. Outcome 3 introduces you to the creation of a physical prototypes. In the final Outcome, you will gain experience in the creation of computerised 3D prototypes in preparation for Rapid Prototyping.

In delivery of this Unit, learners should be provided with the opportunity to gain as much 'hands on' experience as possible.

During the course of the Unit, there may be opportunities for you to develop important Core Skills, in the areas of *Communication, Problem Solving, Information and Communication Technology (ICT)* and *Numeracy*.