Higher National Unit specification

General information

Unit title: CAD: Manufacturing (SCQF level 8)

Unit code: F218 35

Superclass: WA

Publication date: February 2008

Source: Scottish Qualifications Authority

Version: 03 (July 2016)

Unit purpose

This Unit is designed to provide learners with knowledge and skills in the use of Computer Aided Design (CAD) within a manufacturing environment. Learners will also gain knowledge of a variety of materials and material properties used in manufacturing.

Outcomes

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

1 Describe and contrast the properties of materials for use in manufacturing.
2 Design components for manufacture using a 3D CAD system.
3 Produce a CAD/CAM machining sequence.

Credit points and level

2 Higher National Unit 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 HN Units DW1E 34 *CAD: 2D I*, HE27 34 *CAD: 3D Surface and Solid Modelling*, DW17 34 *Design Methodology*, and/or a Higher in Graphical Communication or Craft and Design (or equivalent).

Higher National Unit specification: General information (cont)

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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.

This Unit was developed for the HNC/HND Computer Aided Draughting and Design awards.

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

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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.

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. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Describe and contrast the properties of materials for use in manufacturing.

Knowledge and/or Skills

- Properties
- Metals
- Polymers
- Ceramics
- Natural
- Other materials

Outcome 2

Design components for manufacture using a 3D CAD system.

Knowledge and/or Skills

- 3D CAD techniques
- Material type and selection
- Design considerations
- Manufacturing techniques
- Tolerances
- Manufacturing drawings

Outcome 3

Produce a CAD/CAM machining sequence.

Knowledge and/or Skills

- CAD/CAM process
- Tooling and cutting sequence
- Post processing
- Computer Numerical Coding (CNC) coding
- Simulation

Higher National Unit specification: Statement of standards (cont)

Unit title: CAD: Manufacturing (SCQF level 8)

Evidence Requirements for this Unit

Outcome 1

Evidence for this Outcome will be generated through sampling. Two of the six Knowledge and Skills items must be sampled on each assessment occasion.

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. Learners should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion to prevent the learner being able to predict what they will be asked.

Learners will need to provide evidence to demonstrate their knowledge and understanding of the properties of manufacturing materials.

Where an item is sampled, a learner's response can be judged satisfactory where the evidence provided shows that the learner can:

- describe and contrast a minimum of five physical properties of two of the material types suitable for manufacturing listed under the Knowledge and Skills section.

Evidence should be generated through assessment undertaken in controlled, supervised conditions. Learners will be allowed to refer to relevant course material.

Outcome 2

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that, in response to a given brief, they can:

- design 3D computerised models of two components in two different material types, one of which must be suitable for CAD/CAM process.
- produce hardcopy design detail drawings for the manufacture of the two components with appropriate manufacturing details added (tolerances, machining symbols, annotation).
- explain the design consideration which influenced choice of material, manufacturing techniques and tolerances.

Higher National Unit specification: Statement of standards (cont)

Unit title: CAD: Manufacturing (SCQF level 8)

Outcome 3

Learners will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that, in response to a given brief, they can:

- produce hardcopy print to establish tooling and cutting sequence for one component.
- produce evidence of post processing sequence to generate appropriate CNC coding detail.
- simulate the cutting sequence and save simulation to disc.
- provide a summary of the CAD/CAM process that should include detail of the importance of tooling and cutting sequence, post processing and Computer Numerical Control coding.

Higher National Unit Support Notes

Unit title: CAD: Manufacturing (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 is at SCQF level 8 and has been devised as a mandatory Unit within the HND Computer Aided Draughting and Design award but may be delivered on a standalone basis or within another Group Award.

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

1 Identification and description of the properties of materials.
2 Design of components for manufacture using a 3D CAD system.
3 Production of a CAD/CAM machining sequence.

Topics for delivery are outlined below.

Outcome 1

Describe and contrast the properties of materials for use in manufacturing.

In this Outcome learners are required to provide evidence of knowledge and understanding of a range of materials (polymers, metal, ceramics and wood, other emerging materials) and their associated properties.

Outcome 2

Design components for manufacture using a 3D CAD system.

Learners should be able to design components for manufacture using a 3D CAD system in response to a given brief. Learners produce 3D CAD details, detailed manufacturing drawings and will provide evidence of their knowledge and understanding of the design considerations, manufacturing techniques and tolerances when designing for manufacture.

Higher National Unit Support Notes (cont)

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Outcome 3

Produce a CAD/CAM machining sequence.

In this Outcome learners are required to develop a CAD/CAM machining sequence and show skills in the practical application of the CAD/CAM process. Learners will select and set appropriate tooling, post process and simulate the created machining sequence. Learners will also show skills in the reading of CNC coding and provide evidence of their knowledge and understanding of the CAD/CAM process.

Although not required for assessment, it is suggested where possible that learners are given the opportunity to witness the machining of a component developed through the CAD/CAM process. In particular it would be beneficial for learners to visit a company using the CAD/CAM manufacturing process to see real life CAD/CAM component production.

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 the 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.

Outcomes 1 is assessed by sampling so must be conducted as a supervised assessment. It would be possible to integrate the assessments for Outcomes 2 and 3 if the same design brief were used.

Higher National Unit Support Notes (cont)

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Assessment Guidelines

Outcome 1

This task could be set as extended response questions. The recommended time allocation for the assessment is a maximum of two hours.

Outcome 2

The assessment for this Outcome can be a separate task or could be combined with the assessment for Outcomes 3 if the same design brief were used. Checklists to support the assessment requirements for each of the Knowledge and/or Skills items might be helpful to centres to record evidence. The recommended time allocation for the assessment is a maximum of six hours.

Outcome 3

The assessment for this Outcome can be a separate task or could be combined with the assessment for Outcomes 2 if the same design brief were used. Checklists to support the assessment requirements for each of the Knowledge and/or Skills items might be helpful to centres to record evidence. The recommended time allocation for the assessment is a maximum of four hours.

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**.

Opportunities for developing Core and other essential skills

There are opportunities to develop the Core Skills *of Communication, Information and Communication Technology (ICT)*, and *Problem Solving* at SCQF level 6, and the component 'Using Graphical Information' of the Core Skill of Numeracy at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components. Opportunities to develop these Core Skills are provided during the resolution of a design brief specification — the design and production of design of components for manufacture using a 3D CAD system and the production of a CAD/CAM machining sequence.

History of changes to Unit

Version	Description of change	Date
03	No change to context. Some minor changes to correct errors/typos and transferred to the current template.	06/07/16
02	Superclass changed from VF to WA.	26/06/13

General information for learners

Unit title: CAD: Manufacturing (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 has been designed to provide you with the knowledge and skills that will enable you to understand the basic concepts of *CAD: Manufacturing*.

This Unit will also allow you to develop practical skills that will enable you to create part and assembly drawings.

In the first Outcome you will gain knowledge and understanding in a range of materials (polymers, metallic, ceramics and wood) and their associated properties relevant to the CAD process. In Outcome 2 you will design components for manufacture using a 3D CAD system in response to a given brief, producing 3D CAD details and detailed manufacturing drawings. Outcome 3 deals with the practical application of the CAD/CAM process culminating in the production of a CAD/CAM machining sequence. You will learn about CNC coding.

Where possible, you will be given the opportunity to visit a company using CAD/CAM and observe the machining of a component developed through the CAD/CAM process.

Over the course of this Unit there may be opportunities for you to develop important Core Skills in the areas of *Communication, Information and Communication Technology (ICT)*, *Problem Solving* and the component 'Using Graphical Information' of the Core Skill of *Numeracy* at SCQF level 6 although there is no automatic certification of Core Skills or Core Skills components. Opportunities to develop these Core Skills are provided during the resolution of a design brief specification — the design and production of components for manufacture using a 3D CAD system and the production of a CAD/CAM machining sequence.

Outcomes 1 is assessed by sampling but it is possible to integrate the assessments for Outcomes 2 and 3 by sourcing a solution to an integrated design brief.

The formal assessment for this Unit includes both written and practical elements.

You will be allowed access to all course notes during the assessment event.

At the discretion of the individual centres, the assessment of all Outcomes can be carried out after the teaching of the appropriate topics or as an integrated assignment. This will not usually be attempted until all teaching has been completed.