National 5 Course Specification

National 5 Design and Manufacture

Course code:	C819 75
Course assessment code:	X819 75
SCQF:	level 5 (24 SCQF credit points)
Valid from:	session 2017–18

The course specification provides detailed information about the course and course assessment to ensure consistent and transparent assessment year on year. It describes the structure of the course and the course assessment in terms of the skills, knowledge and understanding that are assessed.

This document is for teachers and lecturers and contains all the mandatory information you need to deliver the course.

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Contents

Course overview

The course consists of 24 SCQF credit points which includes time for preparation for course assessment. The notional length of time for a candidate to complete the course is 160 hours.

The course assessment has three components.

Component	Marks	Duration
Component 1: question paper	80	1 hour and 45 minutes
Component 2: assignment — design	55	See course assessment section
Component 3: assignment — practical	45	See course assessment section

Recommended entry	Progression
Entry to this course is at the discretion of the centre. Candidates should have achieved the fourth curriculum level or the National 4 Design and Manufacture course or equivalent qualifications and/or experience prior to starting this course.	♦ other qualifications in design and manufacture or related areas ♦ further study, employment and/or training

Conditions of award

The grade awarded is based on the total marks achieved across all course assessment components.

Course rationale

National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.

Every course provides opportunities for candidates to develop breadth, challenge and application. The focus and balance of assessment is tailored to each subject area.

The National 5 Design and Manufacture course allows candidates to develop knowledge and skills enabling them to appreciate, contribute and adapt to the diverse opportunities offered in manufacturing industries.

Candidates develop creative and practical skills by designing and making solutions to real problems. In addition, they gain an understanding of the impact of design and manufacture on everyday life.

The course encourages candidates to take a broad view of design and manufacture, through making decisions and taking responsibility for their own actions, generating and developing ideas, applying knowledge, and justifying decisions. These transferrable skills place candidates in a strong position regardless of the career path they choose.

Purpose and aims

The main purpose of the course is to allow candidates to develop the skills and knowledge associated with designing and manufacturing.

The course enables candidates to develop:

- skills in designing and manufacturing models, prototypes and products
- knowledge and understanding of manufacturing processes and materials
- an understanding of the impact of design and manufacturing technologies on our environment and society

Who is this course for?

This course is suitable for learners attracted by practical activities. It provides a foundation for those considering further study or a career in design, manufacturing, engineering, science, marketing, and related disciplines.

The course also offers a complementary practical experience for those studying subjects in the technologies and expressive arts.

Course content

The course comprises two areas of study:

Design

Candidates study the design process from brief to design proposal. This helps them develop skills in initiating, developing, articulating, and communicating design proposals. They gain an understanding of the design/make/test process and the importance of evaluating and resolving design proposals on an ongoing basis. Candidates also develop an understanding of the factors that influence the design of products.

Manufacture

Candidates study the manufacture of prototypes and products. This helps them develop practical skills in the design/make/test process. They gain an appreciation of the properties and uses of materials, as well as a range of manufacturing processes and techniques, allowing them to evaluate and refine design and manufacturing solutions. Candidates also gain an understanding of commercial manufacture.

Integrating the two areas of study is fundamental to delivering the course successfully; it allows candidates to ‘close the design loop’ by manufacturing their design ideas.

Skills, knowledge and understanding

Skills, knowledge and understanding for the course

The following provides a broad overview of the subject skills, knowledge and understanding developed in the course:

- analysing information
- applying knowledge and understanding of:
  - — idea-generation techniques
  - — design factors
  - — graphic techniques
  - — modelling techniques
  - — planning techniques
  - — evaluation techniques
  - — tools, materials, and processes
  - — manufacturing techniques
- knowledge and understanding of commercial manufacture
- knowledge and understanding of the impact of a range of design and manufacturing technologies on our environment and society

Skills, knowledge and understanding for the course assessment

The following provides details of skills, knowledge and understanding sampled in the course assessment:

Assignments		**Question paper**	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
Analysing a brief	♦ carry out research ♦ incorporate research findings into a specification	Analysis of a brief	♦ gathering data ♦ the key stages of the following research techniques: — questionnaires — user trips ♦ reasons for the selection of research techniques ♦ the role of the product specification in the design process
Generating ideas	♦ generate ideas	Idea-generation techniques	♦ appropriate use of idea-generation techniques ♦ the key stages of the following idea-generation techniques: — morphological analysis — brainstorming
Use of modelling	♦ apply modelling techniques to develop a design proposal	Modelling in the design process	♦ the use of modelling in the design process to: — generate and explore — test and refine — communicate ♦ the advantages of using modelling in the design process ♦ reasons for selection of types of models: — sketch — scale

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
			— block — computer-generated
Use of graphics	♦ use appropriate graphics to develop a design proposal	Graphics in the design process	♦ the use of graphics in the design process to: — generate and explore — test and refine — communicate ♦ the advantages of using graphics in the design process ♦ reasons for the selection of types of graphic techniques
Developing ideas	♦ explore ideas towards a proposal ♦ refine ideas towards a proposal ♦ apply knowledge and understanding of design ♦ apply knowledge and understanding of materials and manufacture	Function	♦ the influence of function on the design of products ♦ primary and secondary function
		Performance	♦ the influence of performance on the design of products ♦ maintenance issues associated with products ♦ the influence of a product's life expectancy on design, manufacture, and the environment ♦ fitness-for-purpose of products ♦ safety issues associated with products
		Market	♦ the influence of the target market on the design of products ♦ marketing techniques to influence sales ♦ the benefits of branding ♦ technology push and market pull
		Aesthetics	♦ the aesthetics of products

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
			♦ influences on the aesthetics of products
		Ergonomics	♦ the influence of ergonomics on the design of products: — safety — comfort — ease of use ♦ the use of anthropometric data
		Uses of common materials	♦ properties and appropriate use of: — hardwoods: beech, ash, mahogany, and oak — softwoods: red pine and spruce — manufactured boards: plywood, flexi-ply, MDF, chipboard, and hardboard — non-ferrous metals/alloys: aluminium, copper, and brass — ferrous metals/alloys: cast iron, iron, mild steel, high-carbon steel, and stainless steel — thermoplastics: ABS, acrylic, polypropylene, and polystyrene — thermosetting plastics: urea formaldehyde and melamine formaldehyde
		People who influence design	♦ the role of people who influence the design of products: — designers — manufacturers — marketing teams — consumers — retailers

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
		Commercial manufacture	♦ vacuum forming: uses, identifying features, and patterns ♦ sand casting: uses, identifying features, and patterns ♦ injection moulding: uses and identifying features ♦ rotational moulding: uses and identifying features ♦ die casting: uses and identifying features ♦ computer-aided manufacture (CAM): benefits and drawbacks ♦ laser cutter: uses, benefits, and drawbacks ♦ 3D printer: uses, benefits, and drawbacks ♦ the use of standard components and knock-down fittings ♦ types of manufacturing systems: mass and one-off
		Impact of design and manufacturing technologies	♦ Impact on: — society: changes to workforce, supply of products — the environment: energy production and consumption, pollution ♦ methods to support sustainability
Planning for manufacture	♦ produce a sequence of operations	Planning for manufacture	♦ sequence of operations: — steps and order — tools and machines — safety ♦ working drawings ♦ cutting lists

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
Evaluating	♦ evaluate the design proposal	Evaluation of products	♦ methods to evaluate products: — comparison to other products — user trials — comparison against specification ♦ questionnaires
Measuring and marking-out	♦ use a range of measuring and marking-out tools	Tools for measuring and marking-out	♦ the **use** of measuring and marking-out tools **(there is no requirement for candidates to describe the tool or its component parts):** — callipers: outside and odd-leg — rule — dividers — gauges: marking and mortise — centre punch — scriber — squares: try and engineer's
Using machine and hand tools	♦ use a range of machine and hand tools	Machine and hand tools for cutting and forming materials	♦ the **use** of hand tools **(there is no requirement for candidates to describe the tools or their component parts)**: — saws: coping, tenon, hacksaw, and junior hacksaw — chisels: mortise and bevel-edged — hammers: ball-pein, cross-pein, and claw — mallets: wooden and hide — planes: jack, smoothing, rebate, and plough — drill bits: twist, Forstner, countersink, and centre — files — hand router — pliers

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
			— pop-rivet gun — screwdrivers — tin snips — bending bars — taps and dies — nail punch — bradawl ♦ the **use** of machine **tools (there is no requirement for candidates to describe the machines or their component parts):** — sander: disc and belt — pillar drill: setting-up and depth stop — scroll/fret saw — centre lathe: setting-up, parallel and step turning, taper turning, drilling, and knurling — wood lathe: setting-up, preparing material, parting off, parallel turning, and finishing — mortise machine: setting-up and depth stop — fluidiser — oven — strip heater
Assembling components	♦ prepare components for assembly ♦ assemble components	Assembling	♦ the use of joining methods: — adhesives: PVA and epoxy resin — screws, nails, nuts and bolts — woodwork joints: mortise and tenon, lap, rub, halving, dowel, rebate, and housings — pop-riveting

Assignments		Question paper	
Skill	**Candidates are required to demonstrate ability to:**	**Knowledge and understanding**	**Candidates are required to demonstrate knowledge and understanding of:**
			— welding ♦ the **use** of tools for holding and clamping **(there is no requirement for candidates to describe the tool or its component part):** — vices and guards: machine, bench, hand, engineer's — G clamp — sash cramps ♦ the use of formers and jigs
Finishing	♦ prepare surfaces for finishing ♦ apply finish skilfully	Surface finishing	♦ surface finishing techniques: — sanding/abrading — polishing — varnishing — oiling — staining — waxing — painting/lacquering — dip-coating

Skills, knowledge and understanding included in the course are appropriate to the SCQF level of the course. The SCQF level descriptors give further information on characteristics and expected performance at each SCQF level (www.scqf.org.uk).

Skills for learning, skills for life and skills for work

This course helps candidates to develop broad, generic skills. These skills are based on SQA's Skills Framework: Skills for Learning, Skills for Life and Skills for Work and draw from the following main skills areas:

2 Numeracy

2.2 Money, time and measurement

4 Employability, enterprise and citizenship

4.4 Enterprise

5 Thinking skills

5.2 Understanding
5.3 Applying
5.4 Analysing and evaluating

These skills must be built into the course where there are appropriate opportunities and the level should be appropriate to the level of the course.

Further information on building in skills for learning, skills for life and skills for work is given in the course support notes.

Course assessment

Course assessment is based on the information provided in this document.

The course assessment meets the key purposes and aims of the course by addressing:

- breadth — drawing on knowledge and skills from across the course
- challenge — requiring greater depth or extension of knowledge and/or skills
- application — requiring application of knowledge and/or skills in practical or theoretical contexts as appropriate

This enables candidates to apply knowledge and skills developed through the course to:

- solve design problems in both practical and theoretical contexts
- answer questions, provide descriptions and explanations related to theoretical design and manufacture contexts
- produce a solution to an appropriately challenging design problem

Course assessment structure: question paper

Question paper 80 marks

The question paper has 80 marks out of a total of 180 marks available for the course assessment.

Candidates are required to provide reasoned responses to a range of question types which use command words such as: state, select, outline, identify, describe or explain.

The question paper assesses knowledge and understanding from the following areas of design and manufacturing:

- design (30 marks)
- workshop-based manufacture (30 marks)
- commercial manufacture (20 marks)

Full details of these areas can be found in the ‘Skills, knowledge and understanding for the course assessment’ table in this document.

The question paper has two sections.

Section 1 has 60 marks. This section assesses design and workshop-based manufacture and consists of six or seven questions.

Question 1 has 30 marks. It assesses a range of materials, hand tools and machinery and is based on a workshop-crafted product. This question follows a similar format each year and requires reasoned responses to practical manufacturing tasks.

The remaining questions are worth 30 marks and assess design as specified in the 'Skills, knowledge and understanding for the course' table. The context of the questions is design work and products that focus on particular aspects of design.

Section 2 has 20 marks. This section assesses commercial manufacture and consists of four or five questions.

The first question in this section assesses materials and commercial manufacturing processes. This question follows a similar format each year. Candidates identify, select and justify suitable materials and processes for the commercial manufacture of existing products.

The remaining questions assess the impact of commercial manufacture on society and the environment and other aspects of commercial manufacture, as specified in the 'Skills, knowledge and understanding for the course' table.

Setting, conducting and marking the question paper

The question paper is set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA.

Candidates complete the paper in 1 hour and 45 minutes.

Specimen question papers for National 5 courses are published on SQA's website. These illustrate the standard, structure and requirements of the question papers candidates sit. The specimen papers also include marking instructions.

Course assessment structure: assignment — design

There are two linked assignments: design and practical.

Assignment — design 55 marks

This assignment has 55 marks out of a total of 180 marks available for the course assessment. It assesses the application of design skills to develop a proposal to a set brief. The proposal is then manufactured as evidence for the assignment — practical.

The assignment — design provides an opportunity to demonstrate the skills as listed in the 'Skills, knowledge and understanding for the course' table in this document. Marks are awarded as follows:

- analysing a brief (8 marks)
- generating ideas (9 marks)
- developing ideas (20 marks)
- using models (6 marks)
- using graphics (6 marks)
- planning for manufacture (6 marks)

Candidates should be fully prepared before undertaking the assignment, ie they should have gained the design skills required and be aware of the requirements of the assessment.

Setting, conducting and marking the assignment — design

The assignment is:

- set by SQA
- issued annually
- conducted under some supervision and control
- submitted to SQA for external marking

All marking is quality assured by SQA.

Assessment conditions

Time

Candidates generate evidence of their design skills by responding to a given brief. This evidence is produced over an extended period of time, allowing candidates to develop and refine their work before it is presented for assessment.

Supervision, control and authentication

Under some supervision and control means:

- Candidates do not need to be directly supervised at all times.
- The use of resources, including the internet, is not tightly prescribed.
- The work an individual candidate submits for assessment is their own.
- Teachers and lecturers can provide reasonable assistance.

Teachers must exercise their professional responsibility in ensuring that evidence submitted by a candidate is the candidate's own work.

The teacher must retain the candidate's work between assessment sessions.

Resources

There are no restrictions on the resources to which candidates may have access while producing their assignment.

Reasonable assistance

Candidates must undertake the assessment independently. However, reasonable assistance may be provided prior to the formal assessment process taking place. The term 'reasonable assistance' is used to try to balance the need for support with the need to avoid giving too much assistance. If any candidates require more than what is deemed to be 'reasonable assistance', they may not be ready for assessment or it may be that they have been entered for the wrong level of qualification.

The assignment must be carried out without interruption by periods of learning and teaching.

Candidates can seek clarification regarding the assessment task if they find it unclear. In this case, the clarification should normally be given to the whole class.

The teacher may give advice on the selection of an item to generate suitable evidence, ie it is appropriate for the teacher to remind candidates that their proposal from the assignment — design must allow them to demonstrate the skills required for the assignment — practical.

If a candidate is working on their assignment — design and is faced with more than one possible solution to a problem, then the teacher may explore options with them. The teacher and the candidate can discuss the pros and cons of each option, and the candidate can then decide on a solution based on the discussion.

Once candidates have submitted their completed assignment for assessment, it must not be changed by either the teacher or the candidate.

Evidence to be gathered

Each A3 sheet must be labelled with the candidate's name, Scottish Candidate Number and page number, for example page 1 of 7.

Volume

Candidates should present their work on a maximum of seven A3-sized sheets or equivalent. This includes a research pro forma sheet and a planning for manufacture pro forma sheet, which are issued annually with the assignment. Both sides of the research pro forma sheet may be used, all other sheets must be single-sided.

The above is given to indicate the volume of evidence required. No penalty will be applied.

Course assessment structure: assignment — practical

There are two linked assignments: design and practical.

Assignment — practical 45 marks

This assignment has 45 marks out of a total of 180 marks available for the course assessment. It assesses the application of practical skills to manufacture the proposal developed in the assignment — design.

The assignment — practical provides an opportunity to demonstrate the skills as listed in the 'Skills, knowledge and understanding for the course' table in this document. Marks are awarded as follows:

- measuring and marking-out (9 marks)
- using hand and machine tools (18 marks)
- assembling components (5 marks)

- finishing (9 marks)
- evaluating (4 marks)

Candidates should be fully prepared before being assessed, ie they should have gained the practical skills required and be aware of the requirements of the assessment.

Setting, conducting and marking the assignment — practical

The assignment is:

- set by SQA
- issued annually
- conducted under some supervision and control

Evidence is marked by centres and verified by SQA.

Assessment conditions

Time

Candidates generate evidence of their practical skills by manufacturing the proposal developed in their assignment. This evidence is produced over an extended period of time, allowing candidates to develop and refine their work before it is presented for assessment.

Supervision, control and authentication

Under some supervision and control means:

- Candidates do not need to be directly supervised at all times.
- The use of resources, including the internet, is not tightly prescribed.
- The work an individual candidate submits for assessment is their own.
- Teachers and lecturers can provide reasonable assistance.

These conditions do not overrule normal health and safety conditions that apply to workshop activities.

Teachers must exercise their professional responsibility in ensuring that evidence submitted by a candidate is the candidate's own work.

The teacher must retain the candidate's work between assessment sessions.

Resources

There are no restrictions on the resources to which candidates may have access while producing their work.

Reasonable assistance

Candidates must undertake the assessment independently. However, reasonable assistance may be provided prior to the formal assessment process taking place. The term 'reasonable

assistance' is used to try to balance the need for support with the need to avoid giving too much assistance. If any candidates require more than what is deemed to be 'reasonable assistance', they may not be ready for assessment or it may be that they have been entered for the wrong level of qualification.

The assignment must be carried out without interruption by periods of learning and teaching.
If a candidate is working on their assignment — practical and is faced with more than one possible solution to a problem, then the teacher may explore options with them. The teacher and the candidate can discuss the pros and cons of each option, and the candidate can then decide on a solution based on the discussion.

Once candidates have submitted their completed assignment for assessment, it must not be changed by either the teacher or the candidate.

Evidence to be gathered

A practical solution and a written evaluation of the solution.

Volume

There is no word count.

Grading

A candidate's overall grade is determined by their performance across the course assessment. The course assessment is graded A–D on the basis of the total mark for all course assessment components.

Grade description for C

For the award of grade C, candidates will typically have demonstrated successful performance in relation to the skills, knowledge and understanding for the course.

Grade description for A

For the award of grade A, candidates will typically have demonstrated a consistently high level of performance in relation to the skills, knowledge and understanding for the course.

Equality and inclusion

This course is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

For guidance on assessment arrangements for disabled candidates and/or those with additional support needs, please follow the link to the assessment arrangements web page: www.sqa.org.uk/assessmentarrangements.

Further information

The following reference documents provide useful information and background.

- National 5 Design and Manufacture subject page
- Assessment arrangements web page
- Building the Curriculum 3–5
- Design Principles for National Courses
- Guide to Assessment
- SCQF Framework and SCQF level descriptors
- SCQF Handbook
- SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work
- Coursework Authenticity: A Guide for Teachers and Lecturers
- Educational Research Reports
- SQA Guidelines on e-assessment for Schools
- SQA e-assessment web page

Appendix: course support notes

Introduction

These support notes are not mandatory. They provide advice and guidance to teachers and lecturers on approaches to delivering the course. They should be read in conjunction with this course specification and the specimen question paper and/or coursework.

Developing skills, knowledge and understanding

This section provides further advice and guidance about skills, knowledge and understanding that could be included in the course. Teachers and lecturers should refer to this course specification for the skills, knowledge and understanding for the course assessment. Course planners have considerable flexibility to select coherent contexts which will stimulate and challenge their candidates, offering both breadth and depth.

The following tables provide advice on developing the skills, knowledge and understanding required for this course, together with some suggested learning and teaching activities and approaches.

Design skills

Topic	Further advice on developing design skills	Activities and approaches
Analysing a brief: research	Candidates need key skills, knowledge and understanding before they can analyse a brief. Research alone does not produce successful analysis. The research needs to be focused to gather useful information that can be used to develop a specification. Candidates should develop the knowledge and understanding required to identify and research important issues to develop a specification. Candidates should develop the skills to use appropriate research techniques to gather information. Research should not be limited to desk research. Active research such as user trips, questionnaires, and measuring critical sizes should be encouraged as it can develop a better understanding of design issues as well as providing information. Research can often produce a large amount of unnecessary information. Candidates should be encouraged to select and identify information that will inform the development of their design proposal.	Candidates could: ♦ be provided with a design brief that requires specific information on function, aesthetics, performance, and target market ♦ complete class and individual activities to identify the aspects of a design brief that requires further research ♦ be provided with a range of design task and discuss the types of information required to ensure the development is successful ♦ participate a class/group discussion on different activities that could be used to research function, performance, target market, aesthetics and ergonomics during the design of products ♦ apply different research techniques, eg: — identify, measure, and record a number of critical sizes — write a short questionnaire — plan and carry out user trips on different products to identify important interactions, features, sizes, etc — use an online survey tool to create a questionnaire or rate a product against a design factor

Topic	Further advice on developing design skills	Activities and approaches
Analysing a brief: specification	The knowledge and understanding required to develop a specification underpins the whole design process. An informed specification is key in successfully developing a design proposal. It provides the information that can be used to direct, analyse and evaluate a design proposal. Using research to develop a specification requires specific skills, knowledge and understanding which should be developed during the course. Candidates should develop skills, knowledge and understanding in order to: ♦ identify important information to include in a specification ♦ provide specific statements to inform what the proposal has to do, be and have ♦ use a specification to develop a proposal ♦ appreciate the role of a specification in the design process	Candidates could: ♦ discuss the important role a specification plays in the development of a design proposal ♦ discuss what should be included in a specification and why it would be useful ♦ compare an effective specification and an ineffective specification ♦ analyse and discuss specifications for existing products ♦ write specifications using research provided ♦ use a given specification to evaluate products ♦ use a given specification to generate initial ideas or refine an idea ♦ write a design specification to be used by another member of the class
Generating ideas	Generating ideas requires specific thinking skills informed by knowledge and understanding of design. National 5 candidates are likely to require strategies and techniques to generate ideas. Candidates should: ♦ develop the thinking skills required to generate creative and original ideas ♦ appreciate that there are a range of alternative solutions to any given problem, situation or scenario	Candidates could: ♦ research and investigate alternative solutions to given problems ♦ suggest alternative uses for existing products ♦ focus on generating ideas by providing design briefs, specifications and research ♦ experiment with different techniques to generate ideas, ie: — use a morphological analysis matrix — organise and carry out a brainstorming session for a specific task

Topic	Further advice on developing design skills	Activities and approaches
	♦ apply techniques for generating ideas ♦ gain confidence in generating ideas Candidates should be encouraged to use different techniques for generating ideas. Sketching, drawing, and modelling are useful techniques for communicating ideas, but do not, by themselves, generate ideas.	— use inspiration boards such as lifestyle boards and mood boards — use nature or a theme as inspiration — draw a range of shapes for a product quickly using the 'taking your pencil for a walk' technique ♦ use models and sketches to generate initial ideas ♦ participate in timed activities to stimulate lots of quick, rough initial ideas
Use of modelling	Candidates must develop skills, knowledge and understanding to use modelling to develop design proposals. Candidates are not assessed on their practical skills when producing models. However, they should have the opportunity to develop modelling skills. Making models can improve candidates' exploration and refinement skills and overall understanding of the design process. Candidates should be encouraged to analyse, evaluate, modify, and adapt models at appropriate points during the development of a design proposal. Using models to develop a design proposal offers a range of benefits and should not be limited to a visualisation technique. Models bring a sense of reality to sketches and drawings. They promote exploration and refinement by providing opportunities to interact, test and evaluate theories. Candidates should develop good working practices for recording, saving and presenting modelling activities when developing their design proposals.	Candidates could: ♦ be guided through existing folios and exemplars to demonstrate how and why modelling has been used in the development of proposals ♦ discuss how different modelling types can be used during the development of design proposals ♦ watch demonstrations of practical modelling skills ♦ identify suitable modelling materials that shape and form in a similar way to the materials used in the design proposal ♦ practise making quick models from easily shaped and formed materials ♦ be set a design task or challenge to be completed solely using modelling ♦ practise analysing and altering models ♦ discuss in groups how using models improved their design work

Topic	Further advice on developing design skills	Activities and approaches
Use of graphics	Graphics is an integral part of the design process. It is required to visualise, explore, refine and inform the development of a design proposal. Specific graphic skills are required at different stages of the design process for different purposes. When used skilfully, graphics enhance the design process but they require time to develop. Graphic skills need to be developed sequentially. Basic sketching skills must be established before more complex drawing types, to generate, explore, and refine, can be developed. Practise does not always make perfect. Candidates need clear guidance and strategies to follow when developing graphic techniques. They also need to develop confidence to apply graphics quickly and freely when developing a design proposal. Candidates should not be too precious about their graphic work and should develop skills and techniques that allow for mistakes, experimentation, and exploration.	Candidates could: ♦ analyse the use of graphics in existing or exemplar folios ♦ break down graphic skills into stages, ie: — sketching 2D shapes — combining 2D shapes to construct complex shapes — sketching basic 3D forms — combining basic forms to create complex forms — sketching 3D objects in 2D and 3D objects in 2D ♦ complete timed sketching activities to encourage a quick, free approach to sketching ♦ create orthographic sketches of existing products ♦ be given graphic challenges to communicate specific information such as: — exploring aesthetics — refining ergonomics — assembly of parts — construction details — sizes and dimensions ♦ evaluate the graphic skills of their peers and provide feedback

Topic	Further advice on developing design skills	Activities and approaches
Developing ideas	Developing design ideas is split into two areas to provide a structure to this complex area of the design process. Candidates should develop the skills, knowledge and understanding to: ♦ explore an idea ♦ refine a design idea Exploration and refinement are interdependent and are likely to be approached concurrently. However, the focus and emphasis changes from exploration to refinement as the design process unfolds. Sketching, drawing and modelling, are useful skills that can be used to visualise, communicate, and analyse design work but cannot by themselves lead to exploration and refinement. Candidates need to have a good understanding of what they are trying to achieve from the development stage. This, in part, can come from a detailed specification. A detailed specification can also be used to evaluate a proposal's development and justify decisions taken during the development. Candidates should apply knowledge and understanding of design, materials and manufacture to explore and refine ideas. Candidates should apply knowledge and understanding gained from practical craft activities to develop a proposal that can be manufactured in their centre's workshop.	Candidates do not need to complete every part of the design process for every project set. For example, teachers or lecturers could: ♦ provide research, a specification and initial ideas; candidates can focus on exploring an idea and appreciate the benefit of thorough research and a detailed specification ♦ provide a concept that requires specific or focused refinement to meet a specification Teachers or lecturers could encourage exploration and refinement by introducing new challenges during the development of a proposal. For example, they could: ♦ introduce new materials during the development stage and explore how this influences and impacts on the design's performance and manufacture ♦ ask candidates to seek and explore different approaches and alternatives to the functional aspects of their design proposal ♦ change the target market during the development stage to allow candidates to appreciate and focus on how this impacts on their design's development Other possible activities and approaches include: ♦ Candidates could take a structured approach by listing important aspects of the idea being developed and exploring alternatives to each identified aspect.

Topic	Further advice on developing design skills	Activities and approaches
	Candidates may not have a large body of knowledge to draw on when developing design ideas and may require guidance or strategies in order to explore and refine their ideas. They should be encouraged to carry out additional investigation and research to inform the development of their proposals. Successful exploration requires confidence and resilience. Candidates should be encouraged to critique their design work, identify areas that require further exploration and resist the urge to correct rough work or re-do pages. Refinement should see the concept evolve into a realistic proposal. Successful refinement is likely to be the result of reflection, evaluation, adjustment and improvement to the design proposal. Refinement should focus more on materials, manufacture, construction, and assembly as the development draws to an end. The refinement of a design proposal should allow firm decisions to be made about sizes, materials, construction and manufacture.	♦ Candidates could be provided with a partially complete proposal that requires specific areas to be refined, eg ergonomics or manufacture. This would allow them to identify and develop the specific skills required to refine an idea such as working to scale, adjusting sizes and dimensions. ♦ Candidates could be encouraged to review and justify the changes and decisions taken during a development by: — discussing their design work with their peers — answering questions about their work — presenting their design work to the class ♦ Candidates could reflect on the impact that changes made during the exploration and refinement have on function, aesthetics, performance, market and ergonomics. ♦ Candidates could identify areas of further research, where necessary, to benefit their exploration process.

Topic	Further advice on developing design skills	Activities and approaches
Planning for manufacture	Planning is a complex activity that requires a breadth and depth of knowledge and understanding of each stage of the manufacturing process. Planning should not be completed retrospectively. Candidates should develop the skills, knowledge and understanding to: ♦ produce a dimensioned drawing or sketch ♦ break complex manufacturing tasks into single steps ♦ order manufacturing tasks into a logical sequence ♦ select the correct tools and machinery for different manufacturing tasks ♦ produce a cutting list	Teachers or lecturers could: ♦ walk through existing exemplar plans and evaluate their suitability ♦ provide an incomplete plan for manufacture to be completed by candidates Candidates could: ♦ explain to a peer how they are going to manufacture their next craft project ♦ produce a drawing or sketch with all the dimensions required to manufacture a proposal ♦ produce a cutting list from a given dimensioned sketch or drawing ♦ produce a plan for manufacture, to be used by S1 or S2 learners for a project ♦ produce a plan for manufacture for their own craft work

Practical skills

Topic	Further advice on developing practical skills	Activities and approaches
Measuring and marking-out	Candidates should develop the skills, knowledge and understanding to: ♦ gain confidence and independence when measuring and marking-out ♦ read and transfer information from drawings onto materials ♦ select appropriate measuring and marking-out tools ♦ use tools correctly and accurately ♦ review and evaluate accuracy	Candidates could: ♦ watch teacher or lecturer demonstrations covering selection and use of marking-out tools for wood, metal, and plastic ♦ mark-out their own proposals from dimensioned drawings or sketches ♦ mark-out a test piece or standard component from a dimensioned drawing on wood, metal and plastic ♦ mark-out another candidate's work from their dimensioned sketch or drawing ♦ check the accuracy of another candidate's marking-out
Using machine and hand tools	Candidates should develop the skills, knowledge and understanding to: ♦ gain confidence and independence when selecting and using machine and hand tools to cut and form materials ♦ enhance hand-eye co-ordination and manual dexterity ♦ reflect and evaluate on their selection of machine and hand tools ♦ set and adjust machine and hand tools to ensure safe and accurate cutting and shaping of materials ♦ improve the quality and accuracy of craft work	Candidates could: ♦ watch teacher or lecturer demonstrations covering the selection and use of hand and machine tools to cut, shape, and form wood, metal, and plastic ♦ manufacture their own proposal using appropriate hand tools and machinery ♦ manufacture test pieces, eg woodwork joints specified on the table on page 10 of this course specification — this covers a number of machine and hand tools to both measure and mark-out ♦ manufacture a standard component to be used in a design task — this provides a range of controlled learning and teaching opportunities covering a range of skills, knowledge, and understanding including: — using standard components — measuring and marking-out

Topic	Further advice on developing practical skills	Activities and approaches
		— using the wood lathe — safety checks (This activity could also be completed using the wood lathe, centre lathe, vacuum former or sand casting to create standard components.)
Assembling components	Candidates should develop the skills, knowledge and understanding to: ♦ gain confidence and independence when assembling components ♦ test and check accurate fit of component parts ♦ identify barriers to accurate assembly ♦ make adjustments and alterations to ensure accurate fit ♦ select and use tools to aid assembly ♦ use tools to check accuracy of assembly	Candidates could: ♦ watch teacher or lecturer demonstrations on assembly methods covering testing, checking, holding, and clamping ♦ assemble their own proposals using appropriate methods and tools to check, hold, and clamp ♦ help and assist other candidates to assemble their proposals ♦ assess the quality and accuracy of their own assembly
Finishing	Candidates should develop the skills, knowledge and understanding to: ♦ prepare surfaces for finishing ♦ select tools suitable for applying a finish ♦ apply and achieve a good quality finish ♦ assess the quality of their finish	Candidates could: ♦ watch teacher or lecturer demonstrations on preparing surfaces and applying finishes ♦ apply a finish to a poorly prepared surface and a well-prepared surface and compare the difference ♦ apply finishes to their own proposals ♦ assess the quality of finish of another candidate ♦ identify runs or brush marks and take steps to improve the finish ♦ assess the quality of their own finish by comparing it to the teacher or lecturer's examples

Topic	Further advice on developing practical skills	Activities and approaches
Evaluating	Candidates should develop the skills, knowledge and understanding to: ♦ evaluate the proposal using appropriate evaluation techniques ♦ select aspects that should be evaluated ♦ select appropriate evaluation techniques ♦ carry out evaluation ♦ record findings Candidates should use comparisons, user trials, and questionnaires to evaluate their proposals.	Candidates could: ♦ participate in a class discussion to identify the most appropriate methods to evaluate function, maintenance, safety, ease of use, and aesthetics of existing products ♦ evaluate the function, maintenance, safety, ease of use, and aesthetics of existing products ♦ participate in a class discussion to develop a strategy to evaluate their next piece of craft work ♦ use a specification, user trials, and questionnaire to evaluate their proposal

Knowledge and understanding

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Analysis of a brief	There are many methods of gathering information. Candidates should be familiar with different methods and be able to select methods appropriate to the type of information required. Candidates could use active research such as measuring, observing, visits, surveys, questionnaires, user trips, and desk research such as internet searches, books and journals. Candidates should be able to identify and describe the key stages of questionnaires and user trips. Candidates should develop and demonstrate knowledge and understanding of: ♦ appropriate methods of gathering data ♦ reasons for selecting research techniques ♦ key stages of questionnaires and user trips ♦ how and why a specification is used in the design process	Candidates could: ♦ be given a list of information required for a design proposal and asked to justify the most appropriate research method for gathering each piece of information ♦ write, trial, amend, carry out, analyse, and present a questionnaire ♦ plan and complete a user trip then record and present their findings ♦ describe the key stages of questionnaires and user trips ♦ discuss the role the specification plays during the development of a design proposal ♦ discuss the benefits of using a specification when developing a design proposal ♦ discuss the effect of a detailed specification on the design process compared with a vague specification ♦ discuss the implications of a poorly crafted specification ♦ complete a matching exercise to link reasons for selection with the research technique

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Idea-generation techniques	Candidates should be familiar with different techniques for generating ideas and the benefits of using them at different stages of the design process. Candidates should develop a detailed knowledge and understanding of morphological analysis and brainstorming, including their key stages.	Candidates could: ♦ analyse how techniques for generating ideas have been used in folios and exemplars ♦ discuss the merits of different techniques for generating ideas and how they could be used to generate or explore ideas during the design process ♦ discuss the key stages of brainstorming and morphological analysis, considering issues such as planning, preparation, conducting and recording information ♦ plan and carry out a brainstorming session and record and use information ♦ carry out morphological analysis and present information in a matrix ♦ describe the key stages of brainstorming and morphological analysis ♦ explain the purpose of the key stages of brainstorming and morphological analysis
Modelling in the design process	Candidates should develop and demonstrate knowledge and understanding of: ♦ how modelling could be used to generate and explore, test and refine, and communicate throughout the design process ♦ the benefits of modelling to generate and explore, test and refine, and communicate when developing a design proposal ♦ selecting and using sketch, scale, block and computer-generated models during the design process	Candidates could: ♦ analyse existing folios and exemplars to identify how models have been used and whether they have been effective in the development of the proposal — they should be shown effective and ineffective uses of models ♦ match suitable models to specific purposes ♦ list the type of information that could be gained from sketch, scale, block and computer-generated models

Topic	Further advice on developing knowledge and understanding	Activities and approaches
		♦ investigate how and why sketch, scale, block and computer-generated models are used during the design process ♦ identify and respond to questions on modelling in the design process in past papers and the specimen question paper ♦ write questions and sample answers on modelling in the design process to be answered by other candidates in the class
Graphics in the design process	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ how graphics could be used to generate and explore, test and refine, and communicate throughout the design process ♦ the benefits of using different graphics to generate and explore, test and refine, and communicate throughout the design process ♦ selecting and using different graphic techniques to generate and explore, test and refine, and communicate when developing a design proposal	Candidates could: ♦ analyse existing folios and exemplars to identify how graphics have been used and whether they have been effective in the development of the proposal — they should be shown effective and ineffective uses of graphics ♦ match graphic techniques with specific tasks during the design process ♦ discuss the benefits of using different graphic techniques, eg 2D and 3D sketching, orthographic drawings, CAD, presentation drawings ♦ identify and respond to questions on graphics in the design process in past papers and the specimen question paper ♦ write questions and sample answers on graphics in the design process to be answered by other candidates in the class

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Function	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ why function should be considered when designing products ♦ what influences the function of products ♦ influence and purpose of primary and secondary function	Candidates could: ♦ identify and investigate product failures relating to function ♦ evaluate an existing product's function ♦ discuss why function should be considered when designing products, covering issues such as competition, sales or consumer expectation ♦ analyse existing products and identify how function has influenced their aesthetics, ergonomics and materials ♦ investigate how the target market influences the function of products by comparing similar products aimed at different target markets ♦ analyse existing products to identify primary and secondary functions ♦ discuss the benefits and drawbacks of primary and secondary functions
Performance	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ why maintenance, safety, and fitness-for-purpose should be considered when designing products ♦ why life expectancy should be considered during the design of products ♦ how the design and manufacture of products is influenced by their life expectancy	Candidates could: ♦ identify and investigate product failures relating to maintenance, safety, and fitness-for-purpose ♦ analyse existing products to identify how maintenance, safety, and fitness-for-purpose have influenced their design ♦ evaluate an existing product's maintenance, safety, and fitness-for-purpose ♦ compare throwaway products with products with a long life expectancy (preferably the same type of product) and analyse the differences in function, performance, aesthetics, materials, manufacture, and impact on the environment

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Market	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ why the target market should be considered during the design of product ♦ how the target market influences the design of products ♦ how and why marketing influences the sale of products ♦ the benefits branding offers companies, retailers, and consumers ♦ technology push and its influence on products ♦ market pull and its influence on products	Candidates could: ♦ identify and investigate product failures connected to marketing ♦ analyse existing products and identify how target market has influenced their function, aesthetics, maintenance, safety ergonomics, and materials ♦ complete a matching exercise against profiles of people and existing products, eg cars ♦ discuss how changes in a product, its price, how it is promoted and advertised, and where it is sold could influence sales ♦ identify some global brands and discuss how branding has benefited the companies, considering issues such as advertising, reputation, market share, and sales ♦ discuss the benefits branding offers retailers and consumers, considering issues such as trust, confidence, and predictable sales
Aesthetics	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ what influences the aesthetics of products ♦ why aesthetics should be considered when designing products	Candidates could: ♦ identify and investigate product failures connected to aesthetics ♦ analyse and describe the aesthetics of products, considering form, proportion, colour, texture, and materials ♦ analyse existing products and identify what has influenced their aesthetics, considering issues such as target market, where it will be used, and fashion

Topic	Further advice on developing knowledge and understanding	Activities and approaches
		♦ investigate how the target market influences the aesthetics of products by comparing similar products aimed at different target markets ♦ discuss the importance of aesthetics when developing products, considering issues such as first impressions, appeal, competition, and sales
Ergonomics	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ how physiology, psychology, and anthropometrics influence the design of products ♦ why physiology, psychology, and anthropometrics should be considered when designing products ♦ how anthropometric data is used in the design of products ♦ what anthropometric data would be required to design products	Candidates could: ♦ carry out a user trial to identify important interactions and identify what human dimensions, movements, and percentile ranges would have been used ♦ analyse existing products to identify how physiology, psychology, and anthropometrics have been used to ensure they are safe, comfortable, and easy to use ♦ select anthropometric data required for a design task ♦ identify specific anthropometric data that would have been used to determine the size of items in the classroom, eg door, desk, seat
Uses of common materials	Candidates should develop knowledge and understanding of materials by developing and manufacturing their own design proposals. However, they should also be provided with other activities to ensure they develop the breadth and depth of knowledge that is assessed in the question paper. Candidates should develop their knowledge and understanding of the properties and uses of the materials specified in the table on page 6 of this course specification.	Candidates could: ♦ study a range of products that have been manufactured from the materials specified in the table on page 6 of this course specification — they could interact with or analyse the products before identifying and justifying the materials used to manufacture the products ♦ identify products that have been manufactured from each of the materials specified in the table on page 6 of this course specification and justify why they were suitable

Topic	Further advice on developing knowledge and understanding	Activities and approaches
	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ why specific materials have been used in the design and manufacture of products ♦ how materials influence products ♦ how to select suitable materials based on their properties and the requirements of the product ♦ suitable materials for injection moulding, rotational moulding, vacuum forming, sand casting and die casting	♦ study drawings and images of products and identify and justify the use of materials — additional information about the product may be required to allow reasoned justifications
People who influence design	Candidates should be able to identify what responsibilities designers, manufacturers, marketing teams, and consumers have during the design and manufacture of commercial products and understand why they would be involved in the design and manufacture of products. Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ how a designer, manufacturer, marketing teams, and consumers would influence the design and manufacture of commercial products ♦ why a designer, manufacturer, marketing team, and consumers would be consulted during the design process	Candidates could: ♦ participate in class discussions on the role of designers and manufacturers during the design process ♦ research how marketing teams and consumers influence the design of products

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Commercial manufacture	Candidates should develop their knowledge and understanding of the commercial manufacturing processes specified in the table on page 7 of this course specification. Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ why injection moulding, rotational moulding, vacuum forming, sand casting and die casting are used to manufacture products ♦ how to identify products that have been injection moulded, rotational moulded, vacuum formed, sand cast or die cast ♦ the benefits and drawbacks of CAM compared to other methods of manufacture ♦ what laser cutters are used for in the design and manufacture of products, eg use in modelling, use in CAM, type of product ♦ benefits and drawbacks of using laser cutters over traditional methods ♦ how 3D printers are used for in the design and manufacture of products eg modelling, prototyping, customised products, low volume production ♦ benefits offered by 3D printers compared to traditional modelling and manufacturing methods ♦ drawbacks of 3D printing compared to traditional modelling and manufacturing methods ♦ why knock-down fittings are used in the manufacture of products	Candidates could: ♦ study existing products that have been injection moulded, rotational moulded, vacuum formed, sand cast and die cast and discuss why the processes were suitable, considering issues such as product type, volume of production, form, costs, material, thinning, accuracy, and complexity ♦ participate in a teacher- or lecturer-led investigation of existing products to recognise the manufacturing features of injection moulding, rotational moulding and die casting, eg injection and ejection marks, flashing, material thickness, strengthening, form, draft angles, surface finish, and complexity ♦ watch a teacher or lecturer demonstration on patterns for vacuum forming or sand casting, considering issues such as suitable materials, radiused corners, draft angles, flat backed and vent hole (vacuum forming) ♦ study a range of products manufactured using injection moulding, rotational moulding, die casting, vacuum forming, and sand casting, and identify which process has been used ♦ photograph manufacturing features of each process ♦ compare the benefits of CAM to other methods of manufacture, considering issues such speed, accuracy, consistency, and efficiency ♦ investigate the drawbacks of using CAM, considering issues such as investment, training and flexibility ♦ identify products manufactured using laser cutters

Topic	Further advice on developing knowledge and understanding	Activities and approaches
	♦ why standard components are used in the manufacture of products ♦ mass and one-off manufacture	♦ discuss the benefits and drawbacks of using laser cutters, considering issues such as accuracy, fine cutting, cutting internal shapes, limited waste, speed, ability to etch and engrave, investment, limits on material and form (2D) ♦ investigate benefits and drawbacks of 3D printing compared to traditional modelling and manufacturing methods, eg no lead time, small production runs, flexibility, efficient creation of 3D forms, low set-up costs, no assembly, low volume production, limited materials, and time ♦ assemble a piece of flat-pack furniture and identify where and why knock-down fittings have been used, considering issues such as avoiding complex time-consuming joints, assembly, storage, and transportation ♦ identify standard components in existing products and discuss their use, considering issues such as reliability, affordability, flexibility, reduced research and development ♦ identify and compare mass-produced products with one-offs ♦ investigate the differences between mass and one-off manufacture, considering issues such as set-up costs, volume of production, types of products produced, work force, assembly lines, and standardisation

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Impact of design and manufacturing technologies	Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding of: ♦ how the supply of products has been impacted by design and manufacturing technologies ♦ how the workforce has changed due to design and manufacturing technologies ♦ the positive and negative impact design and manufacturing technologies have on energy production and consumption ♦ the positive and negative impact design and manufacturing technologies have on pollution Candidates should develop and demonstrate knowledge and understanding of: ♦ sustainable manufacture of products ♦ design of sustainable products	Candidates could: ♦ discuss how the supply of products has been impacted by design and manufacturing technologies considering issues such as consumer society, economy, increased leisure time, greater choice, and throwaway society ♦ discuss how the workforce has changed due to design and manufacturing technologies, eg less manual labour, change in skills required, loss of traditional skills, reduction in workforce ♦ discuss the impact design and manufacturing technologies have on energy consumption ♦ discuss the impact design and manufacturing technologies have on pollution ♦ investigate sustainable manufacture, considering issues such as material reduction, efficiency, pollution, design for disassembly, and use of recycled materials ♦ analyse what makes a sustainable product, considering issues such as impact on the environment, materials, life expectancy, sales, power source, and production methods

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Planning for manufacture	Candidates should plan the manufacture of their own proposals by presenting information on tools, dimensions, materials, and sequencing of tasks. However, they could be provided with other activities to ensure they develop the knowledge and understanding that is assessed in the question paper. Candidates could be provided with opportunities to develop and demonstrate knowledge and understanding to: ♦ split a complex practical activity into separate tasks ♦ order tasks into a logical sequence ♦ select machines and tools for a given practical activity or task	Candidates could: ♦ discuss in groups how to manufacture an existing piece of craft work ♦ study images of crafted products or their component parts and list the tools required for their manufacture ♦ discuss what information should be included on a working drawing ♦ create a sequence of operations or fill in the gaps of partially completed examples ♦ select, from a given bank, suitable tools and machines for each stage of a crafted products manufacture
Evaluation of products	Candidates should develop and demonstrate knowledge and understanding of why and how to use: ♦ comparisons to other products ♦ user trials ♦ comparison against specification ♦ questionnaires	Candidates could: ♦ discuss the information that could be gained by comparisons to other products, user trials, and questionnaires when evaluating products ♦ discuss the suitability of different evaluation techniques when evaluating function, maintenance, safety, ease of use, and aesthetics ♦ plan and carry out an evaluation of an existing product

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Tools for measuring and marking-out	Candidates should develop and demonstrate knowledge and understanding of: ♦ the tools used to measure and mark-out wood, metal, and plastic ♦ how and why tools should be used to measure and mark-out	Candidates could: ♦ be given the opportunity to practise: — naming and selecting tools required to measure, mark-out, cut and form wood, metal, and plastic — describing how machine and hand tools should be used to measure mark-out cut and form wood, metal, and plastic — explaining why machine and hand tools are suitable to measure, mark-out, cut and form wood, metal, and plastic ♦ plan and provide short lessons to a group of their peers ♦ record demonstrations and provide a written summary of what they recorded
Machine and hand tools for cutting and forming materials	Candidates should develop and demonstrate knowledge and understanding of: ♦ how and why machine and hand tools should be used to cut and form wood, metal, and plastic ♦ how to use, set, adjust, and check machine tools	
Assembling	Candidates should develop and demonstrate knowledge and understanding when: ♦ selecting and justifying joining methods specified in the table on pages 9 and 10 of this course specification ♦ identifying joining methods ♦ selecting and justifying tools for holding and cramping as specified in the table on page 10 of this course specification ♦ using formers and jigs	Candidates could: ♦ identify products that have used: — adhesives in their assembly, and justify their use — screws or nails or nuts and bolts in their assembly, and justify their use — mortice and tenon, or lap or rub, or halving or dowel, or rebate of housing in their assembly, and justify their use — pop-riveting in their assembly, and justify its use — welding in their assembly, and justify its use ♦ identify products that have been formed and assembled using formers and jigs ♦ discuss the benefits of using formers and jigs ♦ design a former or jig to be used to simplify a manufacturing task

Topic	Further advice on developing knowledge and understanding	Activities and approaches
Surface finishing	Candidates should develop and demonstrate knowledge and understanding of: ♦ how to prepare wood and metal surfaces before applying a finish ♦ how to achieve and apply a finish on wood, metal, or plastic ♦ benefits and drawbacks of different finishes ♦ appropriate finishes for wood, metals, and plastics ♦ what contributes to a poor finish	Candidates could: ♦ write instructions to be used by S1 learners on how to: — prepare wood and metal surfaces before applying a finish — finish the edges of metal or plastic — apply finishes ♦ identify products that have used the finishes specified in the table on page 10 of this course specification, and justify their use ♦ research how to apply finishes specified in the table on page 10 of this course specification ♦ watch their teacher or lecturer demonstrate the surface finishing techniques specified in the table on page 10 of this course specification ♦ investigate how finishes to existing products have been applied, and why they were suitable

Approaches to learning and teaching

The course is practical in nature and is intended to be delivered using a range of learning and teaching strategies to ensure all candidates are motivated, engaged and interested. Skills, knowledge and understanding should be developed through exploratory and experiential learning activities.

Teachers and lecturers should balance direct teaching and candidate-centred learning approaches. For example, providing skills-building activities linked to design-and-make tasks, or walking through existing design folios and discussing the skills, knowledge, and understanding required to successfully produce them, or analysing existing products before beginning a design activity.

The context in which the learning and teaching takes place is an important aspect of the course. Candidates should be given the opportunity to manufacture proposals which they have designed and develop proposals which they will manufacture. This approach allows candidates to see how the skills, knowledge and understanding of design are linked to the skills, knowledge and understanding of manufacture.

It is important that learning and teaching does not become repetitive. Activities and experiences should focus on developing and practising skills before they are applied to design and practical tasks. Going through the design-and-make process a number of times does not develop skills or improve knowledge and understanding. Teachers and lecturers should provide structured activities, such as those suggested in the tables above, to unpack the complex interrelationships that occur during the design process.

Teachers and lecturers should carefully monitor the level of support they provide to candidates throughout the course to ensure that each candidate develops skills, knowledge and understanding which they can later apply with independence. Candidates need more support and direction to gain new skills, knowledge and understanding or to apply skills, knowledge and understanding in new or unfamiliar contexts.

Teachers and lecturers should provide candidates with regular feedback about their performance and progression. They should make candidates aware of their strengths and weaknesses and provide them with strategies for improving and enhancing their performance.

Preparing for course assessment

Teachers and lecturers must ensure that their candidates are experiencing, exploring and engaging in activities that will develop the skills, knowledge and understanding required to respond to all course assessment components, ie:

- question paper
- assignment — design
- assignment — practical

Candidates should be given opportunities to practise activities similar to those they will encounter in the course assessment. Teachers and lecturers could develop tasks and questions similar to those in the specimen course assessment task and specimen question paper.

Knowledge and understanding alone does not guarantee success in the question paper. Teachers and lecturers should build in time throughout the course for candidates to practise good exam technique, eg:

- reading questions and identifying what the question is asking
- answering questions under timed conditions
- planning responses
- writing an appropriate amount in their responses

Developing skills for learning, skills for life and skills for work

Course planners should identify opportunities throughout the course for candidates to develop skills for learning, skills for life and skills for work.

Candidates should be aware of the skills they are developing and teachers and lecturers can provide advice on opportunities to practise and improve them.

SQA does not formally assess skills for learning, skills for life and skills for work.

There may also be opportunities to develop additional skills depending on approaches being used to deliver the course in each centre. This is for individual teachers and lecturers to manage.

Some examples of potential opportunities to practise or improve these skills are provided in the following table.

Skill		How to develop
2	**Numeracy**	
2.2	Money, time and measurement	♦ applying measuring and dimensioning techniques
4	**Employability, enterprise and citizenship**	
4.4	Enterprise	♦ working creatively to resolve design problems, co-operative working
5	**Thinking skills**	
5.2	Understanding	♦ describing techniques and their application ♦ describing the impact of design activities
5.3	Applying	♦ applying design knowledge and skills to simple problems in determining possible solutions
5.4	Analysing and evaluating	♦ evaluating the impact of design

Administrative information

Published: August 2019 (version 3.0)

History of changes to course specification

Version	Description of change	Date
2.0	Course support notes added as appendix.	September 2017
2.1	Minor changes to the 'skills, knowledge and understanding' section: ♦ where 'iron' is listed as a common material, this has changed to 'cast iron' ♦ where 'adhesives' are given as a joining method, this has expanded to read 'adhesives: PVA and epoxy resin'	September 2018
2.2	Reinserted 'iron' into the 'skills, knowledge and understanding' section.	September 2018
3.0	Clarification made to page 7 under the 'Impact of design and manufacturing technologies' heading in 'Skills, knowledge and understanding' section. 'The assignment must be carried out without interruption by periods of learning and teaching' added to 'Course assessment structure — assignment' and 'Course assessment structure — practical' sections. Submission information added to 'Evidence to be gathered' in 'Course assessment structure assignment — design' section. Page 40: course support notes appendix has been amended under 'Impact of design and manufacturing technologies' heading.	August 2019