Advanced Higher Design and Manufacture

Draft National Course Assessment Specification

This edition: December 2012, draft version 1.0

Please refer to the note of changes at the end of this Course Assessment Specification for details of changes from previous version (where applicable).

Contents

Course outline

Course title:	Advanced Higher Design and Manufacture
SCQF level:	7 (32 SCQF credit points)
Course code:	to be advised
Course assessment code:	to be advised

The purpose of the Course Assessment Specification is to ensure consistent and transparent assessment year on year. It describes the structure of the Course assessment and the mandatory skills, knowledge and understanding that will be assessed.

Course assessment structure

Component 1 — project	150 marks
Component 2 — question paper	100 marks
Total marks	**250 marks**

This Course includes eight SCQF credit points for 40 additional programmed hours to allow preparation for Course assessment. The Course assessment covers the added value of the Course.

Equality and inclusion

This Course Assessment Specification has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled learners and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html.

Guidance on inclusive approaches to delivery and assessment of this Course is provided in the *Course Support Notes*.

Assessment

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. Course assessment will provide the basis for grading attainment in the Course award.

Course assessment

SQA will produce and give instructions for the production and conduct of Course assessments based on the information provided in this document.

Added value

The purpose of the Course assessment is to assess added value of the Course as well as confirming attainment in the Course and providing a grade. The added value for the Course will address the key purposes and aims of the Course, as defined in the Course Rationale. It will do this by addressing one or more of breadth, challenge, or application.

To achieve success in the Course, learners must show that they are able to apply these to respond effectively to situations in both practical and theoretical design and manufacturing contexts.

In this Course assessment, added value will focus on the following:

- 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

Through the Design and Manufacture Units, the learner will develop a range of professional techniques and skills in the designing of products to satisfy needs and solve problems. These skills, partnered with underpinning knowledge and understanding of the design and production of commercial products, enables learners to undertake the requirements of the added value.

The added value will be assessed through a learner-generated design and manufacturing project and a question paper.

The project will require the learner to produce a designed solution to a realistic or actual commercial product design and development task. This will allow the learner to confirm their capabilities through challenge and application.

The question paper will require learners to demonstrate aspects of breadth and application in a graphic context, based on recognised professional approaches and principles in the commercial product design industries.

This will be achieved through:

- applying knowledge and understanding from across the Course to describe and explain professional design principles and practices
- applying knowledge and understanding from across the Course to describe, explain and justify the use of materials and commercial manufacturing processes

- applying knowledge and understanding from across the Course to comment on factors which influence design decisions and the impact of those decisions made
- applying skills and knowledge from across the Course to produce a design solution to a potentially complex problem

Grading

Course assessment will provide the basis for grading attainment in the Course award.

The Course assessment is graded A–D. The grade is determined on the basis of the total mark for all Course assessments together.

A learner's overall grade will be determined by their performance across the Course assessment.

Grade description for C
For the award of Grade C, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated successful performance in relation to the mandatory skills, knowledge and understanding for the Course.

Grade description for A
For the award of Grade A, learners will have demonstrated successful performance in all of the Units of the Course. In the Course assessment, learners will typically have demonstrated a consistently high level of performance in relation to the mandatory skills, knowledge and understanding for the Course.

Credit
To take account of the extended range of learning and teaching approaches, remediation, consolidation of learning and integration needed for preparation for external assessment, six SCQF credit points are available in Courses at National 5 and Higher, and eight SCQF credit points in Courses at Advanced Higher. These points will be awarded when a Grade D or better is achieved.

Structure and coverage of the Course assessment

The Course assessment will consist of two Components: a project and a question paper.

Component 1 — project
The purpose of the project is to assess the practical application of knowledge and skills to develop a solution to an appropriately challenging and complex design and manufacture task requiring challenge and application. It will assess the learner's skills in identifying opportunities to design and present solutions to satisfy perceived product needs, research target markets, visualise a range of solutions, test and critically evaluate the solution, and record the process.

The project will have 150 marks (60% of the total mark).

Time will be required for:

- preparation for the project, which could include establishing the brief and/or liaising with a partnered client
- defining the aims and objectives of the project, creating a project plan, identifying tasks and undertaking research activities and background reading
- creating a range of design proposals and synthesising towards a solution
- selecting and developing and refining a final design proposal
- evaluating the solution and the process
- presenting final design work
- recording the stages of the project and self-evaluation

Evidence will be produced through the learner's response to a self-generated brief or through a partnership arrangement.

Marks will be awarded for:

- Research and planning activities (10%)
- Application of the design process, including:
  - Developing and synthesising a range of concepts and design proposals (20%)
  - Communication though visualisation techniques and/or modelling, including manufacturing and materials (20%)
  - Evaluating the solution (20%)
- Recording the process and creating a client presentation (10%)

Component 2 — question paper
The purpose of the question paper is to assess learners' skills, knowledge and understanding they have acquired.

The question paper will have two Sections.

The question paper will have 100 marks (40% of the total mark).

The question paper will give learners an opportunity to:

- demonstrate their understanding of the design process in a commercial context
- demonstrate their understanding of materials and manufacturing processes

- comment on historic design influences in terms of technology, materials and manufacturing processes
- demonstrate their understanding of visualisation techniques and technologies and their application
- demonstrate reasoning ability by determining and applying design factors to specific design situations
- demonstrate an understanding of the influences and needs of markets and users
- comment on the impact of commercial design and manufacturing decisions on the environment and society

The question paper will consist of extended response questions and will give learners the opportunity to demonstrate the application of knowledge and understanding to answer questions by drawing on and applying knowledge and understanding from the table provided in the 'Further mandatory information on Course coverage' section at the end of this Course Assessment Specification.

Setting, conducting and marking of assessment

Question paper

The question paper will be set and marked by SQA, and conducted in centres under conditions specified for external examinations by SQA. Learners will complete the question paper in 2 hours.

Controlled assessment — project

The project is:

- set by centres within SQA guidelines
- conducted under some supervision and control

Evidence will be internally marked by centre staff in line with SQA marking instructions.

All marking will be quality assured by SQA.

Setting the assessment

SQA will provide guidance on the generation of a design and manufacture project brief. Learners will create, in negotiation with their teacher/lecturer, their own brief based on a realistic or actual product design need.

Conducting the assessment

The project will be carried out under open book conditions, but supervised to ensure that the work presented is the candidate's own work.

The teacher/lecturer may also give learners support and guidance to help them progress through each stage of the project; however, the learner is expected to work independently.

The project is designed to discriminate between candidates, and therefore would be expected to provide a wide range of marks. Stronger candidates should be able to complete the project successfully with minimal support and guidance. Weaker candidates may not be able to complete all aspects of the project to a satisfactory standard and so would achieve a lower total mark.

Further mandatory information on Course coverage

The following gives details of mandatory skills, knowledge and understanding for the Advanced Higher Design and Manufacture Course. Course assessment will involve sampling the skills, knowledge and understanding. This list of skills, knowledge and understanding also provides the basis for the assessment of the Units of the Course.

The Course assessment (project and question paper) will require learners to draw on and apply knowledge of any of the concepts listed below. This table should be read in conjunction with the descriptions of the project and the question paper.

The following gives details of the skills, knowledge and understanding.

Advanced Higher Design and Manufacture	
DESIGNING	
Market	Consumer demands, social expectations, niche marketing, branding, introduction of new products. Endorsements, product placement, product promotion, market trends, product life cycle. Product failures (reasons, results and corrections). Changing markets. Influence of politics and the economy. Methods of maintaining market share.
Product re-design	Reasons, alternatives, re-launch of products, product testing, identification of problems with existing products.
Aesthetics	Factors influencing aesthetics, influences of fashion, market trends, style.
Ergonomics	Anthropometrics, psychology, physiology. Use of percentiles, user interface, inclusive design, consumer safety.
Economics	Costs (fixed and variable), safety (British Standards, kite marks), market opportunity, intellectual property rights (confidentiality, patents, copyrights, design rights, trademarks, registered designs), value for money, production systems.
Conflict resolution	Resolution and balance between competing design issues during design and manufacture of products, eg function versus aesthetics, economics versus environment. Relationships between consumer, designer and manufacturer.
Evolution of products	The critical stages, and the historical development and impact of: materials and manufacturing technologies, socio-economics, fashion and style, and influential designers and design movements.

Environmental		Sustainability in manufacture, use and re-use, packaging. Climate change, carbon footprints, sustainable resources, mass production and efficiency, green design, government policy, recycling, consumer awareness/changing attitudes.
Visualisation	Graphic techniques	Annotated sketches, working drawings, pictorial views exploded views, dimensioned views, illustration techniques, computer-aided graphics, and use of scale. The role of graphics in the design process. Use of graphic techniques to develop and communicate ideas. Orthographic drawing (elevation, end elevation, plan, outline, hidden detail, centre-line, dimensioning, section, hatch lines — all to BS conventions). Detail in drawings (wall thicknesses, fillet radii, rib details).
	Modelling	Scale models, mock-ups, fully crafted prototypes, test models, computer generated models, part-product models, simulations, rapid prototyping. Use of appropriate modelling materials such as paper, card, corrugated card, MDF, wire, pipe cleaners, foam, clay, modelling putty, balsa wood, expanded foam, sheet plastic, construction kits. The role of modelling in the design process. Application of modelling techniques to develop and communicate ideas. Detail, progression of models.
	Presenting design responses	Justification, iteration and testing
MANUFACTURING		
Materials	Plastics	Polythene (high and low density), polyvinyl chloride, polystyrene, nylon, cellulose acetate, acrylic, polypropylene, ABS, epoxy resin, melamine formaldehyde, urea formaldehyde, polyester resin, glass-reinforced plastic, carbon-fibre plastics, elastomers.
	Biodegradable polymers	Bio-degradable polymers (bio-batch), compostable polymers — corn starch-based, eg Polyactide (PLA). Applications for biodegradable polymers, eg carrier bags, plastic bottles and detergent sachets.
	Composites	Fibre reinforced polymers, GRP, Kevlar, carbon fibre.

	Metals	Mild steel, high carbon steel, stainless steel, cast iron, brass, bronze, duralumin, aluminium, copper, tin, lead, zinc.
	Woods	Beech, oak, ash, mahogany, teak, walnut, balsa, Scots pine, red cedar, parana pine, spruce.
	Timber derivatives	Manufactured boards (medium density fibreboard, plywood, block-board, chipboard, hardboard), veneer.
Identification of materials		Colour, surface texture, weight, properties, labelling and symbols.
Processes	Metals	Turning, milling, die-casting, pressing, stamping, punching, joining (spot welding, arc welding, riveting, adhesives, fitted joints, bolts, screws, patent devices), sand casting, casting, piercing and blanking, forging, finishing.
	Plastics	Injection-moulding, extrusion, rotational moulding, vacuum-forming, blow-moulding, laminating, joining, compression moulding, finishing.
	Wood	Turning, routing, spindle moulding, laminating, jointing, finishing, vacuum pressing/forming, steam bending.
	Composites	Benefits of composite materials. Carbon fibre, Kevlar based materials, glass reinforced plastics, engineered woods and materials, wood plastic composites,
Joining processes		Permanent, semi-permanent, temporary, adhesive bonding.
Identification of processes		Form, material, split lines, injection points, ejector points, shrinkage, draft angle, intricate form, clean and precise, flash, thinning of sheet material at corners, shear marks, cross-section over length, surface texture.
Production systems		One-off, batch, mass, line, flow. Gantt charts, flow charts, project planning, JIT, jigs, patterns, standard components, CAD/CAM, CNC machining. Quality control, quality assurance.
Functional analysis of products		Assembly methods, wall thicknesses, ribs, material testing.
Advances in materials and technology		Thermo-chromic pigments and films, phosphorescent pigments, shape memory alloys, piezoelectric devices, fibre optics, liquid crystal displays, genetic modification of woods, biodegradable plastics.

Production technology and scheduling processes	Benefits to designer of: CAD, CAM, CNC, stereo and technology lithography, 3D scanning, quick change injection moulding techniques, Quick Response Manufacturing (QRM), Electronic Point Of Sale (EPOS). Flexible Manufacturing Systems (FMS), miniaturisation.
Advances in communication	In supporting design activities, the uses and benefits of: e-mail, video conferencing, virtual reality, file sharing, mobile and touch screen interaction, storage, network access.
CAM processing	CNC — laser cutters and engravers, multi-axis routers and mills, plotter cutters, lathes, 3D printing, fusion deposition or stereo lithographic modelling. Additive and subtractive manufacturing/modelling.

Administrative information

Published: December 2012 (draft version 1.0)

Superclass: to be advised

History of changes

Course details	Version	Description of change	Authorised by	Date