

PRODUCT DESIGN
Advanced Higher

Second edition - January 2009

**NOTE OF CHANGES TO ADVANCED HIGHER ARRANGEMENTS
SECOND EDITION PUBLISHED JANUARY 2009**

COURSE TITLE: Product Design (Advanced Higher)

COURSE NUMBER: C211 13

NATIONAL COURSE SPECIFICATION:

Course Details: Course content clarified

Administrative Information

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National Course Specification

PRODUCT DESIGN (Advanced Higher)

COURSE NUMBER C211 13

COURSE STRUCTURE

This course comprises three mandatory units as follows:

<i>D130 13</i>	<i>Product Design Analysis (Advanced Higher)</i>	<i>1 credit (40 hours)</i>
<i>D131 13</i>	<i>Product Development (Advanced Higher)</i>	<i>1 credit (40 hours)</i>
<i>D129 13</i>	<i>Design Case Study (Advanced Higher)</i>	<i>1 credit (40 hours)</i>

These units can be studied sequentially or concurrently.

In common with all courses, this course includes 40 hours over and above the 120 hours for the component units. This may be used for induction, extending the range of learning and teaching approaches, support, consolidation, integration of learning, and preparation for external assessment. This time is an important element of the course and advice on its use is included in the course details.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained the following or equivalent:

- ◆ Higher Craft and Design at grade A or B.
- ◆ Higher Product Design at grade A or B.

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National Course Specification: (cont)

COURSE Product Design (Advanced Higher)

CORE SKILLS

This Course gives automatic certification of the following:

Complete Core Skill for the Course Problem Solving at Higher

CREDIT VALUE

The Advanced Higher Course in Product Design is allocated 32 SCQF credit points at SCQF level 7.

SCQF points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

RATIONALE

The Advanced Higher Product Design course has been designed to be taught as a two-year course incorporating Higher Product Design. To reinforce continuity and progression, units are considered sequential through Higher to Advanced Higher.

In both industry and society, the pace of change is increasing, and will continue to do so. New materials, processes and practices, as well as techniques and technology have had, and will continue to have a major impact on society, economics and the environment.

The course is experiential in nature. It is firmly focused on the process of design, development and manufacture, offering candidates opportunities to develop confidence, skills and abilities which will serve them well in later life. The course also develops appreciation of the consequences of technological development, manufacturing processes and the complexity of making design decisions.

The learning for design for manufacture is explored within the context of commercial and industrial environments with creative aspects being fostered by generating ideas and creating resolutions to design briefs, using various design techniques and approaches. Technological aspects of the course are derived from developing, analysing and evaluating products.

Candidates are encouraged to adopt a broad outlook to design and it is recognised that other subject areas may have a role to play in the development and acquisition of relevant knowledge and skills.

The course aims to:

- foster understanding of the designing process in commercial and industrial contexts
- develop awareness of the factors which influence design
- enhance knowledge of industrial manufacturing processes
- heighten awareness of economic considerations and the social implications of design
- develop visual awareness associated with requirements for user interface and product detailing
- contribute to personal development, in particular to all aspects of technological capability through reflective practice (*Technology Education for Secondary Schools, SCCC 1996*)
- develop economic and social awareness of the implications of design through an increased emphasis on commercial and industrial production (*Effective Learning and Teaching in Scottish Secondary Schools, HMI, September 1999*)

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

The Advanced Higher builds on the Higher to provide a greater depth of knowledge, understanding and capability in the subject area. This is aided by the practical application of what has been studied, which serves to consolidate and extend learning. Candidates are expected to take responsibility for their own learning and development, and take the lead in carrying out tasks with lecturers/teachers facilitating learning and providing support.

COURSE CONTENT

The Course builds on the experience, knowledge and skills which candidates will have acquired in the Higher Product Design Course.

As with Higher, the Advanced Higher Course content can be broken down into three main sections: designing, communicating and manufacturing. The following lists detail the Course content for Higher with the **Advanced Higher content is in bold**. It should be noted the Higher Product Design content is also liable for testing at Advanced Higher.

Centres must ensure that the content is covered over the duration of the Course. All areas of the Course content will be open for sampling in the Course assessment.

DESIGNING

Candidates should have knowledge and understanding of the design process as applied to commercial products. They should be able to apply this knowledge and understanding to produce potential solutions to complex design tasks.

Candidates should be able to carry out detailed analysis of existing products, identify development opportunities and produce proposals for improvements to the products.

Candidates should have an understanding of the commercial aspects of design.

Candidates should also have knowledge and understanding of the issues which affect the design and manufacture of commercial products. They should understand the relationships between these issues and the need for compromise when designing commercial products.

Candidates should understand the critical stages which affect the evolution of products.

Candidates should have knowledge of the historical development of products and how it has been influenced by people, movements and technology.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Members of a design team:	Designers, market researchers, accountants, engineers, manufacturers. Relationships between team members. Types of teams. In-house v consultants.
Problem identification:	Situation analysis, product evaluation.
Brief:	Purpose, statement of problem, target market.
Research:	Sources of recorded and non-recorded information, methods of gathering information. Analysis, application and presentation of researched material.
Specification:	Types and purpose of specifications: brief, product design specification, performance specification, marketing specification and technical specification. Application of researched material to produce a product design specification.
Idea generation:	Morphological analysis, thought showers, technology transfer, analogy, lateral thinking. Application of idea generation techniques.
Development and refinement of ideas:	Application of knowledge and understanding, synthesis of ideas. Justification and recording of decisions taken. Presentation techniques. Modelling techniques.
Evaluation:	Surveys, questionnaires, user trips/trials, observation, testing, test rigs, comparison to other products, comparison to specification. Application of evaluation techniques, presentation of results.
Function:	Primary and secondary functions, fitness for purpose.
Performance:	Planned obsolescence, value for money, ease of maintenance, environmental concerns. Materials and manufacturing processes.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

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 redesign:	Reasons, alternatives, relaunch 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.
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 v aesthetics, economics v environment. Relationships between consumer, designer and manufacturer.
Evolution of products:	Critical stages and decisions, historical developments and context.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Environmental Concerns: Sustainability, manufacture, use, disposal, legislation, packaging. Climate change, carbon footprints, sustainable resources, mass production, efficiency, green design, government policy, recycling, consumer awareness / changing attitudes.

COMMUNICATING

Candidates should be able to produce high quality graphics and apply a range of graphic techniques. **Candidates should be able to select and apply appropriate graphic techniques to clearly communicate the development of design proposals.**

Candidates should be able to produce a range of quality models by applying practical skills and using a range of techniques and materials. **Candidates should be able to select and apply appropriate modelling techniques to develop and communicate design proposals.**

Graphic techniques: Annotated sketches, working drawings, isometric, oblique, one point and two point perspective, exploded views, dimensioned views, illustration techniques, computer aided graphics, 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).**

Range of modelling techniques and materials: 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, plasticine, 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.**

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

MANUFACTURING

Candidates should be able to demonstrate **detailed** knowledge of materials used in the commercial manufacture of products. They should be able to demonstrate **detailed** knowledge of the characteristics of materials which make them suitable for producing particular products.

They should be able to identify materials used in existing products and apply their knowledge of materials to the design of new products. **They should be able to identify the materials by inspection and testing.**

Candidates should be able to give detailed descriptions of a range of products and justify the materials used in their manufacture. It should be noted that candidates may refer to materials outside of the list given providing the material has appropriate characteristics for the intended use.

Candidates should be able to demonstrate detailed knowledge of the principles of processes used in the commercial manufacture of products. They should be able to demonstrate **detailed** knowledge of suitable processes for producing particular products. They should be able to identify processes used in existing products and apply their knowledge of processes to the design of new products.

Candidates should be able to give detailed descriptions of a range of products and justify the processes used in their manufacture.

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.
Metals:	Mild steel, high carbon steel, stainless steel, high-speed 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, blockboard, chipboard, hardboard), veneer.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Identification of materials:	Colour, surface texture, weight, properties, labelling and symbols.
Plastic processes:	Injection-moulding, extrusion, rotational moulding, vacuum-forming, blow-moulding, laminating, joining, compression moulding, finishing.
Metal processes:	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.
Wood processes:	Turning, routing, spindle moulding, laminating, jointing, finishing.
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:	Benefits of composite materials. Thermochromic pigments and films, phosphorescent pigments, shape memory alloys, piezoelectric devices, fibre optics, liquid crystal displays, genetic modification of woods, biodegradable plastics.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Advances in technology:

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). Kanban, Flexible Manufacturing Systems (FMS), e-mail, video conferencing, miniaturisation.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

COURSE CONTENT

Summary of the outcomes

Unit Product Design Analysis (Advanced Higher)

- Analyse the performance of a commercial product.
- Analyse the production of a commercial product.

Unit Product Development (Advanced Higher)

- Identify a development need within an existing commercial product.
- Produce a design solution to meet the specification and satisfy the brief.
- Produce outline proposals for the commercial manufacture of the design solution.

Unit Design Case Study (Advanced Higher)

- Investigate the development of design in a commercial product.
- Evaluate the factors which may influence the future development of the product.

The extra 40 hours associated with the course will be used to prepare for the external assessment examination paper and extended case study.

Summary of units

Unit Product Design Analysis

This unit is closely linked to the ‘Product Development’ unit and it should be noted that the same product can be used as the focus in both units. Candidates will carry out an analysis of the performance and production of a commercial product. Candidates should consider the design of a chosen product and record its functional requirements, operation and use. Candidates should also consider consequences of the product in terms of environmental impact, influence on society, ethics, aesthetics, user interface, and economic and technical issues. Materials, manufacturing techniques and assembly procedures should be thoroughly investigated, as should the aesthetic qualities of the product.

Unit Product Development

This unit is devoted to identifying, developing and outlining a manufacturing proposal. This work follows on from the Product Design Analysis unit and can be focused on the same product. Candidates should consider the design of an aspect of a product and develop a solution to meet the design opportunity identified. Candidates should consider modifications to the product in terms of the various requirements of clients; users; manufacturers; environmental audits; market response; technical, technological and material science advances, competition, user interface, form and product detailing etc. In

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

developing a solution, considerable research, development and testing will be required, and all decisions taken and proposals suggestions will have to be justified. Candidates are expected to prepare a 'worked up' design proposal for the development and/or modification as defined by the requirements of their specification and brief.

Unit Design Case Study

This unit should provide a logical conclusion to the course and allow the candidates to consolidate and extend learning gained at Higher and from the previous two units of the course.

Candidates will select a commercial product, explore and evaluate its evolution prior to evaluating the factors which may influence its future development. Typically a candidate would explore the historical development of a product through some kind of timeline, highlighting critical stages in its development (such as new technologies and advances in materials) and show how design decisions might have been made. From here, candidates then explore and evaluate future possible development of the product the context of advances in materials and manufacturing processes, environmental issues and sociological factors. This would require the candidates to carry out research and to project current developments into the future.

Candidates would be expected to present the work for this unit as a portfolio of evidence. The depth of treatment and range of content should reflect those of the previous two units of the course.

ASSESSMENT

To gain a course award, candidates must pass all the unit assessments as well as the external assessment. External assessment will provide the basis for grading attainment in the course award.

When the units are taken as component parts of a course, candidates will have the opportunity to incorporate knowledge, understanding and capability across component units, practice these skills and extend them in different contexts, integrating theory with practice. They will therefore achieve performance beyond that required to attain the unit outcomes. This is described in greater detail in the grade descriptions for the course. Such attainment will, where appropriate, be able to be recorded and used to contribute towards course estimates and to provide evidence for appeals.

Further information on the key principles of assessment is provided in the paper *Assessment*, (HSDU, 1996) and in *Managing Assessment*, (HSDU, 1998).

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

DETAILS OF THE INSTRUMENTS FOR EXTERNAL ASSESSMENT

External assessment consists of:

- 1 a written examination paper, externally set and marked
- 2 an Extended Case Study, externally marked

To gain the award of the course, a candidate must achieve all the component units of the course as well as the external assessment. External assessment will provide the basis for grading attainment in the course award. The external instruments of assessment for this course are:

Examination paper (100 marks)

A written paper to test knowledge, understanding and skills in the design process used in the production of commercial products. This paper will be of three hours duration.

Candidates will be presented with questions, which test knowledge, understanding and skills related to the outcomes of the course. The marks allocated to each question will be shown. Options may be available within some questions.

Extended Case Study (150 marks)

An extended portfolio of work produced in response to the Product Design Case Study will be externally assessed to determine the level of course achievement. A guide to assessment will provide assessment criteria, specifications and other details for the instrument of assessment.

GRADE DESCRIPTIONS

The grade of an award will be based on the total score obtained from the two external instruments of assessment, that is the exam and Extended Case Study. The descriptions below indicate the nature of the achievement which is required for the award of a Grade C and a Grade A in the course assessment.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Grade C

For performance at Grade C, the students should be able to:

- use appropriate knowledge, understanding and skills to analysing the design of a commercially manufactured product
- apply the principles of design to identifying and developing an opportunity within a commercially manufactured product
- demonstrate user needs awareness and due consideration to the use of suitable materials and appropriate manufacturing processes
- conducted an appraisal resulting in a development proposal for an aspect of a commercially manufactured product.

Grade A

For performance at Grade A, the students should be able to:

- use a wide range of appropriate knowledge, thorough understanding and high level skills to analysing the design of a commercially manufactured product
- comprehensively apply the principles of design to fully identifying and methodically developing an opportunity within a commercially manufactured product
- demonstrate a high degree of user needs awareness and extensive consideration to the use of suitable materials and appropriate manufacturing processes
- conducted an in-depth appraisal resulting in a innovative development proposal for an aspect of a commercially manufactured.

APPROACHES TO LEARNING AND TEACHING

Further advice and information is available from:

- support materials for each course
- appropriate learning and teaching approaches
- core skills as they relate to the subject
- assessment
- ensuring appropriate access for candidates with special educational needs

Approaches to learning and teaching for Product Design Analysis (Advanced Higher)

The selection of a suitable product is initially made by the candidate, pending approval by the teacher/lecturer. The chosen product must be capable of addressing all the performance criteria of the unit. The chosen product in this unit may require to be tested to destruction. A product should be available to candidates for this purpose.

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

Candidates may analyse identical products or can select individual projects in which they have a specific interest. In the latter case, the teacher/lecturer must ensure that what is proposed can be completed within the time allocation, including a contribution from outwith the classroom, and that it is at an appropriate level for Advanced Higher.

A detailed product analysis should be conducted to allow the candidate to provide a full technical explanation of how the product functions, in terms of operation and user interface.

The construction and assembly of the product should be illustrated and described fully, and the materials, processes and design decisions analysed. This will provide the candidate with information on which to base their reasoned arguments and value judgements on the outcome of their decisions.

The Product Design Analysis will require candidates to:

- employ a range of user tests and evaluation strategies
- evaluate a range of alternative key materials and processes
- investigate approaches to minimising the number of components, material waste, environmental damage etc
- investigate a range of visual issues related to the user interface, product detailing, and product form

The use of a database to record and interrogate findings and conclusions for research purposes should be encouraged. Use of consumer, trade and professional magazines, the internet, and CD ROMs should be encouraged as a valuable source of information. Some development of graphic skills may be necessary to compile the drawings for the product and its various components. Time for this is available in the extra 40 hours allocated to preparation for external assessment.

Approaches to learning and teaching for Product Development (Advanced Higher)

The candidate's proposal for the development of a product, component, modification or extension must provide appropriate content for the 40 hours allocated to it. Negotiation with the teacher/lecturer should take into account the feasibility within the timescale and required rigour and depth to allow the candidate to demonstrate visual and technological capability. The justification for the proposal may be established before designing starts. Some information for this could come from the unit Product Design Analysis.

The performance evidence for this will be expected to contain a detailed design specification and identification of product priorities ie what the product must do, should do, and could do. Performance evidence should also contain a comprehensive investigation resulting in a range of alternative ideas, the most promising of which will show clear evidence of detailed design development. Appropriate model making and visualisation techniques should be used at various stages throughout the redesign and

National Course Specification: course details (cont)

COURSE Product Design (Advanced Higher)

evidence of their use recorded in the folio. Evidence will be required to show the investigation of materials and manufacturing processes, and interface and product detailing considered for the solution. All testing procedures with results should be recorded.

The final presentation of performance evidence should contain enough detail to allow a business to establish the basis for commercial manufacture. To do this, a candidate will need to show how all visual, functional, user and environmental criteria defined in the design specification has been prioritised and synthesised into a product.

Approaches to Learning and Teaching for Design Case Study (Advanced Higher)

Candidates will produce a design case study portfolio that investigates the development of a commercial product and evaluates factors that may influence future development of the product. It will explain and illustrate the design development of a product or range of products. The case study will show the required depth of knowledge of all aspects of product design from historical inception to commercial manufacture and future influences.

Candidates should investigate and reflect on the influence of advances in materials, socio-economic factors that may impinge on manufacturing technologies and future development, processes and production techniques. Environmental considerations, including auditing of economic and technical constraints, market requirements, supplier capabilities, client needs and user responses, should be explored in depth. The impact on the user interface when investigating visual criteria such as colour, texture, form, scale and proportions should be assessed and opinions justified.

Candidates are expected to extend the work in this unit into a the course work component of the external assessment, that is, the Extended Case Study. This should provided candidates with an opportunity, freedom and scope to explore the development of an advanced concept product proposal in an area of interest, appeal or expertise to them.

SPECIAL NEEDS

This Course Specification is intended to ensure that there are no artificial barriers to learning or assessment. Special needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance on Special Assessment Arrangements* (SQA, September, 2003).

National Unit Specification: general information

UNIT Product Design Analysis (Advanced Higher)

NUMBER D130 13

COURSE Product Design (Advanced Higher)

SUMMARY

This is a component unit of Advanced Higher: Product Design.

Candidates will analyse the design and manufacture of a commercial product.

OUTCOMES

- 1 Analyse the performance of a commercial product.
- 2 Analyse the production of a commercial product.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained Higher: Product Design or equivalent at grade A or B.

CREDIT VALUE

1 credit at Advanced Higher (8 SCQF credit points at SCQF level 7*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

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National Unit Specification: general information (cont)

UNIT Product Design Analysis (Advanced Higher)

CORE SKILLS

This unit gives automatic certification of the following:

Complete core skills for the unit	None	
Core skills components for the unit	Critical Thinking	Higher

National Unit Specification: statement of standards

UNIT Product Design Analysis (Advanced Higher)

OUTCOME 1

Analyse the performance of a commercial product.

Performance criteria

- (a) The functional requirements of the product are fully investigated.
- (b) The operation and use of the product is clearly described.
- (c) The aesthetic characteristics of the product are clearly explained and illustrated.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can analyse the performance of a product as defined in PCs (a) to (c).

OUTCOME 2

Analyse the production of a commercial product.

Performance criteria

- (a) The main component materials are correctly identified and their suitability justified.
- (b) The manufacturing processes of the main components are correctly identified.
- (c) The assembly of the main components is clearly described.
- (d) The relationship between the function, form, material and manufacturing processes of the commercial product is evaluated.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can analyse the production of a commercial product as defined in PCs (a) to (d).

National Unit Specification: support notes

UNIT Product Design Analysis (Advanced Higher)

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

Building on prior knowledge and understanding gained at Higher, the analysis in this unit places responsibility on the candidate to become fully conversant with the function, form, aesthetics, user interface, construction and manufacture of a commercial product. Further research of materials and production techniques will be resource-based.

The chosen product must be capable of addressing all the performance criteria of the unit. The chosen product in this unit may require to be tested to destruction. A product should be available to candidates for this purpose. It should be ensured that products chosen for study should have the potential, complexity and scope to be investigated at the level of the course and teacher/lectures will need to emphasise appropriate nature of products to be chosen.

GUIDANCE ON TEACHING AND LEARNING APPROACHES FOR THIS UNIT

This is a candidate-led activity. Teacher/lecturer input should be minimal and concerned mainly with facilitating learning, supporting progress, advising on time management and ensuring quality in standards. Input will be required to extend the candidate's knowledge of various research methods, user trials and reliable evaluative strategies and investigative techniques. Further exploration of certain terms may lead to a deeper understanding of the design decisions and complexity of factors influencing outcomes of design activity.

No restriction is being placed on the type of product which is suitable for analysis other than it should offer the opportunity to extend the work of the studies undertaken in Higher Product Design. It must also satisfy the rigour expected of the allocation of time. Appropriate use of databases, the internet, consumer, trade and professional magazines and CD-ROMs should be positively supported.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

A portfolio of work should record all the evidence of the analysis in this unit. This will provide the performance evidence across all the outcomes and should include a variety of sources such as tests, reports, notes, sketches, drawings, photographs, and digital media.

National Unit Specification: general information

UNIT Product Development (Advanced Higher)

NUMBER D131 13

COURSE Product Design (Advanced Higher)

SUMMARY

This is a component unit of Advanced Higher: Product Design.

Develop an aspect of a commercial product.

OUTCOMES

- 1 Identify a development opportunity within an existing commercial product.
- 2 Produce a design solution to meet the specification and satisfy the brief.
- 3 Produce outline proposals for the commercial manufacture of the design solution.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained Higher: Product Design or equivalent at grade A or B.

CREDIT VALUE

1 credit at Advanced Higher (8 SCQF credit points at SCQF level 7*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

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National Unit Specification: general information (cont)

UNIT Product Development (Advanced Higher)

CORE SKILLS

This unit gives automatic certification of the following:

Complete core skills for the unit Problem Solving Higher

Core skills components for the unit None

National Unit Specification: statement of standards

UNIT Product Development (Advanced Higher)

OUTCOME 1

Identify a development opportunity within an existing commercial product.

Performance criteria

- (a) Key areas of need are established.
- (b) A brief is produced for the proposed development.
- (c) A comprehensive specification is compiled which clearly relates to the proposed development.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can identify a development opportunity within an existing commercial product as defined in PCs (a) to (c).

OUTCOME 2

Produce a design solution to meet the specification and satisfy the brief.

Performance criteria

- (a) A range of concepts is generated which seek to satisfy the brief.
- (b) Concepts are synthesised towards a solution.
- (c) Decisions taken are justified with reference to the specification.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can produce a design solution to meet the specification and satisfy the brief as defined in PCs (a) to (c).

OUTCOME 3

Produce outline proposals for the commercial manufacture of the design solution.

- (a) Appropriate drawings of the solution are produced.
- (b) Appropriate manufacturing processes are selected and justified.
- (c) The selection of materials is reasoned and justified.
- (d) Aesthetic characteristics are appropriately illustrated and described.
- (e) The user interface is effectively demonstrated.

National Unit Specification: statement of standards

UNIT Product Development (Advanced Higher)

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can produce outline proposals for the commercial manufacture of the design solution as defined in PCs (a) to (e).

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

The purpose of this unit is to focus the candidate's attention on a development opportunity within an existing product through applying the design process in a commercial context. The unit offers scope for creativeness and innovation as well as the opportunity to address design development issues. The need for innovation, initiative and attention to detail reflects the reality of designing, and the development of these attributes will be useful preparation for the commercial world of work and higher education.

GUIDANCE ON TEACHING AND LEARNING APPROACHES FOR THIS UNIT

The work of this unit should be recorded in a folio started during the unit Product Design Analysis. While analysing the product in Product Design Analysis, the candidate should have been thinking of how the product might be improved, modified, made more adaptable, used in another situation or with some other attachment, or other ideas. The candidate should now resolve the design specification, explore a range of alternative concepts in order to arrive at a design proposal, which can be evaluated. The processes involved throughout must be recorded in a design folio, which may include 2D and 3D work. This may involve more customer research, visits to industry, testing of materials and models/prototypes, before arriving at a solution.

If studied as a single unit the candidate will not have the folio work from the previous study of the unit Design Analysis. The starting point will be a product in which some aspect has been identified as requiring change to improve visual and/or functional requirements eg easier lifting of a heavy product, look more aesthetically pleasing, make more adaptable, remove a defect etc. The candidate and teacher/lecturer will agree the brief, giving consideration to the amount of work which might be involved in relation to the time available.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Evidence from a portfolio of work should record all the activities in this unit. This will provide the performance evidence across all the outcomes and should include a variety of sources such as reports, notes, sketches and drawings.

National Unit Specification: general information

UNIT Design Case Study (Advanced Higher)

NUMBER D129 13

COURSE Product Design (Advanced Higher)

SUMMARY

This is a component unit of Advanced Higher: Product Design.

This unit describes the design and manufacture of a range of products.

OUTCOMES

- 1 Investigate the development of design in a commercial product.
- 2 Evaluate the factors, which may influence the future development of the product.

RECOMMENDED ENTRY

While entry is at the discretion of the centre, candidates would normally be expected to have attained Higher: Product Design or equivalent at grade A or B.

CREDIT VALUE

1 credit at Advanced Higher (8 SCQF credit points at SCQF level 7*).

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Administrative Information

Superclass: VF

Publication date: June 2002

Source: Scottish Qualifications Authority

Version: 03

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Additional copies of this unit specification can be purchased from the Scottish Qualifications Authority. The cost for each unit specification is £2.50 (minimum order £5).

National Unit Specification: general information (cont)

UNIT Design Case Study (Advanced Higher)

CORE SKILLS

This unit gives automatic certification of the following:

Complete core skills for the unit None

Core skills components for the unit Critical Thinking Higher

National Unit Specification: statement of standards

UNIT Design Case Study (Advanced Higher)

OUTCOME 1

Investigate the development of design in a commercial product.

Performance criteria

- (a) The evolution of the product is clearly explained.
- (b) The critical stages of product development are clearly described.
- (c) The resolution of critical design decisions are clearly evaluated.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can investigate the development of design in a commercial product as defined in PCs (a) to (c).

OUTCOME 2

Evaluate the factors which may influence the future development of the product.

Performance criteria

- (a) Factors that may affect the future choice of materials and manufacturing processes are investigated.
- (b) The future socio-economic factors that may affect the development of the product are explained.
- (c) The environmental factors that may affect the future development of the product are described.
- (d) The external factors which have influenced the design development are clearly evaluated.

Evidence requirements

Evidence from a portfolio of work demonstrating that a candidate can evaluate the factors which may influence the future development of the product as defined in PCs (a) to (c).

National Unit Specification: support notes

UNIT Design Case Study (Advanced Higher)

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

GUIDANCE ON THE CONTENT AND CONTEXT FOR THIS UNIT

This unit provides the candidate with the freedom to produce a folio that can show their best work. It can be thought of as an end of course portfolio. The content will be based on work done in the Higher and the previous two units as well as other design experiences. It will allow the candidate to explore an area of design in which they have particular interest or expertise.

GUIDANCE ON TEACHING AND LEARNING APPROACHES FOR THIS UNIT

Candidates should be given notice well before embarking on this unit. They should be given time to select a suitable design area for the case study. The choice of product should be made with care and examined to ensure that it has the potential for study at this level. As a consequence, some early research work will have to be embarked upon before an agreement can be reached on the design area choice. Tasks contained in the case study will lead the candidates to investigate aspects associated with product design in more depth. These aspects could include aesthetics, user interface, digital technology, flexible manufacturing processes, smart materials, sustainability, recycling related to issues of ethics, economics, society and the environment. Teacher/lecturer support could be in the form of tutorials and as a facilitator. Use of the internet, CD-ROMs, and consumer, trade and professional magazines should also be encouraged as they provide excellent sources of information.

GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT

Evidence from a portfolio of work should record all the activities in this unit. This will provide the performance evidence across all the outcomes and should include a variety of sources such as reports, notes, sketches and drawings. It should be noted that candidates are expected to extend the work in this unit into the course work component of the external assessment, that is, the extended case study.