



Advanced Higher Product Design

**Delivery of Units
NAB (October 2008 edition) Support Materials**

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Introduction

This document has been developed to accompany the Advanced Higher Product Design October 2008 edition NABs. It provides further information for centres delivering Advanced Higher Product Design, clarifying Course content and suggesting structures for Course delivery.

This document should be used in conjunction the following documents:

- ◆ Arrangements Document
- ◆ Specimen Question Paper
- ◆ Extended Case Study Guidance Document
- ◆ External Assessment Reports
- ◆ Internal Assessment Reports
- ◆ National Assessment Bank materials

Course outline

The Advanced Higher Product Design Course consists of three mandatory Units, each with a notional length of 40 hours:

- ◆ D129 13 Design Case Study
- ◆ D130 13 Product Design Analysis
- ◆ D131 13 Product Development

The extra 40 hours associated with the Advanced Higher Product Design Course should be used to prepare candidates for the Question Paper (100 marks) and the Extended Case Study (150 marks).

Unit outline

Unit: Design Case Study

Outcomes

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

Assessment

To gain a pass in the Unit, using the October 2008 edition NAB, candidates are required to produce a report which traces the development of a commercially available product back to its introduction into the market, highlights significant turning points in its development and gives firm opinions on the issues which influenced the development, and which may influence further development.

Full details of the assessment requirements are contained within the NAB.

Before undertaking the assessment

Candidates should develop a deeper understanding and appreciation of the external issues that effect and influence development of products in the commercial world. Candidates should expand their knowledge of issues that influence development in terms of depth and number. Candidates should develop an appreciation as to the complexity and interrelationship of design factors and the pressure they put on the design team and the decisions they have to make. Candidates should develop a sound knowledge of issues such as:

- ◆ Changing target markets
- ◆ Consumer demand
- ◆ Consumer expectations
- ◆ New and emerging markets
- ◆ Legislation, politics and the economy
- ◆ Changing attitudes
- ◆ Health concerns
- ◆ Safety and accountability
- ◆ Marketing and advertising
- ◆ Fashion

A deeper understanding of issues which influence design will improve a candidate's ability to take their own design work to an advanced level. The more issues considered the more mature and reasoned their design work is likely to be. This deeper understanding will also have a direct impact on their performance in the *Product Development* Unit and the two external assessment components. The full range of issues is contained in the content section of this document.

Unit outline

Unit: Product Design Analysis

Outcomes

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

Assessment

To gain a pass in the Unit, using the October 2008 edition NAB, candidates are required to produce a report which analyses 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.

Full details of the assessment requirements are contained within the NAB.

Before undertaking the assessment

Candidates should have gained sound knowledge and experience of research, testing and evaluation techniques. They should also have developed their ability to produce a report which is structured, fluent and well reasoned.

Candidates should build up a deep knowledge of a range of different products. This knowledge will improve a candidate's ability to take their own design work to an advanced level. The deeper their body of knowledge, the more mature and reasoned their design work is likely to be. This breadth of knowledge will also have a direct impact on their performance in the *Product Development* Unit and the two external assessment components.

Unit outline

Unit: Product Development

Outcomes

- ◆ 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

Assessment

To gain a pass in the Unit, using the October 2008 edition NAB, candidates are required to produce a folio of work which demonstrates their ability to identify an opportunity for development within an existing product and to develop a solution to meet the opportunity identified. Candidates must also demonstrate the ability to apply sound knowledge of design issues and to communicate the development of their solution through the use of graphics and models.

Full details of the assessment requirements are contained within the NAB.

Before undertaking the assessment

Candidates should have developed their ability to analyse existing products and their ability to communicate requirements of proposed developments.

Candidates should have developed their skills in idea generation and their ability to develop and synthesise ideas towards a solution. They should also have developed a sound ability to justify their decisions.

Candidates should have enhanced their understanding of issues which impact on design and their ability to apply this understanding to producing design proposals.

Approaches to Learning and Teaching

The Course has been designed so that it is flexible enough to allow centres to deliver it in a way which suits the needs, abilities and aspirations of their candidates, and the interest and expertise of their staff. However, there are a number of points which centres should bear in mind when planning the delivery of the Course:

- ◆ The Unit NABs are assessment tools. They are not learning and teaching activities. Candidates must be given the opportunity to gain knowledge and enhance skills **before** the NABs are undertaken.
- ◆ Designing is a practical activity. It is important that candidates are exposed to learning experiences which blend the acquisition of knowledge and understanding, the development of design skills and the opportunity to apply these to solve design tasks.
- ◆ The Units have been designed so that they can be taught as stand-alone Units and in any order. This allows for different approaches in the method of delivery of the Units. Whichever approach is taken, centres must ensure that all the Outcomes are covered and the full Course content is delivered. Centres are therefore encouraged to deliver the Course using practical activity contexts which appeal to candidate interests.
- ◆ There is no direct connection between *Design Case Study* and the other two Units. It is therefore likely that this will be delivered as a stand-alone Unit. This means it can be delivered at any stage in the Course, sequentially or concurrently with the other Units.
- ◆ The other two Units could be taught sequentially with the research material gathered in *Product Design Analysis* as a starting point for *Product Development*. Alternatively the Units could be delivered as stand-alones with candidates carrying out fresh research for *Product Development*.
- ◆ A range of possible structures for Course delivery is contained in the Appendix.

Clarification of 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 added in bold**. It should be noted that 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 may be sampled 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.

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. Materials and manufacturing processes.
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, e.g. function v aesthetics, economics v environment. Relationships between consumer, designer and manufacture.

Evolution of products:

Critical stages and decisions, historical developments and context.

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 prototypes, techniques and materials:

Scale models, mock-ups, fully crafted 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, and progression of models.

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.**

They 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.
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.
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, miniaturization.

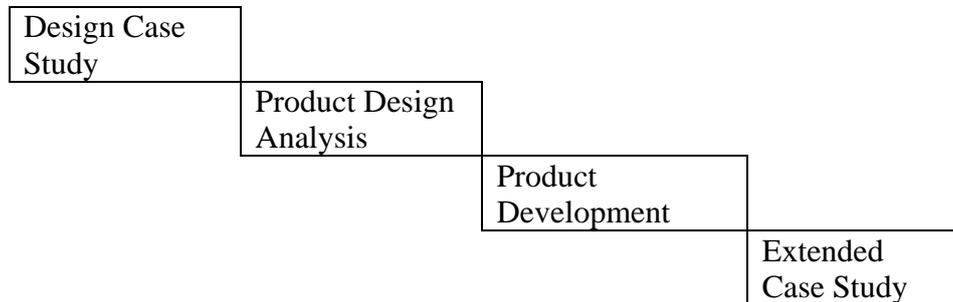
Assessment

To gain a Course award, candidates must pass all Unit assessments as well as the external assessment (Question Paper and Extended Case Study). External assessment provides 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.

Appendix: Structures for Course Delivery

Structure 1



This structure treats each Unit as a stand alone. The *Design Case Study* could be delivered at any stage. It is advised that, even if this stand alone structure is used, *Product Development* should follow *Product Design Analysis*.

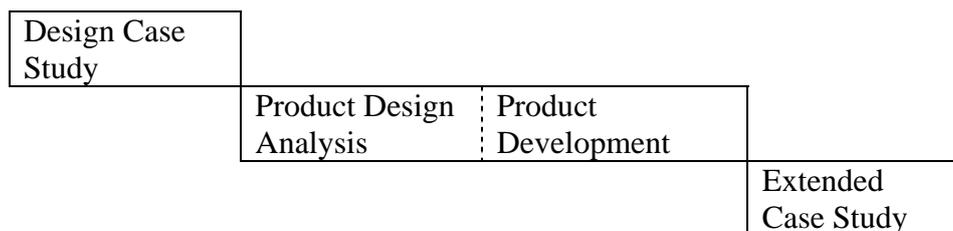
Advantages of Structure 1:

- Ease of administration
- Three different tasks will appeal to many candidates

Disadvantages of Structure 1:

- *Design Case Study* can become tedious when tackled as one block.
- Possible repetition between *Product Design Analysis* and *Extended Case Study*.

Structure 2



In this structure *Product Development* is treated as a follow on Unit to *Product Design Analysis* and the same task is carried forward. Again, the *Design Case Study* could be delivered at any stage

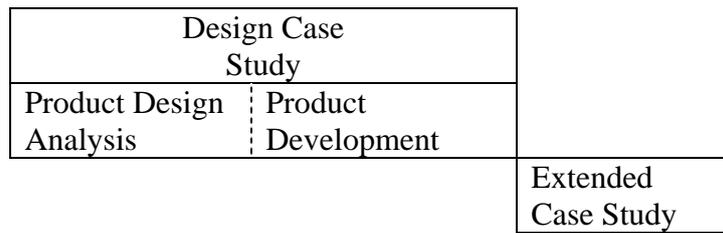
Advantages of Structure 1:

- Ease of administration
- No repetition between *Product Design Analysis* and *Extended Case Study*.

Disadvantages of Structure 1:

- *Design Case Study* can become tedious when tackled as one block.
- Some candidates prefer a new task for each Unit.

Structure 3



This structure delivers the Design Case Study concurrently with the other two Units which may be approached as stand alones or as a follow on.

Advantages of Structure 1:

- More variety for candidates

Disadvantages of Structure 1:

- More difficult to administer