C211/SQP234

Product Design
Higher

NATIONAL QUALIFICATIONS

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SCOTTISH QUALIFICATIONS AUTHORITY

COURSE ASSESSMENT SPECIFICATION

Higher Product Design

This purpose of this document is to provide:

- details of the structure of the Question Paper for this Course
- details of the structure of the Design Assignment for this Course
- guidance to centres on how to use information gathered from the Question Paper and the Design Assignment in this Course to estimate candidate performance

The Course assessment has two components:

Component	Time Allocation	Mark Allocation
Question Paper	2 hours	70
Design Assignment	n/a	70

PART 1

This part of the Course Assessment Specification details the structure of the Question Paper in this Course.

QUESTION PAPER – TOTAL MARKS 70

The purpose of the Question Paper component is to assess the candidate's ability to retain and integrate knowledge and understanding across the Course content.

- this paper will consist of two sections, Section A and Section B
- both sections are mandatory, and there will be no optional questions
- questions will not only focus on areas of content, but will also provide opportunities for integration of topics from across the Course
- questions will tend to examine higher level cognitive skills e.g. explain, describe, differentiate, compare and contrast, justify, analyse, etc

Section A – 30 marks

Section A will consist of a single question requiring extended and reasoned responses. The question will follow a similar structure every year and will test the candidate's knowledge and understanding of areas from across the Course content. The question will also require candidates to integrate knowledge and understanding from across the Course content.

Candidates will be asked questions about a product, with specific reference being made to:

- product specification
- ergonomics
- materials and their associated manufacturing processes

- quality assurance issues
- additional design issues of particular relevance

While the basic structure of this question will remain the same the product will change each year and therefore the relevant design issues will also change.

Section B – 40 marks

This section will consist of 4 to 7 questions. The responses to the questions will require a degree of integration of knowledge and understanding in given contexts. Candidates will be expected to answer all questions.

PART 2

This part of the Course Assessment Specification details the structure of the Design Assignment in this Course.

DESIGN ASSIGNMENT – TOTAL MARKS 70

The purpose of the Design Assignment component is to assess the candidate's ability to apply skills, knowledge and understanding to solve a design task in a given context. It assesses the candidate's ability to communicate, generate and refine ideas and produce a potential solution.

A different Design Assignment task will be issued each year. The context of the Design Assignment task will be based on:

- a problem situation
- a design brief.
- research which is relevant to the problem and design brief
- a design specification derived from all of the above

The Design Assignment task will be externally set by SQA, conducted internally and then externally marked by SQA. SQA will issue the annual Design Assignment task in January and will require submission of completed assignments by the date specified in the Operational Guide for the year of issue.

Design Assignments will be marked against the following areas:

- ideas
- development
- communication

The Design Assignment is conducted internally in a centre over an extended period of time. This allows candidates the opportunity to develop, reflect on and revise their work. Consequently, this will probably be the candidate's 'best work'.

PART 3

This part of the Course Assessment Specification provides guidance on how the Question Paper and the Design Assignment contribute to the Course award and how to use assessment information gathered from both of these components to estimate candidate performance.

When compiling estimates, centres must take account of the equal weighting of the components.

Component	Marks Available
Question Paper	70
Design Assignment	70
Total Marks	140

The cut-off scores are set at approximately 70% for a Grade A, 60% for a Grade B and 50% for a Grade C.

For the total mark range of 0 to 140, the following table gives an indication of the cut-off scores.

Grade	Band	Mark Range
A	1	119-140
A	2	98-118
B	3	91-97
B	4	84-90
C	5	77-83
C	6	70-76
D	7	63-69
NA	8	56-62
NA	9	0-55

These cut-off scores may be lowered if the Question Paper is deemed to be more demanding or raised if less demanding.

Worked example

- In a centre's own Prelim, the candidate scores 43 out of a maximum 70 marks.
- It is the centre's view that their own prelim is slightly less demanding than the national standard set by SQA Question Papers.
- The centre estimates that the candidate should gain 49 out of a maximum 70 marks for the Design Assignment.
- Combining both components (i.e. 43/70 + 49/70), gives a total mark of 92 out of a maximum 140 marks.

- Using the mark range above, this should result in the centre submitting a **Band 3** estimate.
- However, as the centre feels that their own prelim is slightly less demanding than the national standard set by SQA, the centre feels a more realistic estimate would be a **Band 4.**

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Specimen Question Paper
for use in and after 2005

Time: 2 hours

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70 marks are allocated to this paper.

Where appropriate you may use sketches to illustrate your answer.

Attempt ALL questions.

SECTION A

1. Figure 1 shows similar children's high chairs.

Chair 1—BabyDan Feeding Chair

Chair 2—BabyDan Foldable Highchair

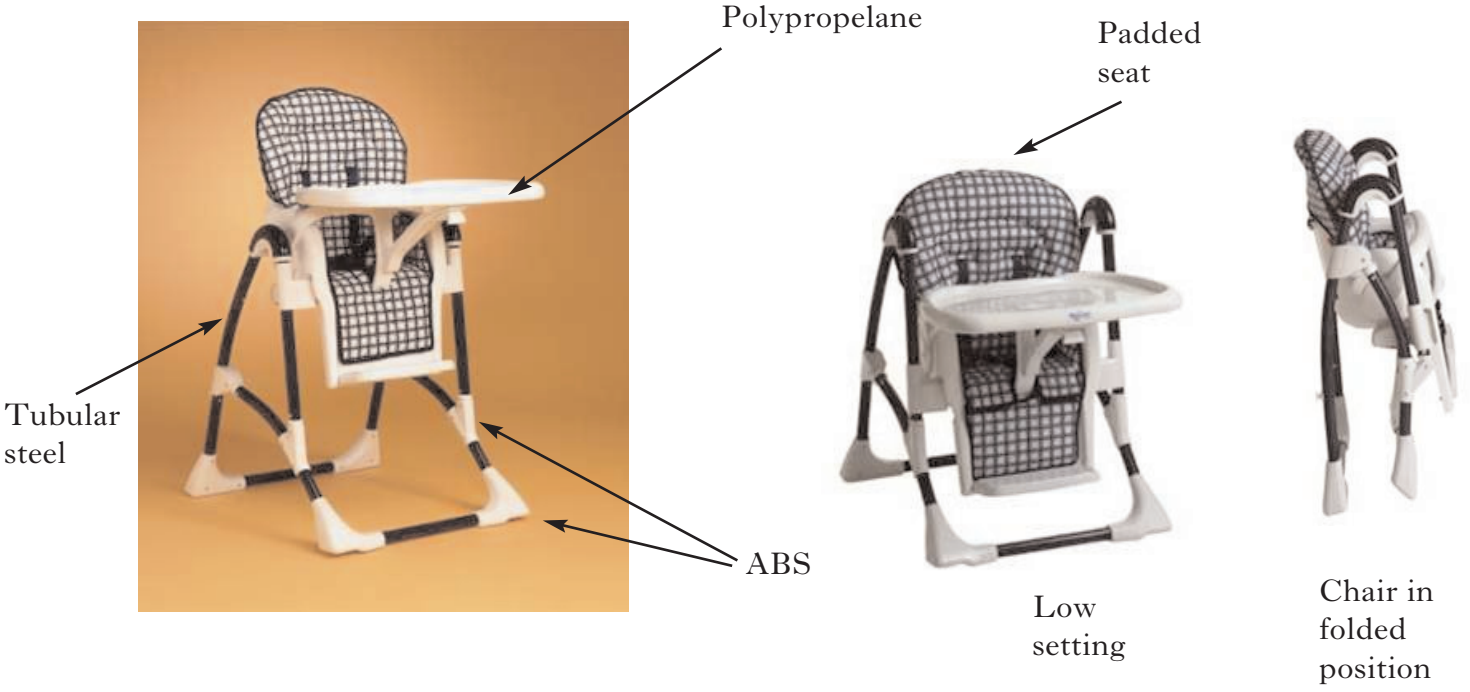

FIGURE 1

Marks

1. (continued)

Figure 1 shows two similar children's high chairs.

The high chairs:

- are mass produced and manufactured by the same company;
- conform to current Health and Safety standards;
- can be used for ages between six months and three years;
- are marketed and priced around £80–£90.

(*a*) Outline a product specification for children's high chairs. **6**

(*b*) Justify the choice of materials which were used in the producton of both chairs. **6**

(*c*) Describe and justify the production methods chosen to manufacture one of the chairs. **6**

(*d*) For both chairs describe the quality assurance issues that would affect:

- the manufacturer;
- the consumer. **4**

(*e*) Explain the appeal of both chairs for a consumer's point of view. **4**

(*f*) Describe the health, safety and environmental issues associated with these chairs and their production. **4**

Total for Section A (30)

Marks

SECTION B

2. The saucepan set shown has been manufactured using the process of press forming.

(*a*) Explain why press forming is a suitable process for this type of product. **2**

There are a number of metals suitable for the manufacture of this product.

(*b*) State the name of one such metal and explain why it is appropriate for the manufacture of the saucepan. **3**

(5)

3. An assembled flat-pack kitchen unit is shown. It is made from manufactured boards and is mass produced.

(*a*) Explain why manufacturers are now using modern construction techniques in favour of traditional methods. **3**

(*b*) Explain the benefits of using manufactured boards. **2**

Designers and manufacturers are increasingly using computer systems to aid the design and manufacture of their products.

(*c*) Describe the benefits of using CAD technology. **3**

(*d*) Describe the benefits of using CNC technology. **2**

(10)

Marks

4. Product safety is a key factor for consideration when designing products for people. Manufacturers use models and prototypes to analyse and test new designs.

(*a*) Describe the differences between a model and a prototype. **2**

(*b*) Describe how a prototype could be used to test safety. **2**

"Rapid prototyping" is increasingly used in the production of prototype models.

(*c*) Describe how rapid prototype models would be produced and their use in the development of a product. **4**

(8)

5. Manufacturers have changed many of their manually skilled processes to automated ones.

(*a*) Describe the implications of automation for both manufacturers and the workforce. **4**

(*b*) Explain the improvements that a company could achieve by introducing automated systems with regard to:

- product diversification; **2**
- production planning systems. **2**

(8)

6. A designer has been asked to produce new concepts for a hair brush.

(*a*) Explain why the designer would need to meet with the client group to develop a brief for this product. **2**

(*b*) Give examples of the type of questions that the designer would need to ask to ensure that a full brief could be written. **3**

(*c*) Explain why the designer would prefer an "open brief" rather than a "closed brief". **2**

(*d*) Describe the "intellectual ownership" issues surrounding the design of this product. **2**

(9)

Total for Section B (40)

[*END OF SPECIMEN QUESTION PAPER*]

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Specimen Marking Instructions
for use in and after 2005

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It should be noted that this is a marking scheme and not specimen answers. Candidates are expected to give detailed answers in the form of sentences and paragraphs.

	SECTION A	
Question	**Answer Scheme**	**Marks**
1 (a)	The high chairs must: • be suitable for the age range identified • manufactured from durable materials • meet appropriate safety criteria • be stable • be easily cleaned and maintained • be adjustable • any other suitable statement 6 statements @ 1mark each	6
(b)	Statements which identify issues such as: • durability of material • strength issues • safety • hygiene • suitability for production methods • aesthetic properties • any other suitable statement 6 statements @ 1mark each	6
(c)	• Identification of the types of manufacturing processes used in the production of one of the illustrated chairs • How production processes relate to the materials used • How manufacturing/assembly techniques are influenced by volume of production Chair 1: Laminated beech plywood back, seat and foot rest. Beech wood frame made using jigs and possibly machine routering. Frame joints either dowelled or mortised. Chair 2: ABS joints and table made using injection moulding. Padded seat and foam inserts machine stitched. Steel frame folded and shaped under pressure. Any 6 relevant issues about materials, processes and their relationships regarding suitability	6

(d)	The manufacturer: • Raw materials checked for quality • Prompt delivery times (JIT) • Safety issues • Component accuracy • Identification of quality in finished bought parts • Project planning of assembly • Any other acceptable issue The consumer: • Product meets legislation standards • Assembly guidelines are clear if required • Operating manual clear (Health and Hygiene etc.) • Guarantees provided • Product is finished to a high standard • Any other acceptable issue Two issues identified for each of the manufacturer and consumer 4 issues @ 1 mark each	4
(e)	Any four identified issues under the headings of: • Aesthetics • Safety • Quality • Corporate image/reputation 4 issues @ 1 mark each	4
(f)	Any four issues described in the context of production, use and disposal for the product life cycle of these chairs • Dust and waste factors whilst production in factories • Wood from renewable sources versus use of metal and plastic from non-renewable sources • Chair 1 grows with the child whereas chair 2 is for a certain age group • Integral safety features 4 issues @ 1 mark each	4
	Total for Section A	30

	SECTION B	
Question	**Answer Scheme**	**Marks**
2 (a)	Press forming is suitable because: • Economies of scale • Shape of product • No finish required • Type of material used • Any other suitable answer	2
(b)	Suitable materials: • Stainless steel • Aluminium • Copper 1 mark for identification of material Justifications: • Thin material • Heat conduction • Finish • Aesthetics • Hygiene 1 mark each for reasons 2@1	3
	Total	5
3 (a)	Any from: • Economies of scale • Highly paid skilled workers not required • Easier to change design styles quickly • Greater flexibility in manufacturing system planning • Components can be bought in • Any other suitable answer 1 mark each for reasons 3@1	3
(b)	Benefits could include: • Available in large flat boards • Choice of thicknesses • Colour range of surface finish • Textural range of surface finish • Any other suitable answer 1 mark each for reasons 2@1	2
(c)	• Greater flexibility when designing • Quicker to production stage • Enhanced graphic presentation to client • Use of library parts • Any other suitable answer 1 mark each for reasons 3@1	3

(d)	• Increased quality assurance and control • Faster turnover rate • Greater manufacturing flexibility • Easier to modify design whilst in production • Any other justified answer 1 mark each for reasons 2@1	2
	Total	10
4 (a)	Models: • Scaled and schematic • Non-functioning • Used to check aesthetic issues such as form and shape, etc. • Used to check certain ergonomic factors • Any other justified answer Prototype: • Fully functioning • Used to test operation and safety • Full sized • Pre-production to ascertain production requirements, assembly details and production feasibility • Any other justified answer 1 mark each to identify differences 2@1	2
(b)	Any suitable and justified description that includes: • Safety • Durability • User trials, etc. 1 mark each description 2@1	2

(c)	RPI would produce a model by: • Printing a model in 3D instead of 2D with a substance that builds up layers vertically thus making a physical model enabling safety and reliability checks to be carried out at the design stage. • Rapid Prototyping (RP) is an additive process, unlike all other familiar workshop machines that cut away at the materials until the desired shape is achieved. These models can be trialled in real environments. • RP enables exceptionally accurate models to be made from Computer Aided Drawing (CAD) files in a much shorter time than conventional methods would permit. 3D models can be produced to perform "what if" scenarios. Potential problems can be identified early in the design process. • The process itself reduces waste, as unused materials can be recycled and their use speeds up the process of product development which enables design concepts to reach the market quicker and cheaper. • Depending on type of RP process used, the end product can be used as a master for production of injection moulding dies, enabling the development of the product to be speeded up thus maximising product performance and reducing the amount of prototyping and testing required. Up to 4 statements showing KU of the RPI process at 1 mark each	4
	Total	8

5 (a)	Any from: (Manufacturer) • Investment costs • Increased flexibility • Increased productivity • Reduction in stock wastage • Less hours lost in production time (Workforce) • Less demand for large workforce • Less labour intensive • Less manual skills required • Greater need for modern skills such as IT • Greater flexibility required in work hours and conditions • Better pay for smaller workforce • Continual training and skill upgrading requirements 1 mark each description 2@2	4
(b)	Product diversification: • More opportunity to alter product design • More opportunity to increase product range • Introduction of new materials • Introduction of new components using rapid prototyping 1 mark each explanation 2@1 Production planning systems: • Outsourcing bought parts • Sub contracting • JIT • Flexible manufacturing • Reduced lead time for products 1 mark each explanation 2@1	2,2
	Total	8

6 (a)	Explanation including issues: • Identification of client requirements • Key design issues • Market requirements • Target group 1 mark each explanation 2@1	2
(b)	Identification of three questions which would give answers which would give information on issues such as: • Target market • Production volume • Safety issues • Market share/competition • Brand image • Etc. 1 mark each explanation 3@1	3
(c)	Any issues such as: • More opportunity for creativity • More scope for innovation • More opportunity to diversify into new related product ideas 1 mark each explanation 2@1	2

(d)	Any description that includes at least two issues from:
	• Creative processes which generate new ideas may have commercial value
	• Ideas are the Intellectual Property (IP) of the creator, either of an individual or a company
	• IP can have enormous commercial value, and can be traded as a commodity
	• Commercially valuable ideas can be at risk if not carefully protected, and others may gain commercial advantage as a result
	• There are five forms of protection:
	  • Trademark
	  • Patent
	  • Registered Design
	  • Copyright
	  • Design Right
	
	1 mark each explanation 2@1
		2

	Total	9
	Total for Section B	40

[*END OF SPECIMEN MARKING INSTRUCTIONS*]