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DESIGN TECHNOLOGY
STANDARD LEVEL
PAPER 3

Candidate session number

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Monday 12 November 2012 (morning)

1 hour

Examination code

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INSTRUCTIONS TO CANDIDATES

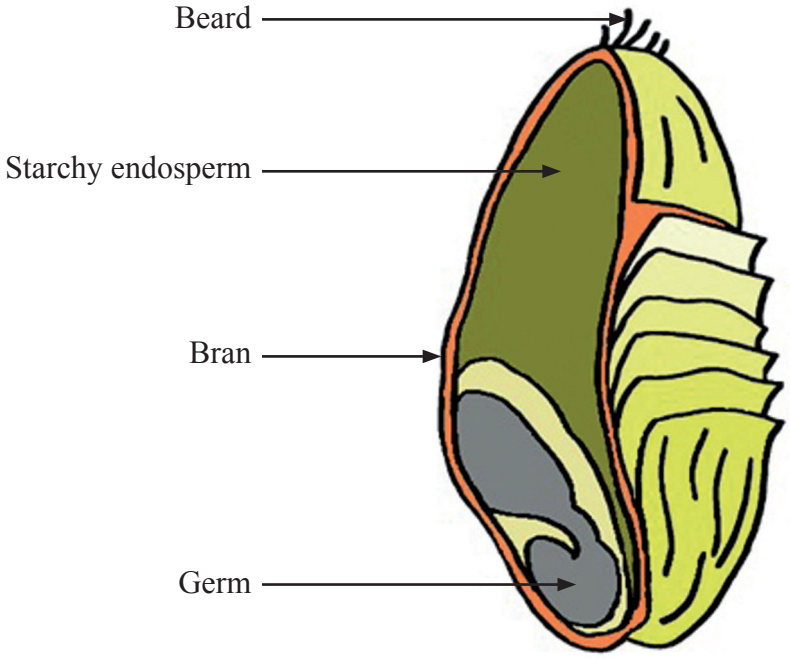
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- Answer all of the questions from one of the Options.
- Write your answers in the boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is *[30 marks]*.

0128

Option A — Food science and technology

A1. Primary processing of cereal grains, such as wheat (see **Figure A1**), to produce white flour removes the fibrous husks as bran and the wheat germ leaving the carbohydrate-rich endosperm. The husks contain most of the dietary fibre so that white flour has lower dietary fibre content than wholewheat flour.

Figure A1: Wheat grain showing starchy endosperm, germ and bran



(a) State **one** benefit of primary processing of wheat to produce white flour. *[1]*

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(b) Outline **one** effect of excess carbohydrate intake. *[2]*

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(Question A1 continued)

(c) Discuss how health awareness affects food choice in relation to fibre intake. *[3]*

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A2. (a) Define *food spoilage*. *[1]*

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(b) Describe the function of preservatives in food. *[2]*

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A3. **Figure A2** shows the label from a pasta ready meal product produced by Tesco Stores Ltd. The label offers allergy advice. The label states that the recipe has no nuts and the factory has no nuts but that the ingredients cannot be guaranteed to be nut free.

Figure A2: Label from a pasta ready meal

Figure A2 removed for copyright reasons.
Please refer to the image at www.dcs.shef.ac.uk/~mark/blog/blog_files/food_and_drink/pasta_label.jpg.

(a) List **two** symptoms of nut allergy. *[2]*

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(b) Outline **one** reason why the label offers information relating to nuts. *[2]*

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A4. Outline **one** issue relating to the scaling up of recipes from bench scale. *[2]*

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A5. Explain, using an example of each, how chronic and acute food-related issues impact on a developed country's health services. *[6]*

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A6. Explain how **three** different corporate strategies have contributed to the development of the global brand of Coca-Cola®. *[9]*

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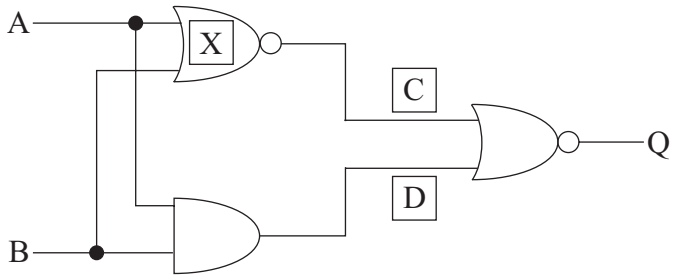
Option B — Electronic product design

B1. **Figure B1** shows a logic circuit diagram for an alarm system combining two inputs and three logic gates with a number of possible outcomes.

Figure B1: Logic Circuit diagram for an alarm system



(a) State the type of logic gate for X. *[1]*

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(b) Describe how an analogue signal can be converted to a digital signal in the control system of the alarm. *[2]*

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(This question continues on the following page)

(Question B1 continued)

(c) Determine the outcomes for C, D and Q for all the combinations of variables A and B by completing the truth table in Table B1. *[3]*

Table B1: Truth table

A	B	C	D	Q
0	0			
0	1			
1	0			
1	1			

B2. (a) State the function of a filter in a digital hearing aid. *[1]*

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(b) Outline **one** advantage of digital technology to the development of hearing aids in relation to amplification. *[2]*

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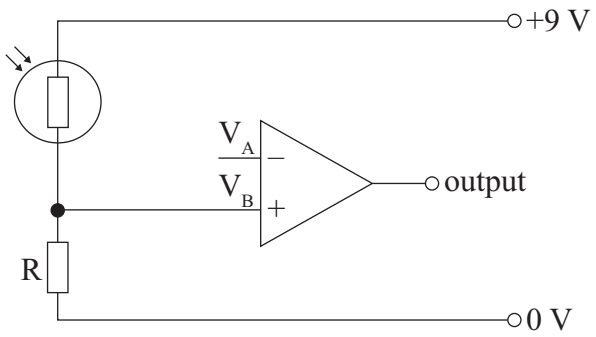
B3. An incomplete comparator circuit is shown in **Figure B2** below where the operational amplifier V_A requires a reference voltage of 3 V.

Figure B2: Part of a comparator circuit



(a) Draw **two** components and their connections on the circuit diagram shown in Figure B2 to demonstrate how the reference voltage could be achieved. *[2]*

(b) Identify what would determine the upper and lower extremes of the range of appropriate ratings for the components you added in response to part (a). *[2]*

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B4. Describe **one** limitation of open loop systems. *[2]*

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B5. Discuss **two** ways in which PIC technology can be regarded as sustainable. *[6]*

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B6. Explain **three** advantages of using optical fibre for transferring information in a communication system. *[9]*

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Option C — CAD/CAM

C1. **Figure C1**, **Figure C2** and **Figure C3** show three stages of the development of a boat hull using CAD/CAM.

Figure C1: CAD image of boat hull.

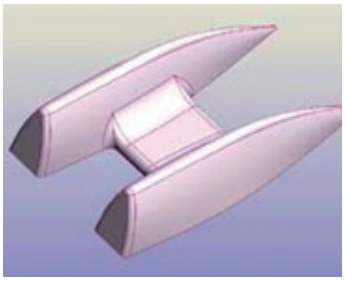


Figure C2: Geocam software calculating tool path.

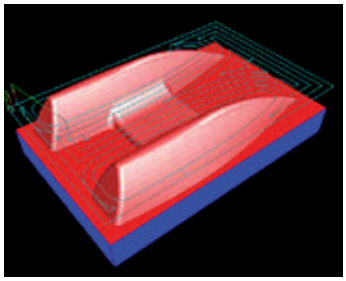
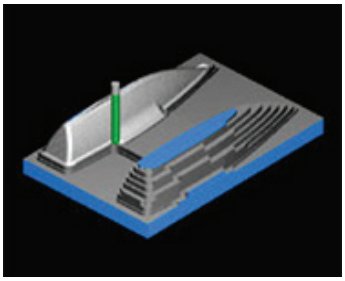


Figure C3: Simulation of milling boat hull.



[Source: www.boxford.co.uk, reproduced with permission.]

(a) State a suitable tool that could be used in a CNC router to machine the part shown in Figure C3. *[1]*

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(b) Outline how the setting of the machine tool step-over variables will impact on the quality of the surface finish of the part shown in Figure C2. *[2]*

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(This question continues on the following page)

(Question C1 continued)

(c) Discuss the constraints of using a 3-axis machine for manufacturing the boat hull. *[3]*

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C2. (a) State an input device for a CAD system. *[1]*

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(b) Outline **one** advantage of using *finite element analysis* (FEA) to design structures. *[2]*

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C3. (a) Outline **one** advantage of LOM as part of rapid prototyping. *[2]*

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(b) List **two** benefits of being able to rapid prototype a product. *[2]*

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C4. Outline **one** reason why numerically controlled (NC) machines are still used in manufacturing systems. *[2]*

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C5. **Figure C4** shows a gold ring.

Figure C4: CAM gold ring

[Source: www.artcam.com. Used with permission.]

Discuss **two** benefits of using CAM when manufacturing the ring shown in Figure C4. *[6]*

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C6. Discuss how the use of Haptic Technology aids the design and use of virtual training in relation to user observation, training and feedback. *[9]*

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Option D — Textiles

D1. **Figure D1** shows a fabric woven from fire retardant fibres. The fabric can withstand temperatures of up to 2000 °F. It can be used instead of metal as a protective heat-shield in cars.

Figure D1: Fire retardant fabric

[Source: http://img.tradeindia.com/fp/0/097/908.jpg]

(a) State **one** benefit to the manufacturer of using the fabric shown in Figure D1 in a car. *[1]*

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(b) Outline **one** advantage of the fabric being made by the technique of weaving. *[2]*

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(This question continues on the following page)

(Question D1 continued)

(c) Explain why the fabric is woven from a fire retardant fibre rather than being treated. *[3]*

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D2. (a) State the name of the substance that a silk worm creates to bind the threads when making a cocoon. *[1]*

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(b) Outline **one** reason why processing silk from silk worms is still a craft industry. *[2]*

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D3. **Figure D2** shows the use of graphic images used on labels for garments.

Figure D2: Garment label symbols

[Source: www.gbnametapes.co.uk/images/woven-washcare.jpg]

(a) Outline **one** advantage to the consumer of the labelling shown in Figure D2. *[2]*

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(b) Outline **one** benefit to the manufacturer of using graphical images on labels. *[2]*

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D4. Outline **one** characteristic of nylon that makes it a suitable material for tents. *[2]*

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D5. **Figure D3** shows packaging that is often used for shirts on display in retail stores.

Figure D3: Shirt in packaging

[Source: www.smartfixtures.com/shop/images/catalog/assembly.90301.real.jpg. Used with permission.]

Discuss **two** issues relating to the use of this type of packaging for the display of shirts in retail stores. *[6]*

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D6. Explain **three** ways in which textile materials can contribute to the enhanced performance of sportsmen/sportswomen. *[9]*

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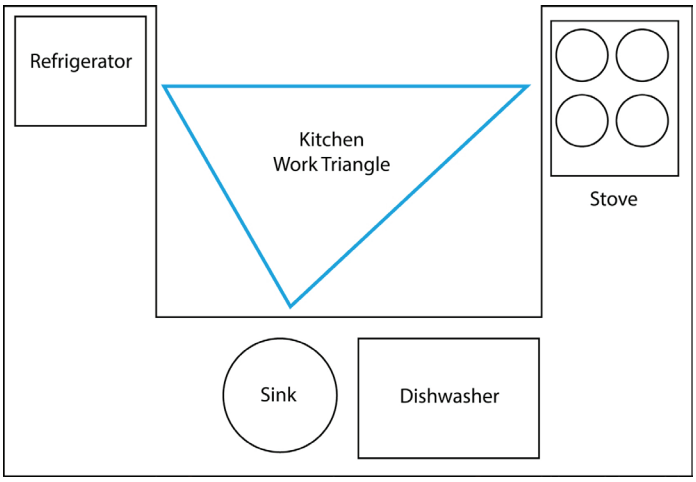
Option E — Human factors design

E1. **Figure E1** shows a work triangle for a kitchen.

Figure E1: Kitchen Work Triangle



[Source: www.jkitchen.comAdapted from: http://en.wikipedia.org/wiki/Kitchen_Work_Triangle]

(a) State **one** reason for the position of the dishwasher in the kitchen layout. *[1]*

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(b) Describe the purpose of the use of a kitchen work triangle for the designer. *[2]*

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(This question continues on the following page)

(Question E1 continued)

(c) Explain how the work triangle can improve safety for users of the kitchen. *[3]*

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E2. (a) Define *biomechanics*. *[1]*

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(b) Describe how biomechanics may affect the choice of a sample of people to be part of a user trial at the design development stage of a new can opener. *[2]*

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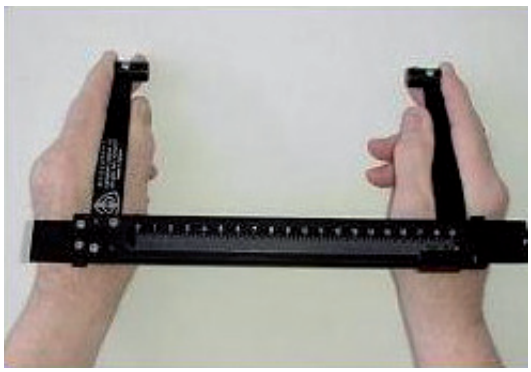
E3. **Figure E2** shows an instrument used to collect anthropometric data.

Figure E2: Instrument for collecting anthropometric data



[Source: www.rosscraft.ca. Used with permission.]

(a) Describe the function of the instrument in Figure E2. *[2]*

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(b) Outline **one** limitation of the use of the instrument in Figure E2 for collecting anthropometric data. *[2]*

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E4. Describe the purpose of conceptual testing to determine adequate product safety. *[2]*

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E5. Discuss how adjustability and range of sizes impact on the global market for clothing. *[6]*

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E6. Explain why feedback, mapping and affordance are important in human factors design. *[9]*

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Answers written on this page
will not be marked.