

General Certificate of Education
June 2004
Advanced Subsidiary Examination



**DESIGN & TECHNOLOGY:
SYSTEMS AND CONTROL TECHNOLOGY
Unit 1 Materials and Components**

SCT1

Monday 14 June 2004 Morning Session

In addition to this paper you will require:

- a lined answer book (AB08) which is provided separately;
- normal writing and drawing instruments.

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Pencil and coloured pencils should be used only for drawing.
- Write the information required on the front of your answer book. The *Examining Body* for this paper is AQA. The *Paper Reference* is SCT1.
- Answer Question 1 and any **two** of Questions 2 to 4.

Information

- The maximum mark for this paper is 100.
- Mark allocations are shown in brackets.
- 40 marks are allocated to Question 1, 28 to each of Questions 2 to 4, and 4 marks overall for Quality of Written Communication.
- This paper carries 30 per cent of the total marks for Advanced Subsidiary awards and 15 per cent for Advanced awards.
- You are reminded of the need for good English and clear presentation. The quality of your written communication will be assessed across all questions.

Advice

- Your answers should be illustrated with sketches and/or diagrams wherever you feel it is appropriate.

Answer Question 1.

1 A student wishes to design a system that will count the number of rotations of a shaft in a given period of time.

(a) Using an annotated sketch describe **one** system for producing a pulse that goes negative for each complete rotation of the shaft. (8 marks)

(b) Describe **one** detailed systems, block or circuit diagram for a three digit counter that will use the pulses in part 1(a). (12 marks)

(c) A motor is used to transmit rotary motion to a parallel shaft using a belt and pulley system. The motor rotates at 2000 rpm. The diameter of the pulley on the motor is 30 mm and the diameter of the output pulley is 100 mm.

Calculate the rotational speed of the output shaft. (6 marks)

(d) The motor is to run at a constant speed.

Using annotated sketches describe **one** method by which the output shaft could be driven at *three* different speeds. Make particular reference to the method of changing the speed of the shaft and any relevant safety issues. (8 marks)

(e) The output shaft is supported by two bearings.

Using an annotated sketch describe a suitable bearing for this application. (4 marks)

(f) Name **one** suitable material for the manufacture of the bearing outlined in part 1(e). (2 marks)

Answer any **two** of Questions 2 to 4.

- 2 (a) Explain the following terms:
- (i) Man made board *(2 marks)*
 - (ii) Non-ferrous metal. *(2 marks)*
- (b) (i) Manufacturers of self-assembly furniture have changed from using natural timber to man made boards.
- Describe the advantages **and** disadvantages of this change. *(6 marks)*
- (ii) Name **one** specific natural timber used in the manufacture of self-assembly furniture. *(1 mark)*
- (iii) Name **one** specific man-made board used in the manufacture of self-assembly furniture. *(1 mark)*
- (c) (i) Manufacturers of motorcar components have changed from using metals to plastics.
- Describe the advantages **and** disadvantages of this change. *(6 marks)*
- (ii) Name **one** specific non-ferrous metal used in the manufacture of motorcar components. *(1 mark)*
- (iii) Name **one** specific thermoplastic used in the manufacture of motorcar components. *(1 mark)*
- (d) Describe **two** *smart materials* and describe a suitable application for each. *(2×4 marks)*

TURN OVER FOR QUESTIONS 3 & 4

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- 3 (a) Compare and contrast electrical and mechanical methods of producing reciprocating motion. Make reference to specific applications. *(2×8 marks)*
- (b) With the aid of sketches describe how it is possible to produce a reciprocating stroke length of 40 mm. *(8 marks)*
- (c) Using annotated sketches describe how reciprocating motion can be converted into oscillating motion. *(4 marks)*
- 4 An alarm has been devised that will be attached to a door. The alarm will be triggered when it senses movement of the door. Once triggered, the alarm latches until the user resets it.
- (a) Using appropriate symbols draw a detailed systems diagram for the latching alarm, showing all sub-systems. *(10 marks)*
- (b) The casing for the alarm could be injection moulded or vacuum formed from a plastic. Using annotated sketches describe **one** of these processes and name a suitable plastic. *(10 marks)*
- (c) The manufacturer of the alarm has the option to batch produce or mass-produce the devices. Describe **four** factors to be considered by the manufacturer before making a choice on the production method. *(4×2 marks)*

END OF QUESTIONS