

General Certificate of Education
June 2007
Advanced Subsidiary Examination



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

SCT1

Friday 8 June 2007 9.00 am to 10.30 am

For this paper you must have:

- a lined answer book (AB08) which is provided separately
- normal writing and drawing instruments
- an **insert** (enclosed).

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen. Use pencil and coloured pencils 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 **three** questions.
- Answer Question 1 and **two** other questions.
- Securely attach the **insert** to the answer book at the end of the examination.

Information

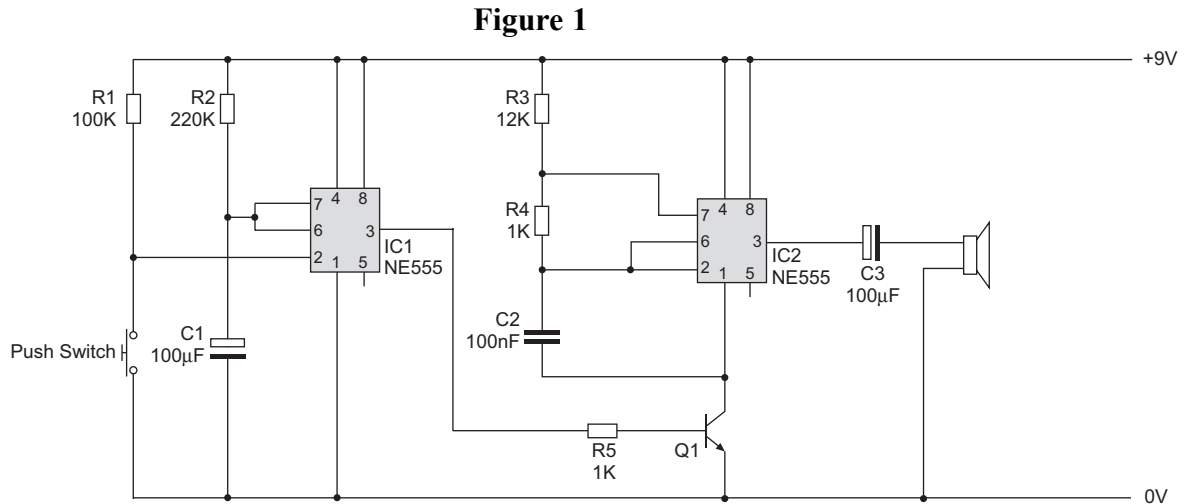
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 100.
- Four of these marks will be awarded for using good English, organising information clearly and using specialist vocabulary where appropriate.
- There are 40 marks for Question 1 and 28 for each of Questions 2 to 4.

Advice

- Illustrate your answers with sketches and/or diagrams wherever you feel it is appropriate.

Answer Question 1.

1 **Figure 1** shows a circuit diagram for an alarm.



(a) Describe in detail the operation of the circuit shown in **Figure 1** once the push switch has been closed. (8 marks)

(b) The output frequency (f) of IC2 is given by the formula:

$$f = \frac{1.44}{(R_3 + 2R_4)C_2}$$

Calculate the output frequency of IC2. (5 marks)

(c) The 'ON' time (t) of IC1 is given by the formula:

$$t = 1.1R_2C_1$$

Calculate the 'ON' time of IC1. (3 marks)

(d) Using the **insert sheet** provided, complete the Printed Circuit Board (PCB) diagram for the circuit in **Figure 1**.

Indicate the component locations, and identify pin 1 on IC1 and IC2. (12 marks)

(e) (i) The circuit shown in **Figure 1** could be housed in a casing made from a thermoplastic.

Name a suitable thermoplastic for the casing of the circuit. (1 mark)

(ii) With the aid of annotated sketches, describe in detail a suitable manufacturing process for a casing using the plastic you identified in part (e)(i). (7 marks)

(f) Quality Control and Quality Assurance are two procedures used in manufacturing industries.

Describe **two** differences between Quality Control and Quality Assurance. (4 marks)

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

- 2 Most automatic washing machines use a logic-based control system. The washing machine senses whether:
- the door of the washing machine is closed,
 - the drum is filled with water to the correct level,
 - the water is at the required temperature.
- (a) Name **three** input components that could monitor the above conditions. A different component should be named for each condition. *(3 marks)*
- (b) Using the input components you identified in part (a):
- (i) draw a circuit diagram that will give an output that goes HIGH when the door of the washing machine is closed, *(3 marks)*
 - (ii) draw a circuit diagram that will give an output that goes HIGH when the drum is filled with water to the correct level, *(3 marks)*
 - (iii) draw a circuit diagram that will give an output that goes HIGH when the water is at the required temperature. *(3 marks)*
- (c) Using annotated sketches, show how the three input components you identified in part (a) could be mounted within the washing machine to enable the three conditions to be monitored. *(3 × 2 marks)*
- (d) Draw a logic diagram that will give a HIGH output only when the following conditions are met.
- The door is closed.
 - The drum is filled with water to the correct level.
 - The water is **below** the required temperature. *(6 marks)*
- (e) Draw a truth table for the logic diagram you drew in part (d). *(4 marks)*

Turn over for the next question

Turn over ►

3 A student has developed a machine that will test the reliability of a push-button switch.

The machine is designed to operate the switch button repeatedly using a *crank and slider* mechanism.

(a) Using annotated sketches, describe in detail the operation of an appropriate *crank and slider*. (6 marks)

(b) The machine is operated by a motor running at a constant speed.

Using annotated sketches, describe a mechanical system that allows the crank to run at **three** different speeds. (6 marks)

(c) The switch button could also be operated repeatedly using a *cam and follower*.

Compare and contrast the use of a *cam and follower* and a *crank and slider* in this application. (6 marks)

(d) The machine should stop automatically after 100 operations of the switch button.

Using annotated sketches, describe in detail **one** method of achieving this requirement. (10 marks)

4 A coat hanger could be manufactured from wood, plastic or metal.

- (a) (i) Discuss the advantages **and** disadvantages of using *wood* to manufacture the coat hanger, making reference to the:
- method of production, (3 marks)
 - scale of production, (2 marks)
 - degree of durability. (2 marks)
- (ii) Name a suitable wood from which the coat hanger could be manufactured. (1 mark)
- (b) (i) Discuss the advantages **and** disadvantages of using *plastic* to manufacture the coat hanger, making reference to the:
- method of production, (3 marks)
 - scale of production, (2 marks)
 - degree of durability. (2 marks)
- (ii) Name a suitable plastic from which the coat hanger could be manufactured. (1 mark)
- (c) (i) Discuss the advantages **and** disadvantages of using *metal* to manufacture the coat hanger, making reference to the:
- method of production, (3 marks)
 - scale of production, (2 marks)
 - degree of durability. (2 marks)
- (ii) Name a suitable ferrous metal from which the coat hanger could be manufactured. (1 mark)
- (d) Describe how **one** of the coat hangers above can be recycled. (4 marks)

END OF QUESTIONS

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Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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Insert

For use with answering Question 1 part (d).

