General Certificate of Education
June 2005
Advanced Subsidiary Examination

DESIGN & TECHNOLOGY:
SYSTEMS AND CONTROL TECHNOLOGY SCT1
Unit 1 Materials and Components

Friday 10 June 2005 Morning Session

In addition to this paper you will require:
- a lined 8-page 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 The common groupings of materials; woods, metals and plastics can be subdivided into two further groups.

(a) Making reference to their characteristics:

(i) describe **four** differences between natural timber and manufactured boards; *(4 × 1 mark)*

(ii) describe **four** differences between ferrous and non-ferrous metals; *(4 × 1 mark)*

(iii) describe **four** differences between thermoplastic and thermosetting plastics. *(4 × 1 mark)*

(b) Using annotated sketches draw **two** mechanical methods of converting rotary motion to reciprocating motion. *(2 × 6 marks)*

(c) Using **one** of the methods described in part (b), show how it is possible to produce a reciprocating stroke length of 50 mm.
Use an annotated sketch in your answer. *(4 marks)*

(d) Using an annotated sketch describe the operation of **one** electrical or pneumatic component capable of directly producing reciprocating motion. *(4 marks)*

(e) The moving parts of mechanical systems require constant lubrication to prevent wear.
Using annotated sketches, describe an *automatic* method of lubrication suitable for use in a mechanical system of your choice. *(6 marks)*

(f) Name **two** materials suitable for the production of bearings that do not require additional lubrication. *(2 marks)*

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

2 **Figure 1** is an electronic method producing a time delay.

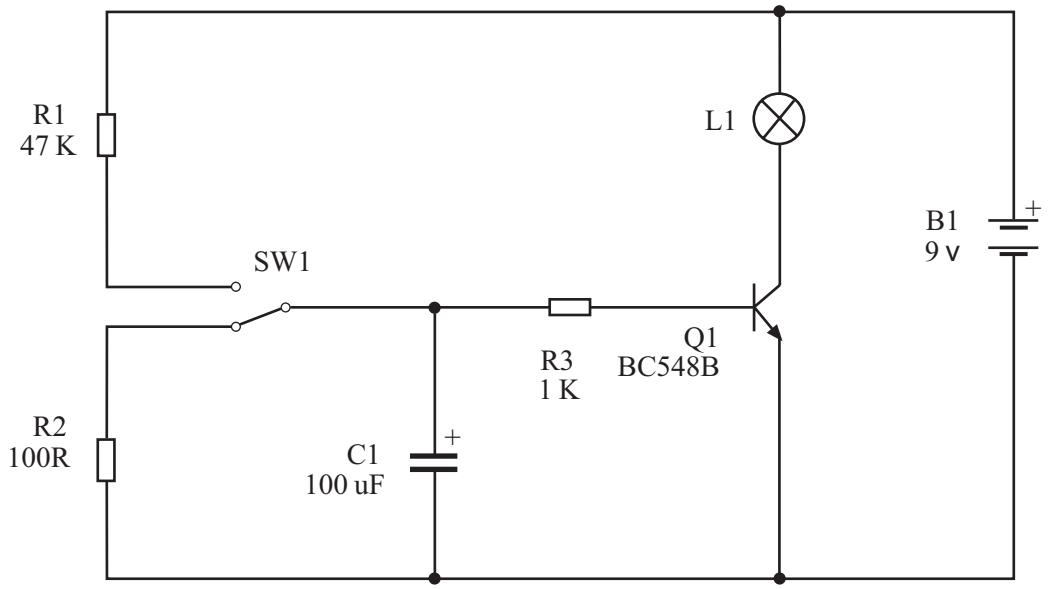

Figure 1

(a) Explain the operation of the circuit as the switch SW1 is connected to R1. *(4 marks)*

(b) Explain the purpose of R2. *(2 marks)*

(c) Give **two** methods of increasing the time delay of the circuit. *(2 marks)*

(d) The lamp requires a current of 60 mA flowing through it to light it at full brightness.
Using the information in **Figure 2** calculate the minimum transistor base current required to light the lamp fully. *(5 marks)*

Device	**Case Style**	**V_{ce} (Max)**	**V_{cb} (Max)**	**V_{eb} (Max)**	**I_c mA (Max)**	**P_{tot} mW (Max)**	**Hfe (Min) @I_c mA**
BC548B	TO-92c	30	30	6	100	500	220 @ 2

Figure 2

(e) The designer has decided that the circuit, in **Figure 1**, should be capable of switching on a different lamp rated at 100 W, 50 V.
Using the information in **Figure 2**, explain why the BC548B transistor is **not** suitable for switching on a lamp rated at 100 W, 50 V. *(4 marks)*

(f) Using the correct symbols, modify the circuit, in **Figure 1**, so that it is able to switch a 50 V supply to drive the lamp in part (e). *(8 marks)*

(g) Give **three** safety precautions that should be observed when soldering electronic components into circuit boards. *(3 marks)*

3 The two doors and the boot lid on a motor car are linked to a logic system that illuminates a warning light on the dashboard if any of them are open and the ignition is switched on.

Each door and the boot lid give a HIGH output if they are open and the ignition gives a HIGH output when it is switched on.

(a) Draw a truth table for the above system. *(8 marks)*

(b) Design a logic diagram for this control system. *(8 marks)*

The manufacturer of the warning system wishes to add an audible warning in addition to the light. A loudspeaker is to be used, and this will require an astable driver circuit.

(c) What is meant by the term astable? *(2 marks)*

(d) Using appropriate symbols draw an astable circuit to drive a loudspeaker. *(10 marks)*

4 (a) Explain the following terms:

(i) One-off production *(2 marks)*

(ii) Batch production *(2 marks)*

(iii) Mass production *(2 marks)*

(b) Using annotated sketches describe the use of the following items in the production of a casing for an electronic product:

(i) Jig *(6 marks)*

(ii) Template *(6 marks)*

(c) CAD/CAM can remove the need for jigs and templates in many manufacturing situations. Discuss the advantages **and** disadvantages of using CAD/CAM instead of jigs or templates. *(10 marks)*

END OF QUESTIONS

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