General Certificate of Education
Summer 2003
Advanced Examination

DESIGN AND TECHNOLOGY: SYSTEMS AND CONTROL TECHNOLOGY SCT6
Unit 6 Written Paper (SCT6)

Friday 27 June 2003 Morning Session

In addition to this paper you will require:
- an unlined answer book (7024);
- normal writing and drawing instruments

Time allowed: 3 hours

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 SCT6.
- Answer **four** questions.
- Answer **one** question from each of Sections A, B and C and **one** other question from any section.

Information
- The maximum mark for this paper is 100.
- 24 marks are allocated to each question and 4 marks overall for Quality of Written Communication.
- Mark allocations are shown in brackets.
- This paper carries 20 per cent of the total marks for Advanced Level 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 **four** questions.

Answer **one** question from each of Sections A, B and C and **one** other question from any section.

Each question carries 24 marks.

SECTION A: MATERIALS AND COMPONENTS

1 (a) Describe the advantages and disadvantages of using the following systems for converting rotary motion to linear motion:

(i) a rack and pinion

(ii) a screwthread

(iii) a cam and follower.

(3 x 6 marks)

(b) For each of the systems mentioned in Question 1(a) describe an application, giving a reason for your choice.

(3 x 2 marks)

2 Most gas central heating boilers are fitted with a safety control system which prevents the main gas valve being activated unless the following criteria are met.

- The pilot light is lit (logic state 1).
- The water in the system is below the required temperature (logic state 0).
- The circulation pump is operating (logic state 1).

(a) Draw a logic diagram to show how this safety system could provide an output (logic state 1) only when the criteria are met.

(8 marks)

(b) (i) With the aid of a block diagram show how the temperature of the water in the system could be monitored. The system should provide an output only when the water temperature is *below* the required level.

(6 marks)

(ii) Draw a suitable circuit diagram to provide the temperature monitoring for the safety control system. You should indicate on your diagram the system for altering the required water temperature.

(10 marks)

SECTION B: DESIGN AND MARKET INFLUENCES

3 (a) Discuss the advantages and disadvantages which using standardised systems, modules, parts and components brings to the:

- Design engineer.
- Method of production.
- Quality Assurance department.
- Service engineer.
- Consumer.

(24 marks)

4 (a) With the aid of a detailed systems diagram, explain the operation of a door that will slide open automatically when a person approaches, then closes after they have passed through. All sub-systems should be clearly identified.

(12 marks)

(b) Select **three** sub-systems from Question 4(a) and describe in detail the function of each. Suggest suitable component(s) for use in each sub-system.

(3 x 4 marks)

TURN OVER FOR THE NEXT QUESTION

SECTION C: PROCESS AND MANUFACTURE

5 (a) Explain in detail with the aid of sketches the operation of **three** products/systems that require high levels of frictional force for their successful operation.

(3 x 6 marks)

(b) Describe in detail **two** methods that can be used to reduce friction between moving mechanical parts. For each method give the relative advantages.

(2 x 3 marks)

6 (a) With the aid of sketches explain in detail the operating principles of **two** dissimilar methods for *harnessing* and *storing* energy from renewable sources.

(2 x 9 marks)

(b) Discuss the limitations and advantages of each method you have described in Question 6(a).

(6 marks)

END OF QUESTIONS