General Certificate of Education
June 2006
Advanced Level Examination

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

Tuesday 20 June 2006 1.30 pm to 4.30 pm

For this paper you must have:
- an unlined answer book (7024) which is provided separately
- normal writing and drawing instruments

Time allowed: 3 hours

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 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.
  4 of these marks are for the Quality of Written Communication.
- There are 24 marks for each question.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers. Quality of Written Communication will be assessed in all answers.

Advice
- Illustrate your answers 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.

There are 24 marks for each question.

SECTION A: MATERIALS AND COMPONENTS

1 With the aid of annotated sketches, describe suitable tests that could be carried out to compare the following properties of a range of materials.

(a) Tensile Strength

(b) Compressive Strength

(c) Shear Strength

For each test you should indicate:

- the approximate size of the sample
- the method of applying the load
- the data that needs to be collected
- the method of collecting the data
- how the data is analysed.

(3 × 8 marks)

2 (a) With the aid of annotated sketches, describe a system for providing precise linear motion over a distance of 500 mm. The system is required to work to an accuracy of 0.1 mm using a 200 step per revolution stepper motor. *(14 marks)*

(b) Describe in detail the advantages of using a stepper motor for providing the movement on CAM machines. *(10 marks)*

SECTION B: DESIGN AND MARKET INFLUENCES

3 (a) With reference to a product of your choice, describe in detail **four** examples of how the manufacture **or** use of the product causes pollution. *(4 × 4 marks)*

(b) For **two** of your examples given in part (a) describe modifications that could be made to reduce the scale of pollution. *(2 × 4 marks)*

4 (a) Describe in detail methods of gathering and presenting information to a manufacturer who is attempting to:

(i) identify a possible market for a product
(ii) decide on a product's possible success. *(2 × 6 marks)*

(b) Explain in detail how the use of computer systems and CAD/CAM has allowed manufacturers to respond quickly to information provided by market research. *(12 marks)*

Turn over for the next question

SECTION C: PROCESSES AND MANUFACTURE

5 In most gas powered boilers a safety control system is fitted that prevents the main gas valve being activated, unless:

- the pilot light is lit
- **and** the pump is operating
- **and** the temperature of the water in the boiler is low.

(a) Draw a suitable *system diagram* to show how this safety control system could be achieved.

(6 marks)

(b) With the aid of a diagram describe a suitable sensing system that will provide a positive output when:

(i) the pilot light is unlit *(4 marks)*

(ii) the temperature of the water in the boiler is low. *(4 marks)*

(c) Draw a suitable *circuit diagram* for the safety control system and explain its method of operation. *(10 marks)*

6 (a) With reference to specific applications, discuss the advantages and disadvantages of programmable control systems compared with systems using discrete components.

(12 marks)

(b) Most alternative energy sources **do not** provide a continuous supply of energy.

Describe in detail how large quantities of energy can be stored and easily released for use when required. *(12 marks)*

END OF QUESTIONS