General Certificate of Education
Advanced Level Examination
June 2014

Design and Technology: Systems and Control Technology SYST3

Unit 3 Design and Manufacture

Tuesday 3 June 2014 9.00 am to 11.00 am

For this paper you must have:
- an AQA 12-page unlined answer booklet which is provided separately
- normal writing and drawing instruments.

A

Time allowed
- 2 hours

Instructions
- Use black ink or black ball-point pen. Use pencil and coloured pencils only for drawing.
- Write the information required on the front of your answer book. The **Paper Reference** is SYST3.
- Answer **three** questions.
- Answer **one** question from **each** of Sections 1 and 2, and **one other** question from **either** section.
- If you choose to answer a question which has several parts, you should answer **all** parts of this question.
- Do all rough work in your answer book. Cross through any work that you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 84.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

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

Answer **three** questions.

Answer **one** question from each of Sections 1 and 2 and **one** other question from either section.

For each question that you answer, you should answer **all** parts of that question.

Section 1

Question 1 Answer all parts of this question.

0 1 A mixture of both renewable and non-renewable production methods are needed to meet the electrical energy demands of the UK.

Discuss why.

[16 marks]

0 2 Describe the advantages **and** disadvantages of electrical energy as a power source for a number of forms of transport.

[12 marks]

Question 2 Answer all parts of this question.

0 3 With the aid of annotated sketches describe in detail **two** different methods of permanently joining specific metals of your choice.

For each method suggest a real life application and explain why the method is suitable.

[2 × 8 marks]

0 4 Discuss the advantages of wastage and redistribution/deformation as methods of making mechanical components from metal.

[12 marks]

Question 3 Answer all parts of this question.

0 5 With reference to a specific product's development describe in detail **two** different **destructive** tests that would have been carried out and why they were necessary. Use sketches to support your answer.

[2 × 8 marks]

0 6 With reference to a specific product's development describe in detail **two** different **non-destructive** tests that would have been carried out and why they were necessary. Use sketches to support your answer.

[2 × 6 marks]

Section 2

Question 4 Answer all parts of this question.

0 7 The table gives the sequence for energising the coils of a stepper motor to produce clockwise rotation.

Sequence Order Stages 1 to 4 Then back to 1 and repeat	**Yellow Coil**	**Orange Coil**	**Black Coil**	**Brown Coil**
1	ON	OFF	OFF	ON
2	ON	OFF	ON	OFF
3	OFF	ON	ON	OFF
4	OFF	ON	OFF	ON

With the aid of diagrams describe in detail **two** different systems for automatically producing the output sequence suitable for energising the coils of a stepper motor.

Each coil operates at 12 volts d.c. and requires a current of 0.5 amps.

[2 × 8 marks]

0 8 For **one** of your systems in **0 7** show how the output sequence can be reversed at any point and cause the stepper motor to reverse.

[6 marks]

0 9 Explain the differences between the action of an input and an interrupt in a control programme, giving an example of where it could be advantageous to use an interrupt and why.

[6 marks]

Turn over for the next question

Question 5 Answer all parts of this question.

1 0 With the aid of an annotated sketch, describe how a double acting cylinder could be made to extend quickly, approximately 5 seconds after a switch is momentarily pushed. After another 20 seconds the cylinder should retract slowly.

[16 marks]

1 1 Discuss the relative advantages and limitations of using pneumatic control and movement systems in an industrial environment.

[12 marks]

Question 6 Answer all parts of this question.

1 2 With the aid of diagrams, describe in detail a system for providing accurate linear movement for one axis of a CNC machine. The system should allow for up to 400mm of movement and be accurate to 0.01mm.

[16 marks]

1 3 Compare the use of electrical systems and pneumatic systems for the control and movement of an automatic sliding door.

[12 marks]

END OF QUESTIONS