

General Certificate of Education  
June 2006  
Advanced Subsidiary Examination



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

**SCT1**

Friday 9 June 2006 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 any **two** of Questions 2 to 4.
- Securely attach the insert to the answer book at the end of the examination.

**Information**

- The maximum mark for this paper is 100.  
4 of these marks are for the Quality of Written Communication.
- 40 marks are allocated to Question 1 and 28 to each of Questions 2 to 4.
- 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**

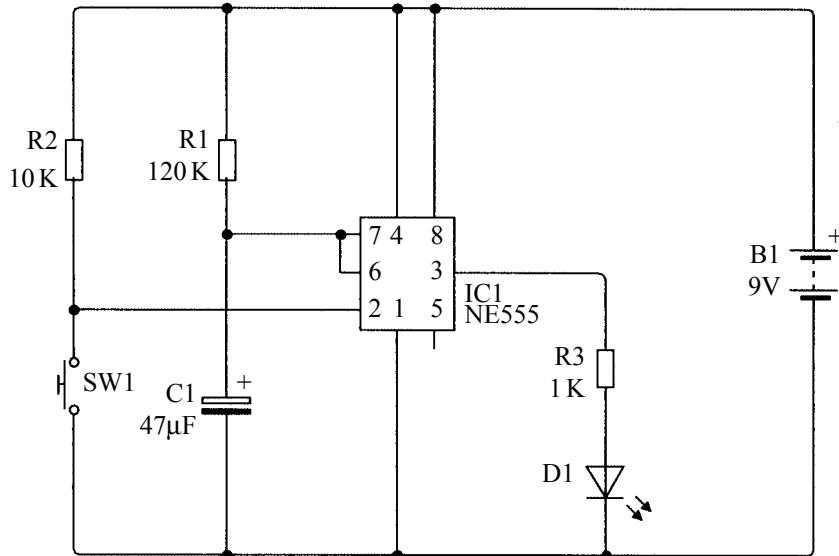
- Illustrate your answers with sketches and/or diagrams wherever you feel it is appropriate.

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 Answer Question 1.
 

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1 The circuit shown below is a monostable timer with an LED output.



- (a) Draw a modified diagram of the circuit that will allow the monostable to operate a solenoid. (4 marks)
- (b) Calculate the 'ON' time of the monostable once it has been triggered. ( $T=1.1R_1C_1$ ) (4 marks)
- (c) The 555 Timer IC is supplied in an 8-pin DIL package.
- (i) Sketch an 8-pin DIL package. (2 marks)
  - (ii) Show how pin 1 is identified. (1 mark)
  - (iii) Number **all** remaining pins. (1 mark)
- (d) The circuit shown above is to be produced on a Printed Circuit Board (PCB).  
Draw a suitable PCB layout for the circuit, indicating the component locations. (8 marks)
- (e) Listed below are four products together with the materials from which they are made.
- (i) Motor car wheel made from aluminium alloy
  - (ii) Printed circuit board made from glass-fibre reinforced plastic
  - (iii) Kitchen cupboard door made from plastic coated MDF
  - (iv) Bath made from acrylic

With reference to the working properties of each material and any other factors which you consider relevant, explain why the material is suitable for each of the products.

(4 × 5 marks)

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

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- 2 (a) (i) Using an example of your choice, describe an *open* loop control system. (3 marks)
- (ii) Using an example of your choice, describe a *closed* loop control system. (3 marks)
- (b) Electronic circuits can be prototyped using breadboard or by modelling on a CAD package.
- Compare these **two** methods of prototyping electronic circuits. (2 × 6 marks)
- (c) Other than for electronic circuit design, describe **two** uses for ICT as a modelling tool. (2 × 5 marks)

- 3 (a) A motor rotates at 6000 rpm.

Design a gear system that will drive an output shaft at 400 rpm in the *opposite direction* to the motor.

You may use any combination of 8, 24 and 40 tooth gears.

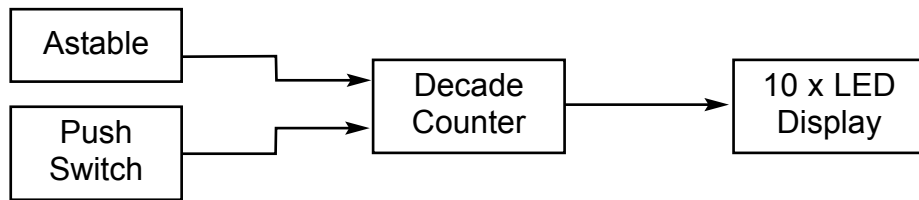
Use an annotated sketch in your answer and show all necessary calculations. (10 marks)

- (b) A worm and wormwheel could be used to provide the same gear reduction as the gearbox in part (a).
- Sketch a worm and wormwheel and state the number of teeth on both gears. (4 marks)
- (c) The output motion of a worm and wormwheel is at 90° to the input motion.
- Using annotated sketches, describe **two** other methods of transmitting rotary motion between two shafts at 90°. (2 × 3 marks)
- (d) Using examples, explain the advantages and disadvantages of using gears compared with belt and pulley systems. (8 marks)

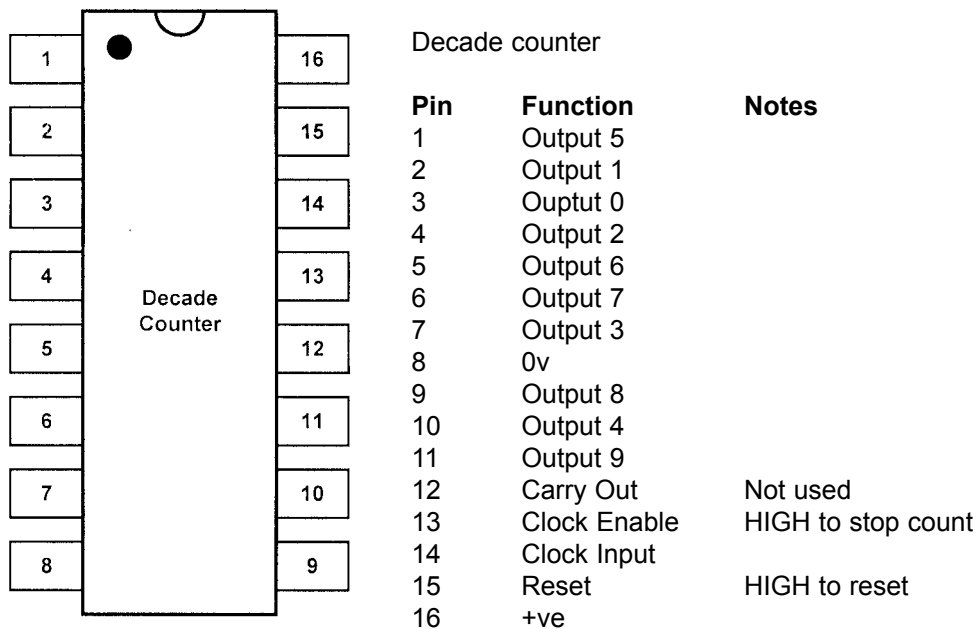
**Turn over for the next question**

**Turn over ▶**

- 4 A systems diagram for a random number generator is shown below. The astable causes each of the ten LEDs to rapidly light in sequence until a switch is pressed when the display will stop on one LED.



- (a) On the **insert** sheet provided, complete the circuit diagram for the random number generator. (12 marks)



- (b) Printed circuit boards can be produced using either rub-down transfers, photo-etching or by milling on computer-aided machinery.

Describe in detail **one** of these processes.

(8 marks)

- (c) Identify **four** health and safety risks when producing and soldering printed circuit boards and state how the risks may be reduced. (4 × 2 marks)

**END OF QUESTIONS**

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

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**Insert**

For use with Question 4 part (a).

