

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

AS

DESIGN AND TECHNOLOGY: SYSTEMS AND CONTROL TECHNOLOGY

Unit 1 Materials, Components and Application

Monday 23 May 2016

Morning

Time allowed: 2 hours

Materials

For this paper you must have:

- normal writing and drawing instruments.

Instructions

- Use black ink or black ball-point pen. Use pencil for drawing only.
- Fill in the boxes at the top of this page.
- Answer **all** questions in Section A.
- Answer **one** question from Section B, **either** Question 5 **or** Question 6.
- Answer the question in Section C.
- You must answer the questions in the spaces provided. Do not write outside the box around each page.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- There are 20 marks for Section A, 20 marks for Section B and 40 marks for Section C.

Advice

- Illustrate your answers with sketches and/or diagrams wherever you feel it is appropriate.
- You are advised to spend approximately 30 minutes on Section A, 30 minutes on Section B and one hour on Section C.



Section AAnswer **all** the questions in this section.

1 (a) Draw the symbol for an NPN Transistor **and** label the legs.

[2 marks]

1 (b) Give **two** properties of copper that make it a suitable material for the production of thin electrical wires.

[2 marks]

Property 1: _____

Property 2: _____

4

2 Explain the following terms:

2 (a) Electrical resistance

[2 marks]

2 (b) Friction

[2 marks]

4



3 Describe a system that would have a clockwise rotary input of 300 rpm and produce an output of 5 rpm counter-clockwise. Use annotated sketches to support your answer. **[4 marks]**

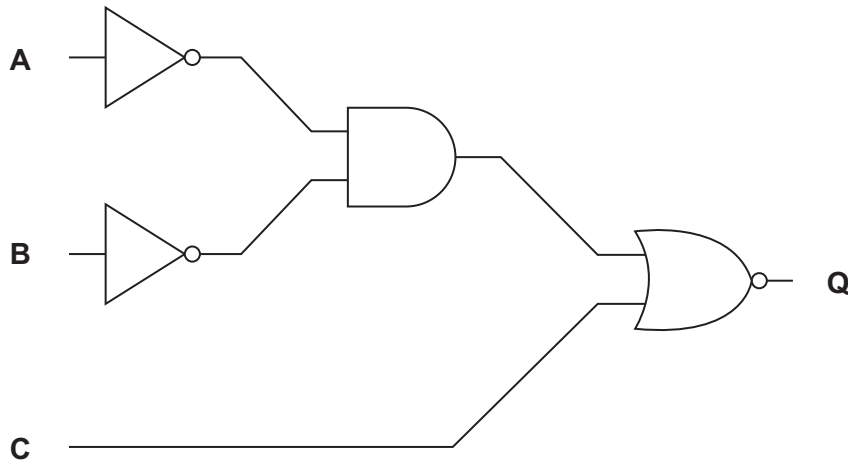
4

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4 (a) Complete the truth table for the circuit shown below.

[4 marks]



A	B	C	Q
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

4 (b) Describe in detail how to test a silicon diode to make sure it is functioning correctly. Use sketches to support your answer.

[4 marks]



Section B

Answer **either** Question 5 **or** Question 6

5 (a) Describe a system that will flash a 12 volt light bulb at a starting frequency of 1 Hz that increases by 1 Hz every 10 seconds. Use annotated sketches to support your answer.
[10 marks]

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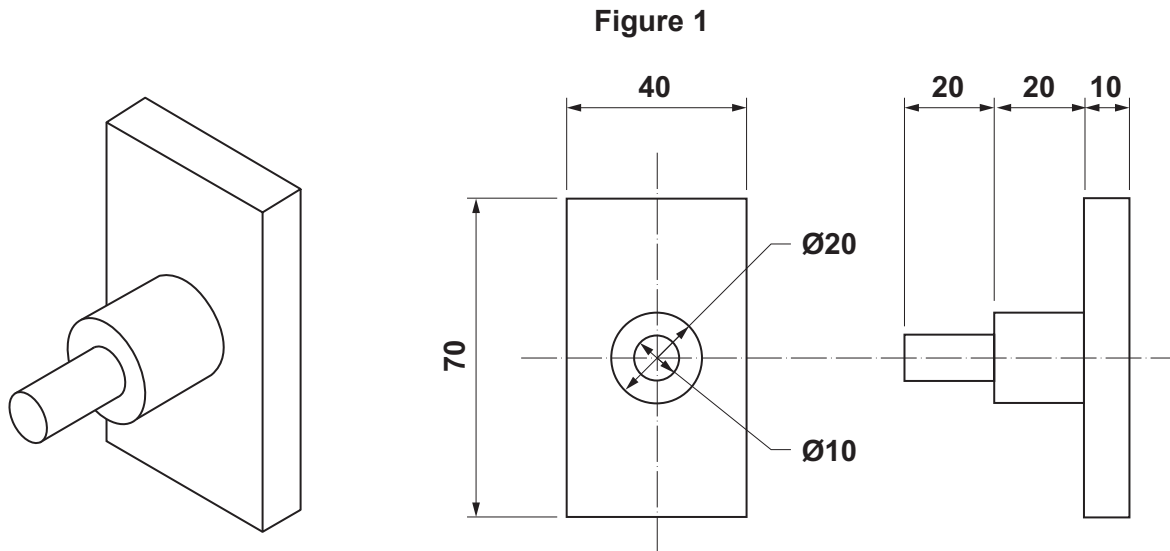


- 5 (b)** Describe in detail how the artefact shown in **Figure 1** could be produced accurately (± 0.1 mm) from a metal of your choice. Use annotated sketches to support your answer.

[10 marks]

Your answer should make reference to:

- how the required level of accuracy is achieved
- the stages in the production process
- the processes, tools and equipment used.



All dimensions shown are in millimetres.



20

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Do **not** answer this question if you have answered Question 5.

6 (a) Show a system that will only illuminate a light when four switches are operated in the sequence:

Switch 1

Switch 2

Switch 4

Switch 3

If any switch is operated out of sequence an alarm should sound and remain on until a separate reset switch is operated. Use annotated sketches to support your answer.

[10 marks]



6 (b) Describe a system that will take 10 seconds to complete one cycle of reciprocating motion.

The amount of linear movement should be variable between 50 mm and 200 mm. Use annotated sketches to support your answer.

[10 marks]

20

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ANSWER IN THE SPACES PROVIDED**



Section C

Answer this Question.

7 A system is required to control the flow of traffic automatically where a railway line crosses a road (a level crossing).

7 (a) (i) Show a system for sensing when a train is approaching **and** show the output it produces when a train is detected.

[4 marks]

7 (a) (ii) Show how the output from **7 (a) (i)** could be communicated to the level crossing which will be a long distance away. Use a diagram to support your answer.

[2 marks]

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- 7 (b) (i)** Describe a system that will switch on a 240 volt lamp automatically when it receives an input. The lamp should remain on until a reset is operated. Use an annotated sketch to support your answer.

[5 marks]

- 7 (b) (ii)** Describe a system that will automatically flash two 240 volt lamps alternately when activated by an input. Use an annotated sketch to support your answer.

[5 marks]



7 (b) (iii) Give a reason why an audible warning device and a physical barrier might also be necessary at a level crossing.

[2 x 2 marks]

Audible warning: _____

Physical barrier: _____

Question 7 continues on the next page

Turn over ►



7 (c) Produce a design for a complete automatic level crossing system that fulfils the following requirements:

- sense when a train is approaching **and** illuminate an amber light to warn motorists
- after 5 seconds two red lights flash alternately at 1 Hz to stop the motorists
- after 10 seconds a barrier closes to block the road
- when the train is fully clear of the level crossing the barrier should open
- when the barrier is fully open all the lights should go off.

Your diagrams should show clearly where **and** how the various parts of the system are positioned and mounted with the control and interaction between the sub-systems explained.

Marks will be awarded for:

- the system that senses the approaching train **[2 marks]**
- the control system **[6 marks]**
- barrier and drive systems **[4 marks]**
- assembly and integration of the sub-systems **[4 marks]**
- selection of materials, components and mountings. **[4 marks]**



Empty box for writing answers.

40

END OF QUESTIONS



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