Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Design and Technology: Systems and Control Technology SYST1

Unit 1 Materials, Components and Application

Wednesday 14 May 2014 9.00am to 11.00am

For this paper you must have:
- normal writing and drawing instruments.

Time allowed
- 2 hours

A

Instructions
- Use black ink or black ball-point pen. Use pencil only for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** the 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 the 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 A

Answer **all** the questions in this section.

1 Explain the following terms and give an example of each:

1 (a) a thermoplastic material

[2 marks]

Explanation .....

.....

Example .....

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1 (b) a semi-conducting material

[2 marks]

Explanation .....

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Example .....

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4

2 Draw symbols for the following electronic components:

2 (a) an input transducer that can detect a change in temperature

[2 marks]

2 (b) a two input NAND gate

[2 marks]

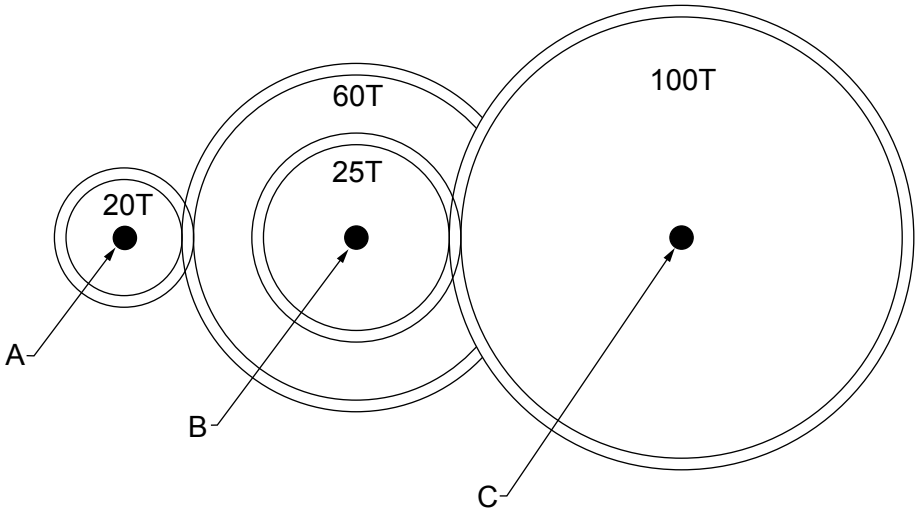
4

Turn over for the next question

3 **Figure 1** shows a compound gear system.

Figure 1

The 60T and 25T gears are attached to shaft B



If shaft A rotates at 360 rpm calculate the speed of rotation of shaft B and shaft C.

[2 × 2 marks]

Shaft B: .....

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Shaft C: .....

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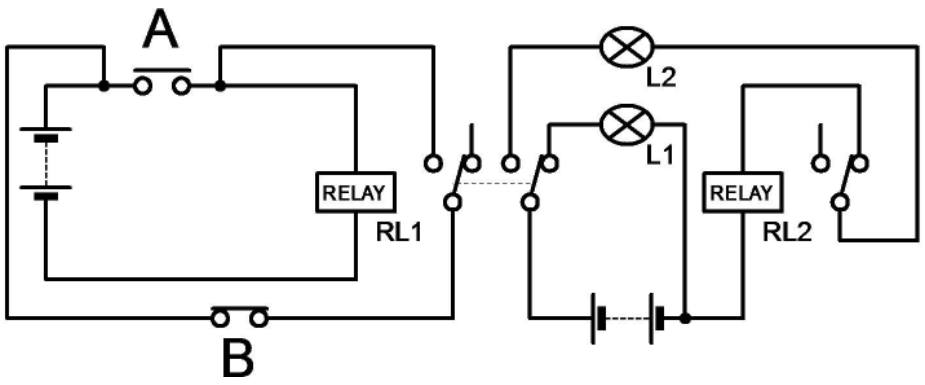
4 **Figure 2** shows a circuit.

Figure 2



4 (a) Explain the operation of the circuit when switch A is momentarily closed.

[6 marks]

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4 (b) Explain the purpose of switch B in the circuit.

[2 marks]

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Turn over ▶

8

Section B

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

5 (a) With the aid of a diagram, describe in detail an electro-mechanical **or** an electronic system for automatically switching on a set of 230 volt ac traffic lights in the sequence:

Red
Red and Amber
Green
Amber
Red

[12 marks]

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5 (b) With the aid of a diagram, explain any modifications that would be required to the system to enable the length of time each light is on to be set as follows:

Red	**55 seconds**
Red and Amber	**5 seconds**
Green	**60 seconds**
Amber	**10 seconds**

[4 marks]

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5 (c) Explain **two** advantages **or** disadvantages of using LEDs for this application in place of 230 volt ac lamps.

[2 × 2 marks]

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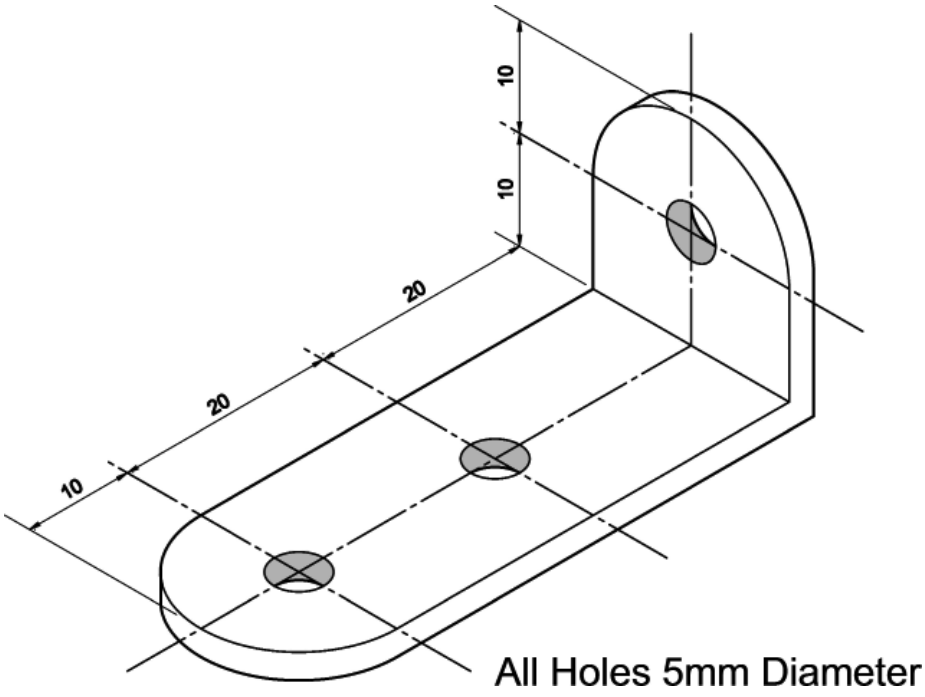
20

Do **not** answer Question 6 if you have answered Question 5.

6 (a) With the aid of annotated sketches, describe in detail a method of batch producing 100 of the brackets shown in **Figure 3** from long lengths of 20mm wide by 1mm thick mild steel strip.

[12 marks]

Figure 3



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6 (b) With the aid of annotated sketches, describe a 'permanent' and a 'temporary' method of joining electronic components together.
You should indicate how good electrical conductivity between the components is achieved.

[2 × 4 marks]

Permanent Method

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Temporary Method

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20

Section C

Answer this question.

7 A system is required to automatically control the entrance of a small car park for 30 cars.

7 (a) With the aid of a diagram, show a suitable system that would automatically sense a car is waiting to enter the car park and produce an electrical output. A pedestrian should not be able to trigger the system.

[4 marks]

Question 7 continues on the next page

7 (b) (i) With the aid of annotated sketches, describe **two** suitable barrier systems that could be used at the car park entrance.

System 1

[4 marks]

System 2

[4 marks]

7 (b) (ii) With the aid of an annotated sketch, describe in detail a system that will automatically determine if there is room in the car park for the waiting car.

[8 marks]

Question 7 continues on the next page

7 (c) Using your ideas from parts 7(a) and 7(b) produce a design for a complete system that will open the barrier if a car is waiting and there is space available, and close it after the car has entered. Your diagram should clearly show the sensing systems, barrier, drive system and control system.

Marks will be awarded for:

- the barrier and drive system **[4 marks]**
- how the movement of the barrier is limited **[2 marks]**
- the sensing and control system **[8 marks]**
- assembly of the sub-systems **[4 marks]**
- selection of materials and components. **[2 marks]**

40

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED