

71 Candidate Num

General Certificate of Secondary Education 2012

Technology and Design

Unit 2: Systems and Control

Element 1: Electronic and Microelectronic Control Systems

[GTD21]

TUESDAY 29 MAY, AFTERNOON



TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

Write your answers in the spaces provided in this question paper. Answer **all** questions.

On page 3 we have provided formulae for you to use with this paper.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

For Examiner's use only					
Question Number Marks					
1					
2					

Total Marks	



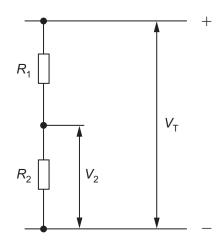
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Formulae for GCSE Technology and Design

You should use, where appropriate, the formulae given below when answering questions which include calculations.

- 1 Potential Difference = current \times resistance ($V = I \times R$)
- 2 For potential divider

$$V_2 = \frac{R_2}{R_1 + R_2} \times V_T$$



$$R_{\mathsf{T}} = R_1 + R_2 + R_3 \ \mathsf{etc}$$

$$\frac{1}{R_{\rm T}} = \frac{1}{R_1} + \frac{1}{R_2}$$
 or $R_{\rm T} = \frac{R_1 \times R_2}{R_1 + R_2}$

4 Time Constant
$$T = R \times C$$

1 (a) (i) State or explain Ohm's Law.

		[2]

(ii) Calculate the current flow in the circuit shown in Fig. 1.

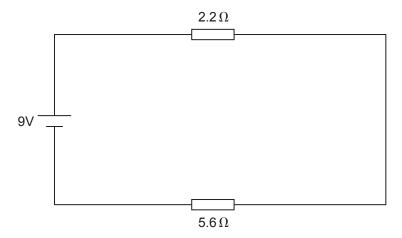


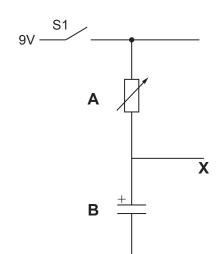
Fig. 1

Calculations

[4]

	(iii)	Use Fig. 1 to show how an ammeter would be connected in th circuit.	is [2]	Examine Marks	er Only Remark
	(iv)	Use Fig. 1 to show how a voltmeter would be connected in this circuit to check the voltage across the 5.6Ω resistor.	s [2]		
	(v)	Use calculations to confirm the expected voltmeter reading for part (iv) of this question.			
		Calculations			
			[4]		
			[.]		
(b)	(i)	Identify each of the two electronic symbols labelled A and B below, which are used in a relay.			
		1			
		A B			
			[2]		
	(ii)	State two applications of a relay.			
	()	Application 1			
		Application 2			
			[4]		

(c) Fig. 2 shows an electronic circuit.



Examiner Only

Fig. 2

(i) Name the circuit shown in Fig. 2.

Name ______[1]

(ii) Name the components represented by the circuit symbols **A** and **B** in **Fig. 2**.

Component A _____[1]

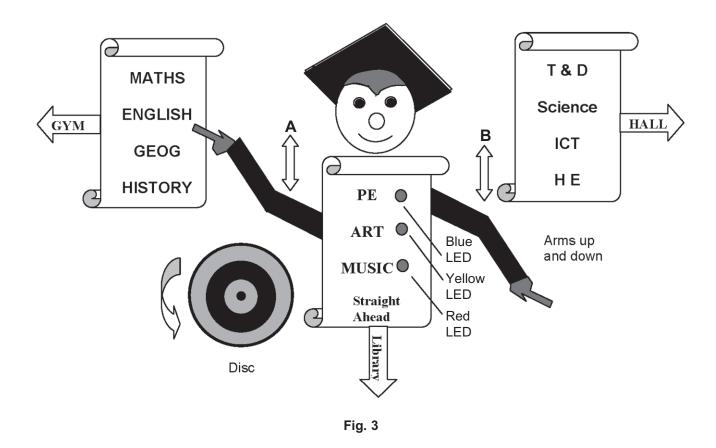
Component B ______[1]

(iii) Describe how this circuit operates to provide an output at point ${\bf X}.$

_____[3]

(d)	(i)	Complete the circuit in Fig. 2 by adding a buzzer, resistor and transistor to enable the buzzer to function.	[5]	Examin Marks	er Only Remark
	(ii)	Outline the primary function of the resistor and transistor in this circuit.	6		
		Resistor	-		
		Transistor	[2]		
(e)		circuit in Fig. 2 is to be developed by adding a Push to Make ch across and in parallel with component B .			
	(i)	Develop the circuit as described above.	[2]		
	(ii)	Describe how this development can influence the operation of circuit.	the		
			[4]		

2 Fig. 3 shows an animated display to give directions to subject areas for a school open night. The arms will move up and down as shown by the arrows labelled **A** and **B**. The LEDs will switch on and off and the disc can rotate. The display will be controlled by PIC microcontroller.



Six of the eight PIC outputs and two of the PIC inputs are to be used to control the display unit. The output connections are shown in **Table 1** and the inputs are shown in **Table 2**.

Outputs 0, 1 and 2 control the LEDs to illuminate three subjects. Outputs 3 and 4 control the movement of the arms to point to groups of subjects and output 5 controls the revolving disc.

Table 1

PIC	Not	Not	Disc	Arm	Arm	Blue	Yellow	Red
Outputs	used	used		" B "	" A "	LED	LED	LED
BIT	7	6	5	4	3	2	1	0

Table 2

PIC Inputs	Not used	Not used	Switch 1	Switch 2	Not used
BIT	4	3	2	1	0

(i)		s make use of quence that ca		on. Write down thusing 3 bits.	e bit	Examiner Or Marks Ren
					[4]	
(ii)	Convert th	e decimal nun	nber 50 to bin	ary.		
					[2]	
(iii)	Convert th	e binary numb	per 00011100	to decimal.		
					[2]	
(iv)		ny some outpu rive certain ou		need to be ampli	fied in	
					[2]	
(v)	•			Which of these oun	•	
	Output De	evices:				
	LED	Motor	Bulb	7 Segment I	Display	
	Answer: _				[2]	

- (i) Complete a flowchart and its relevant bit pattern in **Fig. 4** as follows:
 - Switch 1 must be pressed to start the routine
 - Both arms rise up
 - The red and blue LEDs turn on
 - All outputs turn off

[10]

START		BIT PATTERN

Fig. 4

- (ii) The student decided to improve the routine for the animated display unit. Complete the flowchart and bit pattern in **Fig. 5** as follows:
 - Switch 1 is pressed to start the routine
 - Arm A rises and remains in position for 3 seconds and then falls back to its original position
 - The Red LED goes on for 7 seconds
 - After 2 seconds the Yellow LED goes on for 5 seconds
 - All LEDs turn off
 - Arm B rises and remains in position for 6 seconds before falling back. During this time the disc rotates
 - This routine repeats until switch 2 is pressed. If this switch is pressed the system stops.

START		BIT PATTERN

k

Fig. 5

[18]

THIS IS THE END OF THE QUESTION PAPER

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