



General Certificate of Secondary Education  
2011

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## **Technology and Design**

**Unit 2:  
Systems and Control**  
**Element 1: Electronic and  
Microelectronic Control Systems**

**[GTD21]**

**MONDAY 6 JUNE, MORNING**

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## **MARK SCHEME**

## Element 1

AVAILABLE  
MARKS

## Electronic and Microelectronic Control Systems

1 (a) electrons/amps/voltage/ohms [4]

(b) (i)  $47000\Omega$ ,  $2200\Omega$  [2]

(ii) Fig. 1 Yellow/Violet/Orange [3]

(c) (i) Fig. 1

The silver band (10% Tolerance) tells us that value of the resistor can lie anywhere between + or - 10% of 47 k or  $47000\Omega$ /or similar.

$$\begin{aligned}\text{Tolerance} &= +/ - 10\% \\ &= +/ - 4.7\text{k}\Omega \text{ or } 4700\Omega\end{aligned}$$

Therefore the value of the resistor in Fig. 1 can be anywhere between

$51.7\text{k}\Omega$  and  $42.3\text{k}\Omega$

or

$51700\Omega$  and  $42300\Omega$

[3]

Fig. 2

The gold band (5% Tolerance) tells us that value of the resistor can lie anywhere between + or - 5% of 2.2 k or  $2200\Omega$ /or similar

$$\begin{aligned}\text{Tolerance} &= +/ - 5\% \\ &= +/ - 0.11\text{k}\Omega \text{ or } 110\Omega\end{aligned}$$

Therefore the value of the resistor in Fig. 1 can be anywhere between

$2.31\text{k}\Omega$  and  $2.09\text{k}\Omega$

or

$2310\Omega$  and  $2090\Omega$

[3]

$$(ii) V2 = \frac{R2}{R1 + R2} \times Vt$$

$$V2 = \frac{2200}{47000 + 2200} \times 12$$

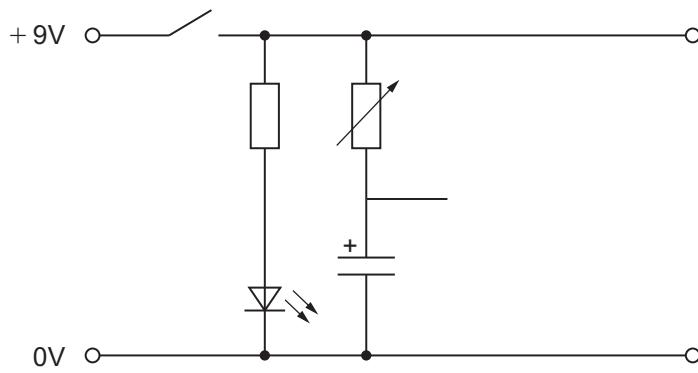
$$V2 = \frac{2200}{49200} \times 12$$

$$V2 = \frac{22}{492} \times 12$$

$$V2 = 0.54\text{V}$$

[5]

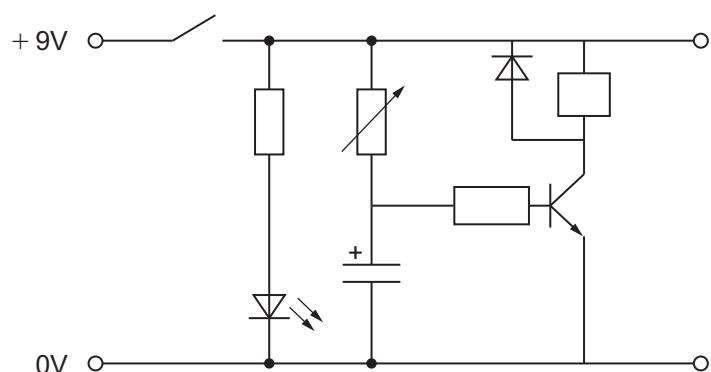
(d) (i)



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[4]

(ii)



[4]

(iii) Resistor to protect the transistor

Diode to protect the component from back emf generated by the relay

[2]

(iv) SPST switch (A) closed to turn on circuit.

LED (B) lights to indicate circuit on.

LED is protected by the fixed resistor.

Variable resistor (C) and Polarised Capacitor (D) form a PD circuit.

Capacitor provides a time delay as it charges.

Output from PD circuit switches on the transistor when output is 0.6/7V.

Relay is then switched on

[8]

(v) To switch on a higher current circuit after a time delay

[2]

40

2 (a) (i)

[3]

A	B	C	D	E	F	G	H
1	0	0	1	0	0	1	0

AVAILABLE MARKS

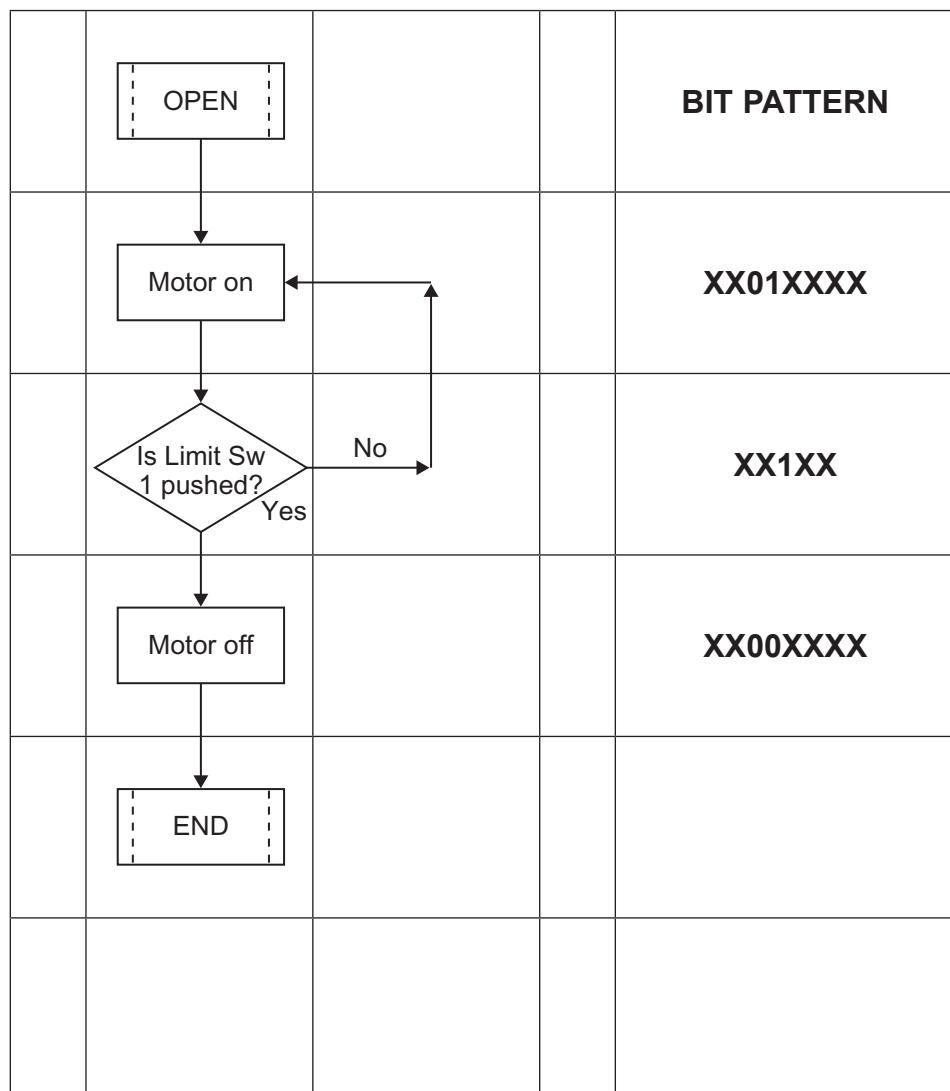
(ii) Microcontroller/PIC has an integrated circuit  
 It contains memory  
 It has a large number of inputs and outputs, etc  $2 \times 1$  [2]

(iii) Microcontroller is extremely versatile  
 Used in more complex circuits  
 Re-programmable  
 Replaces a large number of components, *any two*  $2 \times 2$  [4]

(iv) Household appliances e.g. microwave; washing machine;  
 Medical equipment  
 Vehicle sub-systems  
 Electronic instruments, *any three*  $3 \times 1$  [3]  
 Any other suitable answer

(b) (i)

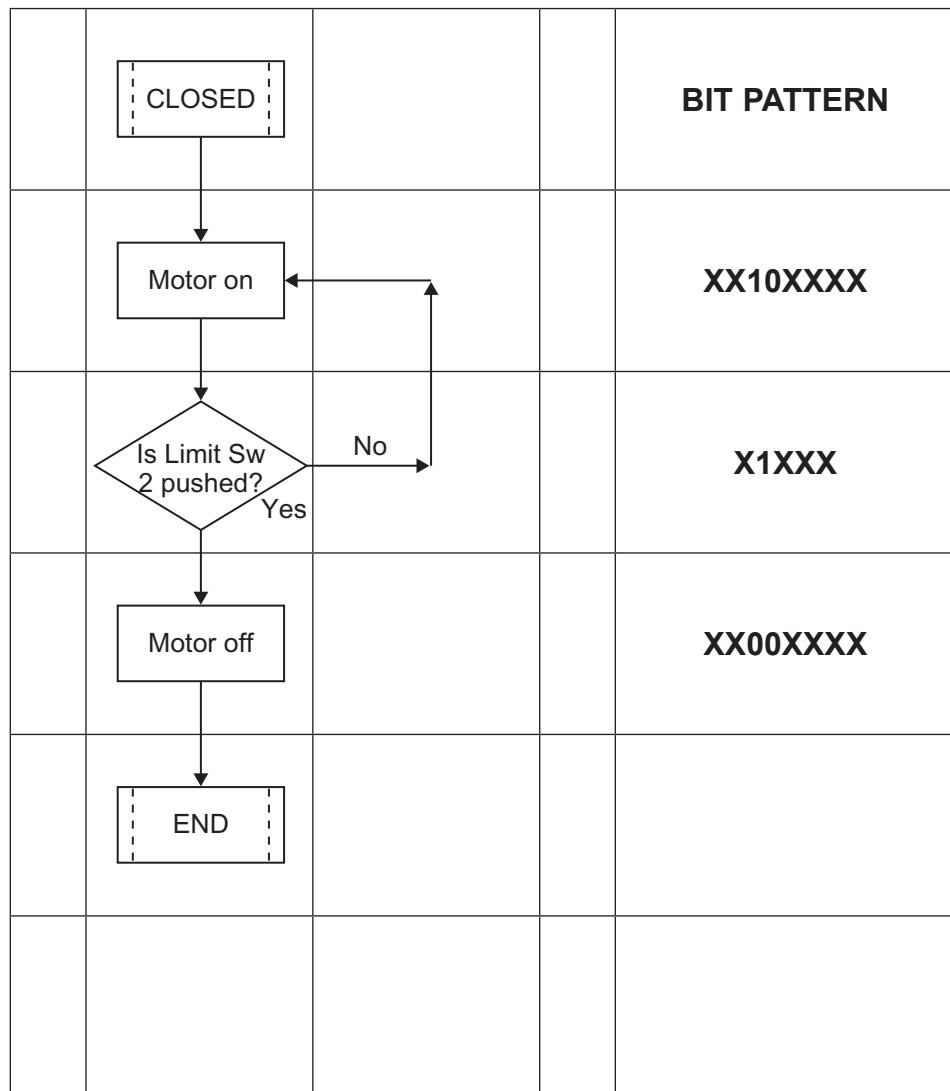
AVAILABLE MARKS



[8]

(b) (ii)

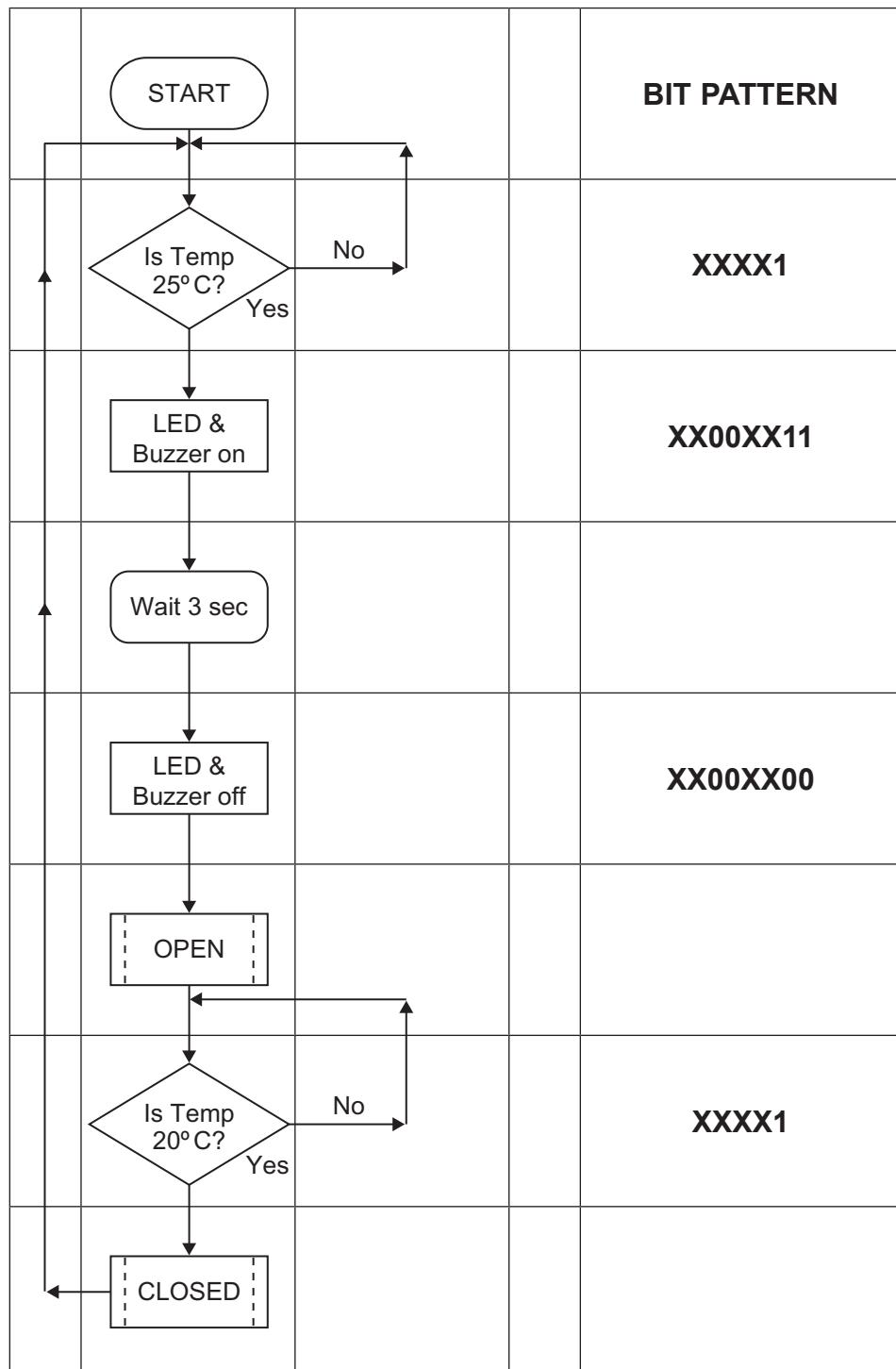
AVAILABLE MARKS



[8]

(b) (iii)

AVAILABLE MARKS



[12]

40

Total

80