



General Certificate of Secondary Education
2011

Technology and Design

Unit 2:

Systems and Control

Element 1: Electronic and
Microelectronic Control Systems

[GTD21]

MONDAY 6 JUNE, MORNING

**MARK
SCHEME**

Element 1

AVAILABLE
MARKS

Electronic and Microelectronic Control Systems

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

(b) (i) 47000Ω , 2200Ω [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 47000Ω /or similar.

$$\text{Tolerance} = +/\text{--} 10\%$$

$$= +/\text{--} 4.7 \text{ k}\Omega \text{ or } 4700\Omega$$

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

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

or

$$51700\Omega \text{ and } 42300\Omega \quad [3]$$

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 2200Ω /or similar

$$\text{Tolerance} = +/\text{--} 5\%$$

$$= +/\text{--} 0.11 \text{ k}\Omega \text{ or } 110\Omega$$

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

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

or

$$2310\Omega \text{ and } 2090\Omega \quad [3]$$

$$(ii) \quad V_2 = \frac{R_2}{R_1 + R_2} \times V_t$$

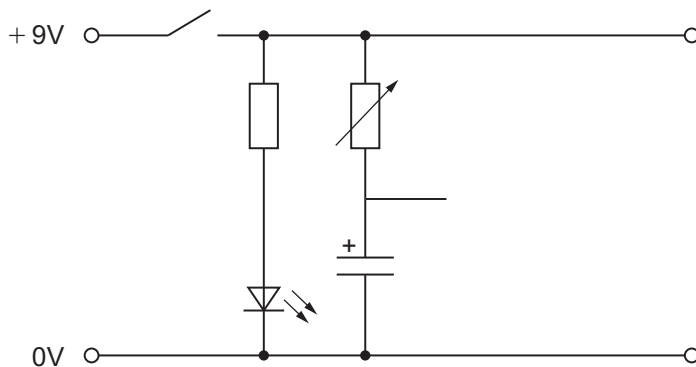
$$V_2 = \frac{2200}{47000 + 2200} \times 12$$

$$V_2 = \frac{2200}{49200} \times 12$$

$$V_2 = \frac{22}{492} \times 12$$

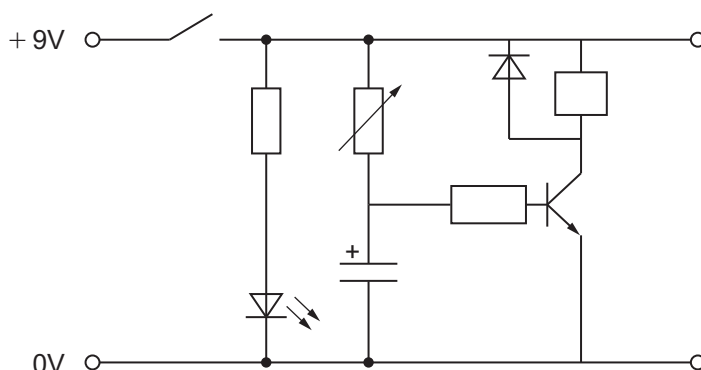
$$V_2 = 0.54V \quad [5]$$

(d) (i)



[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]

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

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

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

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

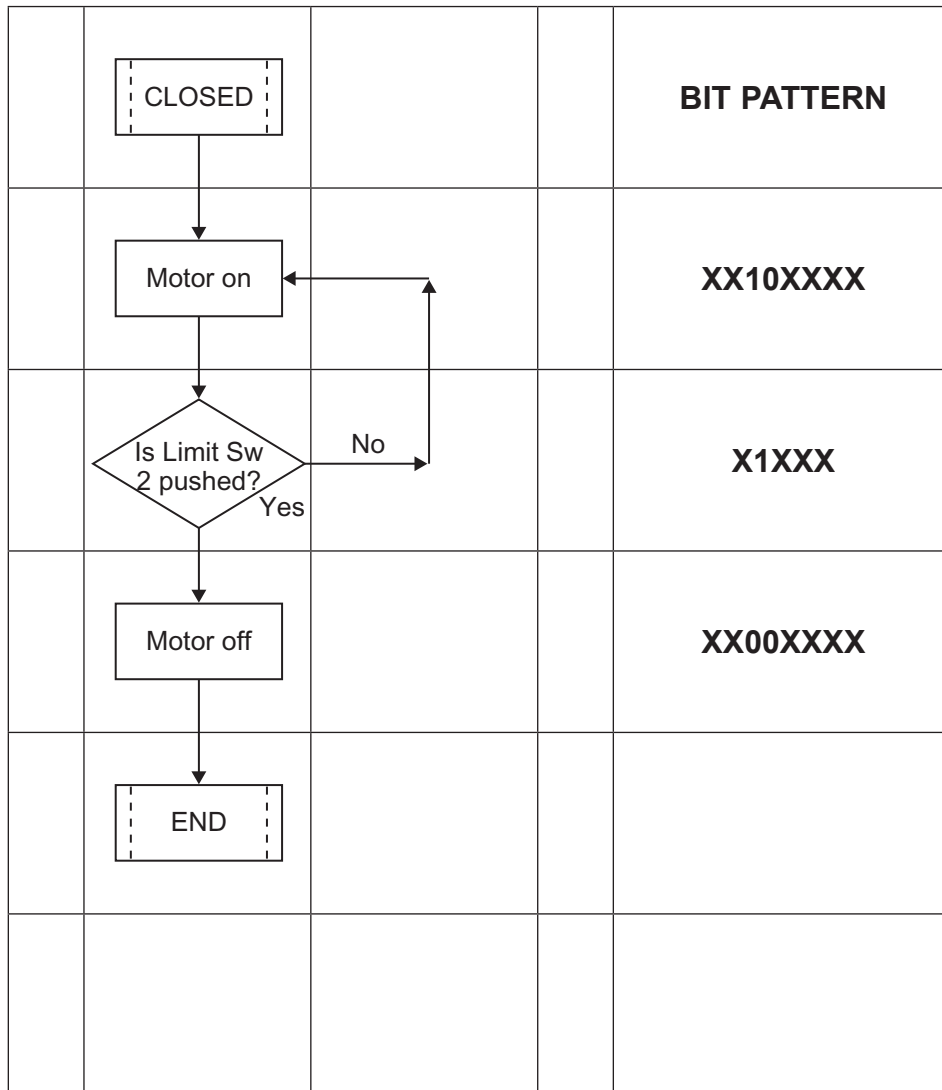
(b) (i)

	<div>OPEN</div>			BIT PATTERN
	<div>Motor on</div>			XX01XXXX
	<div>Is Limit Sw 1 pushed?</div> <div>No</div> <div>Yes</div>			XX1XX
	<div>Motor off</div>			XX00XXXX
	<div>END</div>			

[8]

AVAILABLE MARKS

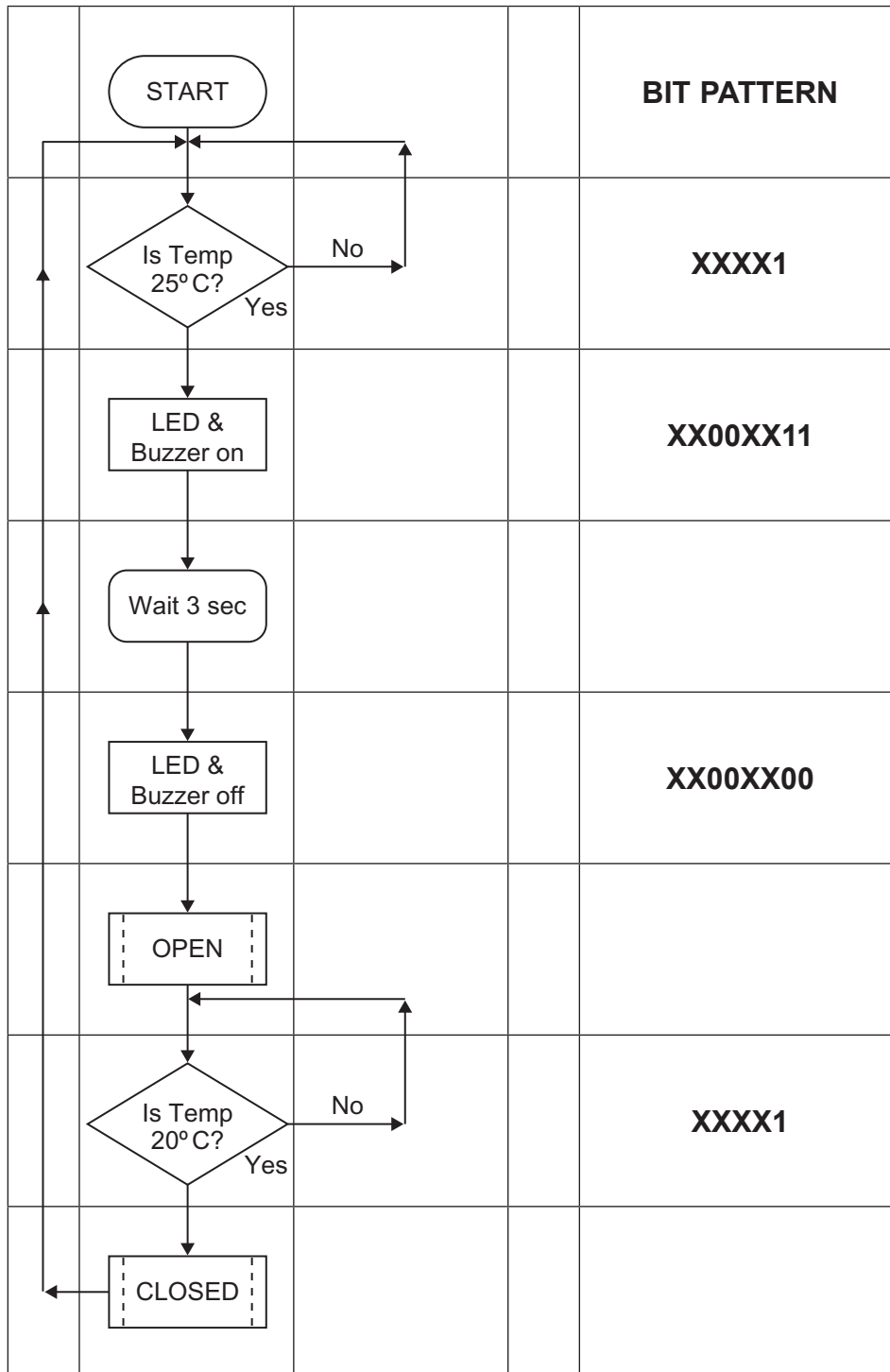
(b) (ii)



[8]

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(b) (iii)



[12]

Total

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40

80