2009 Technological Studies

Intermediate 2

Finalised Marking Instructions

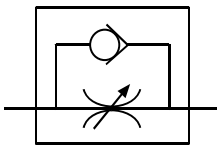
SECTION A

1. (a) **1** **Lever operated, 5/2 valve, spring return** **1 mark**

2 **Double acting cylinder** **1 mark** **2 marks**

(b) (i) **Unidirectional restrictor** **1 mark**

(ii)



allow FTE **1 mark**

(iii) **Restricting exhaust air (outstroking)** **1 mark**

(c) **No electricity near water etc** **1 mark**

(d) **Check piping etc** **1 mark**

Total 7 marks

2. (a) **Brain of microcontroller** **1 mark**
Keeps all the sub-systems working in time together **1 mark**
Connects microcontroller to 'real' world **1 mark** **3 marks**

(b) (i) **Electronic Erasable Programmable Read Only Memory** **1 mark**

(ii) **Program lost on power down / Volatile** **1 mark**

(c) (i) **5, 3, 2** **1 mark**

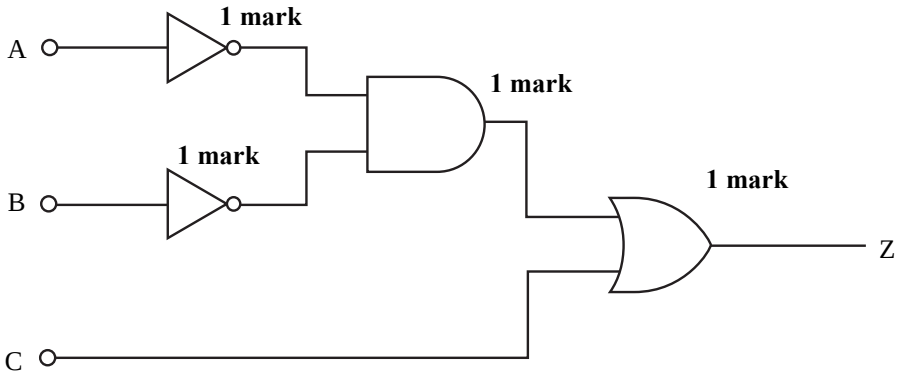
(ii) **Binary value** **1 mark**

Total 7 marks

3. (a) **Hex Invertor** **1 mark**

Quad 2 Input OR Gate **1 mark** **2 marks**

(b) (i)



4 marks

(ii) $\mathbf{Z = (\overline{A} \circ \overline{B}) + C}$

1 mark **1 mark** **1 mark** **3 marks**
Inverting A AND B **ANDing A and B** **ORing A and B**

Total 9 marks

4. (a) (i) $E_k = \frac{1}{2}mv^2$

$= \frac{1}{2} \times 70 \times 6^2$ **1 mark**

$= 1260$ J **1 mark answer from given working** **2 marks**

(ii) $E_k = E_p$ **1 mark**

$E_p = 1260 = mgh$ **(allow FTE)**

$1260 = 70 \times 9{\cdot}81 \times h$ **1 mark**

$h = \frac{1260}{70 \times 9{\cdot}81}$

$= 1{\cdot}8$ m **1 mark answer from given working** **3 marks**

(b) **Loss of energy (1 mark) as a result of heat/friction (1 mark)** **2 marks**

Total 7 marks

5. (a) **More current through/voltage across lamp (3)** **1 mark**

(b) (i) $R_T = \frac{R_1R_2}{R_1 + R_2} = \frac{100 \times 100}{100 + 100}$ **1 mark**

$= 50\ \Omega$ **1 mark answer from given working** **2 marks**

(ii) **50 Ω + 100 Ω = 150 Ω (allow FTE)** **1 mark**

(iii) $V_1 = IR$

$= 0{\cdot}03 \times 100$

$= 3$ V **1 mark answer from given working**

$V_3 = IR$

$= 0{\cdot}06 \times 100$

$= 6$ V **1 mark answer from given working**

$V_S = 3 + 6$

$= 9$ V **1 mark answer from given working** **3 marks**

(c) (2) **0·09 W** **1 mark**

(3) $P = 6 \times 0{\cdot}06$ **1 mark**

$= 0{\cdot}36$ W **1 mark answer from given working** **3 marks**

Total 10 marks

6. (a)

```
if pin 0 = 1 then pump on      1 mark
if pin 1 = 0 then pump off     1 mark
pause 10000                    1 mark
high 5                         1 mark
goto main                      1 mark
```

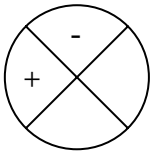
5 marks

(b) **for ... next loop (for counter = 1 to 10….. next counter)** **1 mark**

(c) **(description) easier to change operation/upgrades** **1 mark**

Total 7 marks

7. (a)



symbol in correct position **1 mark**

(b) **Desire temperature level is set. Error detector compares desired level with actual level from temperature sensor. If error exists, output driver switches on the heater. As temperature rises, error is reduced until later switched off.**

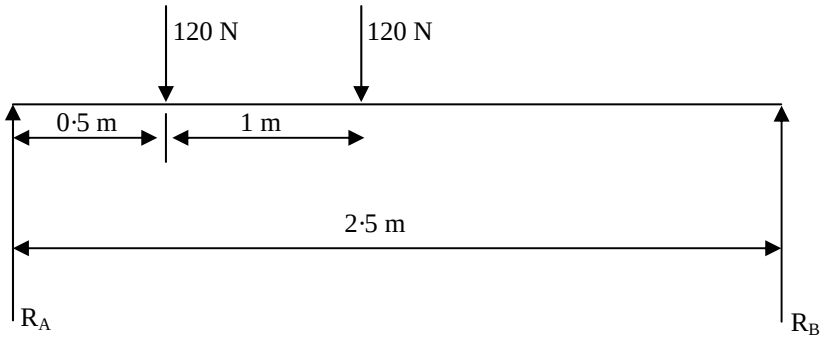
1 mark for each relevant statement **3 marks**

(c) (i) **Negative** **1 mark**

(ii) **Maintains temperature around set/desired level** **1 mark**

Total 6 marks

8. (a)



All forces with directions **1 mark**
All sizes **1 mark** **2 marks**

(b) (i) **Σ clockwise moments = Σ anti clockwise moments**

$R_A \times 2{\cdot}5 = (120 \times 1) + (120 \times 2)$ **1 mark**

$$R_A = \frac{360}{2{\cdot}5}$$ **1 mark**

$= 144$ N **1 mark answer from given working** **3 marks**

(ii) $\Sigma F_V = 0$

$240 = 144 + R_B$ **1 mark (allow FTE)**

$R_B = 96$ N **1 mark** **2 marks**

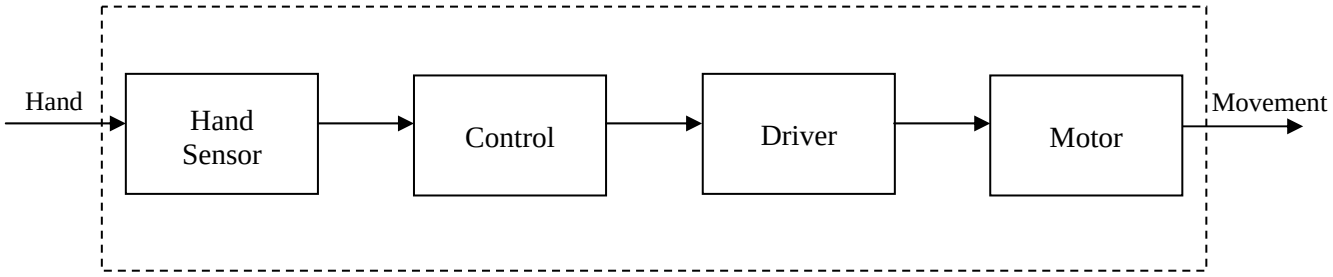
Total 7 marks

SECTION B

9. (a) (i) **Open loop** **1 mark**

(ii) **No feedback** **1 mark**

(iii)



1 mark

(b) $\mathbf{V_1} = \frac{\mathbf{R}}{\mathbf{R_{TOTAL}}} \times \mathbf{V_{CC}}$ **1 mark**

$= \frac{\mathbf{5000}}{\mathbf{55000}} \times \mathbf{5}$ **1 mark**

= 0·45 V **1 mark answer from given working** **3 marks**

(c) (i) **V = 1·5 - 0·7** **1 mark**

= 0·8 V **1 mark** **2 marks**

(ii) $\mathbf{I_b} = \frac{\mathbf{V}}{\mathbf{R}}$

$= \frac{\mathbf{0 \cdot 8}}{\mathbf{1000}}$ **1 mark (allow FTE)**

= 0·0008A **1 mark (answer from given working)** **2 marks**

(iii) $\mathbf{I_c} = \mathbf{h_{FE} \times I_b}$

= 100 × 0·0008 **(allow FTE)**

= 0·08 A **(answer from given working)** **1 mark**

(d) **Double Pole Double Throw (DTDP)** **1 mark**

(e) **Compound gear** **1 mark**

(f) **Clockwise** **1 mark**

(g) $\frac{\text{Driven}}{\text{Driver}} \times \frac{\text{Driven}}{\text{Driver}}$

1 mark —— $\frac{80}{30} \times \frac{50}{10}$ —— **1 mark**

2·67 × 5

13·35 :1 **1 mark**

Output speed:-

$\frac{2000}{13 \cdot 35}$ **= 145·8 rev/min** **1 mark (answer from given working)** **4 marks**

(h) (i) **Turning force etc** **1 mark**

(ii) **Larger output gear or smaller input gear** **1 mark**

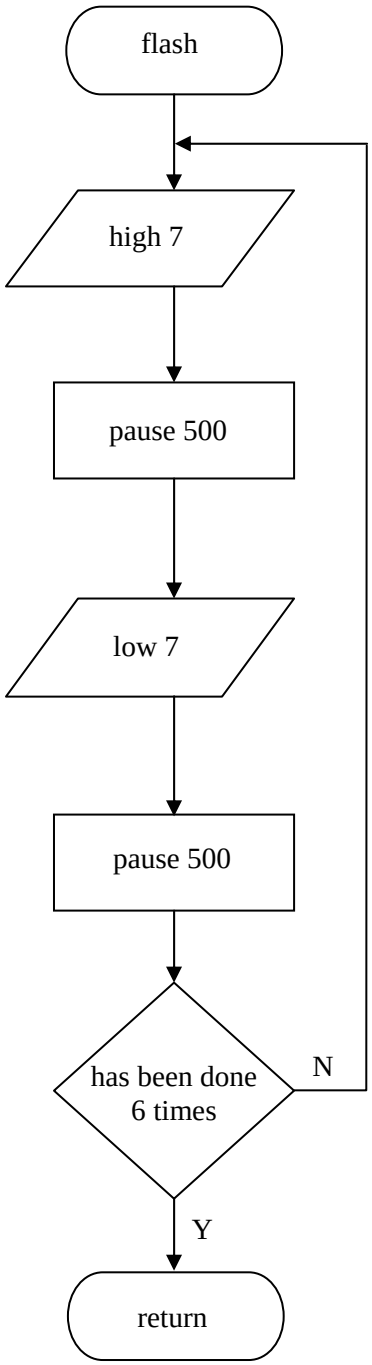
Total 20 marks

10. (a)

let pins	**=**	**0**	**1 mark**
if pin 0	**=**	**0 then main**	**1 mark**
let pins	**=**	**%11000000**	**1 mark**
pause 5000			**1 mark**
low 7			**1 mark**

5 marks

(b)



flash/return	**1 mark**
high 7/low 7	**1 mark**
both pause	**1 mark**
loop & decision	**1 mark**
correct symbols	**1 mark**

5 marks

(c) **Use existing programs/quicker development etc** **1 mark**

(d) $E_s = \frac{1}{2}Fx$ **1 mark**

$1000 = \frac{1}{2} \times F \times 0 \cdot 5$ **1 mark**

$F = \frac{1000}{\left(\frac{1}{2} \times 0 \cdot 5\right)}$

F = 4 kN 1 mark (answer from given working) **3 marks**

(e) **25 × 9·81** **35 × 9·81**
Child A = 245·25 N 1 mark **Child B = 343·35 N 1 mark** **2 marks**

(f) (i) **CWM = 343 × 0·9**
= 308·7 Nm 1 mark (allow FTE)

ACWM = 245 × 1·5
= 367·5 Nm 1 mark (allow FTE) **2 marks**

(ii) **Down / anticlockwise** **1 mark**

(g) **Equilibrium** **1 mark**

Total 20 marks

11. (a) **(A) : Potential 1 mark**

(B) : Kinetic 1 mark

(C) : Electrical 1 mark **3 marks**

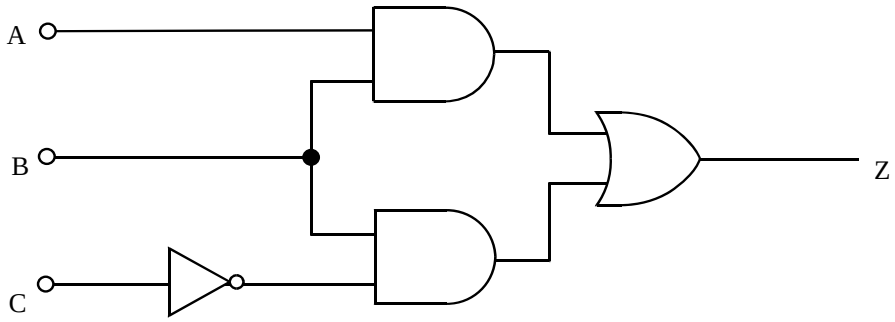
(b) **Wind, solar, tidal, wave, geo-thermal, etc**
1 mark per suitable source

2 marks

(c) **Valve (B) is activated or if valve (A) has been activated, pilot air will activate valve (F) via shuttle valve (E). Valve (F) will cause Gate 1 to outstroke activating valve (D) which will send a signal to valve (G). When valve (G) is activated it will oustroke Gate 2. When valve (C) is activated it will instroke both Gates 1 and 2.**

1 mark for each correct statement **5 marks**

(d) (i)



1 mark for each correct gate. **4 marks**

(ii)

A	B	C	A·B	B·$\overline{C}$	Z
0	0	0	**0**	**0**	**0**
0	0	1	**0**	**0**	**0**
0	1	0	**0**	**1**	**1**
0	1	1	**0**	**0**	**0**
1	0	0	**0**	**0**	**0**
1	0	1	**0**	**0**	**0**
1	1	0	**1**	**1**	**1**
1	1	1	**1**	**0**	**1**
			1 mark	**1 mark**	**1 mark**

Allow FTE for column Z

3 marks

(e) (i) **T T L** **1 mark**

(ii) **1: Not affected by static electricity**
2: Works from 5 V etc

1 mark for each correct statement **2 marks**

Total 20 marks

[END OF MARKING INSTRUCTIONS]