

**Specimen for 2007**

**International General Certificate of Secondary Education**

**MARK SCHEME**

**MAXIMUM MARK: 50**

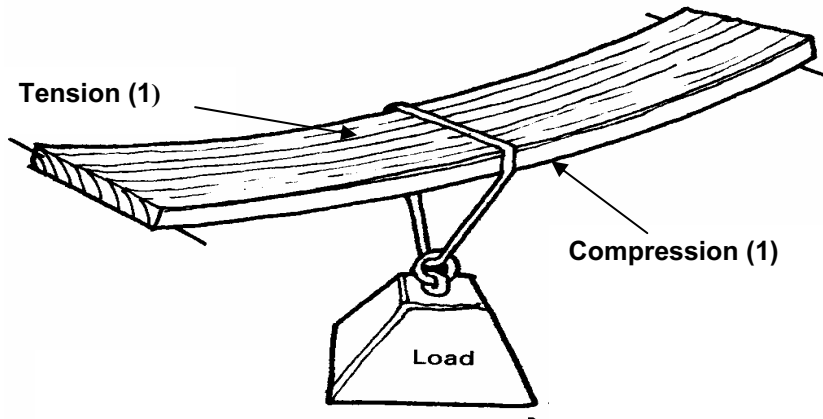
**SYLLABUS/COMPONENT: 0445/04**

**DESIGN AND TECHNOLOGY**

**Systems and Control**

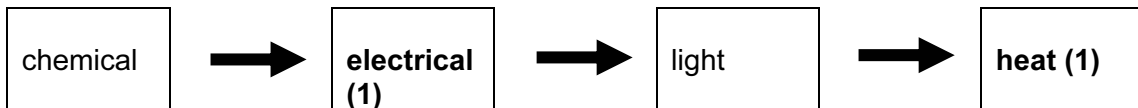
**Section A**

1



2 x (1) [2]

2



2 x (1) [2]

3 Less slip/Positive drive [1]

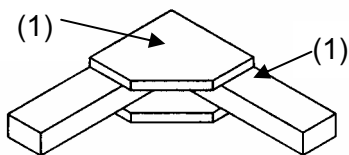
4 Tree/skeleton/shell [1]

5 (a) A: Bevel gears [1]  
 B: Worm and worm wheel [1]

(b) Change axis through 90°/change direction of rotation [1]

6  $V = IR$   
 $R = V/I = (9 - 2)/0.01$  (1)  
 $R = 7/0.01$  (1)  
 $R = 700 \Omega$  (1) [3]

7



[2]

8 1 Linear [1]

2 Oscillating [1]

9 Good insulators [1]

- 10 **A:** 1<sup>st</sup> order [1]  
e.g. See-saw [1]
- B:** 3<sup>rd</sup> order [1]  
e.g. Fishing rod [1]

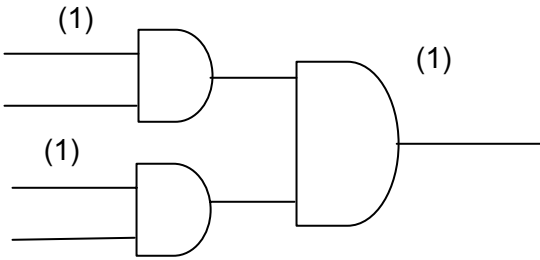
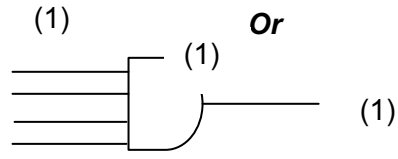
11

Number from diagram	List of words
3	Cantilever beam
2	Tie (Member in tension)
1	Strut (Member in compression)
4	Simply supported beam

4 x (1) [4]

**Total marks: [25]**

**Section B**

- 12 (a) C1 charges up (1)  
LED off (1)  
C1 discharges over time period (1)  
LED on (1)  
3 x (1) [3]
- (b) Altering the values of C1 (1) and R (1) 2 x (1) [2]
- (c) Reduces current flow through LED (1) thus protects it (1) 2 x (1) [2]
- (d) *Name:* Push to make (PTM)  
*Reason for selection:* Momentary action (1)  
Cannot stick 'on' (1)  
Easy to operate (1) [3]
- (e) (i) A: Relay [1]  
Interfaces (1) between low current and high current circuits (1) allows high power devices to be controlled by low power processors (1) [3]
- (ii) Diode [1]  
To protect 555 (1) from back emf (1) [2]
- (f) (i) P : And (1)  
Q : Nand (1) 2 x (1) [2]
- (ii)
- 
- 

**Or**
- 3 x (1) [3]
- (iii) Climate control system/lift control system/washing machine [1]
- (iv) Computer simulations/loctronics kits/breadboard with series of switches [2]

**Total marks: [25]**

13 (a) **Static loading:**  
 A fixed value load (1) that does not move (1) 2 x (1) [2]

**Example:**  
 Roof tiles on the truss [1]

**Dynamic loading:**  
 A fixed value load (1) that is moving (1) [2]

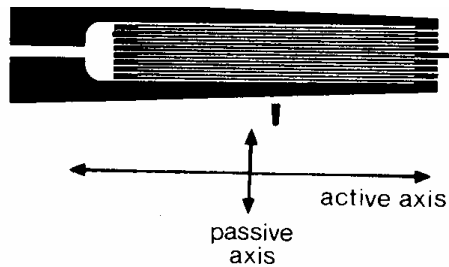
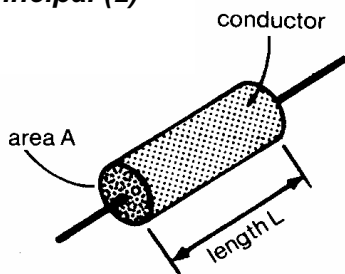
**Example:**  
 Builder walking about on roof/wind blowing against roof [1]

(b) Triangulation (1) promotes rigidity (1) [2]

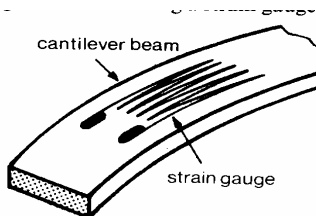
(c)  $L + R = 100 \text{ kN}$   
 thus moments at  $L$   
 $R \times S = S/2 \times 100 \text{ kN}$  (1)  
 $R = 100 \text{ kN}/2 = 50 \text{ kN}$  (1)  
 $50 \text{ kN} + L = 100 \text{ kN}$   
 $L = 100 \text{ kN} - 50 \text{ kN} = 50 \text{ kN}$  (1) 3 x (1) [3]

(d)

**Principal (2)**

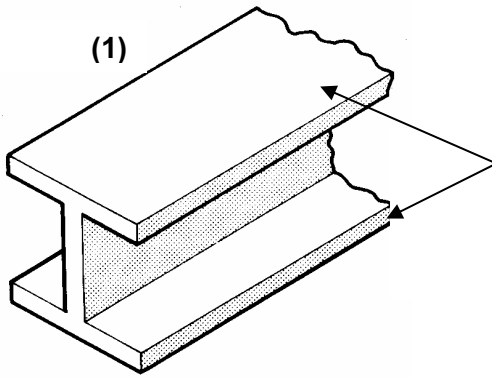


**Application to structural member (2)**



[4]

(e)



The advantage of I beams is that most of the material is placed where the highest stresses (1) are - at the outer edges. (1)

3 x (1) [3]

- (f) (i) **A** Plastic region [1]  
**B** Elastic region [1]  
**C** Break point/Fracture point/Failure point [1]

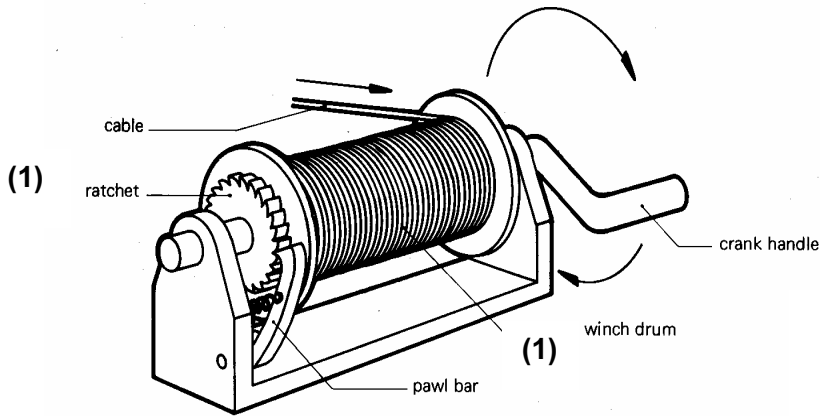
- (ii)  $E = \text{Stress}/\text{Strain}$   
 $200,000,000 \text{ N/m}^2 \times 10^{-6} (1) = \text{Stress}/0.001 (1)$   
 $200/0.01 = \text{Stress} = 200 (1) \text{ K N/m}^2 (1)$

4 x (1) [4]

**Total marks: [25]**

- 14 (a) Increase the speed (1) as driver pulley is bigger than driven (1) [2]  
 (b) The direction is the same (1) as the driver due to belt drive (1) [2]  
 (c)  $VR = \text{Diameter Driven}/\text{Diameter Driver} (1)$   
 $VR = 20 \text{ mm}/40 \text{ mm} = 0.5 (1)$   
 $VR = \text{Speed Driver}/\text{Speed of driven}$   
 $\text{Speed Driven} = \text{Speed driver}/VR = 150 \text{ rpm}/0.5 = 300 \text{ rpm} (1)$  [3]  
 (d) (i) Drilling machine/Lathe [1]  
 (ii) To improve grip (1) to improve location (1) 2 x (1) [2]  
 (iii) To allow speeds for the drill chuck (1) to be varied (1) without having to change the motor speed (1) 3 x (1) [3]

(e) (i)

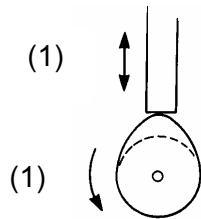


2 x (1) [2]

(ii) Fishing reel/ratchet screwdriver/shaping machine

[1]

(f) (i)



2 x (1) [2]

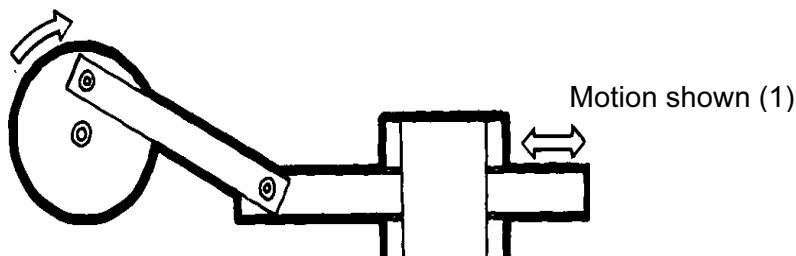
(ii) Motor car engine

[1]

(iii) During this period the follower (1) does not move up or down (1) though the cam continues to rotate (1) 3 x (1) [3]

(iv)

Crank (1)



3 x (1) [3]

**Total marks: [25]**

