Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

DESIGN AND TECHNOLOGY **0445/04**
Paper 4 Systems and Control **For Examination from 2015**
SPECIMEN MARK SCHEME **1 hour 15 minutes**

MAXIMUM MARK: 50

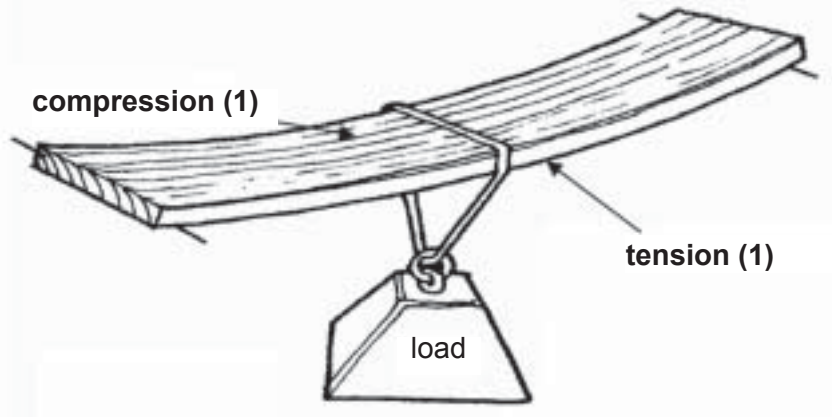
This document consists of **7** printed pages and **1** blank page.

CAMBRIDGE International Examinations

[Turn over

Section A

1



2 × (1) **[2]**

2

chemical → **electrical (1)** → light → **heat (1)**

2 × (1) **[2]**

3 Less slip/Positive drive **[1]**

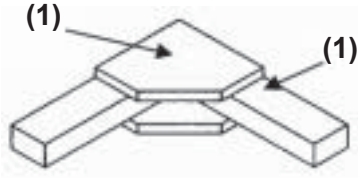
4 Tree/skeleton/shell **[1]**

5 **(a)** **A:** Bevel gears (1)
B: Worm and worm wheel (1) **[2]**

(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 × (1) **[3]**

7



Gusset plate(s) shown (1), framework shown (1) **[2]**

8 1 Linear (1)

2 Oscillating (1) **[2]**

9 Any **one** reason from the following list:

- plastics are good insulators
- plastics are suitable for injection moulding or vacuum forming processes, both of which are used for case manufacture
- plastics are available in different colours so the case colour can be changed quickly, most plastics can be recycled after use
- the waste from manufacture can be recycled. **[1]**

10 **A:** 1st order (1)
e.g. See-saw (1) **[2]**

B: 3rd order (1)
e.g. Fishing rod (1) **[2]**

11

Letter from diagram	Building component
C	Cantilever beam
B	Tie (Member in tension)
A	Strut (Member in compression)
D	Simply supported beam

4 × (1) **[4]**

[Total marks: 25]

Section B

12 (a) Any **three** stages from the following list:
- Trigger pin (2) goes low and circuit is triggered
- C1 charges
- LED switches on
- C1 discharges during timing period
- LED switches off. **[3]**

(b) The time delay is changed by altering the value of **C1** or **R2**. **[2]**

(c) **R3** is a current limiting (1) resistor for the LED (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) **RLA1** is a relay (SPDT). (1)

Interfaces (1) between low current and high current circuits (1)
allows high power devices to be controlled by low power processors (1) **[4]**

(ii) **D1** is a diode (1)

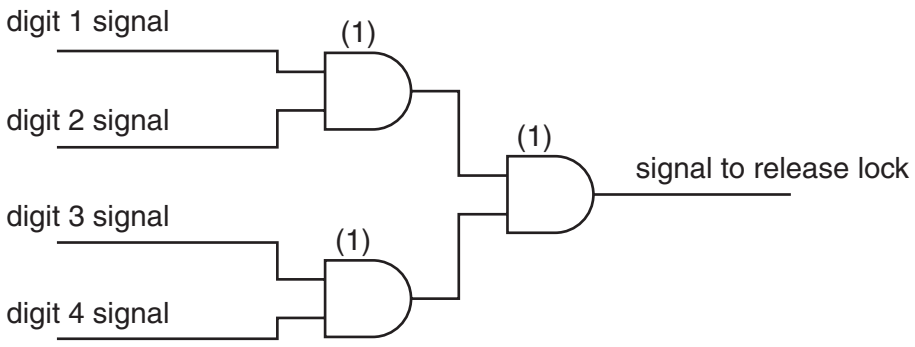
To protect the transistor (1) from back emf (1) **[3]**

(f) (i) **Gate 1** is an AND gate. (1)

Gate 2 is a NAND gate. (1) 2 × (1) **[2]**

(ii)

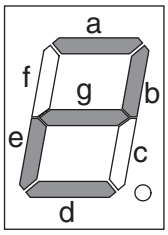
correct signals are logic 1



3 × (1) **[3]**

(iii) Segments for number two are **a**, **b**, **g**, **e**, **d** in any order.

Accept responses that show the segments shaded as below.



[1]

(iv) Modelling can be carried out using:
- real components (1) on a breadboard (1)
- simulated components (1) on simulation software (1)

2 × (1) mark for clear description. **[2]**

[Total marks: 25]

13 (a) (i) ***Static loading:***
A fixed value load (1) that does not move (1)

Example:
Roof tiles on the truss (1) **[3]**

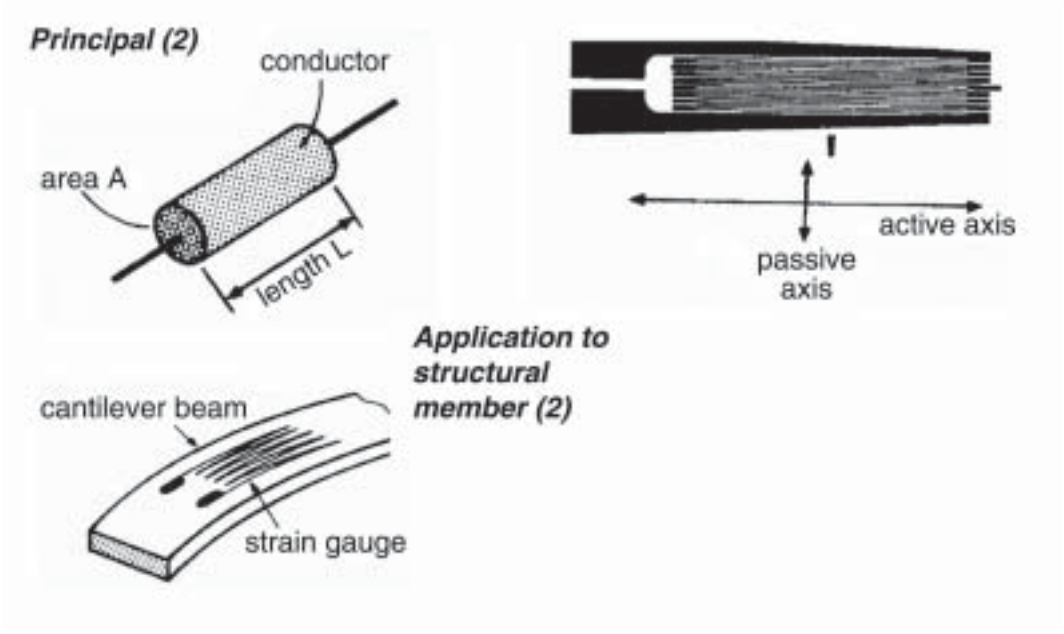
(ii) ***Dynamic loading:***
A variable value load (1) that is moving (1)

Example:
Builder walking about on roof/wind blowing against roof (1) **[3]**

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

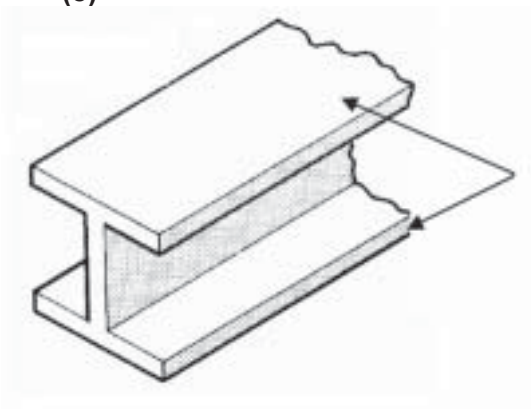
(c) $L + R = 100\,\text{kN}$
$R \times S = S/2 \times 100$ (1)
$2R \times 2S = S \times 100$
$2R = S/2S \times 100$
$R = 100/2 =$ **50 kN** (1)
$L = 100\,\text{kN} - 50\,\text{kN} =$ **50 kN** (1) **[3]**

(d)



[4]

(e)



The web of the **I** beam resists shear (1),
the flanges resist bending (1)
Clear drawing (1)

3 × (1) **[3]**

(f) **(i)** **A** Plastic region (1)

B Elastic region (1)

C Break point/Fracture point/Failure point (1) **[3]**

(ii) Strain = change in length / original length
Change in length = strain × original length (1)
Change in length = $5 \times 10^{-3} \times 300$ (1)
Change in length = 1.5 mm (1)
New length = 300 + 1.5 = **301.5 mm** (1)
(Correct answer with no working 4 marks.) **[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]**

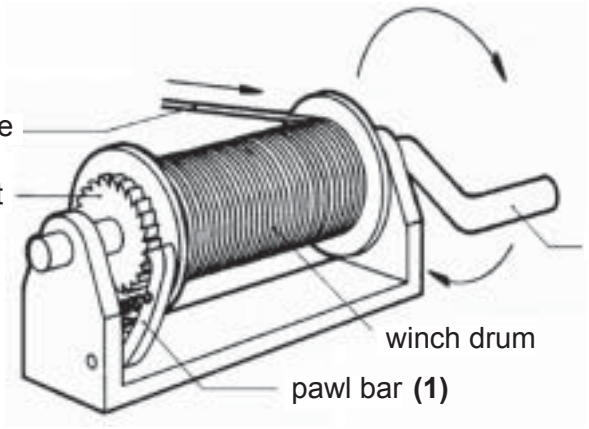
(c) VR = Diameter Driven/Diameter Driver (1)
VR = 20 mm/40 mm = 0.5 (1)
VR = Speed Driver/Speed of driven
Speed Driven = Speed driver/VR = 150 rpm/0.5 = 300 rpm (1) **[3]**

(d) **(i)** Drilling machine/Lathe **[1]**

(ii) To improve grip (1) to improve location (1)
Allow marks for other valid points. 2 × (1) **[2]**

(iii) To allow speeds (1) to be varied (1) without having to change the motor speed (1) 3 × (1) **[3]**

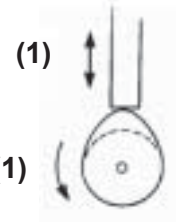
(e) (i)



2 × (1) **[2]**

(ii) Fishing reel/ratchet screwdriver/shaping machine **[1]**

(f) (i)



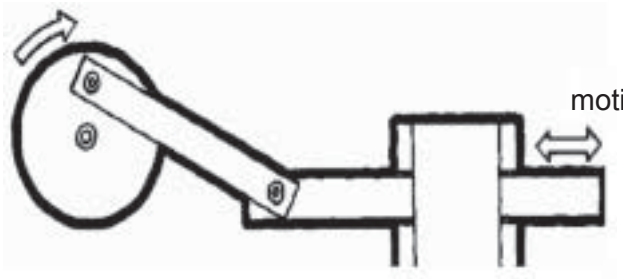
2 × (1) **[2]**

(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 × (1) **[3]**

(iv)

crank **(1)**



3 × (1) **[3]**

[Total marks: 25]