

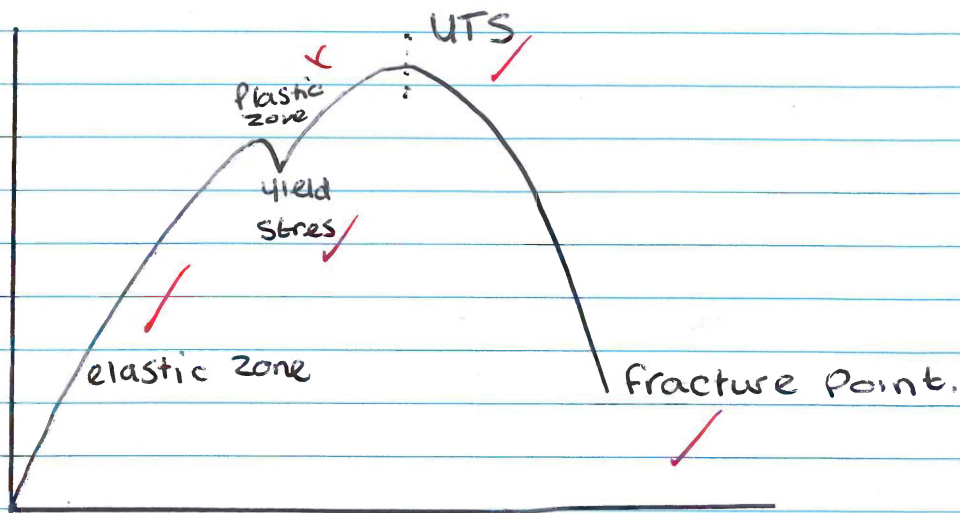
12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

1	Student Number	
2	Title of Examination Paper	MECHANICAL ENGINEERING
3	Module Code	SGE E4017
4	Date and Time of Examination	20/5/25 9:30-11:30
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
A1	13
B1	23
B2	12
B3	5
Total	53%

1



(4)

2. Power = 10kw
in 40 seconds

$$\text{Power} = \frac{WD}{T} = 10 = \frac{WD}{40}$$

$$WD = 10 \times 40 = 400 \text{ J}$$

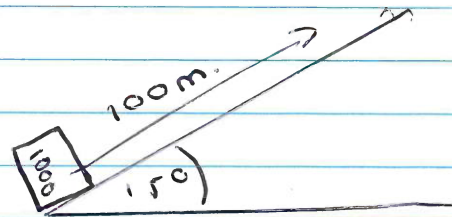
-1 mths.

(4)

3. mass = 1000kg
distance = 100m
is at 15° incline

$$PE = mgh$$

$$1000 \times 9.81 \times 100 = 981,000$$



$$\frac{981,000}{1.5} = 65400 \text{ J}$$

(1)

4. diameter = 200mm = 0.2m
velocity = 2m/s

$$r = \frac{0.2}{2} = 0.1 \text{ m}$$

$$A = \pi r^2 = \pi \times 0.1^2 = 0.031$$

$$\text{flowrate} = A \times v = 0.031 \times 2 = 0.063 \text{ m/s}$$

-1 mths

(4)

5. mass = 2kg
T = 10 - 45°

x

13

Clockwise moments

anti-clockwise moments

Take moments from A1

$$1 \times 4 = 4 \text{ kN}$$

$$4 \times 2 = 8 \text{ kN}$$

$$10 \times 6 = 60 \text{ kN}$$

$$60 + 8 = 68$$

$$68 = 8R_2$$

$$\frac{68}{8} = R_2 = 8.5$$

$$R_2 = 8.5$$

$$(1 \times 4) + 10 = 14$$

$$14 - 8.5 = R_1 = 5.5$$

$$R_1 = 5.5$$

$$R_2 = 8.5$$

$$\text{Max SF} = 8.5$$

$$\text{Bm at 1} = 0$$

$$\text{Bm at 2} = 0$$

$$\text{Bm at 3} =$$

$$5.5 \times 4 = 22 \text{ kN}$$

$$4 \times 2 = 8 \text{ kN}$$

$$22 - 8 = 14 \text{ kN}$$

$$\text{Bm at 4} =$$

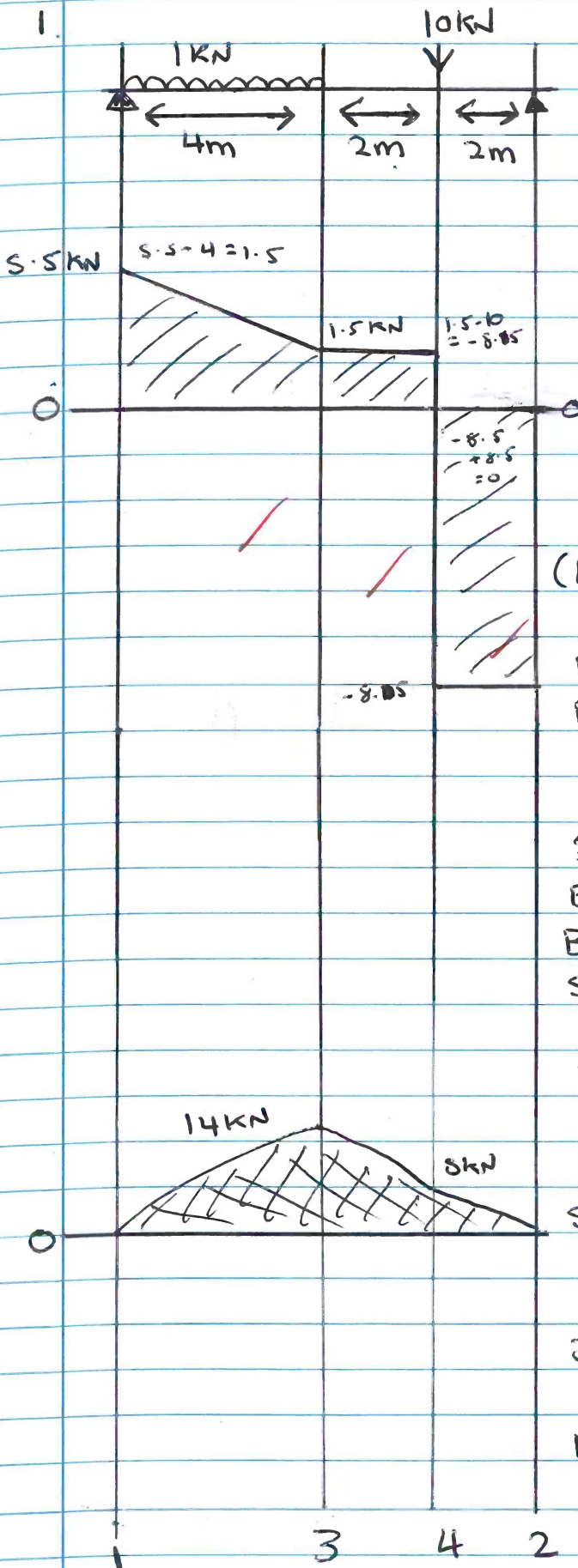
$$5.5 \times 6 = 33 \text{ kN}$$

$$4 \times 2 = 8 \text{ kN}$$

$$10 \times 2 = 20 \text{ kN}$$

$$33 - 8 - 20 = 5 \text{ kN}$$

$$\text{Max BM} = 14 \text{ kN}$$



(5)

(10)

(8)

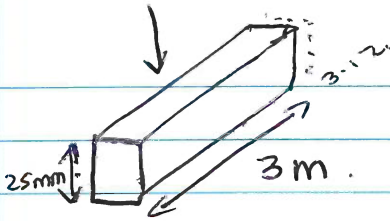
23

$$\Delta L = \frac{F \times L}{A \times E}$$

$$F = 1000 \text{ kN.}$$

2

a)



$$25 \text{ mm} = 0.025 \text{ m.}$$

$$A = 0.025 \times 0.025 = 625 \times 10^{-6} \text{ m}^2$$

$$F = 1000 \text{ kN.}$$

$$L = 3 \text{ m}$$

$$\Delta L = 3.012$$

(2)

$$3.012 = \frac{1000 \times 3}{625 \times 10^{-6} \times E}$$

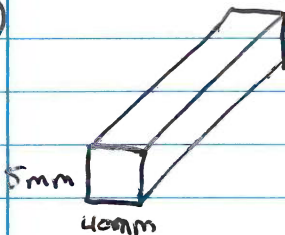
$$3.012 = \frac{3000}{625 \times 10^{-6} \times E} \quad \times$$

$$\frac{3.012}{3000} = 625 \times 10^{-6} \times E$$

$$1.004 \times 10^{-3} = 625 \times 10^{-6} \times E$$

$$\frac{1.004 \times 10^{-3}}{625 \times 10^{-6}} = E = 1.6064 \quad \times$$

b)



$$\text{Stress} = 385 \text{ MN/m}^2 \quad \checkmark$$

$$40 \text{ mm} = 0.04 \text{ m}$$

$$5 \text{ mm} = 0.005 \text{ m}$$

$$0.04 \times 0.005 = 200 \times 10^{-6} \quad \checkmark$$

$$F = \text{UTS} \times A = 200 \times 10^{-6} \times 385 \times 10^6 = 77,000 \text{ N} \quad \checkmark$$

(10)

12

3a) $F = ma$

The force upon an object is the mass of the object $\times$ the acceleration.

every force has an equal and opposite reaction on an object.

b) ~~work is the power needed to lift an object over a distance~~ ~~workdone~~

Power is the workdone by the time it takes

$$\text{Power} = \frac{\text{Work done}}{\text{time}}$$

Work is ~~workdone~~ = distance $\times$ time.

how long it takes to move an object over a distance.

$PE = mgh$ is how ~~the~~ the mass of an object subjected to gravity (9.81 m/s) times the height.

~~KE can be~~ is $\frac{1}{2}mv^2$ this is $\frac{1}{2}$ of the mass times velocity squared.
 The energy needed to move an object

c) mass = 850 kg

85 km/h $\rightarrow$ 20 km/h

Force = 350 N

$$KE = \frac{1}{2}mv^2$$

$$KE = \frac{1}{2} 850 \times 85^2 = 3070625$$

$$KE = \frac{1}{2} \times 850 \times 20^2 = 170000$$

$$3070625 - 170000 = 2900625 \text{ J}$$

d) ~~the~~ mass = 50 kg.

amplitude = 1m.

Time = 10 seconds.

$$f = \frac{1}{T} = \frac{1}{10} = 0.1 \quad \checkmark$$

-1 missing unit (1)

$$\omega_n = 2\pi f = 2\pi \times 0.1 = 0.628 \quad \checkmark$$

$$50 \times 0.628 = 31.4 \text{ N}$$

31.4

$$V = \omega_n \sqrt{r^2 - x^2}$$

$$V = 0.628 \sqrt{0.3^2 - 0.1^2} = 0.178 \text{ m/s}$$

x

1.5