



SURNAME: Williams

FORENAME(S): Llewelyn

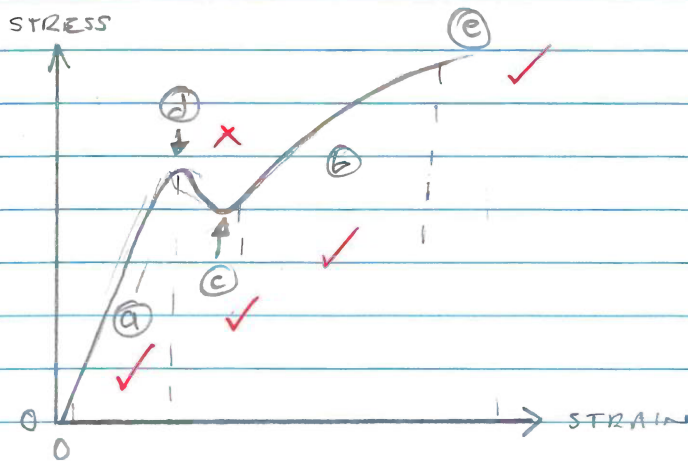
12 Pages

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	SAEE4017
4	Date and Time of Examination	TUESDAY 20TH OF 2025 MAY 9:30
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	25
B2	16
B4	23
Total	77%

(Gweler yr ochr arall am y fersiwn Cymraeg)



a) ELASTIC ZONE

b) PLASTIC ZONE

c) YIELD STRESS

d) UTS

e) FRACTURE POINT

$$2. \quad P = 10 \text{ kW} \quad t = 40 \text{ sec}$$

$$P = \frac{WD}{t} \quad \therefore \quad WD = Pt = 10,000 \times 40 = 400,000$$

(4)

/- missing unit

4. $d = 200 \text{ mm}$ $v = 2 \text{ m/s}$

$$Q = N \times q$$

~~$$q = \pi \times r^2 \times v = \pi \times 0.1^2 \times 2$$~~

$$q = \pi \times r^2 = \pi \times 0.1^2 = 0.0314 \text{ m}^2$$

$$Q = 2 \times 0.0314 = 0.063 \text{ m}^3/\text{s} \quad \checkmark$$

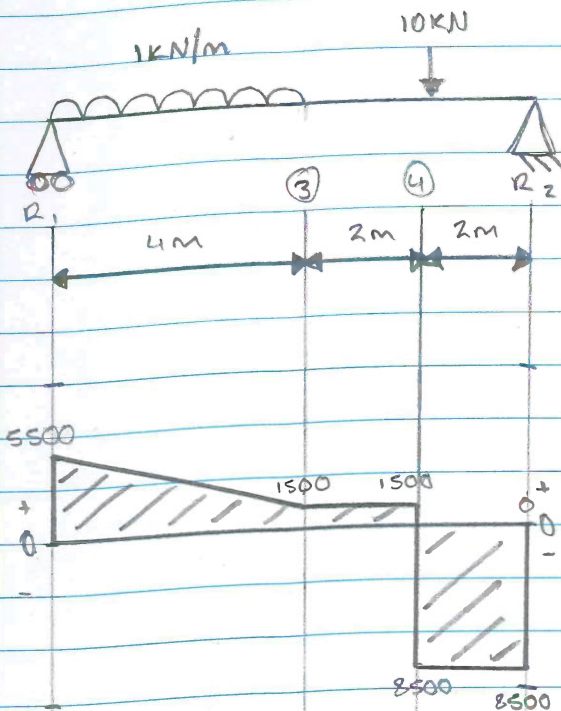
(5)

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Question No.

SEC B.

1.

TAKE MOMENTS ABOUT R_1 .

CW MOMENTS = CCW MOMENTS.

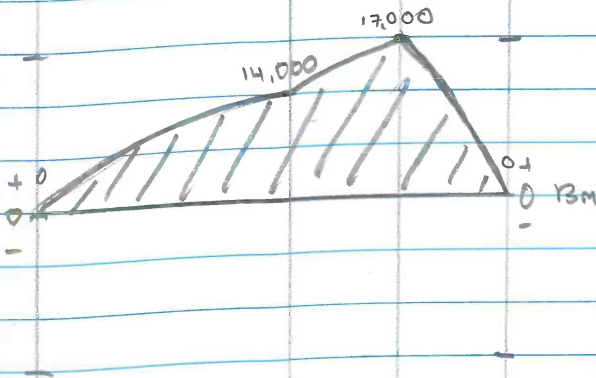
$$(4000 \times 2) + (10,000 \times 6) = R_2 \times 8$$

$$8000 + 60,000 = R_2 \times 8$$

$$\frac{68,000}{8} = R_2 = 8500 \text{ N}$$

$$R_1 = 14,000 - R_2 = 5500 \text{ N}$$

$$\text{MAX S.F.} = 8500 \text{ N}$$



$$\text{BM AT ①} = 0 \text{ Nm}$$

$$\text{BM AT ②} = 0 \text{ Nm}$$

$$\text{BM AT ③} = 14 \text{ Nm}$$

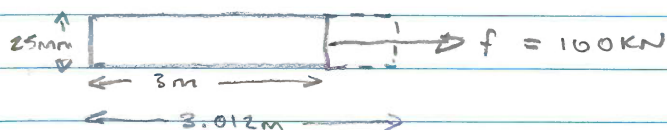
$$\text{BM AT ③} = (5500 \times 4) - (4000 \times 2) = 14,000 \text{ Nm}$$

$$\text{BM AT ④} = (5500 \times 6) - (4000 \times 4) = 17,000 \text{ Nm}$$

$$\text{MAX BM} = 17,000 \text{ Nm}$$

2.

a)



$$E = \frac{\sigma}{\epsilon}$$

$$\epsilon = \frac{\Delta L}{L} = \frac{0.012}{3} = 0.004 \quad \checkmark$$

(4)

$$\sigma = \frac{f}{A} = \frac{100 \times 10^3}{0.075} = 1.33 \times 10^6 \quad \checkmark$$

$$A = 3 \times 0.025 = 0.075 \text{ m}^2 \quad \checkmark$$

$$\sigma = 1.33 \times 10^6$$

$$E = \frac{\sigma}{\epsilon} = \frac{1.33 \times 10^6}{0.004}$$

$$E = \frac{\sigma}{\epsilon}$$

$$= \frac{1.33 \times 10^6}{0.004} = 333.33 \times 10^6 \quad \checkmark$$

b)

$$\sigma_{\max} = 385 \text{ MN/m}^2 \quad w = 0.04 \text{ m} \quad t = 0.005 \text{ m}$$

$$A = 0.04 \times 0.005 = 200 \times 10^{-6} \text{ m}^2 \quad \checkmark$$

$$f = \sigma \times A = 385 \times 10^6 \times 200 \times 10^{-6} = 77000 \text{ N} \quad \checkmark$$

(10)

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Question No.

4.

$$a) \quad a = 2.5 \text{ m/s}^2 \quad t = 6.2 \text{ sec}$$

$$u = 0 \text{ m/s} \quad v = ?$$

$$v = u + at = 0 + (2.5 \times 6.2) = 15.5 \text{ m/s} \quad \checkmark$$

$$s = \left(\frac{u + v}{2} \right) t = \left(\frac{0 + 15.5}{2} \right) \times 6.2 = 48.05 \text{ m} \quad \checkmark$$

(12)

$$b) \quad \omega_1 = 2000 \text{ Rev/min} \quad \omega_2 = 4500 \text{ Rev/min}$$

$$t = 10 \text{ sec}$$

$$bi) \quad 2000 \times \frac{2\pi}{60} = 209.44 \text{ Rad/s} \quad 4500 \times \frac{2\pi}{60} = 471.24 \text{ Rad/s}$$

(3)

~~bi)~~

$$bii) \quad \omega_2 = \omega_1 + \alpha t \quad \therefore \alpha = \frac{\omega_2 - \omega_1}{t}$$

$$= \frac{471.24 - 209.44}{10} = 26.18 \text{ Rad/s}^2$$

(5)

$$biii) \quad \theta = \left(\frac{\omega_1 + \omega_2}{2} \right) \times t = \left(\frac{209.44 + 471.24}{2} \right) \times 10$$

$$= 3403.4 \text{ Revolutions}$$

- 1 unit

(3)

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