



Complete, fold and seal
(see note 2 below)

Davies

FORENAME(S):

Daniel

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	1801345
2	Title of Examination Paper	Engineering Science
3	Module Code	M4X02192
4	Date and Time of Examination	3/5/19 11:00
5	Examination Venue	106, IQ
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	1 8
2	6 11
3	2 10
4	5 10
Total	14 39

IV'd Team Tuxon

36 %.

1.)

$$Q = hA(T_2 - T_1)$$

$$Q = 1100 \text{ W/m}^2\text{K}$$

$$hA = 55 \text{ kW} \quad (55 \times 10^3) = Q \times \text{Area ?}$$

$$T_2 = ? \text{ (hot temp)}$$

$$T_1 = ? \text{ (cold temp)} \quad \frac{1100 \text{ W/m}^2\text{K}}{55 \text{ kW}} = \frac{55 \text{ kW} (T_2 - T_1)}{55 \text{ kW}}$$

$$(T_2 - T_1) = \frac{1100 \text{ W/m}^2\text{K}}{55 \text{ kW}} = 0.02 \quad \text{shame!}$$

①.

1/8.

2.)

a.)

$$F = 250 \text{ N}$$

$$A = 400 \times 10^{-3} \times 100 \times 10^{-3} \times 25 \times 10^{-3}$$

$$x = 2 \text{ mm}, 2 \times 10^{-3} \text{ m} \quad \text{①} \quad \text{0.002 m}$$

$$l = 100 \text{ mm} \cdot 0.1 \text{ m} \quad \text{①}$$

~~Area~~a.) Shear stress τ ,

$$\tau = \frac{F}{A}$$

$$\tau = \frac{250 \text{ N}}{(0.4 \text{ m} \times 0.1 \text{ m} \times 0.002 \text{ m})} \quad \text{①}$$

You have calculated a volume.

$$\tau = 250000 \text{ N/m}^2$$

$$= 250 \times 10^3$$

$$\tau = 250000 \text{ N/m}^2$$

2.b.)

The shear strain, γ .

$$x = 2 \text{ mm}, 2 \times 10^{-3}, 0.002 \text{ m}.$$

$$l = 100 \text{ mm} = 0.1 \text{ m}$$

$$\gamma = \frac{x}{l}$$

~~$$\gamma = \frac{2 \times 10^{-3}}{100} = 2 \times 10^{-5}$$~~

$$\gamma = \frac{0.002 \text{ m}}{0.1 \text{ m}} = 0.02$$

$$\gamma = 0.02 \text{ (no units)}$$

$$= 20 \times 10^{-3}$$

✓ (2)

2.c.) Experimental value
of modulus of rigidity (G)

$$\tau = 250000 \text{ N/m}^2$$

$$\gamma = 0.02$$

$$G = ?$$

$$G = \frac{\tau}{\gamma}$$

$$= \frac{250000 \text{ N/m}^2}{0.02}$$

$$G = 1250000 \text{ N/m}^2$$

$$G = 1.25 \times 10^6$$

✓ (3)
X Carried error

6/11

3.)

$$l = 0.75\text{m}$$

$$T = 1200\text{NM}$$

$$\text{radians of rotation} = 0.0005 \text{ radians}$$

$$d = ?$$

$$G = 210 \times 10^9 \text{ N/m}^2$$

$$J = ?$$

$$r = ?$$

$$\theta = ?$$

$$\frac{T}{J} = \frac{\tau}{r} = \frac{G\theta}{l}$$

$$J = \frac{\pi D^4}{32}$$

$$\left(\frac{1200\text{NM}}{J} \right) = \frac{\tau}{r} = \frac{210 \times 10^9 \times \theta}{0.75\text{m}}$$

$$\frac{T}{J} \times \frac{G\theta}{l} = \frac{\tau}{r}$$

$$T \times l = \frac{G \times \theta \times J}{\tau}$$

~~1200 \times 0.75 = \frac{210 \times 10^9 \times J}{\tau}~~

$$\frac{1200 \times 0.75}{J} = \frac{210 \times 10^9}{\tau}$$

$$\frac{1}{J} = \frac{1200 \times 210 \times 10^9}{0.75} \quad (1)$$

$$= 3.36 \times 10^{14}$$

$$\frac{1200 \times 0.75}{J} = \frac{210 \times 10^9 \times J}{\tau}$$

Shame!

2/10

4.)

$$F = 273 \text{ N}$$

$$x = 0.0035 \text{ mm}, 3.5 \times 10^{-6}$$

$$l = 0.25 \text{ m}$$

$$d = 15 \text{ mm} = 0.015 \text{ m}$$

$$E = ?$$

$$A = (0.25 \text{ m} \times 0.015 \text{ m})$$

$$\sigma = 72000 \text{ N/m}^2$$

$$E = 1.4 \times 10^{-5}$$

$$\epsilon = \frac{3.5 \times 10^{-7}}{0.25 \text{ m}}$$

$$0.25 \times 10^{-7} = 3.5 \times 10^{-7}$$

$$\epsilon = 3.5 \times 10^{-7} \times 0.25 \text{ m} = 8.75 \times 10^{-8}$$

$$\text{strain} = 8.75$$

4.)

$$\sigma = \frac{F}{A}$$

$$\sigma = \frac{273\text{N}}{(0.25\text{m} \times 0.015\text{m})} = 72800\text{N/m}^2$$

Area of a circle = $\frac{\pi d^2}{4}$

(1)

$$\sigma = 72800\text{N/m}^2$$

$$= 72.8 \times 10^3$$

$$E = \frac{x}{l}$$

$$E = \frac{3.5 \times 10^{-6}}{0.25\text{m}}$$

$$E = \frac{1.4 \times 10^{-5} \text{ (no units)}}{14 \times 10^{-6}}$$

✓

(3)

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

5/10

(1)

$$E = \frac{72800}{1.4 \times 10^{-5}} = 5.2 \times 10^9$$

~~5.2 \times 10^9 \text{ N/m}^2~~

$$E = 5.2 \times 10^9 \quad \text{Shame. Units?}$$

Question No.

Examiner's

Arholwr yn unig

y Cwestiwn

Question No.

Examiner Only

Arholwr yn i

Phliff y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

f y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

ity Cwestiwn

Question No.

Examiner O



Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi! gael ei theipio a chael yr ymgeisydd i dalu.

- arholi o dan unrhyw amgylchiadau.

[illegible]

(See the other side for English version)

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: