



Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Examination Answer Books

12 Pages

Instructions to Candidates

- Please give the information requested in the boxes below.
- Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
- 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.
- Write your answers in ink.
- Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
- No part of this book is to be torn out; it must be handed in complete.
- If more books than one are used, fasten them together using the tags available from the invigilator(s).
- Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

Complete, fold and seal
(see note 2 below)

SURNAME:

Marshall

FORENAME(S):

Toby

1	Student Number	1702695
2	Title of Examination Paper	Mechanical Principles Rhose test 1
3	Module Code	15X02261
4	Date and Time of Examination	9.00 17.1.18
5	Examination Venue	Vivan Hall
6	Seat Number	G019
7	Number of Answer Books handed in	~~Five~~ One

List the numbers of the questions you have attempted	Office Use
One	10
Two	7.
Three	8
Four	10.
Five	10.
Total	45 (90%)

(Gweler yr ochr arall am y fersiwn Cymraeg)

Smashing!
23/01/19

AGP

i

$$\begin{aligned} \epsilon_x & 15 \times 10^{-6} \\ \epsilon_y & -18 \times 10^{-6} \\ \nu & 0.26 \\ E & 169 \times 10^9 \end{aligned}$$

$$\sigma_x = \frac{E}{1-\nu^2} (\epsilon_x + \nu \epsilon_y)$$

$$= \frac{169 \times 10^9}{1-0.26^2} \times (15 \times 10^{-6} + 0.26 \times -18 \times 10^{-6})$$

$$\sigma_x = 1.87 \times 10^6 \quad (\text{Tensile})$$

$$\sigma_y = \frac{E}{1-\nu^2} (\epsilon_y + \nu \epsilon_x)$$

$$= \frac{169 \times 10^9}{1-0.26^2} \times (-18 \times 10^{-6} + 0.26 \times 15 \times 10^{-6})$$

$$\sigma_y = -2.56 \times 10^6 \quad (\text{compressive})$$

ii

$$\begin{aligned} \sigma_x & 65 \times 10^6 \\ \sigma_y & 10 \times 10^6 \\ \nu & 0.26 \\ E & 169 \times 10^9 \end{aligned}$$

$$\epsilon_x = \frac{1}{E} (\sigma_x - \nu \sigma_y)$$

$$= \frac{1}{169 \times 10^9} \times (65 \times 10^6 - 0.26 \times 10 \times 10^6)$$

$$\epsilon_x = 369.23 \times 10^{-6}$$

$$\epsilon_y = \frac{1}{E} (\sigma_y - \nu \sigma_x)$$

$$\epsilon_y = -40.83 \times 10^{-6}$$

$$= \frac{1}{169 \times 10^9} \times (10 \times 10^6 - 0.26 \times 65 \times 10^6)$$

- 2 Isotropic - forces in all in same direction
non-Isotropic - unipredictal forces

i $r = 25 \times 10^{-3}$
EP 20×10^5
E 163.2×10^9
 $v = 0.3$
k ?

$$k = \frac{E}{3(1-2v)} = \frac{163.2 \times 10^9}{3(1-(2 \times 0.3))}$$

$$k = 1.36 \times 10^{11}$$

ii $E_v ?$

$$k = \frac{\sigma}{E_v}$$

$$k E_v = \sigma$$

$$E_v = \frac{\sigma}{k}$$

$$\sigma = 20 \times 10^5$$

$$E_v = \frac{20 \times 10^5}{1.36 \times 10^{11}}$$

$$E_v = 14.71 \times 10^{-6}$$

iii

$$V_{\text{sphere}} = \frac{4}{3} \pi r^3 = \frac{4}{3} \pi \times (0.025)^3$$

$$V_s = 6.5 \times 10^{-5}$$

$$E_v = \frac{\delta V}{V}$$

$$\delta V = E_v V = 14.71 \times 10^{-6} \times 6.5 \times 10^{-5}$$

$$\delta V = 9.56 \times 10^{-10}$$

IV The term 'isotropic' means that all the forces of a material are in the same direction. ~~X~~

The term 'non-isotropic' means that the forces are unpredictable. A example material of this would be: Rubber/silicon ~~X~~.

3 L 1.3m
 i UDL - 1500
 PL - 5×10^3
 EI 2.2×10^6

$$\text{UDL } \frac{WL^4}{8EI} = \frac{-1500 \times 1.3^4}{8 \times 2.2 \times 10^6} = -2.43 \times 10^{-4}$$

$$\text{ii PL } \frac{FL^3}{3EI} = \frac{-5 \times 10^3 \times 1.3^3}{3 \times 2.2 \times 10^6} = -1.66 \times 10^{-3}$$

iii Max D = UDL D + PL D

$$-2.43 \times 10^{-4} + -1.66 \times 10^{-3} = -1.903 \times 10^{-3}$$

~~-1.903 mm~~

iv $y_1 = ND - PLD$

$$-3.5 \times 10^{-3} - (-1.66 \times 10^{-3}) = -1.84 \times 10^{-3} \quad \text{X}$$

$$y_1 = \frac{FL^3}{3EI} \quad y_1 3EI = FL^3 \quad \frac{y_1 3EI}{L^3} = F$$

$$\frac{-1.84 \times 10^{-3} \times 3 \times 2.2 \times 10^6}{1.3^3} = -5.528 \times 10^3 \quad \text{X}$$

NPI - OPL = Increase

$$-5.528 \times 10^3 - -5 \times 10^3 = -528$$

528 N

Amount Point load can be increased by.

$$4 \quad D \quad 0.35 \text{ m}$$

$$L \quad 0.8 \text{ m}$$

$$\eta_L \quad 0.85$$

$$\eta_c \quad 0.95$$

$$P \quad 20 \times 10^5$$

$$\sigma \quad 110 \times 10^6$$

$$t = ?$$

$$\sigma_c = \frac{PD}{2t\eta_L}$$

$$\sigma_c = \frac{PD}{4t\eta_c}$$

$$\sigma_c 2t\eta_L = PD$$

$$\sigma_c 4t\eta_c = PD$$

$$t = \frac{PD}{\sigma_c 2\eta_L}$$

$$t = \frac{PD}{\sigma_c 4\eta_c}$$

$$= \frac{20 \times 10^5 \times 0.35}{110 \times 10^6 \times 2 \times 0.85}$$

$$= \frac{20 \times 10^5 \times 0.35}{110 \times 10^6 \times 4 \times 0.95}$$

$$t = 3.74 \times 10^{-3}$$

$$3.74 \text{ mm}$$

$$t = 1.67 \times 10^{-3}$$

$$1.67 \text{ mm}$$

This would be the minimum wall thickness of the material could be.

5 OD 0.15 r_o 0.075 ✓
 ID 0.13 r_i 0.065
 P 80×10^5

@ r_i $P = -80 \times 10^5$ ✓

@ r_o $P = 0$ ✓

$\sigma_{R_o} = 0$

$\sigma_{R_i} = -80 \times 10^5$

$0 = a - \frac{b}{0.075^2}$

$\times 0.075^2$

$-80 \times 10^5 = a - \frac{b}{0.065^2}$

$\times 0.065^2$

$0 = a \cdot 0.075^2 - b$ ✓

①

$-33.8 \times 10^3 = a \cdot 0.065^2 - b$ ②

① - ②

$33.8 \times 10^3 = a(0.075^2 - 0.065^2)$

$33.8 \times 10^3 = a(1.4 \times 10^{-3})$ ✓

$a = \frac{33.8 \times 10^3}{(1.4 \times 10^{-3})}$

$a = 24.14 \times 10^6$ ✓

$0 = a - \frac{b}{0.075^2}$
 $\times 0.075^2$

$b = 135 \times 10^3$ ✓

$0 = a \cdot 0.075^2 - b$

$+b$

$b = a \cdot 0.075^2$

$b = 24.14 \times 10^6 \times 0.075^2$

$$\sigma_{c0} = a + \frac{b}{r_o^2}$$

$$\sigma_{ci} = a + \frac{b}{r_i^2}$$

$$r_o = 0.075$$

$$a = 24.14 \times 10^6$$

$$r_i = 0.065$$

$$b = 135.79 \times 10^3$$

$$= 24.14 \times 10^6 + \frac{135.79 \times 10^3}{0.075^2}$$

$$= 24.14 \times 10^6 + \frac{135.79 \times 10^3}{0.065^2}$$

$$\sigma_{c0} = 48.28 \times 10^6$$

$$\sigma_{ci} = 56.28 \times 10^6$$

$$48.28 \text{ MPa}$$

$$56.28 \text{ MPa}$$

Question No.

Examiner C

Arholwr yn unig

y Cwestiwn

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Arholwr yn unig

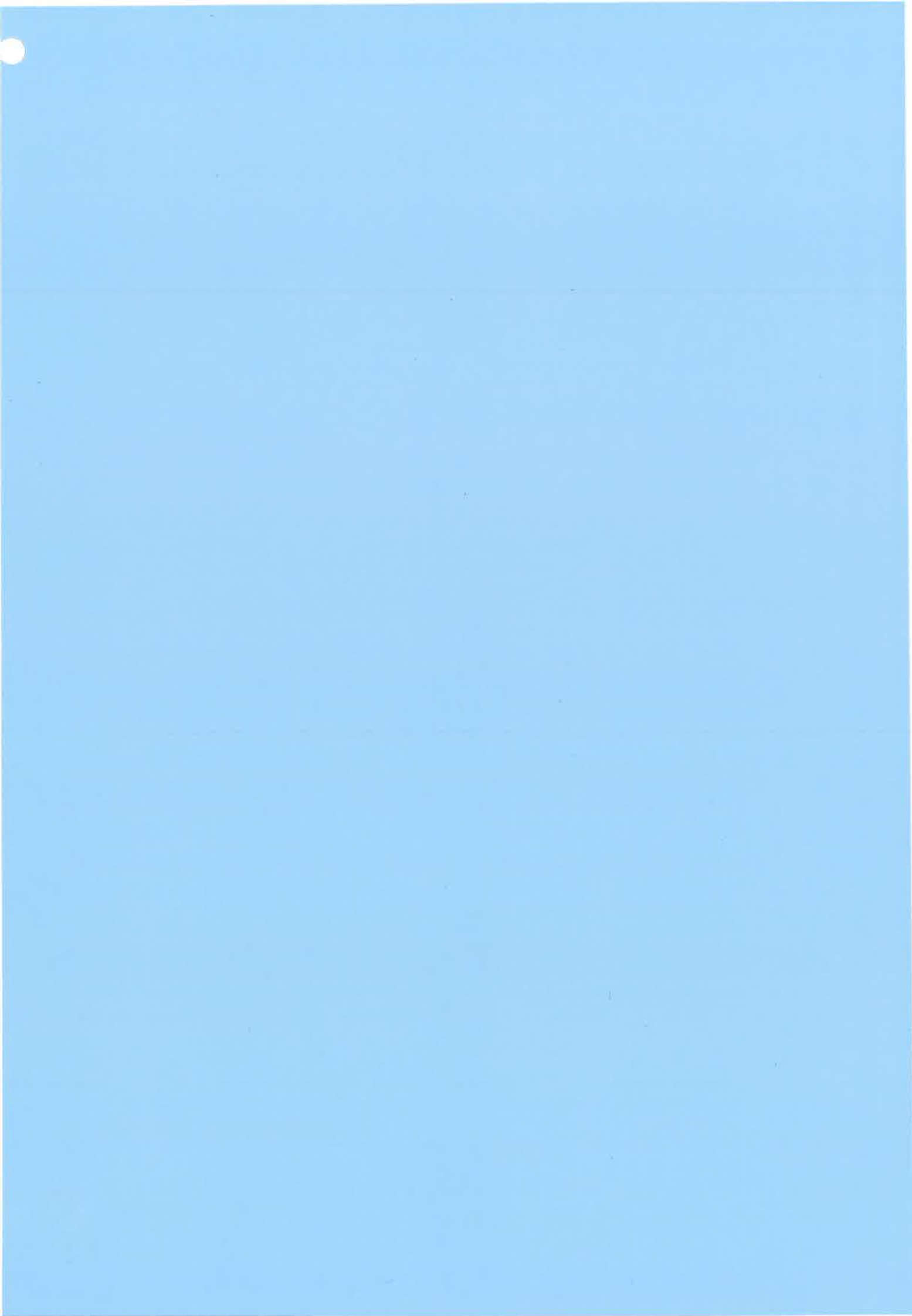
f y Cwestiwn

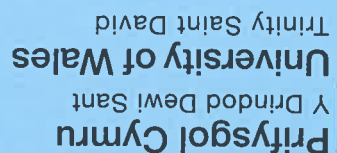
Question No.

Examiner C

Arholwr yn unig

y Cwestiwn





12 Tüdalen

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarparwyd ar y dde, plynwch ef a'i selio i lawr (gan dddefnyddio'r label a ddarparwyd) i guddio'ch enw.

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

4. Ysgriennwch eich atebion mewn inc.

5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwylwyr/gwylwyr.

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Arholiad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyriwr	

[illegible]

(See the other side for English version)

Llenwch, plygwh a seliwh
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: