



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

Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the box below.
2. Enter your name in the space provided to the right, and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your handwriting 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.

Complete, fold and seal
(see note 2 below)

SURNAME: Bass

FORENAME(S): Joshua

1	Student Number	P146018
2	Title of Examination Paper	CAE + Stress Analysis
3	Module Code	M5X02064.
4	Date and Time of Examination	09/05/2019 12:00
5	Examination Venue	(1145 Glas) Registry.
6	Seat Number	
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	10
2	15
3	~~4~~ 8
	33
Total	32

(Gweler yr ochr arall am y fersiwn Cymraeg)

5331.7

551



Q1)

$$a) \sigma_H = \frac{pd}{2t}$$

Forces due to pressure = Forces due to hoop stress

$$\uparrow = \downarrow$$

$$f = p_a = f = \sigma_H \times a$$

$$f = (pdL) = f = (\sigma_H \times 2Lt)$$

$$pdL = \sigma_H(2Lt)$$

$$\frac{pdL}{2Lt} = \sigma_H$$

$$\frac{pd}{2t} = \sigma_H$$

$$b) i) \sigma_H = 200 \text{ MPa}$$

$$d = 3.5 \text{ m}$$

$$t = 0.5 \text{ mm}$$

$$P = \rho gh$$

$$(500 \text{ ft}) \pm$$

$$P = \frac{\sigma_H \times 2t}{d}$$

$$P = \frac{200 \times 10^6 \times (2 \times 0.5 \times 10^{-3})}{3.5}$$

$$P = 57.14 \times 10^3 \text{ Pa} = 57.14 \text{ kPa}$$

$$15,000 \text{ feet} / 4572 \text{ meters}$$

(4)

(2)

ii) 8000 ft.

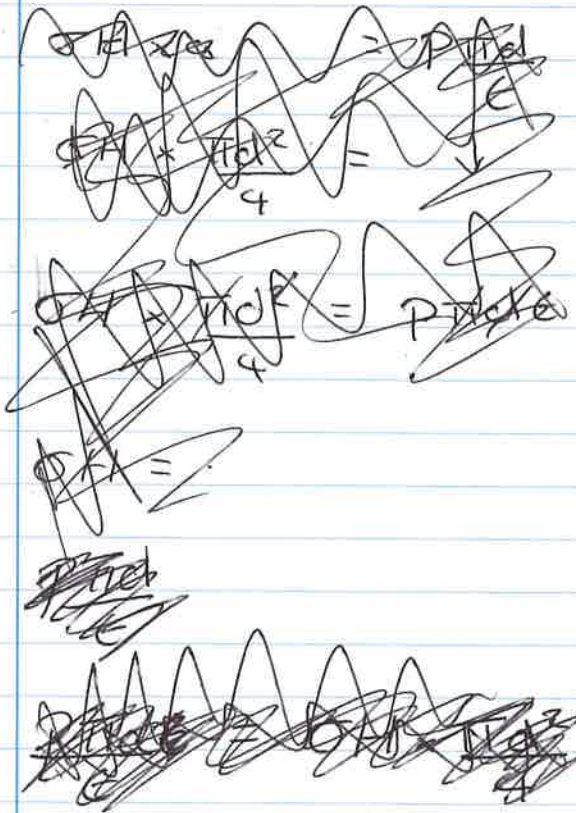
$$P = \rho g h \quad \text{WATER}$$

$$P = 1000 \times 9.81 \times 8000.$$

$$P = 78.48 \times 10^6 \quad \text{or } 78.48 \text{ MPa.}$$

d) $\sigma_H = \frac{Pd}{4t}$

forces $\leftarrow = \rightarrow$



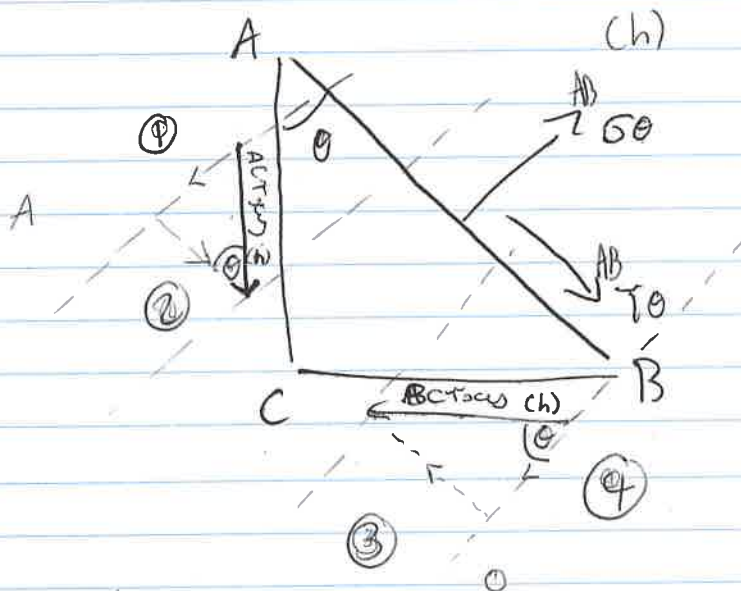
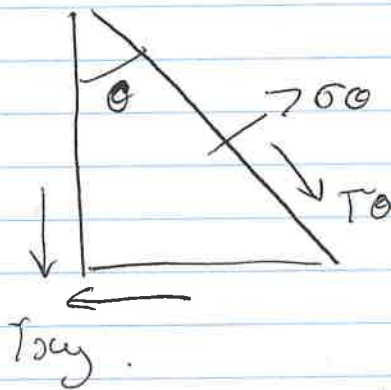
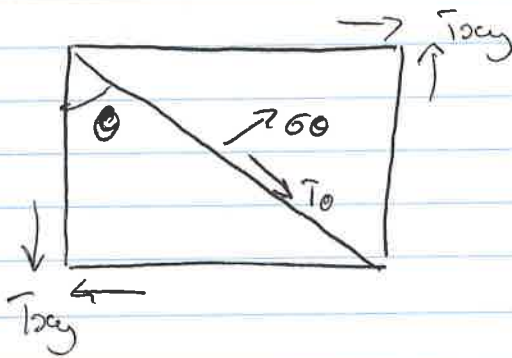
$$\frac{P d^2}{4} = \sigma_H \times \pi d t$$

$$\frac{P d}{4 t} = \sigma_H$$

b) $\sin \theta \cos \theta = \frac{1}{2} \sin 2\theta$

$\sin^2 \theta - \cos^2 \theta = -\cos 2\theta$

c) $\sigma_\theta = \tau_{xy} \sin 2\theta$



- ① $AC T_{xy} \sin \theta$
- ② $AC T_{xy} \cos \theta$
- ③ $BC T_{xy} \sin \theta$
- ④ $BC T_{xy} \cos \theta$

$$\sin \theta = \frac{BC}{AB}$$

$$\cos \theta = \frac{AC}{AB}$$

$$\tan \theta = \frac{BC}{AC}$$

$$\leftarrow \quad \uparrow = \downarrow$$

$$AB \sigma_\theta = AC T_{xy} \sin \theta + BC T_{xy} \cos \theta$$

$$\sigma_\theta = \frac{AC}{AB} T_{xy} \sin \theta + \frac{BC}{AB} T_{xy} \cos \theta$$

$$\sigma_\theta = T_{xy} \sin \theta \cos \theta + T_{xy} \cos \theta \sin \theta$$

$$\sigma_\theta = \frac{1}{2} T_{xy}$$

$$\sigma_\theta = T_{xy} \left(\frac{1}{2} \sin 2\theta \right) + T_{xy} \left(\frac{1}{2} \sin 2\theta \right)$$

$$\sigma_\theta = \frac{1}{2} T_{xy} \sin 2\theta + \frac{1}{2} T_{xy} \sin 2\theta$$

$$\sigma_\theta = T_{xy} \sin 2\theta$$

ii) //

$$\leftarrow = \rightarrow$$

$$BC T_{xy} \sin \theta = AB \tau_\theta + AC T_{xy} \cos \theta$$

$$BC T_{xy} \sin \theta - AC T_{xy} \cos \theta = AB \tau_\theta$$

$$\frac{BC}{AB} \tau_{xy} \sin \theta - \frac{AC}{AB} \tau_{xy} \cos \theta = \tau_{\theta}$$

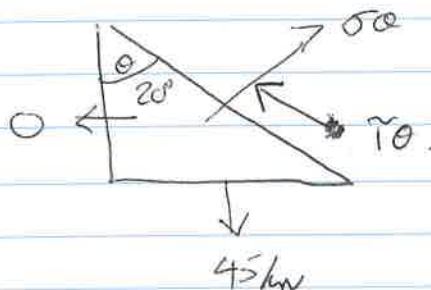
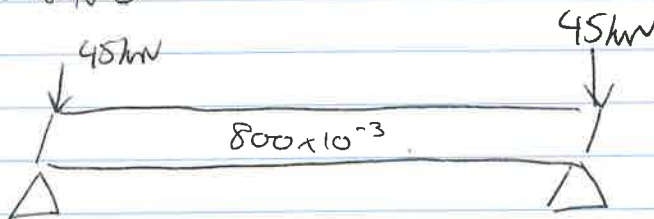
$$\tau_{xy} \sin^2 \theta - \tau_{xy} \cos^2 \theta = \tau_{\theta}$$

$$\tau_{xy} (\sin^2 \theta - \cos^2 \theta) = \tau_{\theta}$$

$$\tau_{xy} (-\cos 2\theta) = \tau_{\theta}$$

$$\tau_{\theta} = -\tau_{xy} \cos 2\theta$$

c) ~~$A = 800 \text{ mm}^2$~~
~~Area of cross section~~
 ~~$\sigma = 45 \text{ MPa}$~~
 ~~$\tau = 36 \text{ MPa}$~~
 ~~$\theta = 20^\circ$~~
 ~~$\sigma_{\theta} = \frac{1}{2}(\sigma_1 + \sigma_2) + \frac{1}{2}(\sigma_1 - \sigma_2) \cos(2 \times 20^\circ)$~~
 ~~$= \frac{1}{2}(36000 + 36000) + \frac{1}{2}(36000 - 36000) \cos(40^\circ)$~~
 ~~$= 36000 \text{ MPa}$~~
 ~~$\tau_{\theta} = \frac{1}{2}(\sigma_1 - \sigma_2) \sin(2 \times 20^\circ)$~~
 ~~$= \frac{1}{2}(36000 - 36000) \sin(40^\circ)$~~
 ~~$= 0 \text{ MPa}$~~



5

X

~~800 x 10⁻³ x 45 x 10³~~

$$800 \times 10^{-3} \times 45 \times 10^3$$

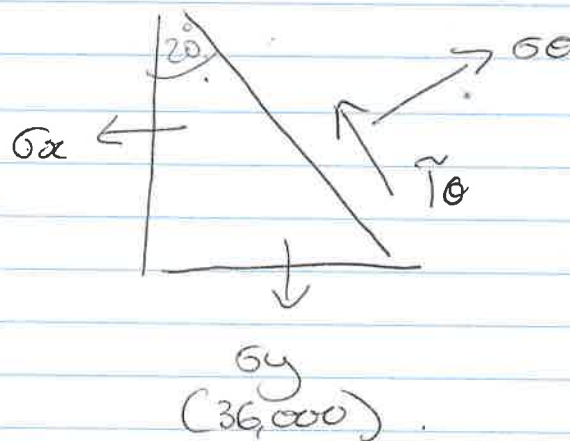
$$= 36,000 \text{ N. } (\sigma_y)$$

$$\sigma_\theta = \frac{1}{2}(0 + 36,000) + \frac{1}{2}(0 - 36,000) \cos(2 \times 20)$$

$$\sigma_\theta = 4211.20 \text{ N}$$

$$\tau_\theta = \frac{1}{2}(0 - 36,000) \sin(2 \times 20)$$

$$\tau_\theta = -11570.18 \text{ N}$$



METHOD

2

Question 1

c)

The advantage of pressurizing plane cabins allows an understanding on how much pressure is grounded on the planes surface at low altitude over sea level. Given my answer in part b, this shows a 57.14kpa pressure on the plane cabins at 15,000 feet

X

e)

Oil is stored in volumetric capacity, so using the hoop stress equation can be useful to know which one it can be stored in without the stress being too high. For longer distances they would be stored in a spherical tank due to its amount of pressure it can hold and capacity.

X

Question 2

a)

The term principle stress means; the minimum and maximum stress, such as σ_1 and 2.

The principle plane means the angle on which σ_p , σ_x over τ_{xy} . In which the direction is acting upon for minimum and maximum, such as θ_1 and 2. Varies in between 90 degrees of each other.

/ (3)

Question 3

a)

An analysis problem only has one answer, however, the design problem needs to meet the specific needs required which goes through a lot of processing and time.

(2)

b)

The design process is usually an iterative process; this means that there are requirements to be met, because it is unsafe, too expensive and not matching the required needs. However, by using an analysis process this can allow too save time and allow it to be primarily sequential.

(2)

c)

- 1) Define the problem
- 2) Gather relevant Information
- 3) Generate multiple solutions
- 4) Analyse and select a solution
- 5) Test and implement the chosen solution

(4)

French's model 1966:

Boltzman/Beltzman model:

Henry's model:

Question No.

Examiner Only

Question No.

Examiner On

Arholwr yn unig

iff y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

Y Cwestiwn

Question No.

Examiner Only

Atbolytwr yn un

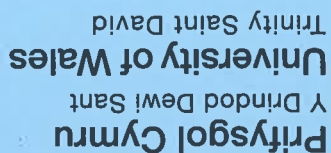
Rhif y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

ff y Cwestiwn



12 Tüdalen

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

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Atholwyr naill ai anwybyddu sgrifft annarllennadwy, neu drefnu 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 ftras nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.

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

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

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu dermyddio neu heb eu dermyddio, allan o'r lleoliad arthol 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 Myfyrwr	

[illegible]

(See the other side for English version)

Llenwch, plygwrch a selwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: