



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 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.**

Complete, fold and seal
(see note 2 below)

SURNAME: Jones

FORENAME(S): Timothy Matthew

1	Student Number	1701384
2	Title of Examination Paper	CAE & Stress Analysis
3	Module Code	MSX02064
4	Date and Time of Examination	12:00 9/5/19
5	Examination Venue	IQ 310
6	Seat Number	G048
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	20
2	12
3	10
Total	42

(Gweler yr ochr arall am y fersiwn Cymraeg)

70%



1)

a

$$F = P \times A \quad A = dL \quad F = PdL$$

$$F = \sigma_H \times 2Lt$$

$$\sigma_H \times 2Lt = PdL \quad \div L$$

$$\sigma_H \times 2t = Pd \quad \div 2t$$

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

/ (4)

b)

$$\sigma_H = 200 \text{ MPa}$$

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

$$L = 0.5 \times 10^{-3} \text{ m}$$

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

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

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

$$P = 57142.86 \text{ Pa} \quad P = 57.142 \text{ KPa}$$

i

$$\text{Sea level pressure} = 101 \text{ KPa}$$

$$101 - 57.142 = 43.858 \text{ KPa}$$

$$= 20,000 \text{ ft}$$

(4)

ii

$$75.3 - 57.142 = 18.158 \text{ KPa}$$

$$= 40,000 \text{ ft}$$

(3)

c By pressurizing the plane cabin the plane can fly at higher altitudes which is more efficient. ✓ (2)

d.

~~$F = P \times A$~~

$$F = \frac{P \pi d^2}{4}$$

$$A = \frac{\pi d^2}{4}$$

$$F = \sigma_H \pi r dt$$

$$\sigma_H \pi r dt = \frac{P \pi d^2}{4} \div \pi$$

$$\sigma_H dt = \frac{P d^2}{4} \div d$$

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

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

e ~~the~~ cylindrical tanks have a more cost effective shape, saving material, where as a cylindrical container can withstand double the pressure and fly at a greater altitude. ✓ (3)

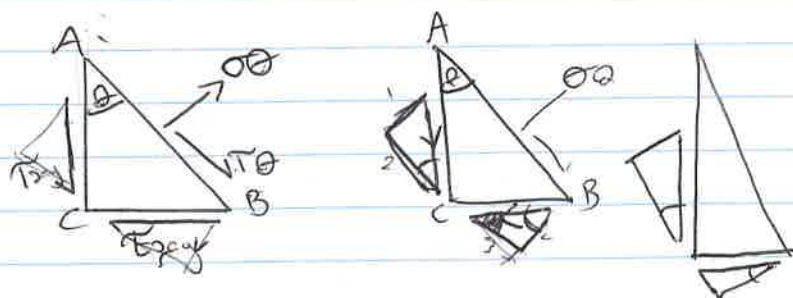
2.

- a) Principle stress and principle plane are the resultant forces in terms of σ and τ at angle θ to each the plane.

(1)

b)

i



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

$$\frac{AC \tau_{xy} \sin \theta}{AB} + \frac{BC \tau_{xy} \cos \theta}{AB} = AB \sigma_{\theta} \quad \div AB$$

$$\tau_{xy} \cos \theta \sin \theta + \tau_{xy} \sin \theta \cos \theta = \sigma_{\theta} \quad \cos \theta \sin \theta = \frac{1}{2} \sin 2\theta$$

$$\sigma_{\theta} = \tau_{xy} 2 \sin 2\theta \quad \tau_{xy} \times \frac{1}{2} \sin 2\theta$$

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

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

(5)

ii

$$ABT\theta + (2) = (3)$$

$$ABT\theta + A\tau_{xy}\cos\theta = B\tau_{xy}\sin\theta \quad \therefore AB$$

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

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

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

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

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

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

c

$$A = 800\text{mm}^2 = 0.0008\text{m}^2$$

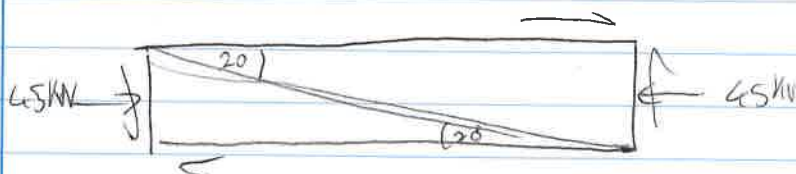
$$F = 45\text{kN} \quad \sigma = \frac{F}{A}$$

$$\sigma = \frac{45 \times 10^3}{0.0008}$$

$$\sigma = 562,500 \frac{\text{N}}{\text{m}^2} = 562.5 \frac{\text{kN}}{\text{m}^2} \quad \text{UNITS}$$

$$\frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y)\cos 2\theta = \tau_{xy}\sin 2\theta$$

$$\tau_{xy} = \frac{1}{2}\tan 2\theta(\sigma_x - \sigma_y)$$



$$\tau_{\theta} = \frac{1}{2}(\sigma_x - \sigma_y) \sin 2\theta$$

$$\sigma_x = 562.5 \frac{\text{KN}}{\text{m}^2}$$

$$\sigma_{\theta} = \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y) \cos 2\theta$$

$$\sigma_{\theta} = \frac{1}{2}(562.5 + 0) + \frac{1}{2}(562.5 - 0) \cos(2 \times 20)$$

$$\sigma_{\theta} = 496.7 \frac{\text{KN}}{\text{m}^2} \quad \text{UNITS}$$

$$\tau_{\theta} = \frac{1}{2}(\sigma_x - \sigma_y) \sin 2\theta$$

$$\tau_{\theta} = \frac{1}{2}(562.5 - 0) \sin(2 \times 20)$$

$$\tau_{\theta} = 180.78 \frac{\text{KN}}{\text{m}^2} \quad \text{UNITS}$$

6

3)

a

An Analysis problem can be solved with a singular solution. A design problem will have a specification which can be met ~~to~~ with a number of solutions down to creativity to meet the specification in number of ways.

3

b)

An analysis problem is primarily sequential to set the boundaries in which the design process must stay within. An analysis problem sets the specification and then the design process can vary as long as the specification is met. The design process then must ~~include~~ have time to develop and include the ~~an~~ required desire of the customer. ~~as well as~~

4

C For a design process it is important to define the problem. ~~By this means knowing the criteria for success as well as meeting the needs of the customer.~~

One of the models used in the design process is the 5 step method which: ~~defines the problem,~~

- defines the problem
- Gathers the relevant information
- Generates multiple solutions
- Analyses and selects a solution
- Test and implement solution

This method questions the aims of the design and looks at existing, if any, methods currently exist and then presenting new ideas. An advantage of this method is that it tests after repeated evaluation to reduce the amount of prototypes ~~that~~ that are made reducing cost and ~~duration~~ saves time.

✓ ③

Question No.

Examiner Only

Arholwr yn unig

rhif y Cwestiwn

Question No.

Examiner Only

Arholwr ym unig

Rhif y Cwestiwn

Question No.

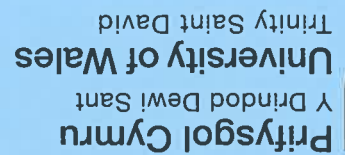
Examiner Only

Question No.

Examiner Only

Question No.

Examiner Only



12 Tudalen

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 llawysgriflen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio a chael yr ymgeisydd i dalu.

4. Ysgrifennwch 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 rhwgo 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 amgylchriadu.

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

[illegible]

(See the other side for English version)

Llenwch, plygwrch a seliwrch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: