



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:

STUBBINGS

FORENAME(S):

BRYN,
SIMON

1	Student Number	1702064
2	Title of Examination Paper	CAE & Stress Analysis
3	Module Code	M5X02064
4	Date and Time of Examination	9/5/19 12:00pm
5	Examination Venue	1A 112
6	Seat Number	
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	17
2	3½
3	11
Total	31½

(Gweler yr ochr arall am y fersiwn Cymraeg)

52.5%





$$F = PA$$

$$F = P \partial L$$

$$F = \sigma A$$

$$F = \sigma_H 2lt$$



$$F = PA$$

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

$$F = \sigma A$$

$$F = \sigma_H \pi \partial t$$

1) a) Pressure ~~A~~ ~~$\frac{\pi \partial^2}{4}$~~ $\uparrow F = F \downarrow$

$$F = PA$$

$$F = P \partial L$$

Hoop Stress ~~$\frac{\pi \partial^2}{4}$~~ $F = \sigma A$

$$F = \sigma_H 2lt$$

$$\therefore P \partial L = \sigma_H 2lt$$

$$\sigma_H = \frac{P \partial}{2t}$$

(4)

1) d) Pressure $F = P A \quad \leftarrow F = F \rightarrow$

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

Resistive $F = \sigma A$

$$F = \sigma_H \pi d t$$

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

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

1 e) In terms of volume vs footprint of the storage system cylindrical containers are best. However spherical tanks can work at higher pressure due to the hoop stress being halved.

b)

i)

$$P_{max} = \frac{\sigma_H \times 2t}{d}$$

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

$$P_{max} = \frac{200 \times 10^6 \times 0.5 \times 10^{-3}}{3.5}$$

$$P_{max} = 28,571 \text{ Pa}$$

$$28.6 \text{ kPa} \quad \times$$

$$101 - 28.6 = 72.4 \text{ kPa}$$

Max Alt. 9,000 ft

ECF

(3)

$$\text{ii)} \quad 75.3 - 28.6 = 46.7 \text{ kPa}$$

Max Alt. 20,000 ft

ECF.

(3)

i)c) Pressurizing the plane cabin allows the maximum altitude of the plane to increase. This also means that there would be less hoop stress on the pressurized cabin, compared to the non-pressurized at the same altitude.

BUT WHY?

(0)

Design Problem

Iterative / cyclical process
 Solution evolves
 multiple solutions

Analysis Problem

Single Solution
 more defined problem
 primarily sequential

3/a)

A design ~~solution~~ problem is an iterative process, where there are multiple solutions and the problem is generally more broadly defined. ~~with~~ The solution evolves over the process ~~with~~ in a cyclical fashion.

A analysis problem however, has a tendency to be more clear cut and more accurately defined. There is usually only one solution and the process happens primarily sequentially.

3

- 1) define Problem
- 2) Gather relevant Information
- 3) Generate Solutions
- 4) Analysis and Selection
- 5) Testing and Implementation

3)c) The design process can be condensed into 5 general points

- 1) Define the Problem
establish a need for a ^{new} product or service, and define success criteria for it. Specifications to meet or attributes to possess.
- 2) Gather Relevant Information
If there are current solutions for the problem, research these looking at what makes the good or bad establish the value of the solution to the problem to the customer.
- 3) Generate Solutions
This would include various experts within the ~~field~~ field brainstorming ideas. The ideas for solutions can be new or based on deconstructing current solutions and looking to improve weaknesses or limitations.
- 4) Analysis and Selection
Analysis can include
 - Functionality analysis
 - Strength analysis
 - Manufacturability
 - ergonomics
 - Safety and reliability
 When selecting a solution a decision matrix can be used to determine the best fit solution

3)c) 5) Testing and Implementation
 This includes building prototypes to conduct real world conditions testing.
 Documenting everything is also essential for legislative testing and if audits of the final product are carried out.

3)b) A design process with basic initial specifications and desired attributes, that need to be refined as the problem and solutions are further explored. An element of the design process can be 'trial and error', where something may need to be modeled or made to identify any additional problems. This may lead to a solution being modified or replaced by a more suitable one. This means parts of the process are repeated until a ~~certain~~ ~~star~~ defined standard is met.

An ~~analytical~~ analysis problem begins more clearly defined. Follow this ~~the tests~~ appropriate tests and conducted and relevant data collected that will generally point to a single solution that can then be implemented.

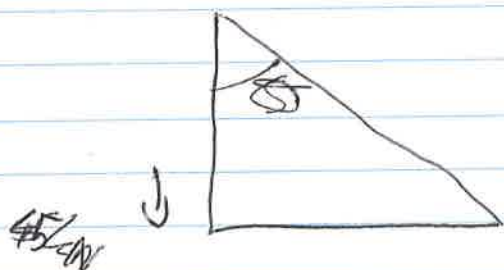
2)a) Principal stress is where the overall stress amounts up to and the principal plane is in which plane and direction the principal stress is.

$2\frac{1}{2}$

2)c)

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

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



$$\sigma_{\theta} = 0.5(45 \times 10^3 + 45 \times 10^3) + 0.5 \times 0 \times \cos 2\theta$$

$\times \textcircled{1}$

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

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

$\times \textcircled{0}$

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

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

$\times \textcircled{0}$

3)C) An advantage to this process
cont. is that it forms on logical fashion
a disadvantage is that there is
little opportunity for section to
overlap $\&$, reducing length and ultimately
cost of process.

Question No.

Examiner Or

Arholwr yn unig

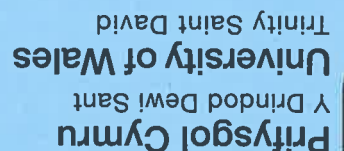
hif y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

llyf y Cwestiwn



12 Tudalen

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

3. Rhaid i'r atebion fod mewn llawysgriften ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgript annarllennadwy, neu drefnu iddi gael ei theipio a chael yr ymgaisydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fras nodiadau yn y llyfr atebion a thynnwch 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 gwyllwrr/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 Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyriwr	

[illegible]

(See the other side for English version)