



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.

1	Student Number	1805078
2	Title of Examination Paper	CAE and STRESS ANALYSIS
3	Module Code	MSX02064
4	Date and Time of Examination	12pm. 09/05/2019
5	Examination Venue	IQ 310
6	Seat Number	G030
7	Number of Answer Books handed in	1

Complete, fold and seal
(see note 2 below)

SURNAME: GLIO

FORENAME(S): ZHANGWEI

List the numbers of the questions you have attempted	Office Use
1	16
2	17
3	
Total	41

(Gweler yr ochr arall am y fersiwn Cymraeg)

68.3%

Question I.

a)

$$P \cdot d \cdot L = 2 \times \sigma_H \times t \times L$$

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

(2)

b) i If the cabin is sealed at sea level,

$$P = 101 \text{ kPa}$$

$$\therefore \sigma_H = \frac{P \cdot d}{2t}, \quad t = 0.5 \text{ mm} = 0.0005 \text{ m}, \quad 200 \text{ MPa} = 200 \times 10^6 \text{ Pa}$$

$$\therefore P = \frac{2t \cdot \sigma_H}{d} = \frac{2 \times 0.0005 \times 200 \times 10^6}{3.5} = 57 \text{ kPa.}$$

$\therefore$ pressure outside should over $101 - 57 = 44 \text{ kPa}$

From table 1. find the maximum altitude can fly is 20000 ft.

(4)

ii If the cabin is sealed at an equivalent pressure of 8000 ft, from the table 1., find $P = 75.3 \text{ kPa}$.

$$\therefore P = \frac{2t \cdot \sigma_H}{d} = \frac{2 \times 0.0005 \times 200 \times 10^6}{3.5} = 57 \text{ kPa.}$$

$\therefore$ pressure outside should over $75.3 - 57 = 18.3 \text{ kPa}$

From table 1, find the maximum altitude can fly is 6000 ft.

(3)

c)

As we can see from the answers to part b, when we pressurizing plane cabins, pressure outside can be much lower and that means the maximum altitude can fly can be higher.

As we all know, higher the cabin fly, less density of air, higher fly efficiency and higher fly stability.

(2)

d)

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

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

(2)

e)

As we can see from the equations derived in parts a and d, when it comes to the storage capacity ~~the~~, cylindrical containers seem

much more suitable ~~than~~. But the pressure that cylindrical containers can stand is only half to spherical tanks, so we have to choose spherical tanks for some fluids which ~~are~~ need to be in a high pressure.

3

Question 2.

- a) In most complex stress system, there will be both normal stress and shear stress at the same time. But in the principle stress system, there will be only normal stress ~~on the~~ called principle stress on the principle plane inclined at an angle without shear stress. Sometimes, problems will be much more easier in a stress system without shear stress and that's why we call them 'Principle Stress' and 'Principle Plane'.

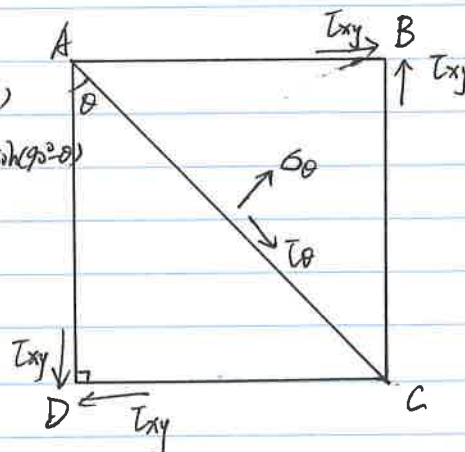
- b) i in the direction of σ_θ .

$$\begin{aligned}\sigma_\theta \cdot AC &= \tau_{xy} \cdot AD \cdot \sin \theta + \tau_{xy} \cdot CD \cdot \sin(90^\circ - \theta) \\ &= \tau_{xy} \cdot AC \cdot \cos \theta \cdot \sin \theta + \tau_{xy} \cdot AC \cdot \cos(90^\circ - \theta) \cdot \sin(90^\circ - \theta) \\ &= \tau_{xy} \cdot AC \cdot \sin \theta \cos \theta + \tau_{xy} \cdot AC \cdot \sin \theta \cos \theta\end{aligned}$$

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

$$\therefore \sin \theta \cos \theta = \frac{1}{2} \sin 2\theta$$

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



- ii in the direction of τ_θ .

$$\begin{aligned}\tau_\theta \cdot AC &= \tau_{xy} \cdot CD \cdot \cos(90^\circ - \theta) - \tau_{xy} \cdot AD \cdot \cos \theta \\ &= \tau_{xy} \cdot AC \cdot \cos(90^\circ - \theta) \cdot \cos(90^\circ - \theta) - \tau_{xy} \cdot AC \cdot \cos \theta \cdot \cos \theta \\ &= \tau_{xy} \cdot AC \cdot \sin \theta \cdot \sin \theta - \tau_{xy} \cdot AC \cdot \cos \theta \cdot \cos \theta \\ \tau_\theta &= \tau_{xy} \cdot \sin^2 \theta - \tau_{xy} \cos^2 \theta = \tau_{xy} (\sin^2 \theta - \cos^2 \theta)\end{aligned}$$

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

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

- c) As we can find,

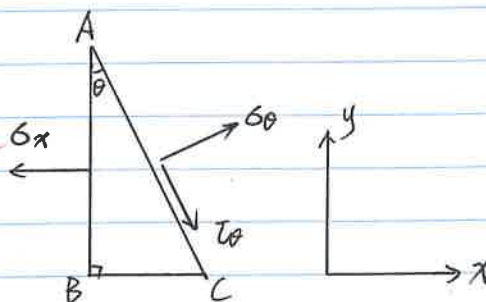
$$\sigma_x = \frac{45 \text{ kN}}{800 \text{ mm}^2} = \frac{45 \times 10^3 \text{ N}}{800 \times 10^{-6} \text{ m}^2} = 56.25 \text{ MPa}$$

$$\sigma_y = 0$$

$$\tau_{xy} = 0$$

$$\theta = 20^\circ$$

$$\begin{aligned}\sigma_\theta &= \frac{1}{2}(\sigma_x + \sigma_y) + \frac{1}{2}(\sigma_x - \sigma_y) \cdot \cos 2\theta = \frac{1}{2} \times 56.25 \times 10^6 + \frac{1}{2} \times 56.25 \times 10^6 \times \cos 40^\circ \\ &= 56.25/2 \times (1 + \cos 40^\circ) \\ &= 49.67 \text{ MPa}\end{aligned}$$



$$\tau_{\theta} = \frac{1}{2} (\sigma_x - \sigma_y) \cdot \sin 2\theta = \frac{1}{2} \times 56.25 \times 10^6 \times \sin 40^\circ = 18.08 \text{ MPa.}$$

So the normal stress on the plane is $\sigma_{\theta} = 49.67 \text{ MPa.}$

shearing stress on the plane is $\tau_{\theta} = 18.08 \text{ MPa}$

(7)

Question 3

a) Firstly, design problem is vaguely defined than analysis problem. After that analysis problem will have one answer but design problem is a system which has some specific properties and there can be many devices to solve it. Finally, design problem is cyclic and iterative process while analysis problem is primarily sequential.

/ 3

b) For design problem, it is a system with many specific properties which means maybe the design is good enough but it is too expensive so we have to make some improvements or dismiss it at all. So the final design comes after a few times of the cycle like this, that why it is an iterative process.

For analysis problem, we follow the steps as follows: define the problem - gather relevant information - generate multiple solutions - evaluate and select solutions - test and improve solutions. Finally, we will find a suitable solution for the problem.

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c) i. We should split the problem to several small part, so that we can solve these parts one by one or at the same time but by different people. So the time will be short by we may need more expense.

ii. Give the material to the model to make it more like real. It will make the results much more reasonable but also needs more time and expense to finish that.

iii. Apply the load to the model to put the model in a real situation so that we can make the calculation. It is necessary and we can change the load to whatever we want to reduce the number of physical prototypes.

IV. We should evaluate it on the end. By doing this step, we can have a double check to see if the design meets the needs. If not, we can still make some improvements on it. But it will costs us more time for this step.

X

Question No.

Examiner C

Arholwr yn unig

y Cwestiwn

Question No.

Examiner Only

Arholwr yn u

Rhif y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

f y Cwestiwn

Question No.

Examiner Only

Arholwr yn un

Rhif y Cwestiwn

Question No.

Examiner O

Question No.

Examiner Only

Arholwr yn unig

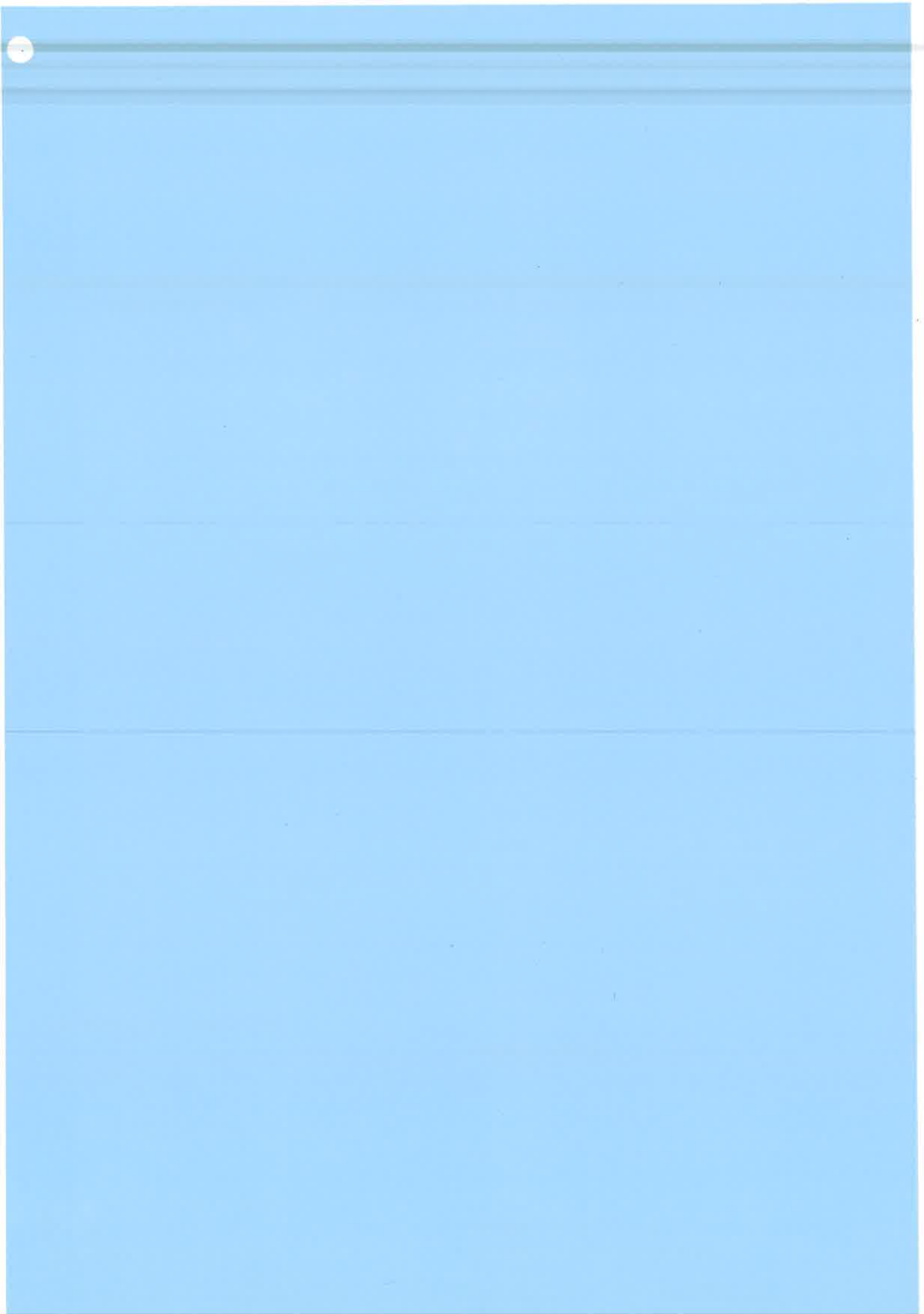
Rhif y Cwestiwn

Question No.

Examiner O

Arholwr yn unig

y Cwestiwn



Cyfarwyddiadau i Ymgeiswyr

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, pigwch 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 Arholwyr naill ai anwybyddu sgrïpt annarllennadwy, neu drefnu iddi gael ei threipio 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 gwyllwyr/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 amgylchïadau.

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	

Rhestrwch ffâu'r cwestiynau a ymgaisitwyd	Cyflanswm
At Ddlbention y Swyddfa	geinnych

(See the other side for English version)

Llenwch, plygwrch a s

CYFENN:

ENW(AU) CYNTAF: