



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:

Oke

FORENAME(S):

Alex

1	Student Number	P151012
2	Title of Examination Paper	CAE & Stress Analysis
3	Module Code	MSX02064
4	Date and Time of Examination	12:00 09/05/19
5	Examination Venue	IQ Room 310
6	Seat Number	G028
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1a	
1b	
1bii	
1c	
1d	
1e	
2a	
2b	
2bii	
2c	
3a	
3b	
3c	
Total	128, 31

128, 31

51.77



Q1.)

A.) Show $\sigma_H = \frac{pd}{2t}$ Forces $\uparrow$ = Forces $\downarrow$

$$P \times A = 2\sigma_H \times A$$

$$P \times d \times \cancel{L} = 2\sigma_H \times t \times \cancel{L}$$

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

$$\text{So, } \sigma_H = \frac{pd}{2t}$$

B.)
i.) $\sigma_H = 200 \times 10^6 \text{ Pa}$
 $D = 3.5 \text{ m}$
 $T = 0.5 \times 10^{-3} \text{ m}$ So, @ sea level $\sigma_m \text{ Pa} = 101 \text{ kPa}$.

$$P_{\max} = \frac{\sigma_H \cdot 2 \cdot t}{d} = \frac{(200 \times 10^6) \cdot (2) \cdot (0.5 \times 10^{-3})}{3.5}$$

$$P_{\max} = 57.14 \text{ kPa}$$

$$\text{So, } 101 - 57.14 = 43.86 \text{ kPa}$$

It can fly at = 20,000 ft if pressurized @ sea level.ii.) So, @ 8000 ft '2438 m' $P = 75.3 \text{ kPa}$.

$$75.3 - 57.14 = 18.16 \text{ kPa}$$

So, the plane can fly at a max altitude of 40,000 ft if pressurized at 8000 ft.C.) ~~As~~ The plane can fly higher due to pressurizing the cabin and the air is less dense at 40,000 ft. Therefore the plane is using less power and fuel to travel through the air. So fuel efficiency is the main advantage.

(4)

(4)

(3)

(2)

d.) Show $\sigma_H = \frac{pd}{4t}$

So, Force on = Forces reacting
 $F_{\rightarrow} = F_{\leftarrow}$

$$\sigma_H \cdot A = P \cdot A$$

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

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

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

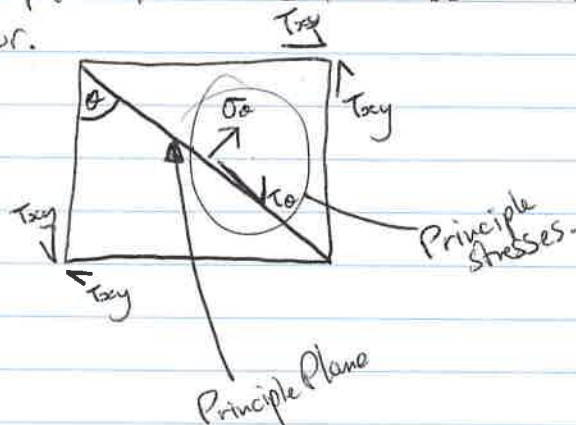
e.) Due to the shape, the spheres can hold more fluids as it can be at a higher density and pressure as opposed to when it is stored in a cylinder. This is due also to the half of hoop stress experienced in spherical containers as opposed to cylinders.

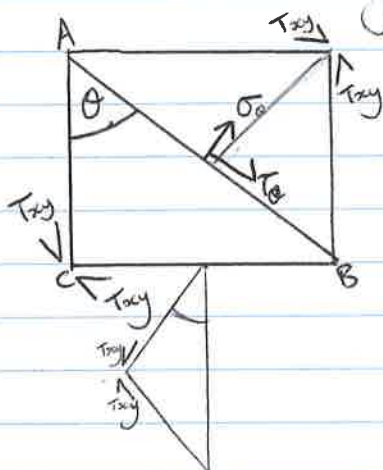
Q2.)

A.)

The principle stress is the stress happening perpendicular to the principle plane.

The principle plane is where the ~~stress~~ normalised stresses occur.



B.)
i.)S_x C_y T_xShow $\sigma_\theta = T_{xy} \sin \theta$ Clockwise = Cos
Anticlockwise = Sin

$$\text{So, } \sigma_\theta = T_{xy} \sin \theta$$

$$AB = \sigma_\theta \cos \theta$$

$$AB \sigma_\theta \cos \theta =$$

ii.)

c.)

$$\theta = 20^\circ$$

$$T_{xy} = 45 \times 10^3 \text{ N}$$

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

$$\sigma_\theta = (45 \times 10^3) \sin (40)$$

$$\sigma_\theta = 28.92 \text{ kN}$$

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

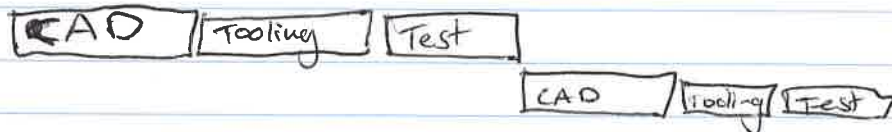
$$T_\theta = -(45 \times 10^3) \cos (40)$$

$$T_\theta = 34.47 \text{ kN}$$

Q3.)

A.) Design problems are things such as colour, touch, feel and material properties and the analysis problems are such as: meshing appropriately, finding relevant physical attribute properties such as what dimension these are.

B.) Design problem is usually iterative due to the fact it's not got any analytics so a design then tooling and test must happen and this process goes on in a loop until the solution is found.



Whereas, analysis problems are solved in a sequential manner, following a structured routine where one task must be complete to supply outcomes to the next stage. This is known as S.I.M.P.L.E.

- ① Split = simplify into mesh.
- ② Interpret = See if the mesh is appropriate.
- ③ Material = Add in material properties and in os.
- ④ Physical properties = Such as the thickness or if its 1D or 2D
- ⑤ Loading = calculate the loads which must be used on the ~~or~~ ~~or~~
- ⑥ Evaluate = This where optimisation can take place. FEA resting.

C.) Please see next page.

C.) S.I.M.P.L.E

S = Split = Simplify into mesh

I = Interpret = See if the mesh is appropriate.

M = Material info. = Add in material properties and info.

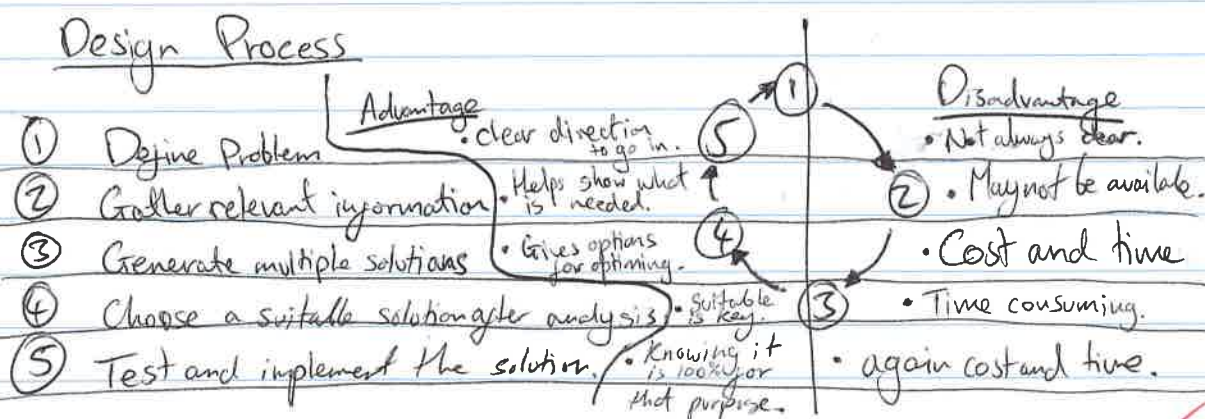
P = Physical properties = Such as thickness and if its 1D-2D or 3D

L = Loading = calculate and apply correct loading.

E = Evaluation. = Evaluate the solution to see if it can be improved.

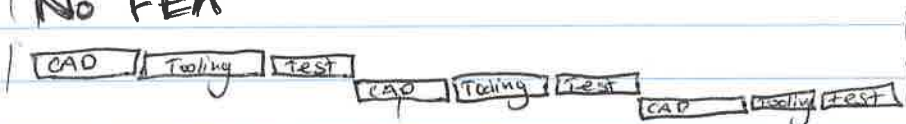
X

Design Process

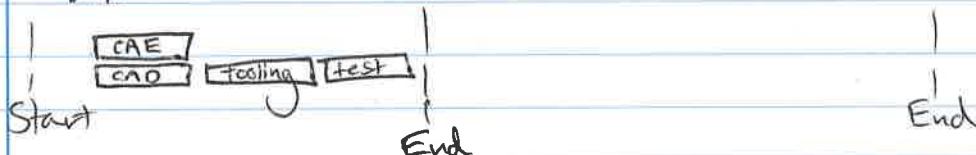


No FEA compared to with FEA.

No FEA



With FEA and CAE



With FEA in design: More time, money and materials, ^{many} iterations.

Without FEA in design: Less time, less money and less materials. ^{less} iterations.

3

6

Question No.

Examiner Only

Arholwr yn unig

thif y Cwestiwn



Question No.

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Arholwr yn unig

Rhif y Cwestiwn



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Question No.

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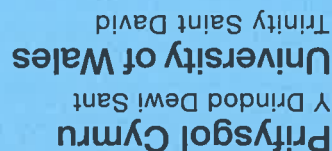


Question No.

Examiner Only

Arholwr yn unig

hif y Cwestiwn



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 llawysgriften ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïp 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 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 gwyllwr/gwyliwr.

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 unthwy 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, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENW:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: