



12 Pages

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	1804598
2	Title of Examination Paper	CAT SURFSS ANALYSIS
3	Module Code	M5X02064
4	Date and Time of Examination	2019.5.9
5	Examination Venue	IQ-310
6	Seat Number	G032
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	15
2	10
3	11
Total	36

Complete, fold and seal
(see note 2 below)

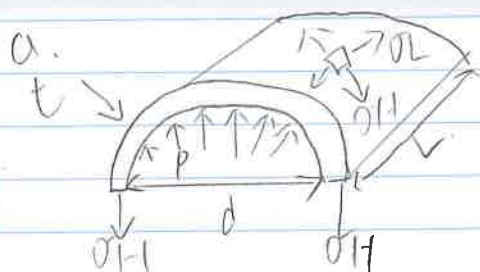
SURNAME: Hu

FORENAME(S): Zhao yu

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60°





From the above, we can see that

$$F_{\uparrow} = p \cdot d \cdot L$$

$$F_{\downarrow} = 20H \cdot t \cdot L$$

$$\therefore F_{\uparrow} = F_{\downarrow} \quad \therefore p d L = 20H \cdot t \cdot L$$

$$\therefore 0.1H = \frac{pd}{2t}$$

(4)

b. $\therefore$ From a we know that

$$0.1H = \frac{pd}{2t} \quad \therefore p = \frac{2 \cdot 0.1H}{d}$$

$\therefore$ hoop stress not exceed = 200 MPa

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

$$\therefore P_{max} = 57.14 \text{ MPa}$$

From the table sea level = 101 kPa

$$\therefore p = 101 \text{ kPa} - 57.14 \text{ MPa} = 43.86 \text{ MPa}$$

$$\therefore FL = 20000 \text{ ft}$$

(4)

ii - From the table 8000 ft = 75.3 kPa

$$\therefore p = 75.3 \text{ kPa} - 57.14 \text{ MPa} = 18.16 \text{ MPa}$$

$$\therefore FL = 40000 \text{ ft}$$

(3)

c. Using pressurizing plane cabins could make cabin exceed higher pressure than the plane can fly higher. And?

(0)

d. from the sphere we know that

$$F_{\uparrow} = p \cdot A = p \cdot \frac{\pi d^2}{4} = \frac{\pi p d^2}{4}$$

$$F_{\downarrow} = 0.1H \cdot \pi d t$$

$$\therefore \frac{\pi p d^2}{4} = 0.1H \cdot \pi d t \quad \therefore F_{\uparrow} = F_{\downarrow}$$

$$\therefore \frac{\pi p d^2}{4} = 0.1H \cdot \pi d t$$

$$\therefore 0.1H = \frac{pd}{4t}$$

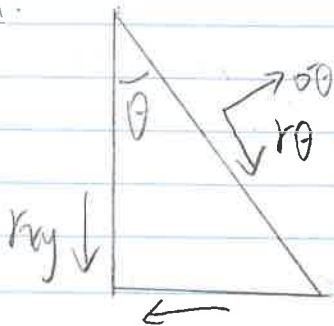
(4)

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e. From the formula we got finally between $\sigma_H = \frac{p_d}{2t}$ and $\sigma_H = \frac{p_d}{4t}$, we can know that the sphere can take higher pressure internal than the cylinder. While the cylinder can take more weights as long as its length have longer. so some situations that the high pressure should choose sphere while need more weights should use the cylinder.

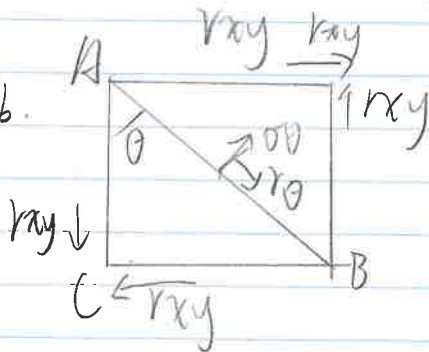
2.

a.



From the photo, we can see that the τ_{xy} which will make the object apart that is 'principal plane'. while the σ_θ and τ_θ will make the object be forced that is 'principal stress'.

b.

i. In $\triangle ABC$,

$$BC = AB \cdot \sin \theta$$

$$AC = AB \cdot \cos \theta$$

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

$$\therefore \sigma_\theta \cdot AB = \tau_{xy} \cdot \cos \theta \cdot \sin \theta \cdot AB + \tau_{xy} \cdot \sin \theta \cdot \cos \theta \cdot AB$$

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

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

$$ii. AB \cdot \tau_\theta = \tau_{xy} \cdot \sin \theta \cdot BC - \tau_{xy} \cdot \cos \theta \cdot AC$$

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

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

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

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

$$\cos 2\theta = \cos 40^\circ = 0.766$$

$$\sin 2\theta = \sin 40^\circ = 0.642$$

$$\sigma_b = 28.925 \text{ MN}$$

$$\tau_b = -34.47 \text{ MN}$$

if the pressure

$$p = \frac{\sigma_b}{A} = 36 \text{ MPa}$$

$$p_r = \frac{\tau_b}{A} = -43 \text{ MPa}$$

XO

3.

a. Design problem answer always are more vaguely than Analysis problem. Analysis problem has only one answer while Design problem answer are always a system which can meet many requirements. Many devices and systems can meet the requirements.

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b. Design problem answer should meet many requirements such as customer needs and some performance. The FEA can judge the performance and sometimes need to do design again to get better performance. It's always in updation and that is an iterative process. While analysis problem often have only one answer which only if have been finished it will be put out and completed. So the design problem is usually an iterative process, whereas an analysis problem is primarily sequential.

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c. Using FEA to carry out an design problem have five steps.

1. Define the problem

what is the customer need?

what is the criteria of success?

what is the problem statements?

This step can make the design problem more accurate while it will take plenty of time.

2. Gather the information

Is this problem really accurate?

Is this problem have some solutions?

Is this problem need new solutions?

What economies will the problem need?

Is it could be manufactured in this solution?

In this step, Some solutions could be came up while some more details in problems should be finished. It will take plenty of time.

3. Get the multiply solutions

Get a brainstorm to find solutions

All the team should take all the risks

find the different kinds of disciplines people to discuss the solutions.

Find the phase related to the problem.

This step is very significant which make find an property owner to help the problem. It will take many expenses and times. All team members should concentrate on the work and give all their best minds

4. Analysis and select the solutions

Electric and Electronic

Mechanical / Manufacture

Economies / Business

Finance

Regulations / Standards

Safety / testability

This step should analysis all the solutions and select the best solution to the problem. the team and select the best solution although it is little bit complex and tired for the team members

5. Test and implement the solutions
Test everything under the real condition
Documentation
Apply for the patents to protect the design

In the final step, everything should be test and make the documentation.

Although it is expensive and need much time it is very safety after you test everything.

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Question No.

Examiner Only

Arholwr yn unig

hif y Cwestiwn

Examiner Only

Rhif y Cwestiwn

Question No.

Arbeitsgruppen

Question No.

Examiner Only

Arholwr yn unig

Rhif y Cwestiwn

Question No.

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Question No.

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