



12 Pages

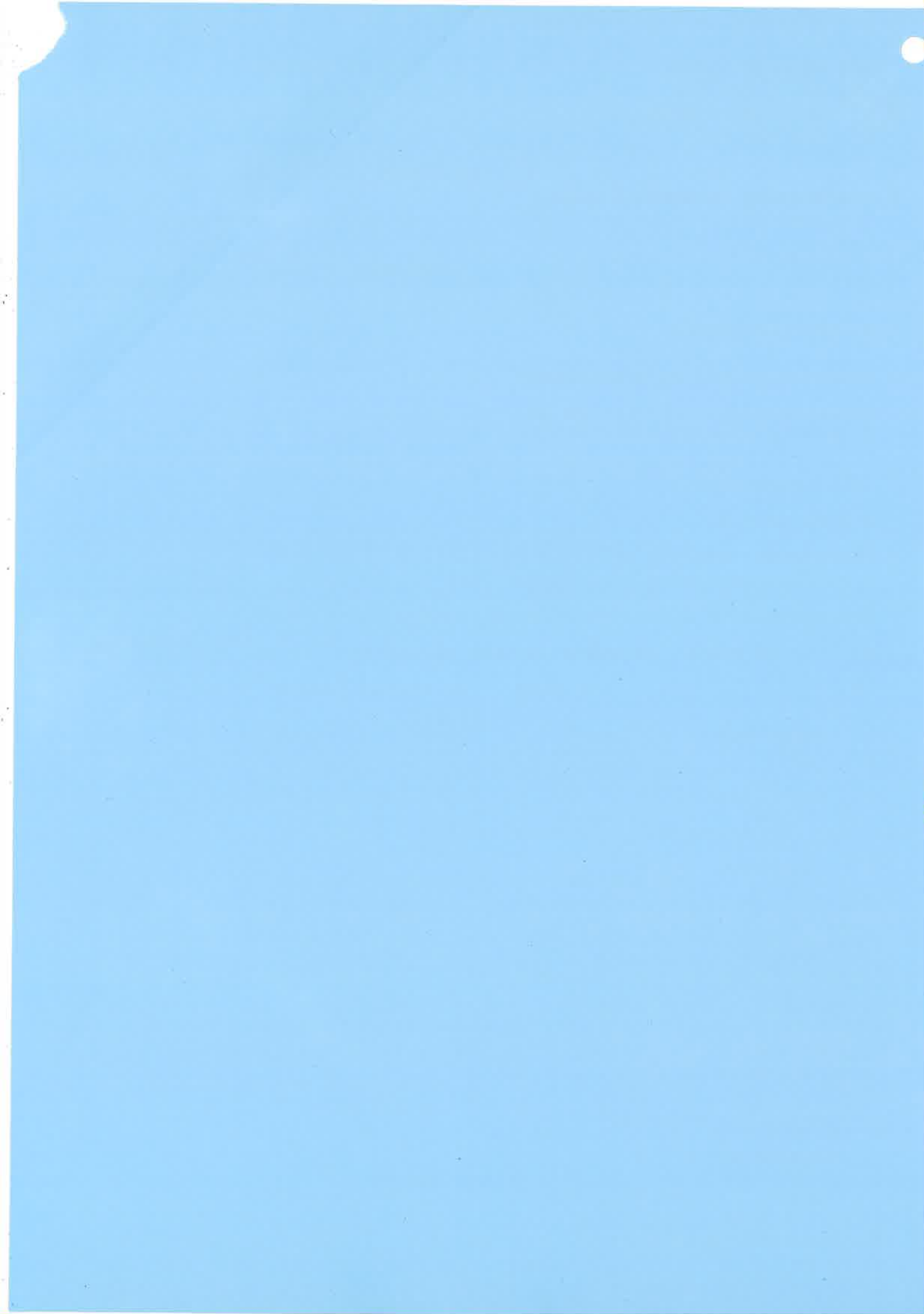
1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense 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.
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1	Student Number	P151245
2	Title of Examination Paper	CAE & stress Analysis
3	Module Code	M5X02064
4	Date and Time of Examination	9/5/19
5	Examination Venue	1Q310
6	Seat Number	G011
7	Number of Answer Books handed in	

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

75%



Q1 a) $\sigma_H = \frac{Pd}{2t}$

Pressure stress = Hoop stress

$$P = \frac{F}{A}$$

$$F = PA$$

$$A = dL$$

$$\therefore F = PdL \quad \leftarrow \text{resolve} \rightarrow$$

$$\sigma = \frac{F}{A}$$

$$F = \sigma A$$

$$A = 2tL$$

$$\sigma = \sigma_H$$

$$\therefore F = \sigma_H 2tL$$

$$PdL = \sigma_H 2tL$$

$$\sigma_H = \frac{PdL}{2tL}$$

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

b) $\sigma_H = 200 \text{ MPa} \quad d = 3.5 \text{ m} \quad t = 0.5 \times 10^{-3} \text{ m}$

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

$$\frac{\sigma_H 2t}{d} = P = \frac{(200)(2)(0.5 \times 10^{-3})}{3.5} = 0.05714 = 57.142 \text{ kPa}$$

Pressure at sea level = 101 kPa

$$\frac{46.6 - 37.6}{10} = 0.9 \quad 101 - 57.142 = 43.858 \text{ kPa}$$

0.9 per 1000 ft Approximately 21500 ft

ii

$$\text{pressure at } 8000\text{ft} = 75.3 \text{ kpa}$$

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

approximately 40000ft

(3)

c)

A pressurized plane has a higher maximum ~~altitude~~ altitude as pressure affects the hoop stress of a cylinder.

AND ?

(0)

d)

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

$$P = \frac{F}{A}$$

$$F = PA$$

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

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

$$\sigma = \frac{F}{A}$$

$$F = \sigma A$$

$$\sigma = \sigma_H$$

$$A = \pi td$$

$$\therefore F = \sigma_H \pi td$$

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

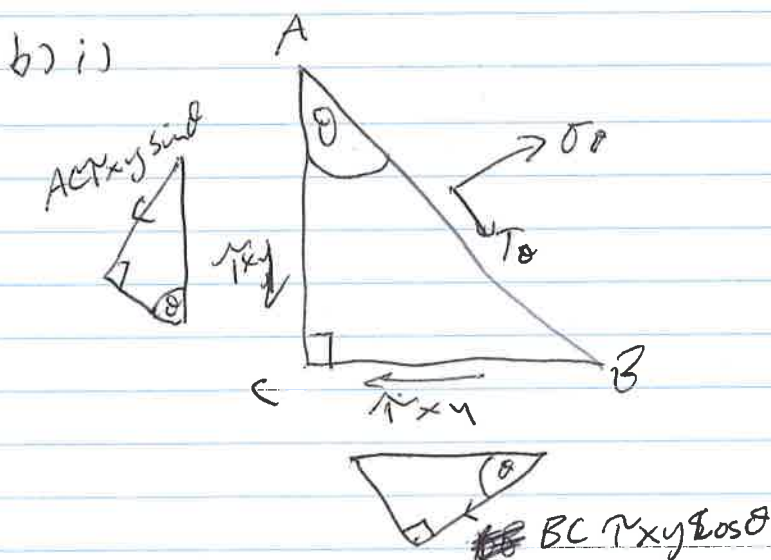
$$\sigma_H = \frac{P\pi d^2}{\pi td \cdot 4}$$

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

(4)

- Q) some fluids in an oil storage facility might be contained in a spherical container as they need to be kept under higher pressures, spheres can withstand double the stress that cylinders can. FOOTPRINT?

- 2a) Principal stress is complex stress acting upon an object or particle and principle plane is the plane or angle through which it acts



$$\begin{aligned} \sin \theta \quad SOH &= BC/AB \\ \cos \theta \quad CAH &= AC/AB \\ & \quad TOA \end{aligned}$$

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

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

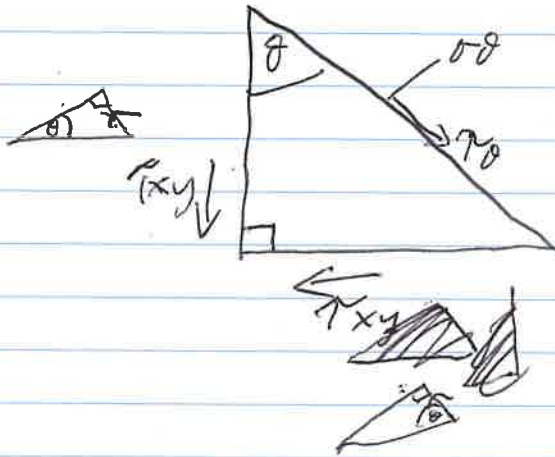
$$\sin \theta \cos \theta = \frac{1}{2} \sin 2\theta$$

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

$$\sigma_\theta = 2 \left(\frac{1}{2} \tau_{xy} \sin 2\theta \right)$$

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

ii)



Sorry mind has gone blank!

$$c. \quad \sigma_x = \frac{F}{A} = \frac{45 \times 10^3}{800 \times 10^{-3}} = 56250 \text{ } 56.25 \text{ kPa} \quad \text{UNITS}$$

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

$$\sigma_\theta = \frac{1}{2} (56.25) + \frac{1}{2} (56.25) \cos 2(20)$$

$$\sigma_\theta = 49.67 \text{ kN/m}^2 \quad \text{UNITS}$$

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

$$\tau_\theta = \frac{1}{2} (56.25) \sin 2(20)$$

$$\tau_\theta = 18.08 \text{ kN/m}^2 \quad \text{UNITS}$$

Q3 a) An Analysis problem is precise in nature and has a definite answer or outcome, design problems are vague in nature and can go through numerous iterations before a final outcome and even then the result could be deemed to be too expensive, doesn't work or not functional.

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b) Design problems are iterative because during a design you could make small or large changes due to updated needs of the customer or adding changes as thought of in previous versions. Many factors could lead you to change a design resulting in numerous iterations.

Analysis problems tend to be quantitative, i.e. have an answer of yes it will work or no it will not work. Due to this, this process tends to be sequential without the back and forth of making multiple designs.

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c). French Design methodology. 1985

The French methodology is focused on the conceptual phase but concentrates on form over function. The concept is designed to be purely functional. The problem with this method is that the user isn't considered during any part of the method.

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Pahl & Beitz Method. 1996

The Pahl & Beitz method is heavily concentrated upon the conceptual phase of design, i.e. the initial idea. A disadvantage is that the concept doesn't get evaluated or analysed until the part is made. This leads to high production costs if the concept is it fails. Also this can prolong the phase greatly. ~~This method focuses on function over form.~~

(3)

British Standard 2015

The British standard method is based upon the Pahl & Beitz method and is conceptual in nature but with further emphasis on ergonomics, i.e. the usability within human interaction with the concept. The problem is the British standard offers no method to implement the ergonomics into the part.

(3)

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