

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.**

SURNAME: Sykes

FORENAME(S): Thornice David

1	Student Number	P147408
2	Title of Examination Paper	CAE and stress analysis
3	Module Code	M52C02064
4	Date and Time of Examination	9th May 12pm
5	Examination Venue	Room 310 IQ building
6	Seat Number	G043
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	8
2	5
3	4
Total	17

(Gweler yr ochr arall am y fersiwn Cymraeg)

28.3

Q1)

a)

Pressure on inside of ^{top} cylinder is = PdL
 resisting force of ~~eq~~ cylinder = $2\sigma_H \cdot ztL$

$$\therefore PdL = 2\sigma_H \cdot ztL$$

$$\therefore \sigma_H = \frac{Pz}{2t}$$

$$b) \sigma_{H \text{ max}} = 200 \text{ MPa}$$

$$d = 3.5 \text{ m}$$

$$t = 0.5 \text{ mm}$$

$$h = 500 \text{ ft}$$

$$P = \rho gh$$

$$P_{\text{max}} = 200 \text{ MPa}$$

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

$$6 \text{ ft} = 1.8 \text{ m}$$

$$200 \times 10^6 = (P)(9.81)(3)$$

~~is~~

$$P = \frac{200 \times 10^6}{9.81} = 20.4 \times 10^8$$

there fore $h_{\text{max}} = 10,000 \text{ m}$

$$ii) P = \rho gh$$

$$P = \rho gh$$

← No value for density

$$P = 6.26(9.81)(2438)$$

$$\therefore \frac{200 \times 10^6}{(9.81)(2438)} = 8.36 \times 10^3 \text{ kg/m}^3$$

$$P = 18.39 \times 10^3 \text{ Pa} \left[\begin{matrix} \text{or} \\ \text{(kPa)} \end{matrix} \right]$$

C

Pressurising at a lower altitude increases the maximum altitude achievable.

Ans?

d)

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

$$\text{pressure} = Pd/L$$

$$\text{resistance} = 2\sigma_H \cdot 2tL$$

$$\therefore 2\sigma_H \cdot 2tL = Pd \cdot 2L$$

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

(4)

e) From parts a and d it is reasonable to assume that some fluids exert a higher pressure on the inside of their container therefore a liquid of higher pressure would need to be stored in a cylindrical ~~and~~ container where as liquids which exert less pressure will be in spherical containers due to spherical containers being able to manage half the ~~half~~ stress a cylinder can.

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

cylindrical

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

spherical

x(2)

- a) principle stress σ_1 and σ_2 are the maximum and minimum stress ~~on a~~ material ~~at that~~
- b) and the principal plane is the plane on which these stresses act on within a component/material

(3)

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

if $\sigma_x = 0$
and $\sigma_y = 0$

$$\therefore \sigma_\theta = \frac{1}{2}(0+0) + \frac{1}{2}(0-0)\cos 2\theta + \tau_{xy}\sin 2\theta$$

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

X 0

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

$$\therefore \sigma_x = 0$$

$$\sigma_y = 0$$

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

X 0

$$A = 800 \text{ mm}^2$$

$$P = 45 \text{ kN}$$

$$\theta = 20^\circ$$



$$\sigma_\theta = \frac{1}{2}(0+45) + \frac{1}{2}(0-45)\cos(40) \neq 0$$

$$\sigma = 5.26 \text{ pa}$$

$$\tau_\theta = \frac{1}{2}(0-45) + \frac{1}{2}(0+45)\sin(40) \neq 0$$

$$\tau_\theta = 6.43 \text{ pa}$$

X (2)

Q3)

a) A design problem is when determining how to solve a problem whilst constrained by either design parameters or tooling ~~test~~ abilities/materials, i.e. packaging issues for ~~example~~ a component which ~~has~~ has a performance link to size where ~~the~~ if a length for optimum performance is unable to be fitted how can it be ~~fixed~~ ^{worked} around or what's the next best solution.

A Analysis problem is where post CAD or prototype phase determining/Analysing what failures or mistakes made i.e. a failure in component, ~~the~~ you must determine what failed, where, why and how to improve the design/develop.

b) Design problems are usually iterative due to the fact some variables may be known and others unknown therefore several iterations need to be made to determine necessary variables to solve the problem. Such a maximum trials available and ~~there~~ therefore will it achieve/withstand its design purpose.

Analysis problems are usually sequential due to testing processes being relatively standard procedures when analysing/testing a design, laws are applied and results are read ~~as~~ a success or failure.

c)

~~Identify a problem~~ - determine
SIMPLE or 5 step design process

~~1~~

Separate problem into elements - Allows for a complex analysis of the problem ~~allows well as~~ however it allows room for assumption and approximation which may cause inaccuracies.

Interpret the Geometry - Determining ~~what~~ effects the component in question allowing for an analysis of the forces resultant directions, However this also creates possibilities of errors when dividing components into manageable ~~elements~~ Elements

Material properties - When determining material properties this allows for a specific demonstration of ability between materials which are best suited, however what the tolerance/composition of a material should be in ~~theory~~ is not necessarily what it will be in practicality/real world.

~~Physical properties/dimensions~~ ~~are~~ ~~are~~ ~~are~~ such as whether the component is 1D or 2D allows preliminary determine whether the solution needed is linear or Non-linear solver however this doesn't account for 3D ~~situations~~.

Steps of the design process

Identify a problem - this step allows for the identification of issues ~~preliminary~~ that speeds up the process
Gather info - However issues are not commonly simple to find.

~~Identify solutions~~

Evaluate and choose solution

Gather Information - Determine what current development properties and materials exist giving a head start

- unfortunately current products/designs may cause development issues (copy right ect)

8 Steps of

Identify Solutions - compiling multiple solutions gives a greater chance of discovering a new solution or

- If it is an existing issue you may formulate an existing solution or create further issues.

Evaluate and select solution - Allows for certification of a possible solution

- may determine solutions are all impractical setting back to step 1

3

Question No.

Examiner Only

Arholwr yn un

Rhif y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

Arif y Cwestiwn

Question No.

Examiner Only

Question No.

Examiner Or

Arholwr yn unig

hif y Cwestiwn

Question No.

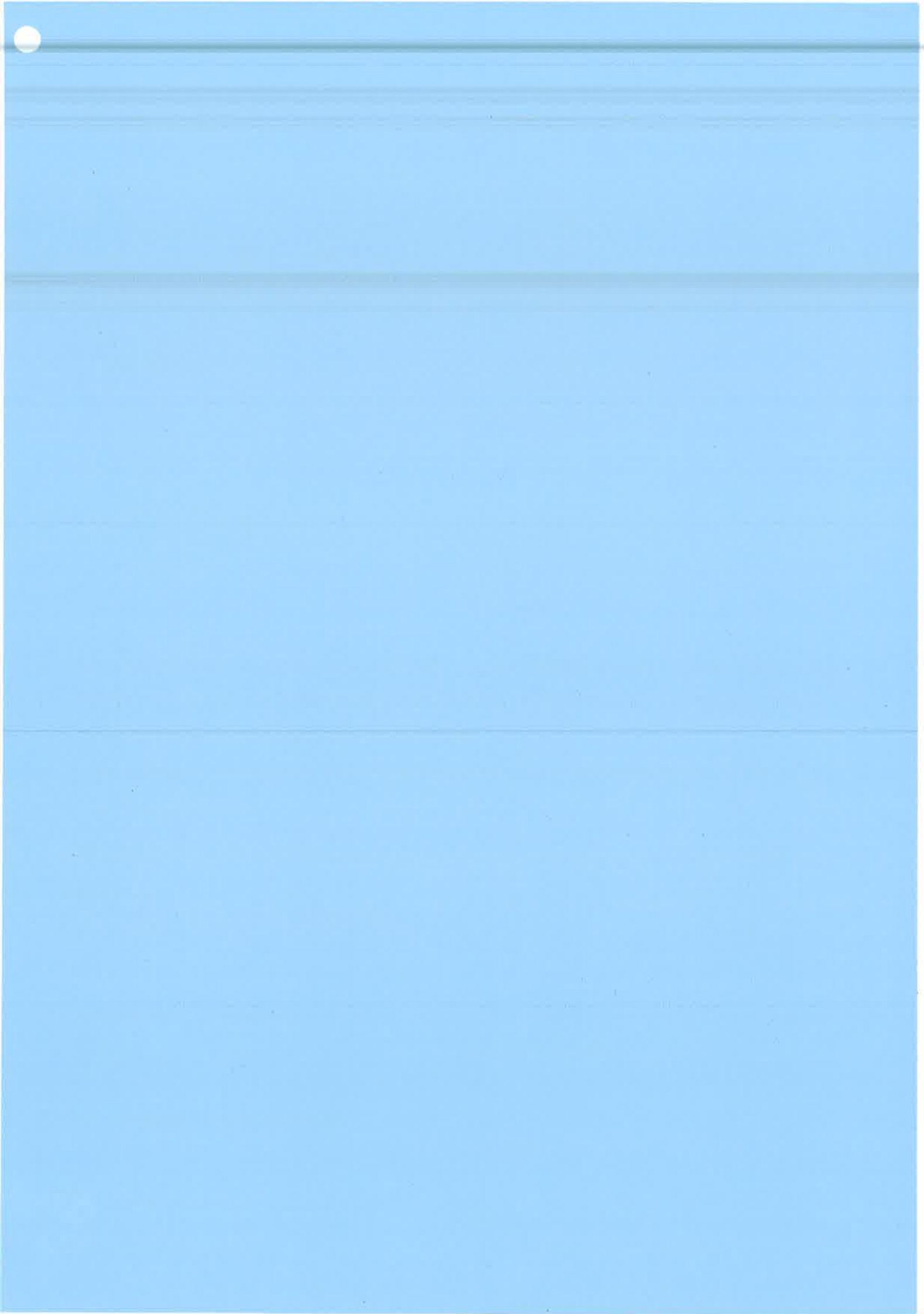
Examiner Only

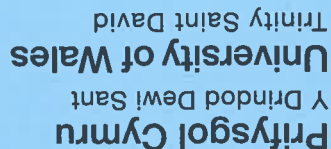
Question No.

Examiner On

Arholwr yn unig

llyf Cwestiwn





12 Tüdalen

1. Rhwch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhwch eich enw yn y lle a ddarparwyd ar y dde, plynwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.

CYFENN:

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

3. Rhaid i'r atebion fod mewn llawysgriften ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarllenadwy, neu drefnu iddi gael ei theipio 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 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 gwyllwyr/gwylwyr.
8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad

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)