



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).
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SURNAME: Thomas

FORENAME(S): Joseph Teuan

1	Student Number	P151048
2	Title of Examination Paper	Stress analysis and CAE
3	Module Code	MSX02064
4	Date and Time of Examination	12:00pm 09/05/2019
5	Examination Venue	1Q 310
6	Seat Number	G012
7	Number of Answer Books handed in	

List the numbers of the questions you have attempted	Office Use
1	20
3	7
4	0
Total	27

(Gweler yr ochr arall am y fersiwn Cymraeg)

45%



Q1

A) $Pf = P \times A = P \times dL$

$$\downarrow F = 2\sigma_H \times Lt$$

$$P \times dL = 2\sigma_H \times Lt$$

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

B) $\sigma_H = 200 \text{ MPa}$

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

$$t = 0.5 \times 10^3 \text{ m}$$

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

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

$$P = 57.14 \text{ kPa}$$

From table 1 @ sea level $P = 101 \text{ kPa}$

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

From table 1, max altitude @ 43.86 kPa
 $= 20,000 \text{ Ft}$

From table 1 @ 8000 Ft $P = 75.3 \text{ kPa}$

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

From table 1, max altitude = 40,000 Ft

- C) In terms of plane structure, pressurizing the planes cabin allows the plane to fly higher, thus meaning the plane can travel quicker due to thinner air density and use less fuel. ✓ (2)

D)

$$\rightarrow F = P \times A = P \times \frac{\pi d^2}{4}$$

$$\leftarrow F = \sigma_H \times \pi d t$$

$$\therefore P \times \frac{\pi d^2}{4} = \sigma_H \times \frac{\pi d t}{1}$$

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

- E) Based on the equations previously derived, it is evident to see that the advantages of containing oil in a spherical container would allow higher pressure at a lower quantity. Therefore containing oil in a cylindrical container would allow a higher quantity of oil at a lower pressure. ✓ (3)

Q3

A) A design problem is one in which that can be amended early in the design process. An analytical problem is one in which occurs later on in the process and is solved sequentially.

①

B) A design problem is normally solved in an iterative manner, meaning it is handled in a trial and error manner, or multiple solutions are gathered and analysed to solve the problem. An analysis problem is solved sequentially meaning the process must be taken back a step to then diagnose and solve the occurred problem.

③

C) Next page.

- C) The design process :-
- Define the problem
 - Gather information
 - Generate multiple solutions
 - Analyse and select solution
 - Test and implement solution.

1/ Once the problem has been defined, information must be gathered to gain an inventory of knowledge concerning the problem, this may include researching other solutions to problem and finding out how others are ~~going~~ ~~round~~ the tackling the problem. This may be a problem as other companies may have patented their solution already.

2/ After ~~research~~ ^{information} has been gathered, multiple solutions must be obtained. Advantages of this ~~will~~ ^{will} be that other areas of different disciplines may be involved to find the best solution, a disadvantage of this ~~would~~ ^{would} be that too ~~many~~ many solutions can take time to ~~and~~ analyse and waste time.

3/ ~~After analysing solutions the solutions and dedicating one to the problem it~~

3/ After generating multiple solutions, it is essential to analyse and select one of the solutions, problems may occur when selecting a solution as it may be deemed un-economical, unsafe, ~~un~~ un-aesthetically pleasing etc, however the solution found can be amended to suit the needs and requirements for all.

4) Once a solution has been agreed on, it is essential to test and implement the solution, problems may occur when testing as ~~docum~~ documentation such as patenting ~~may~~ will be necessary and testing will not be permitted if the ~~pro~~ solution is un-safe. An advantage of testing is that will be the data that comes from it means it is possible to re-analyse and improve on the solution implemented.

(3)

Q4) Next Page.

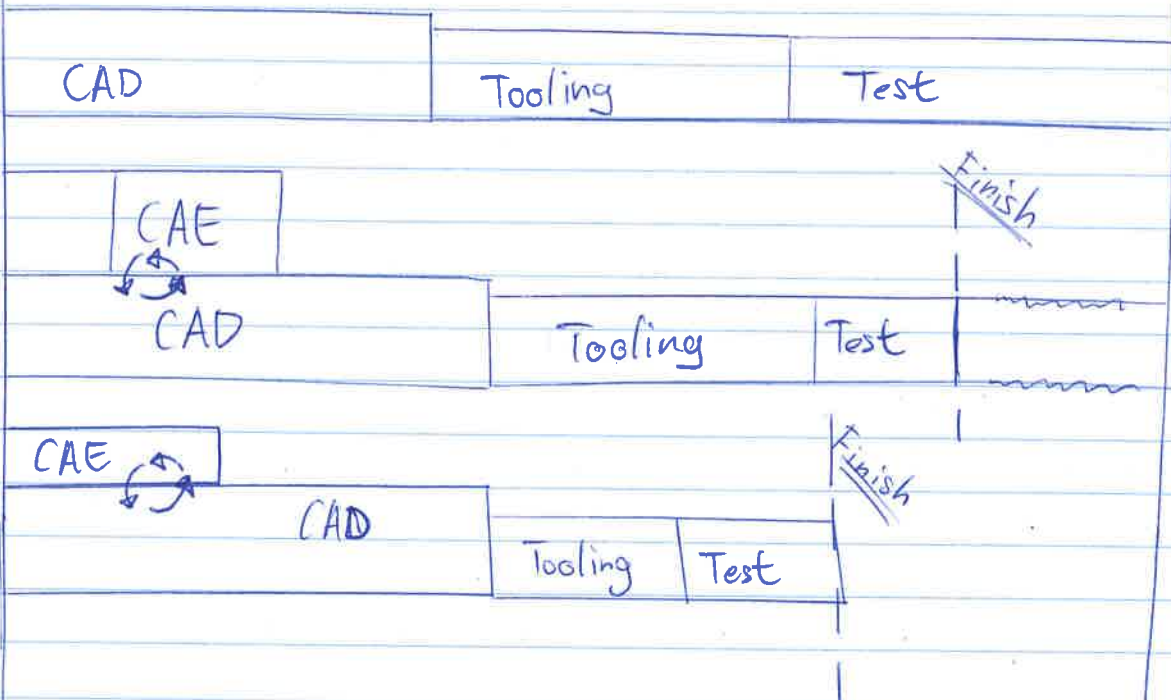
Q3

4 A)

With and Without CAE

Start

Finish



A) Using the diagram shown above it is possible to see that using CAE speeds up the ~~design~~ design process dramatically, moving CAE closer to the start decreases the time ~~again~~ again. The limitations lay ~~in the~~ when CAE is not used ~~at~~ during the design process, ~~so~~ thus meaning once test has finishing it is necessary to go back to the CAD stage and restart the procedure.

B) A major limitation of gradient based optimisation that can be overcome ~~by~~ ^{is} in the conceptual stage of the process, Using FEA can completely disregard Computer aided design in the early stages of the process, thus meaning that businesses that prefer the method of 'Quote on the day' tactics are able to give more accurate assumptions to work that is needed.

c) One type of optimisation concerning FEA (Finite element Analysis) is in the finishing stages of a design process. FEA can be used to analyse data of ~~the~~ final design produced through the design process.

Another optimisation is that in the early stages such as the point discussed in part (B), the business handing out quotes would be able to spare the expense of ~~comp~~ CAD, ^{thus} saving them money.

Finally, the use of FEA through the procedure ~~on~~ would mean that in an ideal ~~world~~ world it would be possible to skip the testing phase of the process ~~and~~ and move straight to product tooling, unfortunately the testing is necessary as it 'signs off' the solution as safe.

X

Question No.

Examiner Only

Arholwr yn unig

hif y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

Unig y Cwestiwn

Question No.

Examiner Only

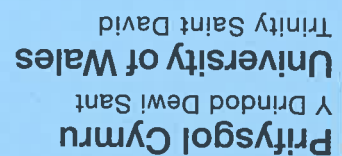
Question No.

Examiner Only

Arholwr yn unig

Arholwr yn unig





12 Tüdalen

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 amgylchiadau.

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 Myfyrwr	

[illegible]

(See the other side for English version)

Lienwch, plygwch a seilwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: