



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.**

FORENAME(S): Nia

1	Student Number	P151615
2	Title of Examination Paper	Advanced Stress
3	Module Code	MGX00420
4	Date and Time of Examination	
5	Examination Venue	
6	Seat Number	
7	Number of Answer Books handed in	

[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

47.5%

the 1990s, the number of people in the UK who are aged 65 and over has increased by 1.5 million, and the number of people aged 75 and over has increased by 1 million (Office of National Statistics 1999).

There is a growing awareness of the need to develop strategies to meet the needs of the ageing population. The Department of Health (1999) has published a strategy for ageing, which sets out the government's commitment to improve the lives of older people. The strategy is based on three main principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

The strategy is based on the following assumptions: (1) that older people are a diverse group with different needs and interests; (2) that older people should be able to live independently and actively; (3) that older people should have access to the services and support they need; and (4) that older people should be treated with respect and dignity. The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity. The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity. The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity. The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity. The strategy is based on the following principles: (1) to ensure that older people have the opportunity to live independently and actively; (2) to ensure that older people have access to the services and support they need; and (3) to ensure that older people are treated with respect and dignity.

Question 3

- (a.) Meshing is an important preprocessing step. If poor information is entered into the FEA study, then poor results will be produced "Garbage in = garbage out". The higher quality the mesh, the more accurate the results, but also the run time will increase too.

Mesh checks include:

- Mesh Size - size of mesh is critical to quality of results. The smaller the mesh, the greater the accuracy.

- Mesh Quality - draft mesh can be used for conceptual work. Better to use higher quality mesh such as H-adaptive for improved accuracy of analysis.

- Mesh Free Edges - Geometry element errors resulting in exposed free edges.

- Mesh Normal

1D elements: determine ^{second moments of area.} ~~size~~ quality.

determine thickness of 2D elements

- Mesh Elements 1D, 2D, 3D. — 3D elements determined by FEA

- Mesh Duplicates - overlapping mesh elements resulting in double stiffness on surface, will produce inaccurate readings.

ERROR CHECKS:

- Geometry linear analysis
- Normal linear analysis
- Non-linear analysis

- (b) FEA models are great for eliminating the need to create lots of ~~more~~ prototypes, as testing can be completely virtually instead. The reduced requirement for prototypes means money is saved and time wasted waiting for prototypes is removed too. Ideally FEA models would remove the need for prototypes at all, and instead virtually tested prototypes could move straight to production however, it is good to test prototypes too to gain confidence in FEA results and to 'sign off' designs. FEA analysis tools ~~such~~ such as dynamic, thermal, or optimisation can help improve the design. FEA tools such as mold analysis can aid the design of a part for manufacturing.

X

Question 4

- (a) When conducting FEA, the process can be split into the following;

PREPROCESSING - Preparing the model and inputting data required to complete the analysis. Follow steps 'SIMPL'; Split, Interpret, material, physical properties, loads.

PROCESSING - Processing is where the computer is actually calculating all inputted data to produce results.

POST PROCESSING - Post-processing is step 'E' from 'SIMPLE', where the results will be Evaluated. Review of data required to see if any inputs require changes, which will affect E.

6

- (b.) It is often less time consuming to build a large model by using an automatic mesher, which is true. An automatic mesher is appropriate for first conceptual models, however, the accuracy of results could be negatively affected.

An increased computer ~~size~~ capacity can reduce the run time for FEA studies which has ~~therefore caused a reduced use~~ in the special techniques used to minimize number of elements. Simply because the ^{increased} computer capacity means users experience a shorter run time, despite complex number of elements.

An increased computer capacity has lessened the need to use special techniques to minimize number of elements as the runtime will have improved. The use of an automatic mesher can also be less time consuming as inputted mesh data does not need to be determined by the user, however analysis results could be affected as automatic mesher might not be appropriate or accurate enough for work greater than conceptual.

The technique SIMPLE should be used to minimise number of elements;

S - Split - Split geometry into finite elements.
Determine element size, mesh quality etc.

I - Interpret - Idealise the design by removing complex geometry that will not affect the analysis results.

M - Material. - Choose material. Also determine linear or non linear analysis.

P - Physical Properties. 1D - determine second moment of area.
2D - thickness of elements
3D - this information is already defined by geometry of elements.

L - LOAD - Determine if any loads are applied, in what direction and if there are any constraints

E - EVALUATE Evaluate results. Review inputted data to see if any changes are required. Garbage in = garbage out.

Using the techniques discussed above with 'SIMPLE', run time can be significantly reduced without hugely affecting the accuracy or analysis results.

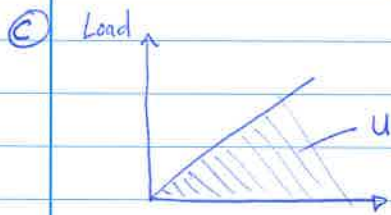
2

Question 1

(a) Strain = stress within an area divided by force.

X
0

(b) ~~show that $\epsilon = \frac{Pds}{AE}$ for stiffer.~~



where $L = ds$.

$$U = \frac{1}{2} \times \frac{P \times Pds}{AE}$$

$$U = \frac{P^2 ds}{2AE}$$

for Stiffer; $U = \int_0^L \frac{P^2 ds}{2AE} = \frac{P^2 L}{2AE}$

/ 2

(d) ~~Resilience is the square of stress over twice value of Young's Modulus.~~
Resilience is Strain divided by the multiple of area times length.

/ 1

(e) ~~Resilience is~~ $\frac{\sigma^2}{2E}$ by; $U = \frac{P^2 L}{2AE}$
 $U = \frac{\sigma^2 A^2 L}{2AE}$
 $U = \frac{\sigma^2 AL}{2E}$
 $\frac{U}{AL} = \frac{\sigma^2}{2E}$

/

2

⑧ $F = \sigma \times A$

where Total $A = 15 \times 10^{-3} \times 15 \times 10^{-3} \times 1$
 $= 2.25 \times 10^{-4} \text{ m}^2$

$F = 200 \times 10^6 \times 2.25 \times 10^{-4}$
 $= 45000 \text{ N}$

$\therefore U = \frac{P^2 L}{2AE}$ $\leftarrow$ Assuming circle rod.
 No formula provided for square rod.

$U = \frac{45000^2 \times 1}{2 \times 200 \times 10^6 \times 2.25 \times 10^{-4}}$

~~$U = 2.53 \times 10^{-4} \text{ J}$~~
 $U = 22.5 \text{ Pa. J}$

✓ 3½

- ⑨. Great care must be taken when designing machine parts to ensure catastrophic failure ~~isnt~~ doesn't occur if suddenly a large load is applied. A part should be designed to be strong enough to meet its functional requirements, but also not too strong that if equipment failure, the equipment gets damaged, instead of the consumable part.

✗ 0

⑩ $E = \frac{\sigma}{\epsilon} \rightarrow \delta = \frac{PLs}{AE}$

✗

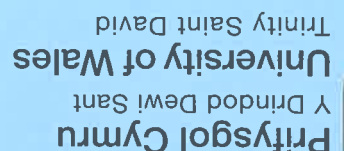
0

Question No.

Examiner On

Arholwr yn unig

hif y Cwestiwn



12 Jüdalen

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

3. Rhaid i'r atebion fod mewn llawysgrifn ddarllenadwy. Gall yr Arholwyr nall ai anwybyddu syript annarllenadwy, 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 rhwgo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.

7. Os deinyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddeinyddio'r tagiau sydd ar gael oddi wrth y gwyliwlr/gwyliwlr.

8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atedion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

1	Rhif Myfyriwr	
2	Teitl y Papur Arholiad	
3	Cod y Modwl	
4	Dyddiad ac Amser yr Archoliad	
5	Lleoliad yr Arholiad	
6	Rhif Sedd	
7	Nifer y Llyfrau Atebion a gyflwynwyd	

[illegible]

(See the other side for English version)

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF: