



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	1705015
2	Title of Examination Paper	ADVANCED STRESS & FEA
3	Module Code	MX00420
4	Date and Time of Examination	31/1/2020 @ 13:30
5	Examination Venue	IQ002
6	Seat Number	FRONT FAR RIGHT
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
2	4
3	10
4	13
Total	27

(Gweler yr ochr arall am y fersiwn Cymraeg)

45%

Complete, fold and seal
(see note 2 below)

SURNAME: KILBANE

FORENAME(S): SHAWN

the 1990s, the number of people in the world who are undernourished has increased from 600 million to 800 million (FAO 1996). The number of people who are malnourished has increased from 1.1 billion to 1.5 billion (FAO 1996).

There are a number of reasons why the number of people who are undernourished has increased. One of the main reasons is that the world population has increased. The world population is now over 6 billion and is expected to reach 9 billion by the year 2050 (FAO 1996).

Another reason why the number of people who are undernourished has increased is that the world's food supply is not keeping pace with the world's population. The world's food supply is not keeping pace with the world's population because the world's food supply is not growing fast enough to keep up with the world's population.

There are a number of reasons why the world's food supply is not growing fast enough to keep up with the world's population. One of the main reasons is that the world's food supply is not growing fast enough to keep up with the world's population.

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Question 3

- a. It is important to check for an uniform mesh ^{element} size, an uniform mesh size will impact the results.

Duplicate nodes are something that should be ~~avoided~~ ^{avoided}, this is when instead of being a single node ~~where~~ where 2 lines meet, there are 2 nodes, this will provide a duplication possibly of the result.

The mesh ^{element} size itself is important, ~~the~~ the finer the mesh, generally the more accurate the results.

Mesh element shape is important, this ~~may be~~ ^{may be} the internal angles within an element. As irregularity of shape will impact the calculated stresses. The number of sides to an element is important, going from a quad to a triangle in the same meshed part is not preferred.

These errors may be caused by the computer program used to create the mesh, the shape and size of the mesh may vary significantly in some areas, the engineer may need to modify the mesh manually to improve shape and size in particular areas.

Question 3

a.

- b. FEA is an approximation, it indicates what may occur to the physical body, it is a tool that is used to estimate. It is important then to run a physical test on a body to confirm the FEA results. Tests include tensile testing, Static and dynamic testing may be done, crash testing for vehicle impact to analyze deformation of structure for passenger safety. Vibration & frequency testing are others.

FEA is not a verification tool, but it does provide an indication of what may occur in reality.

1

Question 4

a. 'Pre-processing' describes the tasks done to set up the model & mesh prior to running the analysis. The term 'SIMPLE' is used; Split, Interpret, material, Physical properties and loading, these are all done at the 'pre-processing' stage. N.B. - The 'E' in SIMPLE does not come under 'pre-processing'.

'Processing' is a term used for the calculation phase of the analysis. This is when Stiffness matrices are used to determine the stresses within a model.

'Post-processing' - The 'E' in 'SIMPLE' is done here, it simply means Evaluate. The results are now available and they should be checked and understood. This includes determining what the results mean and are there any errors or something that should be investigated further.

6

Question 4

- b. The statement claims that the time to mesh a model using an automatic mesher is quicker, this statement in itself is true. However, the automatic meshing process will often simplify the mesh as much as possible without paying attention to problematic regions, the results returned may ~~be~~ therefore be somewhat inaccurate.

The second part of the sentence claims that ~~the~~ due to the improvement in computer power, we need not worry so much about ~~the~~ minimizing the element size. It is indeed true that the ~~the~~ improvements in computer technology means the machine can handle more data and run calculations much faster than the older machines. However, this does not mean that we should simply disregard the ~~element~~ element size, on the contrary, we should optimise the mesh to the necessary size and type to balance the run time. The finer or more complex the mesh, the more calculations required therefore the greater the run time.

In conclusion, yes the statement is true, but, we should use the advancement in computers to benefit us by improving our results and balance that with time. To interpret the ~~rested~~ statement as simply an excuse to let the

Computer program itself automate the process is irresponsible and a Shame.

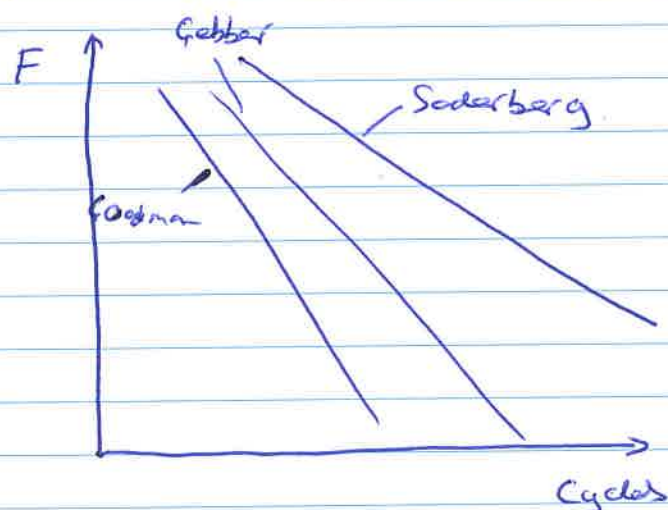
Garbage in = Garbage out!

The meth should still be analyzed and optimised where necessary.

7

Question 2

Q.



X

Goodman uses a very conservative value for calculating life/cycles of a product.

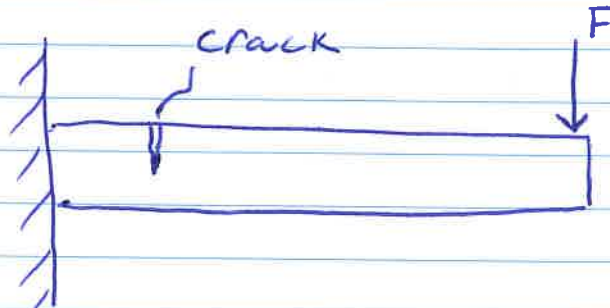
Soderberg is ~~not~~ relatively lenient, suggesting that more cycles may be done.

Gibber is in between the two others, but an engineer must look at other factors and consider what applies for each application. I.e. if it was a safety critical part, then one would be inclined to use the most conservative method.

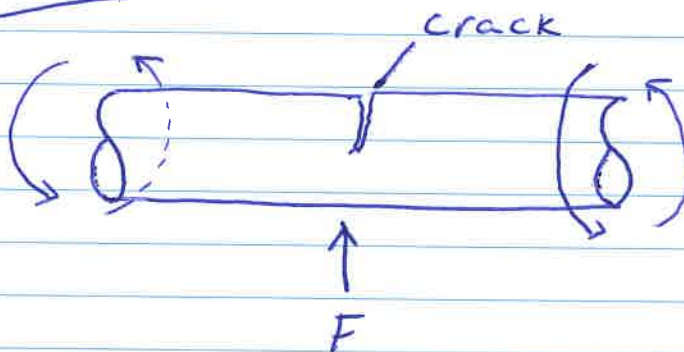
X

Question 2

- a. A crack ^{may start} ~~start~~ as a surface scratch or for example, amongst other causes, but there are several ways it may propagate to become a fatigue failure.

e.g. 1

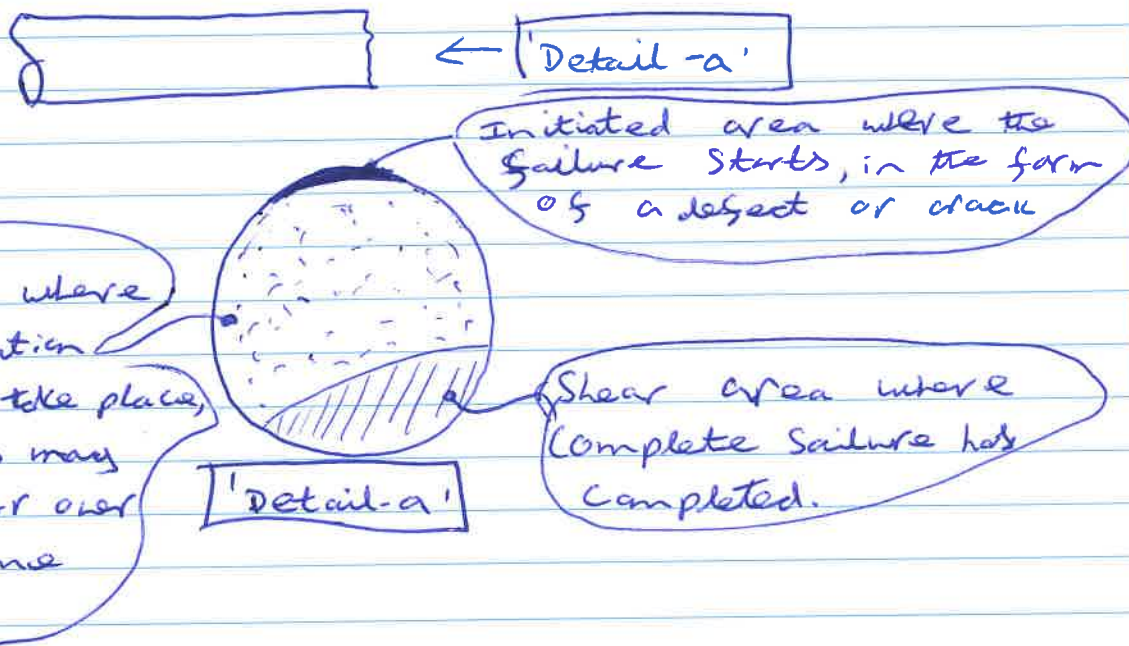
In the situation above, if the force (F) was not constant, i.e. it was applied then removed, multiple times, this would cause a fatigue failure as the crack would grow.

e.g. 2

In this example, a rod/bar fixed at both ends is rotating, a constant force this time is applied at a point along the shaft. The force is constant, however as the shaft rotates, one side of the shaft is in compression, one is in tension whilst the mid axis is neutral. This switching from tension to compression opens and closes

the crack thereby making it larger and may ultimately fail. This is also known as fatigue.

b.



c.

Question No.

Examiner Or

Arholwr yn unig

hff y Cwestiwn

Question No.

Examiner Only

Question No.

Examiner On

Arholwr yn unig

hif y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

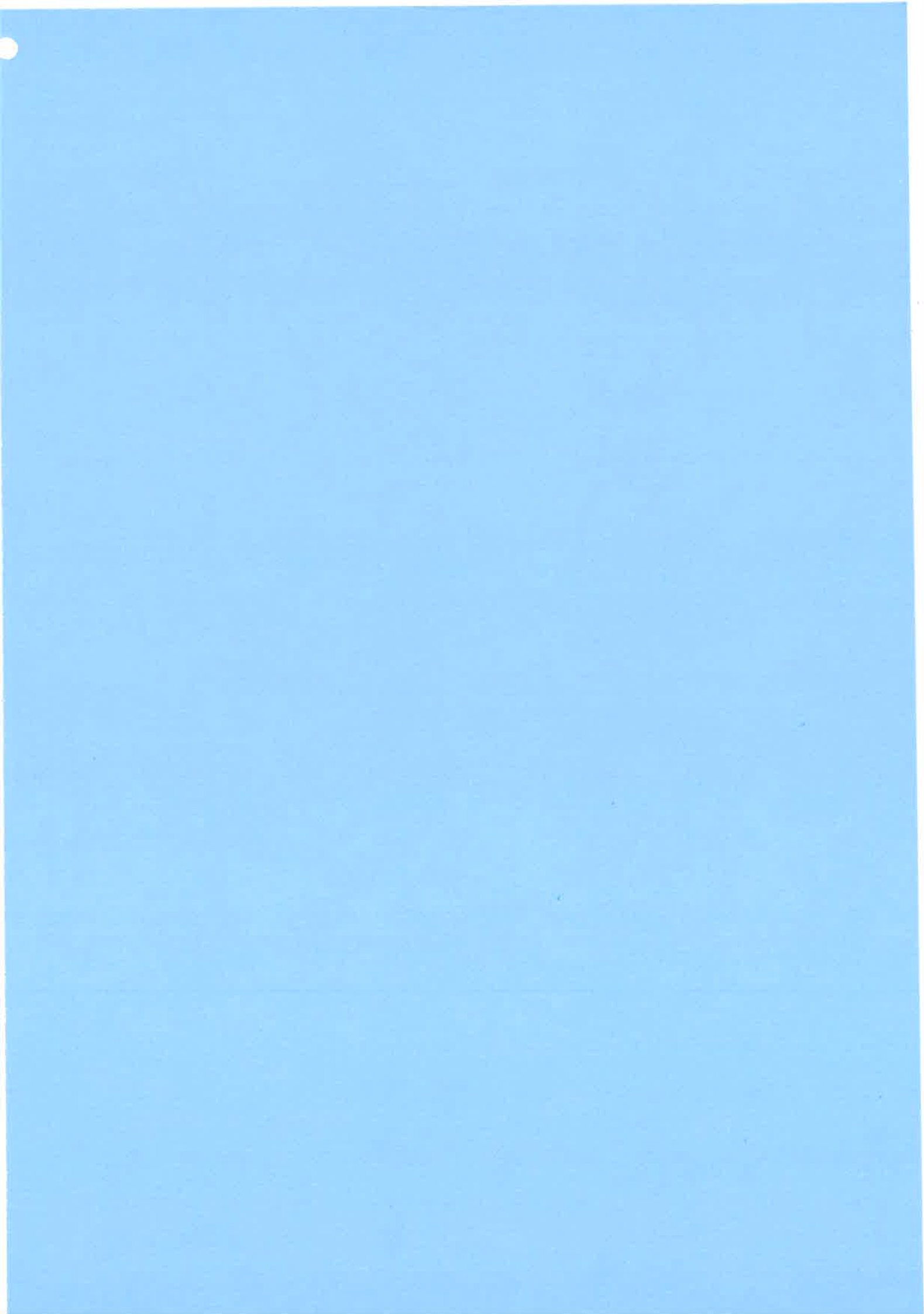
Rhif y Cwestiwn

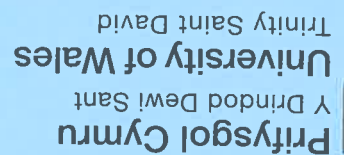
Question No.

Examiner On

Arholwr yn unig

rhif y Cwestiwn





Cyfarwyddiadau i Ymgeiswyr

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

3. Rhaid i'r atebion fod mewn llawysgrifen ddarllenadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt 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 thynnwch llinell drwyddynt.

6. Ni ddylid rhwgo 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 gwyllywr/gwylwyr.

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 Myfyriwr	

[illegible]

(See the other side for English version)

Лленвч, плгвч а селвч
(гвелер нодн 2 исод)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: