



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: Parry

FORENAME(S): MATTHEW

List the numbers of the questions you have attempted	Office Use
2	10
3	9
4	6
Total	25

41.7

the 1990s, the number of people in the world who are undernourished has increased from 250 million to 800 million (FAO 1996).

There is a growing awareness of the need to improve the nutritional status of the world's population. The United Nations World Food Programme (WFP) has been instrumental in this regard, and has been successful in increasing the number of people who are receiving food aid from 100 million in 1980 to 1.2 billion in 1995 (WFP 1996).

One of the main reasons for the increase in the number of people who are undernourished is the increase in the number of people who are living in poverty. The number of people who are living on less than \$1 a day has increased from 1 billion in 1980 to 2 billion in 1995 (WFP 1996).

There are a number of factors that contribute to the increase in the number of people who are living in poverty. One of the main factors is the increase in the number of people who are living in rural areas. The number of people who are living in rural areas has increased from 1 billion in 1980 to 2 billion in 1995 (WFP 1996).

Another factor is the increase in the number of people who are living in urban areas. The number of people who are living in urban areas has increased from 1 billion in 1980 to 2 billion in 1995 (WFP 1996).

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Q2.

a) Cracks may be initiated in weak areas of materials and components such as keyways, threads, holes. Increased cyclic loading of a material can also lead to failure.

3

b) Cup and Cone effect of failed component.

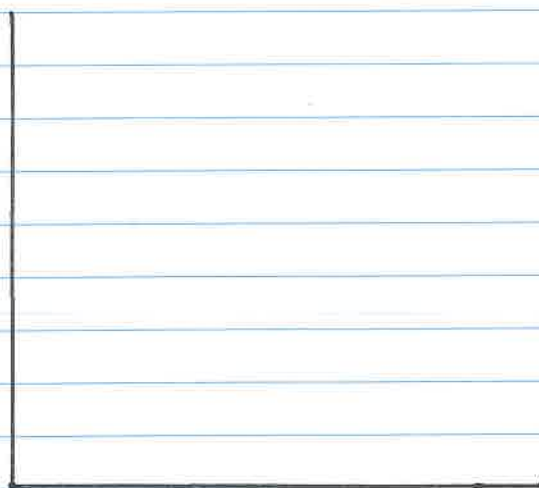
Initiation of crack.

Propagation

Rupture of material.

3

c)

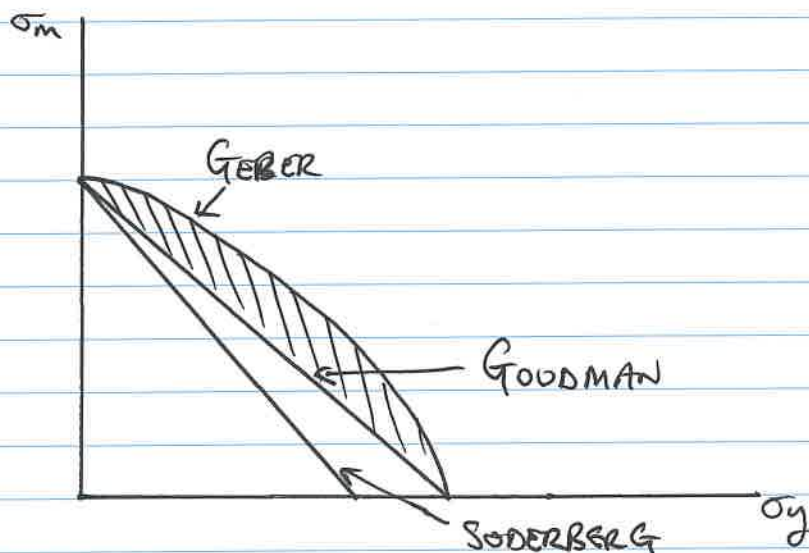


X

$$d) \sigma_r^a N_f = k_1$$



e)



The shaded region is where materials have failed. Owing to this Soderberg theory is most widely used as it is a more conservative assumption.

4

3 a) When selecting a mesh for your part it is important to consider the geometry of the part being analysed. By using the acronym SIMPLE you can check that your mesh is correct.

Split - Split the part and apply the mesh

Interpret - What areas are required for analysis

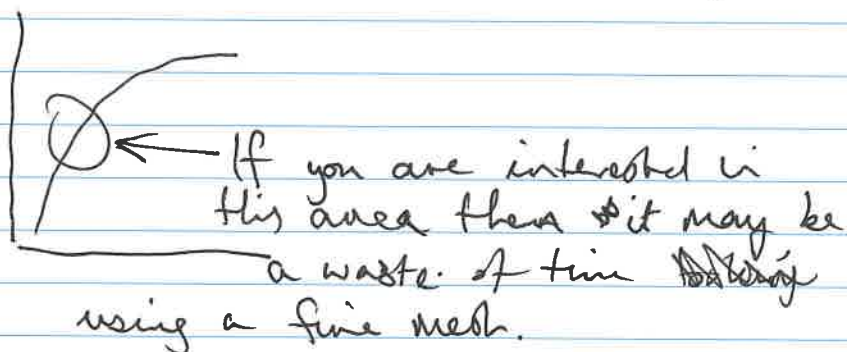
Material - Input the material properties

Physical Properties - Where the load is applied.

Loading - Apply loading, forces etc.

Evaluate - Consider the results to see if they are as expected.

Also when running analysis on a part it is important what stage of the design a project is at. For example if a part is in the early stages then it can be time consuming to apply a fine mesh on to a complex geometry that may only be under a small constraint and load. There is a fine balance between selecting the appropriate size mesh that will not take long to get results vs how accurate you require the results. For example if you are only interested in the materials ^{40%} yield strength then there is no need in using a fine mesh to run the analysis.



In the first run of FEA it is important to know what ~~the~~ order mesh to use i.e. 1D, 2D or 3D. The more detailed mesh i.e. with more nodes would generate results that would be over refined for the

of application. Other tools such as H and P adaptive may be used which apply a mesh that suit complex areas of the part geometry.

Some potential errors could arise if there are overlapped areas ~~the~~ where the mesh has been duplicated and analysed the geometry twice.

9

b) Once a component have been analysed and the high stress areas are discovered then these can be run through a simulation to see

b) FEA models can be ~~prepared~~ used as prototypes ie for example 3D printing an FEA model can give the designer an insight on how it may perform.

Topology studies can be used to optimise the material volume to see if the reduction in material may still allow the component to withstand.

XO

4 a) Pre processing - ensure the correct mesh size and mesh order has been selected to suit the geometry being analysed. Ensure the correct software is being used i.e. a linear or non-linear solver. Ensure that the geometry has the correct constraints and loadings with the correct material.

Processing - ensure there is a good balance between the quality of the mesh vs run time of the analysis.

Post processing - Ensure the results generated are consistent with what is being asked of the software. A FEA study will only generate results that are being asked of it. If the wrong information has been used then the results will not help to solve the problem. Garbage in = Garbage out so when analysis results ensure they are of what was asked ~~of~~ from the study.

- b) Using an automatic mesher has its positives as the tool looks for changes in the part's geometry to apply different mesh sizes and nodes to assist in solving the ~~ans~~ problem. By doing so where there is a need for more elements to be added over complex geometry they can be reduced over areas of the part that are not important to the analysis. There must always be a trade off between run time and the results being achieved from the analysis.

2

Question No.

Examiner Or

Arholwr yn unig

liff y Cwestiwn

Question No.

Examiner On

Arholwr yn unig

ntif y Cwestiwn

Question No.

Examiner Only

Arholwr yn unig

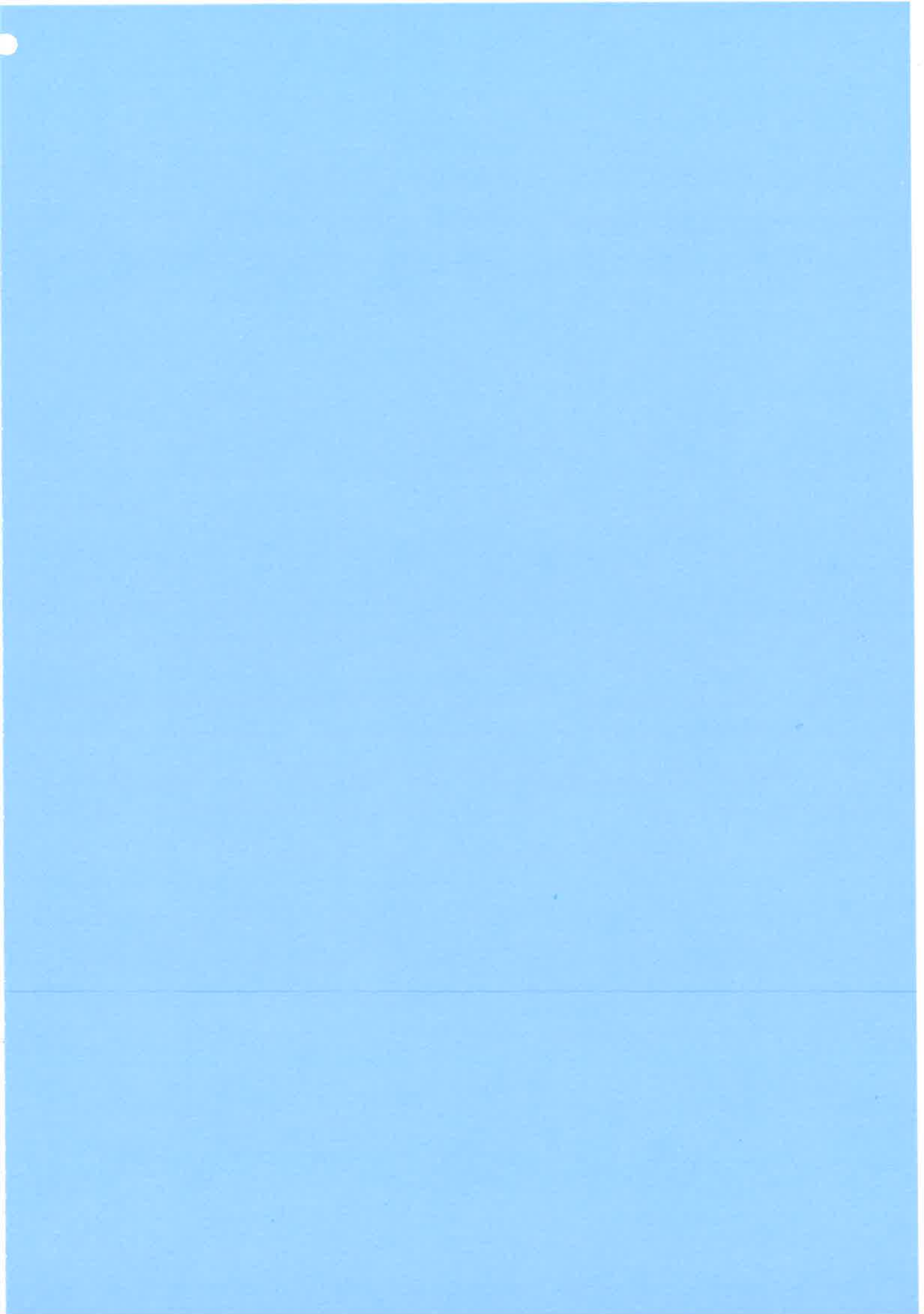
Rhif y Cwestiwn

Question No.

Examiner Onl

Arholwr yn unig

hif y Cwestiwn



Cyfarwyddiadau i Ymgeiswyr

12 Tudalen

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.

- arholi o dan unrhwy amgylchiadau.

[illegible]

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: