Kafr elsheikh University | Department: Production Engineering & Mechanical Design | Faculty of Engineering

Total marks: 70 Marks

Course Title: Stress Analysis
Course Code: MPD2106
Year: 2nd Year production Engineer (Final Exam)

Date: 20 -1- 2020
Allowed time: 3 hrs.
No. of pages: 3

Answer all the following questions: (Assume any missing data)

Q1. **(20 marks)**

a- Three identical bars of length L are hung in a vertical position as shown in Fig.1. A rigid, weightless beam is attached to their lower ends and this in turn carries a load P. Calculate the load in each bar.

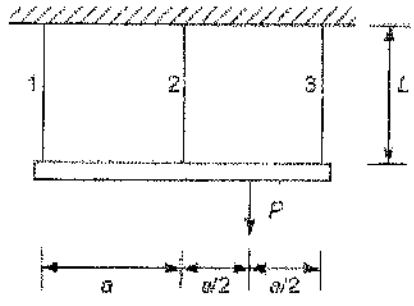

Fig.1

b- Draw normal force, shear force and bending moment diagrams for the cranked cantilever beam shown in Figure 2. Insert all the principal values.

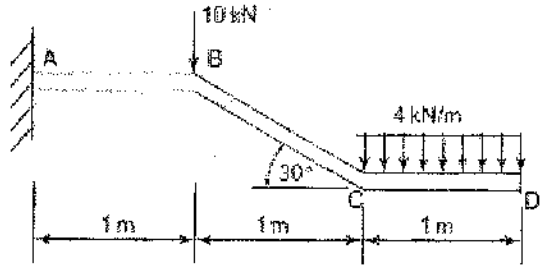

Fig (2)

Q2. **(20 marks)**

a) A **60 mm** diameter steel rod supports a **20 kN** tensile load and is subjected to a twisting moment of T = **1.5 kJ** as shown in figure 3. Determine the maximum tensile and the maximum shear stresses in the rod by the following.

1. Analytical method
2. Graphical method

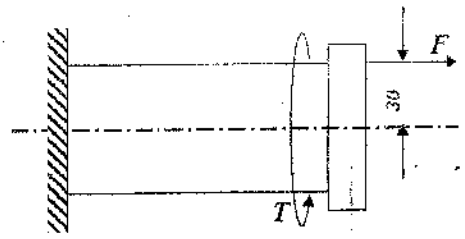

Fig (3)

b) The block of material shown in Figure **4** is subjected to the stress system shown. If Young's modulus, E, is **200 000 N/mm²** and Poisson's ratio, **ν** is **0.3** calculate the percentage change in volume in the block.

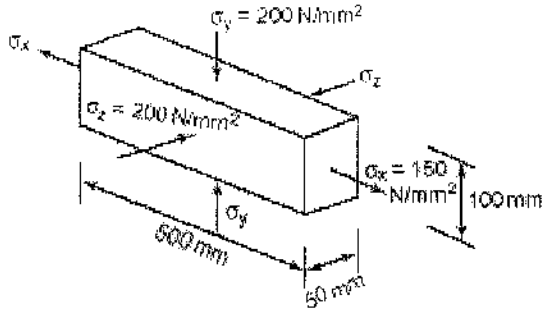

Fig (4)

Q3. **(20 marks)**

1- For the beam shown in Fig. **5** .Find the factor of safety using:

1) Maximum shear stress theory.
2) Maximum distortion energy theory.
3) Draw the bending moment diagram.

Take the tensile yield strength of the material as **300** MPa.

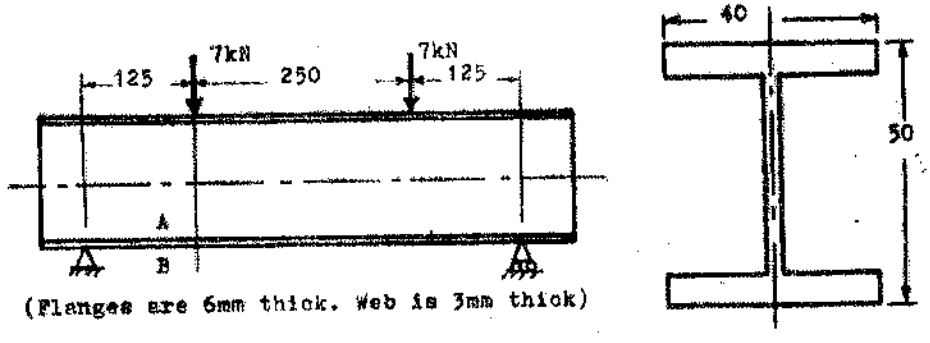

Fig (5)

2- A thin-walled spherical shell is fabricated from steel plates and has to withstand an internal pressure of **0.75 N/mm²**. The internal diameter is **3 m** and the joint **efficiency**