



PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY (PNGUOT)
MECHANICAL ENGINEERING

ME222: Solid Mechanics
Second Semester Examination, 2022
Second Year Mechanical Engineering
Thursday, November 3rd, 2022- 8:20 A.M
Room No: M118/M1

Time Allowed: 2 Hrs

Instructions:

- 1. You have 10 minutes to read the paper. Do not write anything during this time.*
- 2. Write your **name** clearly on the front-page using **Capital letters**.*
- 3. There are **total five (5) questions**. Answer **any four (4) questions**.*
- 4. All questions carry equal marks.*
- 5. All questions must be answered only in the booklet provided.*
- 6. Calculators are permitted in the examination room.*
- 7. Any student found cheating will be disqualified.*



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Question 1: (25 Marks)

PART-A (5 Marks)

A. Define Thermal stresses? When these types of stress are developed?

PART-B (20 Marks)

B. A steel rod 10 mm in diameter and 2 m long is heated through 25°C. Find the new length of the rod if the temperature is raised to 70°C. Find the magnitude and the nature of the force required to prevent this expansion. Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $\alpha = 12 \times 10^{-6}/^\circ\text{C}$.

Question 2: (25 Marks)

PART-A (5 Marks)

A. Draw different types of beams?

PART-B (20 Marks)

B. A simply supported beam 5 m long is carrying a clockwise couple '10 kNm' at 'C' distance of 2 m and 3 m from A and B respectively. Draw SFD and BMD for the beam and determine the maximum absolute value.
(a) Of the shear and
(b) Of the bending moment

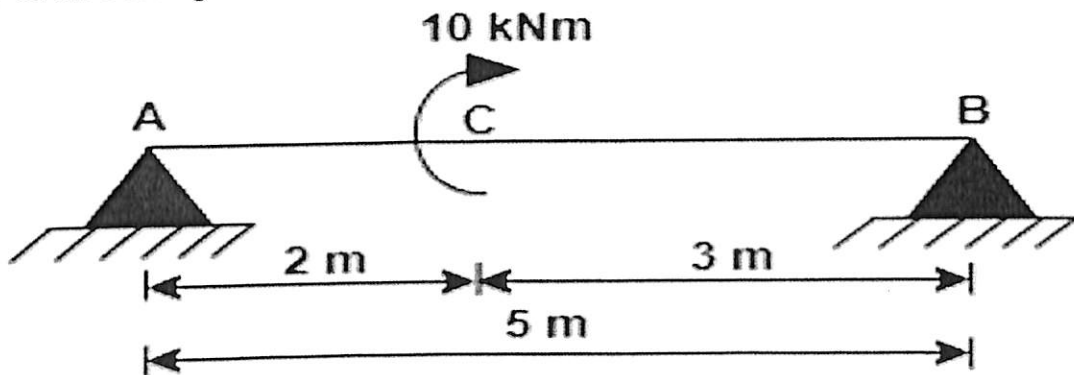


Fig. 1

Question 3: (25 Marks)

A. For the beam and loading shown in Fig. 2, If for the section, $I_{xx} = 5 \times 10^{-6} \text{ m}^4$ and $E = 200 \text{ GPa}$ Determine:
(a) The equation of the elastic curve for portion AB of the beam.
(b) The deflection under the load and
(c) The position and amount of maximum deflection.



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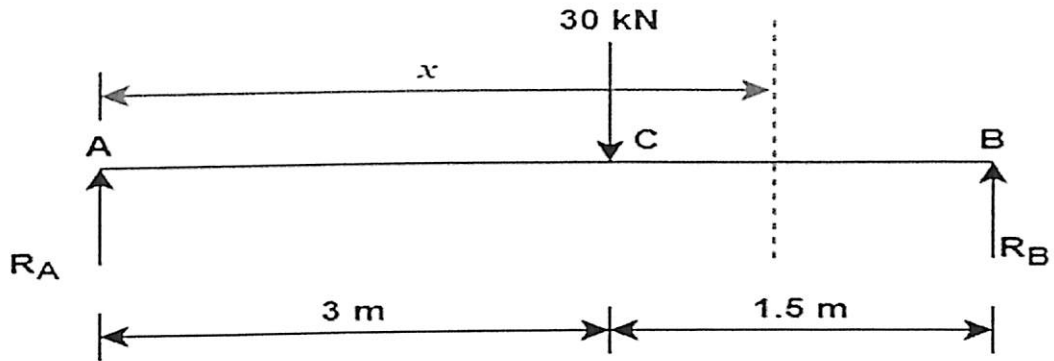


Fig. 2

Question 4: (25 Marks)

PART-A (5 Marks)

A. What are principal stresses? Write the formulae for each stress.

PART-B (20 Marks)

B. A bar with the plane stress state is as shown in Fig. 3 below. Determine the normal and shearing stresses on a phase inclined at 30° to the CCW direction of loading and show them on a sketch of a properly oriented element. Solve by Mohr's circle method. Also find maximum shearing stress, the principal stresses and the principal plane.

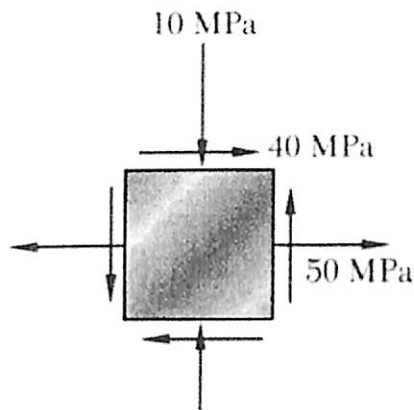


Fig. 3



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Question 5: (25 Marks)

PART-A (5 Marks)

A. What types of stresses are developed in columns?

PART-B (20 Marks)

B. An 8" diameter timber pole fixed in a large concrete footing at grade and pinned at the top. $E = 1.0 \times 10^6$ psi Find: Maximum height of the pole to support a 25-kip load.

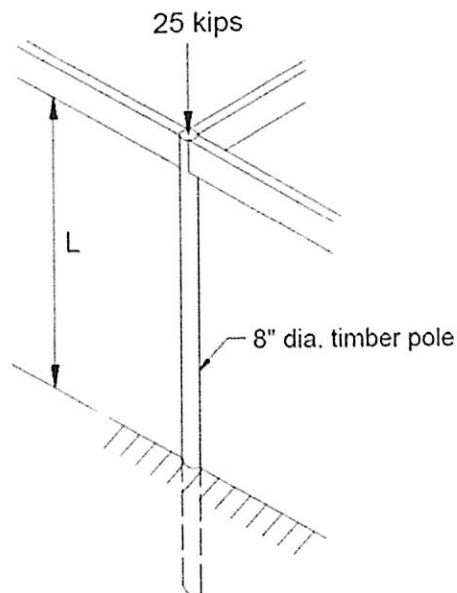


Fig. 4

Good luck!!!