

VEER SURENDRA SAI UNIVERSITY OF TECHNOLOGY (VSSUT), ODISHA
Odd Mid Semester Examination for Academic Session 2024-25

COURSE NAME: B. Tech

SEMESTER: 3rd

BRANCH NAME: Mechanical Engg

SUBJECT NAME: **Mechanics of Deformable Solids**

FULL MARKS: 30

TIME: 90 Minutes

Answer All Questions.

The figures in the right hand margin indicate Marks. *Symbols carry usual meaning.*

- Q1. Answer all Questions. [2 × 3]
- a) Derive a relation for change in length of a bar hanging freely under its own weight? - CO1
 - b) What do you mean by Principal planes and Principal stresses? - CO2
 - c) Define hoop stress and longitudinal stress with mathematical formula for both. - CO3

- Q2. [8]
- a) A bar of length 1.2 m extends through 3 mm under the action of an axial pull of 2.4 kN. Compute the strain in the material, if diameter of the bar is 20 mm. Find the stress in the bar. (3) - CO1
 - b) An aluminium bar of uniform cross sectional area 300 mm² is subjected to axial forces as shown in Figure No. 1. Determine the force 'P' required for equilibrium of the bar. Also determine the change in length of the bar. Take $E = 70 \text{ GPa}$. (5) - CO1

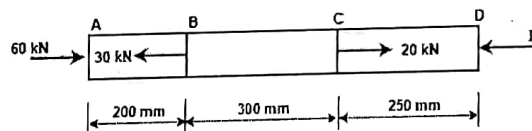


Figure 1

OR

- a) A 3 mm thick aluminum sheet is cut with a 4 cm diameter round punch. If the punch exerts a force of 6 kN, what is the shear stress in the sheet? (3) - CO1
 - b) A steel rod of 30 mm diameter, 280 mm long is subjected to axial forces alternating between compression of 15 kN and a maximum tension of 5 kN. Find the difference between the greatest and least lengths of the rod. Take $E = 210 \text{ GPa}$. (5) - CO1
- Q3. [8]
- A mild steel bar 20 mm internal diameter and 40 cm long is encased in a brass tube of same length whose external diameter is 30 mm and internal diameter is 25 mm. The composite bar is heated through 80 °C. Calculate the stress induced in each metal, Take α for steel = 11.2×10^{-6} per °C; α for brass = 16.5×10^{-6} per °C. E for steel = $2 \times 10^5 \text{ N/mm}^2$ and E for brass = $1 \times 10^5 \text{ N/mm}^2$. - CO2