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B2

# CONTINUOUS ASSESSMENT TEST – I - WINTER SEMESTER 2019-2020

**Programme Name & Branch** : B-Tech (BME)

**Course Code &Name** : MEE 2002, Strength of Materials

**Faculty-In-Charge** : Prof: Sreeja Sadasivan, Prof: Rajesh M

**Class Number(s)** : VL2019205002081, VL2019205001770

**Exam Duration: 90 Minutes** **Maximum Marks: 50**

Answer all the questions

1. (a) What is a bulk modulus? Derive an expression for Young's Modulus in terms of Bulk modulus and Poisson's ratio.

   (b) A square plate 0.25 m thick is subjected to tensile stress 1.4 $N/m^2$ in one direction and compressive stress 1.4 $N/m^2$ in the other direction. Find the change in volume of the plate.

2. Two vertical rods one of steel and the other of copper are each rigidly fixed to the top and 45 cm apart. Diameters and lengths of each rod are 2 cm and 4 cm respectively. A cross bar is fixed to the rod at the lower end carries a load of 4500 N such that the cross bar remains horizontal even after loading. Find the stress in each rod and the position of the load on the bar.

   Take '$E'_{steel} = 2 \times 10^5$ $N/mm^2$ and $E_{copper} = 1 \times 10^5$ $N/mm^2$

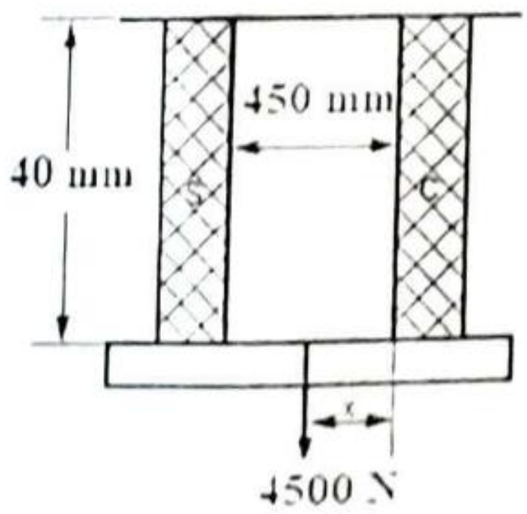


**Fig. 1**

3. A steel rod of 25 mm diameter passes centrally through a copper tube of 55 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. If the temperature of the assembly is raised by 60°C, calculate the stresses developed in copper and steel.

   Take E for steel and copper are 200 $GN/m^2$ and 100 $GN//m^2$ and $\alpha$ for steel and copper as $12 \times 10^{-6}$ /° C and $18 \times 10^{-6}$ /° C.

4. The state of plane stress at a point is represented by the stress element below (Fig.2). Determine graphically

**a)** the stresses acting on an element oriented 30° clockwise with respect to the original element.

**b)** the principal stresses and position of the principal planes.

**c)** the maximum shear stress, plane of maximum shear stress.

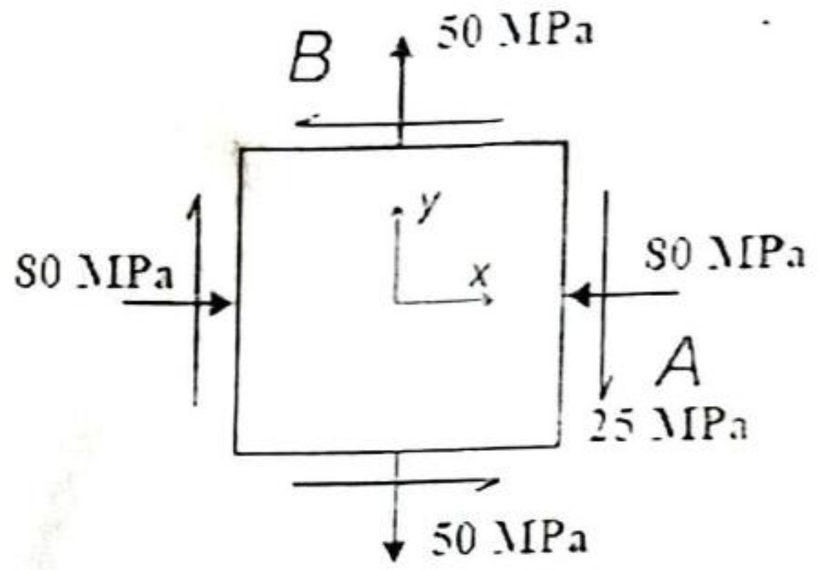


**Fig. 2**

5. Determine the reactions at A and B for the steel bar and loading shown in Fig. 3, assuming a close fit at both supports before the loads are applied.

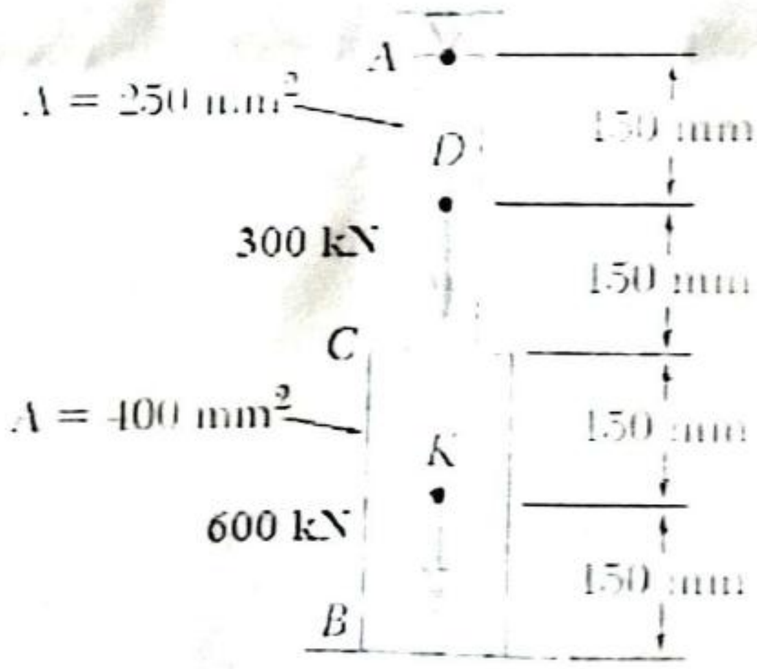


**Fig. 3**