Final Assessment Test - November 2016

Course: **MEE2002 - Strength of Materials**
Class NBR(s): **1658 / 1716 / 1744 / 8276** Slot: **E2+TE2**
Time: **Three Hours** Max. Marks: **100**

General Instructions:
Assume suitable initial guess/data/method if required.

PART – A (10 X 2 = 20 Marks)
Answer ALL Questions

1. Determine the reaction at A and C of the steel bar (Fig. 1) of cross-sectional area 250 mm^2 held firmly by the ends and loaded by an axial force of 25 kN at B.

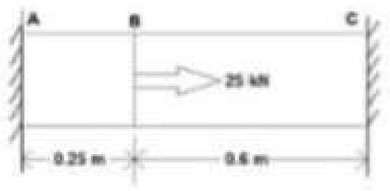

Fig. No. 1

2. The SFD and BMD for the set of loading are shown in the Fig. 2. Draw its matching load diagram. Shear forces are in N and bending moment are in Nm.

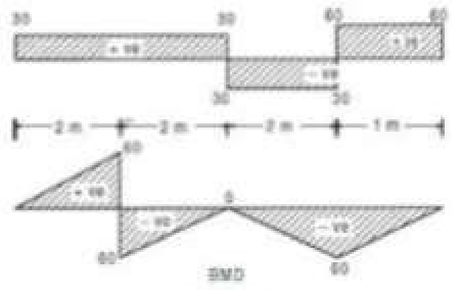

Fig. No. 2

3. Explain the terms; principal stress and principal plane.
4. Write the assumptons made to derive the expressions in the theory of simple bending.
5. A steel rod of diameter 10 mm and 1 m long is heated from 20°C to 120°C. It's $\alpha = 12\times10^{-6}$ / °C and E = 200 GN/m^2. If the rod is free to expand, determine the thermal stress developed in it.
6. Calculate the bursting pressure for cold drawn seamless steel tubing of 60 mm inside diameter with 2 mm wall thickness. The ultimate strength of steel is 380 MN/m^2.
7. Give two application for each of the following;
   (i) Torsion spring (ii) Circular spring
8. Write the independent expressions to calculate the strain energy stored in a body subjected to the following types of loads:
   (i) Gradually applied loads,
   (ii) Suddenly applied loads,
   (iii) Falling or impact loads.
9. Establish the relationships between slope, deflection and radius of the curvature of a loaded elastic beam.
10. In a steel member, at a point the major principal stress is 180 MN/m^2, and the minor principal stress is compressive. If the tensile yield point of the steel is 225 MN/m^2, find the value of the minor principal stress at which yielding will commence. Use Maximum shearing stress failure criteria.

PART – B (5 X 16 = 80 Marks)
Answer any FIVE Questions

11. A steel rod of 10 mm diameter passes centrally through a copper tube of external diameter 40 mm and internal diameter 30 mm and of length 2 m. The tube is closed at each end by 20 mm thick steel plates which are screwed by the nuts (Fig. 3). The nuts are tightened until the copper tube is reduced to length 1.9996 m. Find the stresses in the rod and the tube. If the whole assembly is heated through 60 °C, what are the stresses in the rod and the tube? Assume that the thickness of the plates remain unchanged.
    Take:
    E_{Steel} = 210 GN/m^2; E_{Copper} = 100 GN/m^2;
    $\alpha_{Steel} = 12\times10^{-6}$ per °C and
    $\alpha_{Copper} = 17.5\times10^{-6}$ per °C.

Fig. No. 3

12. State of stress at a point in a material is as shown in the Fig.4. Determine
    (i) principal stresses
    (ii) maximum shear stress
    (iii) plane of maximum shear stress and
    (iv) the resultant stress on the plane of maximum shear stress. (Use both analytical and graphical method)

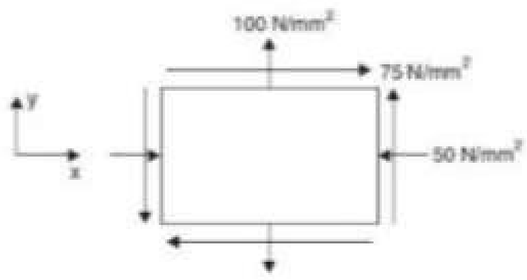

Fig. No. 4

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