Code No: OR210851 **OR**

II B.Tech I Semester Supplementary Examinations, May 2005
MECHANICS OF SOLIDS
(Common to Chemical Engineering and Metallurgy & Material Technology)
Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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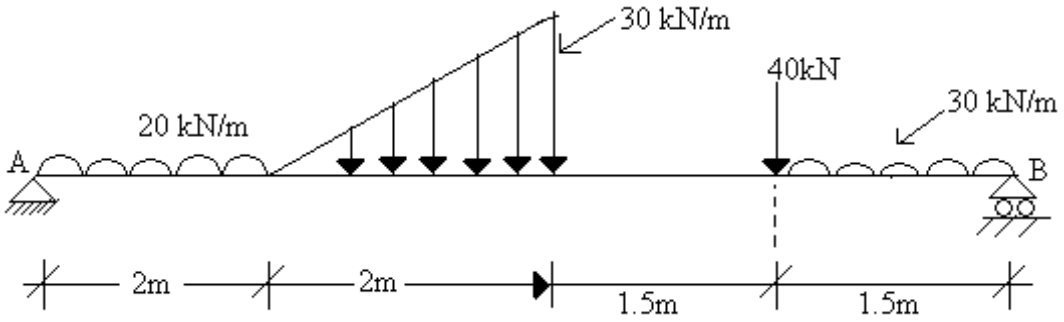
1. (a) Draw the stress-strain diagram for a mild steel specimen subjected to tensile test. Explain the salient features of the diagram.
   (b) Tension test was conducted on a bar that tapers from (D+a) mm to (D-a) mm diameter. But mean diameter was used for calculations of E. Prove that, error involved in calculating E is $\left(\frac{10a}{D}\right)^2$ percent.

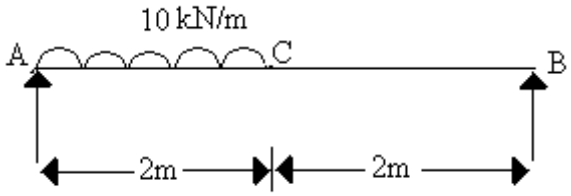
2. (a) What are temperature stresses? Obtain an expression for the same.
   (b) An aluminium rod 2 m long is secured between two walls of the stress in the rod is zero when temperature is 10^0C, compute the stress when temperature drops to 10^0C. Given $\alpha = 23 \times 10^{-6}/^oC$ *and* $E = 60GPa$.
   Solve, assuming
      i. that walls are rigid
      ii. that the walls yield by 0.5 mm together as temperature drops.

3. Draw the BMD and SFD for the beam shown in figure. Find the maximum bending moment.



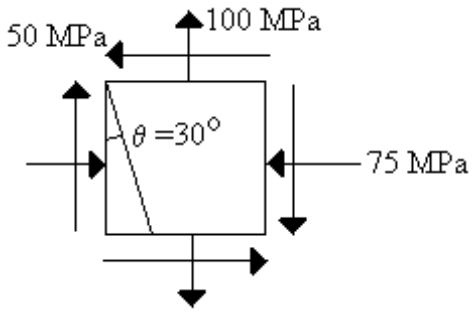
4. (a) What are the assumptions made in the theory of pure bending.
   (b) A simply supported beam 10 cm wide and 12 cm deep is 5 m long and carries a load of 10 kN at the mid span and a ud1 of 20kN/m over the entire span. Determine the magnitude of the maximum tensile and compressive stresses setup due to bending. Also find the maximum u.d.1 the beam can carry under the above stresses.

5. Determine the maximum deflection and its location in the beam shown in figure. The beam has a rectangular cross section 50 mm wide and 10 mm deep. E = 200 Gpa.



6. (a) Derive Lames equations for thick cylinder.
   (b) Find the thickness of the metal necessary for a thick cylinder of internal diameter 100 mm to with stand a internal pressure of 50 Mpa. The maximum hoop stress is 150 N/mm^2.

7. For the state of stress shown in figure determine:
   (a) The principal stresses and principal planes
   (b) Maximum shear stresses and their planes
   (c) Normal and tangential stresses on a plane inclined at 30^0as shown. Sketch the planes of principal stresses and mark their stresses.



8. A hallow steel shaft, 150 mm internal diameter and 300 mm external diameter is to be replaced by a solid shaft. If polar modulus has the same value for both, calculate the diameter of the solid shaft and the ratio of torsional rigidities. C for hallow shaft is 2 times C for solid shaft. If the torsional rigidity has the same value for both, calculate the ratio of polar moduli.

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