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AU/ME-221 (CBCS)

B.E. III Semester

Examination, December 2017

Choice Based Credit System (CBCS)

Strength of Materials

Time : Three Hours

Maximum Marks : 60

Note: i) Attempt any five questions.
ii) All questions carry equal marks.
iii) Assume suitable data if necessary.

1. a) Define the terms : Elastic limit, Young's modulus and modulus of rigidity.

   b) A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 850 kN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 150 mm. Take E for steel as 2×10^5 N/mm^2 and for brass as 1×10^5 N/mm^2.

2. A bar of 30 mm diameter is subjected to a pull of 70 kN. The measured extension on gauge length of 200 mm is 0.12 mm and change in diameter is 0.004 mm. Calculate:
   i) Young's modulus
   ii) Poisson ratio and
   iii) Bulk modulus

3. An elemental cube is subjected to tensile stresses of 30 N/mm^2 and 10 N/mm^2 acting on two mutually perpendicular planes and a shear stress of 10 N/mm^2 on these planes. Draw the Mohr's circle of stresses and hence or otherwise determine the magnitudes and directions of principal stresses and also the greatest shear stress.

4. A timber beam of rectangular section is to support a load of 20 kN uniformly distributed over a span of 3.5m, when beam is simply supported. If the depth of section is to be twice the breadth, and the stress in the timber is not to exceed 7 N/mm^2, find the dimensions of the cross-section.

5. A simply supported beam of 6m span is subjected to a concentrated load of 20 kN at 4m from left support. Calculate : (i) The position and value of maximum deflection. (ii) Slope at mid-span (iii) Deflection at the load point. Take E = 200 GPa and I = 15×10^6 mm^4.

6. Derive an expression for the shear stress produced in a circular shaft which is subject to torsion. What are the assumptions made in the derivation?

7. A solid circular shaft is subjected to a bending moment of 40 kN-m and a torque of 12 kN-m. Design the diameter of the shaft according to :
   i) Maximum principal stress theory.
   ii) Maximum shear stress theory.
   iii) Maximum strain energy theory.
   Take $\mu = 0.25$, stress at elastic limit = 200N/mm^2 and factor of safety = 2.

8. Find an expression for crippling load for a long column when one end of the column is fixed and other end is hinged.

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