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AU/ME/IP/IEM - 303

B.E. III Semester

Examination, December 2012

Strength And Mechanics of Materials

Time : Three Hours

Maximum Marks : 70/100

Note: *1. Answer any five questions.*
2. All questions carry equal marks.
3. Assume suitable data/dimensions missing, if any.
4. Illustrate your answers with neat sketches.

1. a) Distinguish clearly between a ductile and Brittle material. Sketch a stress-strain diagram for copper.
   b) Define the following
   (i) Proportional limit (ii) Ultimate Tensile stress
   (iii) Percentage elongation (iv) Rupture stress.

2. Prove the relation $\frac{T}{J}=\frac{Ls}{r}=\frac{I\theta}{l}$
   with the usual meaning of notations. To which theory this mathematical relation belongs? What are the assumptions made in this theory.

3. A hollow steel shaft 240mm external diameter & 160mm internal diameter is to be replaced by a solid shaft. If both the shafts should have the same polar modulus. Find the diameter of the latter and the ratio of TORSIONAL RIGIDITIES. Assume C for steel = 2.4xC for alloy.

4. In a shaft transmitting power, the shearing stress at the surface at the shaft is 60N/mm^2. In addition there is a bending moment producing a bending stress of 85N/mm^2 at the surface. Find the

magnitude and direction of the PRINCIPAL STRESSES. If the diameter of the shaft is 75mm, find the equivalent bending moment, which acting alone on the shaft would produce a strain equal to the maximum principal strain. Given poisson's ratio = 0.286.

5. Show that in a strained material subjected to two dimensional stresses the sum of the normal component of stresses on any two mutually perpendicular planes is constant.

6. For a Prismatic beam prove that

   Bending moment $M = EI\frac{d^2y}{dx^2}$

   Shear force $S = EI\frac{d^3y}{dx^3}$

   & Rate of loading = $EI\frac{d^4y}{dx^4}$

7. A rolled steel beam having a span of 6m carries a point load of 40KN at a distance of 4m from the left hand support. Find the deflection under the load and the position and amount of maximum deflection. I_{XX} for the section = 7.33×10^7 mm^4. Given E = 200 KN/mm^2.

8. A round steel rod of diameter 15mm and length 2m is subjected to a gradually increasing axial compressive load. Using EULER'S formula calculate the BUCKLING LOAD. Find also the maximum lateral deflection corresponding to the buckling condition. Both ends of the rod may be taken as hinged. Assume E = 2.1×10^5N/mm^2 and yield stress of steel = 250N/mm^2.

9. Write short notes on any 4 of the following:
   i) Poisson's ratio
   ii) End conditions of column
   iii) Deflection of a simply supported beam loaded at the centre by a point load P.
   iv) Polar moment of inertia of a circular section.
   v) Bulk Modulus.
   vi) Point of Contraflexure.