ANNA UNIVERSITY OF TECHNOLOGY, COIMBATORE

B.E. / B.TECH. DEGREE EXAMINATIONS : NOV / DEC 2011

REGULATIONS : 2008

FOURTH SEMESTER - CIVIL ENGINEERING

080100019 - STRENGTH OF MATERIALS

Time : 3 Hours **Max.Marks : 100**

PART - A

(10 x 2 = 20 MARKS)

ANSWER ALL QUESTIONS

1. Differentiate between shear strain and compressive strain.
2. State Maxwell's reciprocal theorem.
3. Draw the bending moment diagram for a cantilever beam with uniformly distributed load over the entire span.
4. What are the methods used to find slope and deflection of a loaded beam?
5. Give the Euler's formula to calculate critical load for a column.
6. Differentiate between thin and thick cylinders.
7. What do you mean by strain energy?
8. Define principal stress.
9. What are the assumptions made in Winkler-Bach theory?
10. Write the differences between symmetrical and unsymmetrical bending.

PART - B

(5 x 16 = 80 MARKS)

ANSWER ALL QUESTIONS

11. (a) In a tensile test, a test piece of 25 mm diameter, 200 mm gauge length, stretched 0.0975 mm under a pull of 50 kN. In a torsion test, the same rod twisted 0.025 radian over a length of 200 mm when a torque of 0.4 kNm was applied. Evaluate Poisson's ratio and the three elastic moduli for the material.

(OR)

11. (b) A steel bar 4 cm by 4 cm in section, 3m long is subjected to an axial pull of 128 kN. Taking E = 200 GN/m^2 calculate the alteration in the length of the bar. Calculate also the amount of energy stored in the bar during the extension.

12. (a) Derive the expression for a fixed beam carrying a concentrated load eccentrically placed on the beam.

(OR)

12. (b) A steel girder of 6m length acting as a beam carries a uniformly distributed load w N/m run throughout its length. If I = 30 x 10^{-6} m^4 and depth 270 mm, calculate (i) The magnitude of w so that the maximum stress developed in the beam section does not exceed 72 MN/m^2. (ii) The slope and the deflection (under this load) in the beam at a distance of 1.8m from one end.
Take E = 200 GN/m^2.

13. (a) A hollow C.I column whose diameter is 200 mm has a thickness of 20 mm. It is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine-Gordon formula using a factor of safety of 4.

(OR)

13. (b) A thick walled closed-end cylinder is made of an A1-alloy (E = 72 GPa, (1/m) = 0.33), has inside diameter of 200 mm and outside diameter of 800 mm. the cylinder is subjected to internal fluid pressure of 150 MPa. Determine the principal stresses and maximum shear stress at a point on the inside surface of the cylinder. Also determine the increase in inside diameter due to fluid pressure.

14. (a) A piece of material as in figure 1 is subjected to two compressive stresses at right angles, their values being 40 MN/m^2 and 60 MN/m^2. Find the position of the plane across which the resultant stress is most inclined to the normal and determine the value of this resultant stress.

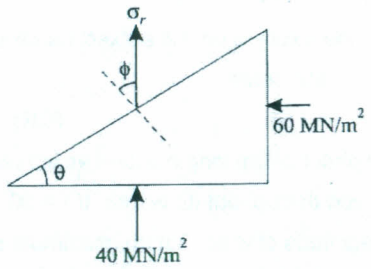

Figure – 1

(OR)

14. (b) A shaft is subjected to a maximum torque of 10 kNm and a maximum bending moment of 7.5 kNm at a particular section. If the allowable equivalent stress in simple tension is 160 MN/m^2 find the diameter of the shaft according to the maximum shear stress theory.

15. (a) A cantilever of I section, 2.4 m long is subjected to a load of 200 N at free end as shown in figure 2. Determine the resulting bending stresses at corners A and B, on the fixed section of the cantilever.

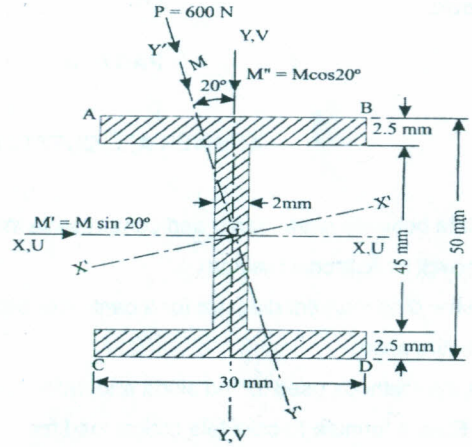

Figure 2

(OR)

15. (b) A curved bar is formed of a tube of 120 mm outside diameter and 7.5 mm thickness. The centre line of this beam is a circular arc of radius 225 mm. a bending moment of 3 kNm tending to increase curvature of the bar is applied. Calculate the maximum tensile and compressive stresses set up in the bar.

*******THE END*******