Code No: OR320359 **OR**

III B.Tech II Semester Supplementary Examinations, April/May 2005
ADVANCED STRENGTH OF MATERIALS
(Common to Mechanical Engineering and Production Engineering)
Time: 3 hours **Max Marks: 70**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define the terms principal stresses, principal planes and maximum shear stress.
   (b) Using Mohr's circle of stresses, find the magnitude of principal stresses and the location of principal planes in the case of normal stresses of 60MPa (tensile) and 30MPa (compressive) acting on mutually perpendicular planes having shearing stress of 25MPa. Find also the magnitude and direction of max shear stress.

2. (a) Define and discuss the terms equivalent bending moment and "equivalent twisting moment".
   (b) Determine the deflection, bending stress and shear stress induced in an open coiled helical spring due to axial load of 700N. The number of coils are 20, and angle of helix 12^0. Consider E = 200 GN/m^2 and N = 80 GN/m^2.

3. (a) Explain the maximum principal stress theory.
   (b) At a particular point in the wall of a thin stainless steel tube, there are principle stresses of 70 MPa and 40 MPa, both tensile. Taking 1/m = 0.24, calculate the equivalent stress in simple tension according to
      i. Maximum principal strain theory
      ii. Maximum strain energy theory

4. Two 225 mm x 75 mm mild steel channels are welded together at their toes to form a section 225 mm x 150 mm x 6 meters long. The beam is hinged at its ends and carries a uniformly distributed load of 8 kN/m on a 150 mm side and an axial end thrust of 320 kN. If the beam is prevented from bending in a lateral direction, find the maximum deflection and the maximum stress in the material. Thickness of the channel may be assumed as 10 mm. Take E = $2 \times 10^5 N/mm^2$.

5. A compound steel cylinder has a bore of 80 mm and an outside diameter of 160 mm, the diameter at the common surface being 120 mm. Find the radial pressure at the common surface which must be provided by shrinkage if the resultant maximum hoop tension in the inner cylinder under a superimposed internal pressure of 50 N/mm^2 is to be half the value of the maximum hoop tension which would be produced in the inner cylinder if that cylinder alone were subjected to an internal pressure of 50 N/mm^2. Determine the final hoop tensions at the inner and outer surfaces of both cylinders under the internal pressure of 50 N/mm^2.

6. (a) Derive an expression for load carrying capacity of an eccentrically loaded long column, one end fixed and other end free.

(b) Find the Euler's crippling load for a hollow cylindrical steel column of 40 mm external diameter and 9 mm thick. Take length of the column as 2 m and hinged at its both ends. Take E = 200 kN/mm^2.

7. A chain link is made of 20 mm diameter round steel with mean radius of circular ends 25 mm, the length of straight portion being 22 mm. Determine the values of maximum tensile and compressive stresses, when the link is subjected to a pull of 25 kN at its end.

8. Write short notes on the following:

   (a) Stresses in rotating rings

   (b) Analysis of crane hooks

   (c) Shear center

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