Printed Pages : 4

EME-302

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 140302

Roll No.

B. Tech.

(SEM. III) (ODD SEM.) THEORY EXAMINATION, 2014-15

STRENGTH OF MATERIALS

Time : 3 Hours] [Total Marks : 100

Note : Attempt all questions.

1 Attempt any TWO parts of the following : 2×10=20

(a) At a point in a bracket the stresses on two mutually perpendicular planes are 400 MPa (tensile) and 300 MPa (tensile). The shear stress across these planes is 200 MPa. Determine graphically, the magnitude and directions of principal stresses and shear stresses.

(b) Derive an expression for strain energy in cantilever due to bending and shear under concentrated edge load.

(c) State the generalized Hook's law and prove for an anisotropic elastic material the maximum number of elastic constant is 21 only. Also show for isotropic material it is 2.

2 Attempt any TWO parts of the following : **2×10=20**

(a) Compare the bending strength of three beams, one having a square cross-section, the second one of a rectangular cross-section (with depth twice breadth) and third of a circular cross-section, all of the three having the same weight and having a cross –section of 1000 mm^2 each.

(b) A simply supported beam of span length L carries a UDL per unit length over the left half of the span. Find the deflection at the mid span.

(c) A hollow shaft of diameter ratio 3/8 is required to transmit 600 KW at 110 rpm. The maximum torque being 20% greater than than the mean. The shear stress is not to exceed 63 MPa. and twist in a length of 3 m not to exceed 1.4 degree. Calculate the maximum external diameter satisfying these conditions. Take G = 84 GPa.

3 Attempt any TWO parts of the following : **2x10=20**

(a) Determine the ratio of the buckling strengths of the two columns of circular cross section one hollow and the other solid when both are made of the same material have the same length, cross-sectional area and end conditions. The internal diameter of the hollow column is half of its external diameters.

(b) A steel carriage spring is 800 mm long and carries a central load of 6 KN. The plates are 70 mm wide and 5 mm thick. Determine the number of plates in the spring to sustain a maximum bending stress of 200 N/mm^2 .what will be the deflection in the spring? To what radius should each plate be curved so that it becomes straight under the given load? Take E = 20 KN/mm^2.

(c) A steel carriage spring of length 1.5 m having a plate width 150 mm and thickness 10 mm is subjected to a bending stress of 200 N/mm^2. The spring during its straightening and absorbs 150 Joules of energy .Find the number of plates and their radius of curvature. Given E= 200 KN/mm^2.

4 Attempt any TWO parts of the following : **2×10=20**

(a) Derive the Lame equations for the hoop and radial stresses in a thick cylinder subjected to an internal and external pressure and show how theses may be expressed in graphical form.

(b) A thick spherical shell of inner radius 150 mm is subjected to an internal pressure of 80 MPa. Calculate its wall thickness based upon the :

(I) Maximum principal stress theory and

(II) Total strain energy theory

(c) The pressure within the cylinder of a hydraulic press is 9 MPa. The inside diameter of the cylinder is 25 mm. Determine the thickness of the cylinder wall ,if the permissible tensile stress is 18 N/mm^2.

5 Attempt any TWO parts of the following : **2x10=20**

(a) Derive the equation to find the position of neutral axis for the following cross section of curved beam :

(I) Rectangular Section

(II) Trapezoidal Cross section

(b) What is shear centre? Prove that shear centre for a thin –walled balanced Z - section coincides with its centroid.

(c) A 40 mm × 40 mm × 5 mm angle is used as a simply supported beam over a span of 2.4 m. It carries a load of 200 N along the vertical axis passing through the centroid of the section. Determine the resulting bending stresses on the corners of the section, along the middle section of the beam.