Roll No. .....

24171

B. Tech 4th Semester (Mechanical Engg.) Examination – May, 2013

STRENGTH OF MATERIALS – I

Paper : ME-206-F

Time : Three hours] *[Maximum Marks : 100*

Before answering the question, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Question No. 1 is ***compulsory***. Attempt any ***five*** question in total by selecting at least ***one*** question from each Section.

1. Define the following terms related to strength of materials:

   (i) Stress, strain and their types

   (ii) Poisson's ratio and elastic constants

   (iii) Torsion and horse power

   (iv) Factor of safety and working stress

(v) Beam and its types

(vi) Moment of inertia and polar moment of inertia

(vii) Thermal stress and strain

(viii) Strain energy and resilience. $8 \times 2.5 = 20$

SECTION – A

2. A steel rod 20 mm diameter is passed through a brass tube 25 mm internal diameter and 30 mm external diameter. The tube is 80 cm long and is closed by thin rigid washers and fastened by nuts, screwed to rod. The nuts are tightened until the compressive force in the tube is 5 kN. Calculate the stresses in the rod and in the tube. $E_s = 200$ GPa, $E_b = 80$ GPa. 20

3. At a certain point in a materials under stress the intensity of the resultant stress on a plane is 65 Mpa tensile inclined at 30° to normal to that plane. The stress on a plane at right angle to this plane has a normal tensile component of intensity 45 Mpa. Find fully :

(a) the resultant stress on the second plane,

(b) the principal planes and stresses. 20

SECTION – B

4. A beam 8 m long rests on two supports one at right end and other 2 m from its left-hand end. The beam carries a uniform load of 15kN/m over its entire length and a concentrated load of 80 kN at the middle of the 6 m span. Draw the bending moment and shear force diagrams and determine the position and amount of maximum bending moment. 20

5. A solid shaft is to transmit 300 k W at 100 r.p.m. If the shear stress is not to exceed 80 Mpa, find the diameter of the shaft. What percentage saving in weight would be obtained if this shaft we replaced by a hollow one whose internal diameter equals 0.6 of the external diameter , the length, material and maximum shear stress being the same? 20

SECTION – C

6. A tubular steel strut is 6.5 cm external diameter and 5 cm internal diameter. It is 2.5 m long and has hinged ends. The load is parallel to the axis but eccentric. Find the maximum eccentricity for a crippling lad of 0.75 of the Euler value , the yield stress being 320 MPa. 20

7. A propeller shaft of 20 cm external diameter and 15 cm internal diameter has to transmit 1103.25 kW at 100 r.p.m. It is additionally subjected to a bending moment of 10 kN-m and an end thrust of 200 kN. Find

(i) the principal stresses and their planes, and

(ii) the maximum shear stress and its plane. 20

SECTION – D

8. A beam AB simply supported at the ends is 4 m long. It carries a uniformly distributed load of intensity 20 kN/m over a length of 2m starting at a distance of 1 m from left end support together with a concentrated load 40 kN at a distance of 3 m from the left end support. Calculate the deflection at the centre if E is 210 GPa, I = 9600 cm^4. 20

9. (a) Derive an expression for maximum deflection in a fixed beam subjected to uniformally distributed load of w N/m. 10

(b) Derive an expression for maximum deflection in a fixed beam subjected to couple T,N-m at any position on beam. 10