D 8563 (Pages : 2) Name..... .....

Reg. No.....

THIRD SEMESTER B.TECH.(ENGINEERING) DEGREE EXAMINATION, DECEMBER 2010

AM / ME 04 304 MECHANICS OF SOLIDS

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions.*

I. (a) Define Factor of safety, Poisson's ratio and Strain energy.

(b) State Hooke's law and hence define modulus of elasticity.

(c) How do you classify loads ? Give examples.

(d) Define a beam. Explain with neat sketches various types of supports and loads on them.

(e) Derive the Bending equation from first principle.

(f) Derive the relation between curvature, slope and deflection of the beam.

(g) Define Principal planes and Principal stresses and explain their uses.

(h) Explain the construction of Mohr's circle to obtain principal stresses.

(8 × 5 = 40 marks)

II. (a) A steel bar 3.2 m long is acted upon by forces as shown in the Fig 1. Determine the total elongation of the bar. Take E = 205 kN/mm^2.

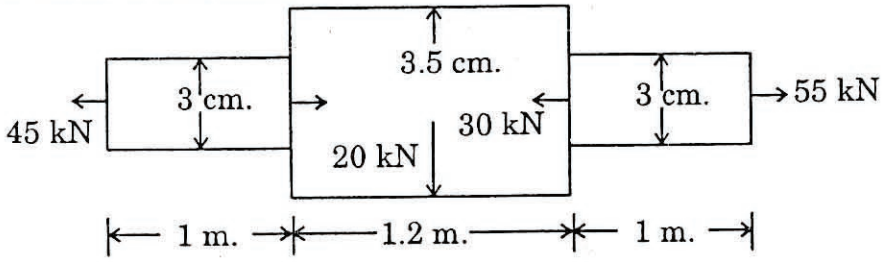

Fig. 1

Or

(b) A metallic rod of 1 cm diameter, when tested under an axial pull of 10 kN was found to reduce its diameter by 0.0003 cm. The modulus of rigidity for the rod is 51 kN/mm^2. Find the Poisson's ratio, Modulus of elasticity and Bulk Modulus.

III. (a) (i) What are the advantages of a hollow shaft over a solid shaft in torsion ? Justify properly any statement, you make.

(ii) A solid steel shaft of 150 mm diameter is to be replaced by a hollow steel shaft of the same material with internal diameter equal to half of the external diameter. Design the hollow shaft and find out the saving in material, if the maximum allowable shear stress is same for both shafts.

Or

(b) A simply supported beam AB, 6 m long is loaded as shown in the Fig. 2.

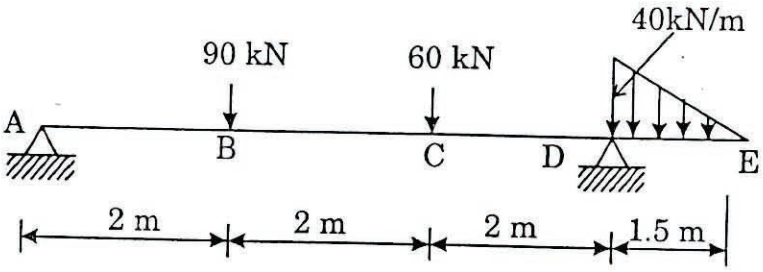

Fig. 2.

IV. (a) An I section is having overall depth as 550 mm and overall width as 200 mm. The thickness of the flanges is 25 mm whereas the thickness of the web is 20 mm. If the section carries a shear force of 45 kN, calculate the shear stress values at salient points and draw the sketch showing variation of shear stress.

Or

(b) A simply supported beam A B of span 6 metres and of flexural rigidity EI = 8×10^4 kN-m^2 is subjected to a clockwise couple of 60 kN-m at a distance of 4 m from the left end. Find the deflection at the point of application of the couple and the maximum deflection and slope.

V. (a) Direct stresses 120 MPa tensile and 90 MPa compressive are applied to an elastic material at a certain point on planes at right angles. The greater principal stress is limited to 150 MPa. What shearing stress may be applied to the given planes and what will be the maximum shearing stress at the point ?

Or

(b) A built-up I section has an overall depth of 400 mm, width of flanges 300 mm, thickness of flanges 50 mm and web thickness 20 mm. It is used as a beam with simply supported ends and it deflects by 10 mm when subjected to a load of 40 kN/m length. Find the safe load on this I-section used as a column with both ends hinged. Use Euler's formula. Assume a factor of safety 1.75 and take E = 2×10^5 N/mm^2.

(4 × 15 = 60 marks)