D 2319 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2009

CE 04 303—MECHANICS OF SOLIDS

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions.*

I. (a) Define the terms.

(i) Proportional limit.

(ii) Poisson's ratio.

(iii) Proof stress.

(b) State Hooke's law. Sketch the stress-strain diagram for a ductile material like mild steel tested under tension upto destruction, marketing the salient points on it.

(c) What is meant by pure bending ? What are the assumptions made in the theory of simple bending ?

(d) Distinguish clearly the difference between (i) overchanging and continuous beam ; (ii) simply supported and rigidly fixed beam ; (iii) uniformly distributed and uniformly varying load.

(e) Define section modulus and determine its value of a hollow circular section of outer diameter 100 mm and inner diameter 75 mm.

(f) From first principles derive the expression for shear stress at any point in any cross section of a beam which is subjected to a shear force F.

(g) Derive the Euler's formula for a hinged at both ends.

(h) Compare thin cylinder and Thick cylinder in terms of the stresses induced and its variation.

(8 × 5 = 40 marks)

II. (a) An aluminium tube of 40 mm external diameter and 20 mm internal diameter is snugly fitted on to a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by a axial load P. Find the stress in aluminium, when the stress in steel is 70 N/mm^2. Also find the value of P. Take E for steel as 200 kN/mm^2 and E for aluminium as 70 kN/mm^2.

Or

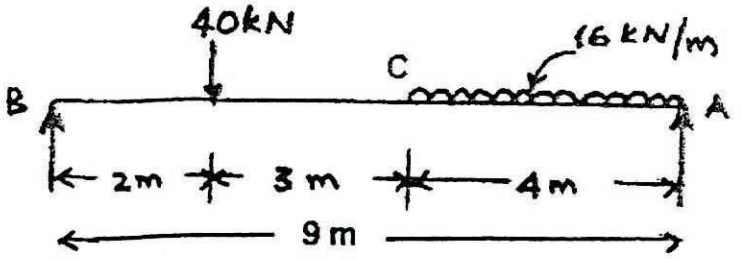
(b) Find the Poisson's ratio and Bulk modulus of a material whose modulus of elasticity is 200 GPa and modulus of rigidity is 80 GPa. A2 m long rod of 40 mm dia. Made with the same material is stretched by 2.5 mm under some axial load. Find the lateral contraction.

Turn over

III. (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 where as the thickness of the web is 20 mm. If the section carries a shear force of 45 kN, calculate the shear values at salient points and draw the sketch showing variation of shear stress.

Or

(b) Draw shear bending moment diagrams for the simply supported beam shown in fig. 1.



IV. (a) A cantilever of 3 meters length and of uniform rectangular cross section 150 mm wide and 300 mm deep is loaded with a 30 kN load at its free end. In addition to this it carries a uniformly distributed load of 20 kN per metre run over its entire length, calculate :

(i) The maximum slope and maximum deflection.

(ii) The slope and deflection at 2 metres from the fixed end.

Or

(b) An overchanging beam of length 6 m. is supported at the end and 1 m. from the right end. It carries point loads of magnitude 40 kN and 20 kN at 2 m. and 6 m. from the left end respectively. Using conjugate beam method, determine :

(i) The slope at the end.

(ii) The deflection at 3 m. from the end. Take $EI = 3 \times 10^{12}$ N.mm^2.

V. (a) 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 10mm 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 $E = 2 \times 10^5$ N.mm^2.

Or

(b) A thin cylindrical shell of diameter 325 mm ia closely wound around its circumference by a 2 mm diameter steel wire under an initial tension of 75 MPa. This cylinder is further subjected to an internal pressure of 2.5 MPa. Determine the wall thickness of the cylinder if the resultant hoop stress in the cylinder walls is 14 MPa (tensile) and the cylinder is made of copper. $E_{steel} = 210$ GPa, $E_{copper} = 105$ GPa and Poisson ratio for Copper = 0.32.

(4 × 15 = 60 marks)