D 23516 (Pages : 2) Name.....

Reg. No.....

THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2011

ME 04 304—MECHANICS OF SOLIDS

Time : Three Hours Maximum : 100 Marks

Answer **all** *the questions.*

I. (a) Sketch a typical load deflection curve obtained from tension test conducted on mild steel specimen and explain salient features.

(b) The Young's modulus and modulus of rigidity of a material are 200 GPa and 80 GPa respectively. Determine the Poisson's ratio and bulk modulus of the material.

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

(d) What is shear force and bending moment ? Explain with *one* simple example.

(e) What is elastic section modulus ?

(f) Give the equivalent conjugate beam for the beam shown in Fig. 1.

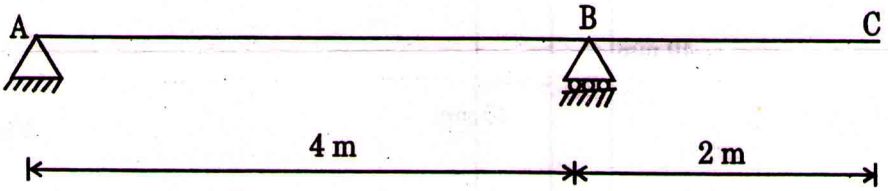

Fig. 1

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

(h) Define Slenderness ratio. State the limitations of Euler's formula.

(8 × 5 = 40 marks)

II. (a) Three bars made of Copper, Zinc and Aluminium are equal length and have cross sectional areas of 400, 800 and 1200 mm^2 respectively. They are rigidly connected at their ends. If compound member is subjected to a longitudinal pull of 350 kN, estimate the proportion of load carried by each bar and induced stresses. Take elastic moduli of Copper, Zinc and Aluminium to be 1.2×10^5 N/mm^2 , 1.0×10^5 N/mm^2 , and 0.89×10^5 N/mm^2 respectively.

Or

(b) A bar of 30 mm diameter is subjected to pull of 60 kN. The measured extension on a gauge length of 200 mm is 0.09 mm and change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the value of three moduli.

III. (a) Find the diameter of the shaft required to transmit 60 kW at 150 r.p.m. if the maximum torque is likely to exceed the mean torque by 25% for a maximum permissible shear stress of 60 N/mm^2. Find also the angle of twist for a length of 2.5 metres.

Or

Turn over

(b) Draw Shear Force and Bending Moment diagrams for the simply supported beam shown in Fig. 2.

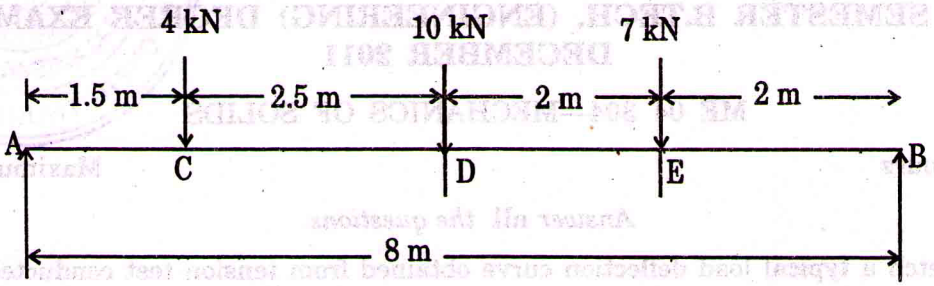

Fig. 2

IV. (a) For a channel section shown in Fig. 3 determine the section modulus. Hence calculate the maximum bending stresses. Sketch the distribution of bending stress if the section is subjected to a B.M of 40 kNm.

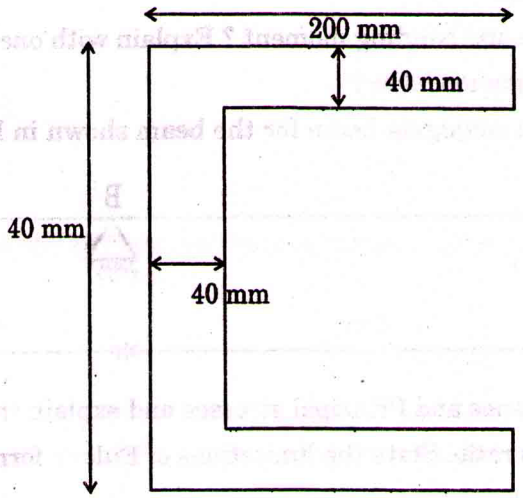

Fig. 3

Or

(b) A beam 5m long is supported at one end and at point 1m from the other end. The beam carries a uniformly distributed load of 12 kN/m run over the whole length and concentrated loads of 10 kN at the extreme overhanging end at a section midway between the supports. Determine the deflection of the overhanging load below the supports. Take $E = 2 \times 10^5$ N/mm^2 and $I = 12 \times 10^{-6}$ m^4.

V. (a) At a certain point in a strained material the intensities of normal stresses on two planes at right angles to each other are 20 N/mm^2 and 10 N/mm^2 both tensile. They are accompanied by shear stress of 10 N/mm^2. Find the principal planes and the principal stresses. Find also the maximum shear stress.

Or

(b) A 1.5 m long column has a circular cross-section 50 mm. diameter. Both ends of the columns are fixed. Taking factor of safety of 3, calculate the safe load using Rankine's formula and Euler's formula. Take a = 1/1600 and f_c = 560 N/mm^2 and $E = 2 \times 10^5$ N/mm^2.

(4 × 15 = 60 marks)