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(Pages : 2) Name..

Reg. No

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION OCTOBER 2011

ME/PTME 09 502—ADVANCED MECHANICS OF SOLIDS

(2009 Admissions)

Time : Three Hours Maximum : 70 Marks

Answer **all** *the questions.*

Part A

I. (a) Define Elasticity.

(b) Define Lame's law.

(c) Define Strain energy.

(d) What is complementary energy ?

(e) What is torsion ?

(5 × 2 = 10 marks)

II. (a) Draw the stress-strain curve for an elastic material and define salient points.

(b) Derive relation between Modulus of elasticity and Rigidity modulus and Bulk modulus.

(c) What is plane stress and plane strain ? Explain in detail.

(d) Describe the various supports of beams and their reactions.

(e) Describe the principle of virtual work for bending.

(f) Derive the torsion equation for non circular prismatic bars.

(4 × 5 = 20 marks)

III. (a) An aluminum 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 an axial load P. Find the stress in aluminum, 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 aluminum as 70 kN/mm^2.

Or

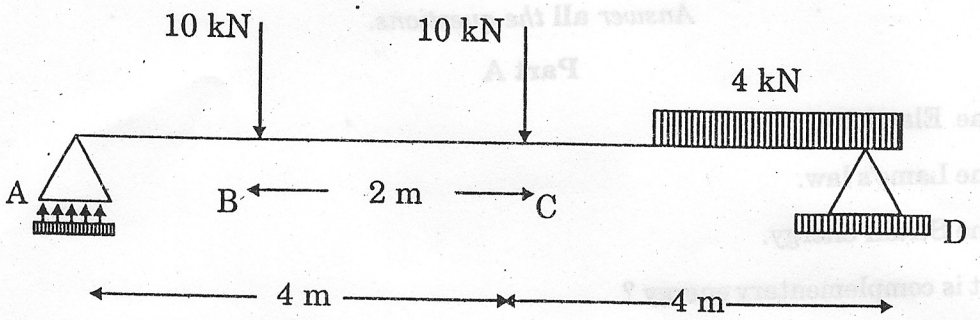
(b) A bar 30 mm. × 30 mm. × 250 mm. long is subjected to a pull of 90 kN in the direction of its length. The extension of the bar was found to be 0.125 mm, whiloe the decrease in each lateral dimension is found to be 0.00375 mm. Find the Young's modulus, Poisson's ratio, Modulus of rigidity and Bulk modulus for the material of the bar.

Turn over

IV. (a) A hollow shaft of diameter ratio 3/8 is required to transmit 600 kW at 110 rpm, the maximum torque being 20 % greater than the mean. The shear stress is not to exceed 63 N/mm^2. and the twist in a length of 3 m. not to exceed 1.4 degrees. Calculate the maximum external diameter satisfying these conditions.

Or

(b) Draw Shear force and Bending moment diagrams for the simply supported beam shown below.



V. (a) A cast iron water main 12 metres long, of 500 mm inside diameter and 25 mm. wall thickness runs full of water and is supported at its ends. Calculate the maximum stress in the metal if density of cast iron is 7,200 kg/m^3. and that of water is 1,000 kg/m^3.

Or

(b) A rolled steel joint ISMB 250 × 125 mm. carries a point load of 20 kN at 3. from one end of a simply supported beam of span 9 m. I_{xx} and E for the beam are 5131.6 cm^4. and 200 GPa respectively. Using conjugated beam method, find the deflection under the load and the maximum deflection of the beam.

VI. (a) Explain in detail the following :—

(i) Saint Venant's Theory.

(ii) Prandtle's method.

Or

(b) Compare the crippling loads given by Euler's and Rankine formula for a tabular steel column 2.5 m. long having outer and inner diameters 40 mm. and 30 mm. respectively loaded through pin joint at each end. Take $\sigma_y = 330$ MPa, $\alpha = \frac{1}{7500}$ and $E = 2.05 \times 10^5$ MPa.

(4 × 10 = 40 marks)