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06CV33

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Strength of Materials

Time: 3 hrs. Max. Marks:100

Note : ***1. Answer any FIVE full questions.***

1 a. Mention the assumptions made in the theory of simple stresses and strains. Also derive the equation $dL = \frac{PL}{AE}$ from first principles. **(05 Marks)**

b. Explain with neat sketches principle of super position. **(03 Marks)**

c. A stepped bar is subjected to forces as shown in the Fig. Q1(c). Determine the magnitude of the force P, taking the allowable stress for the material as 80 MPa. Also find the net deformation induced. Take E = 84 GPa.

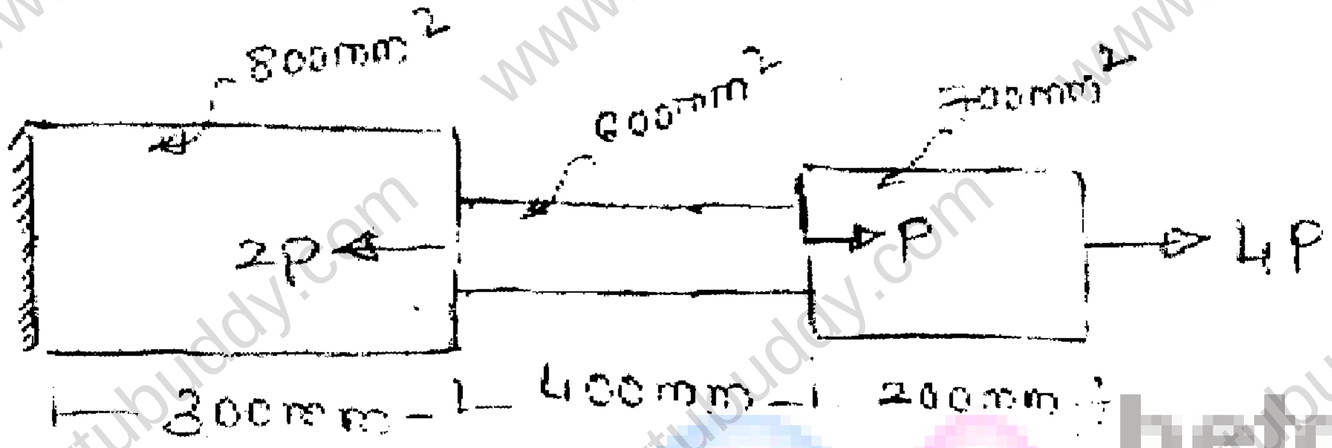

Fig. Q1(c) **(12 Marks)**

2 a. Establish the relationship between E, G and the Poissons ratio γ. **(08 Marks)**

b. A metallic rod of 10 mm diameter when tested under an axial pull of 10 kN, it was found to reduce its diameter by 0.003 mm. The modulus of rigidity for the rod is 51 GPa. Find Poissons ratio, Young's modulus and bulk modulus for the material. **(12 Marks)**

3 a. Direct stresses of 120 MPa tension and 90 MPa compressions are applied to an elastic material at a certain point on the planes at right angles. The maximum principal stress is limited to 150 MPa. What is the corresponding shear stress on the given planes and what will be the maximum shearing stress at that point? **(12 Marks)**

b. Derive Lame's equation for the radial and hoop stresses for thick cylinder, subjected to internal and external fluid pressure. **(08 Marks)**

4 a. Define shear fore and bending moment in beams. Also state the engineering significance of the same. **(05 Marks)**

b. From the given shear force diagram shown in the Fig.Q 4(b) develop the load intensity diagram and draw the corresponding bending moment diagram indicating the salient features.

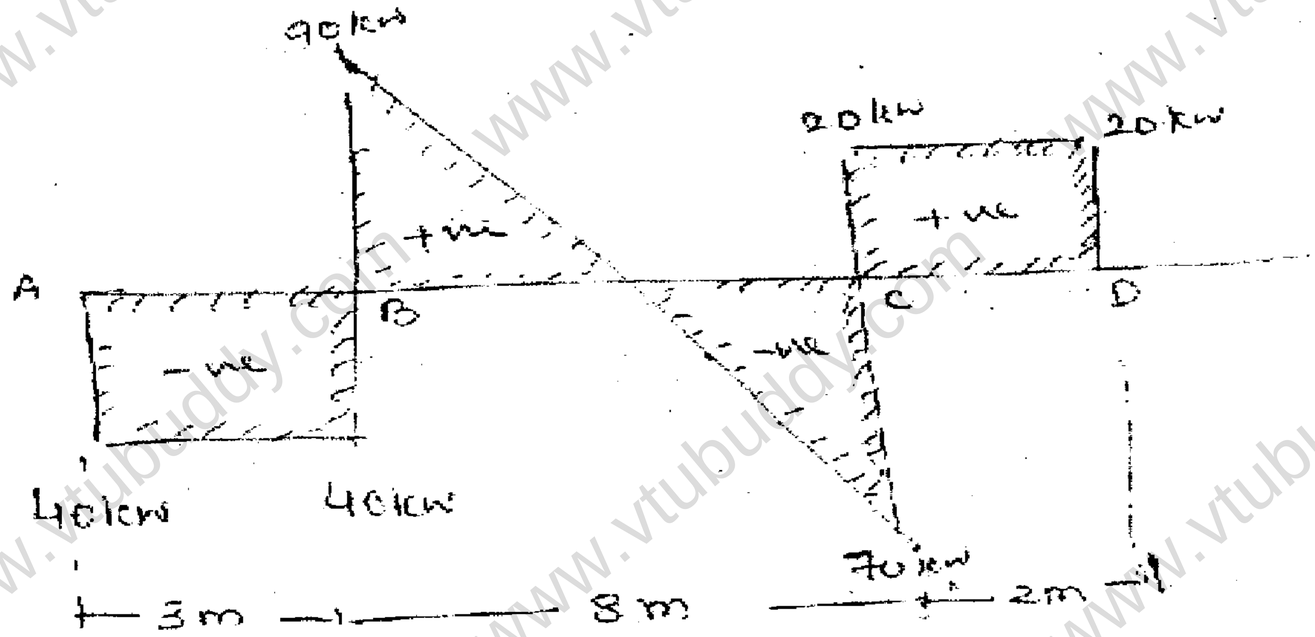

Fig.Q 4(b) **(15 Marks)**

5 a. State the assumption made in the theory of simple bending. **(05 Marks)**

b. Prove that the maximum shear stress in rectangular section of width 'b' and depth'd' is equal to 1.5 times of its mean shear stress.

c. A cross section of the beam is as shown in Fig.Q 3(c). The shear force on the section is 400 kN. Estimate the shear stress at various points and plot the shear stress distribution diagram.

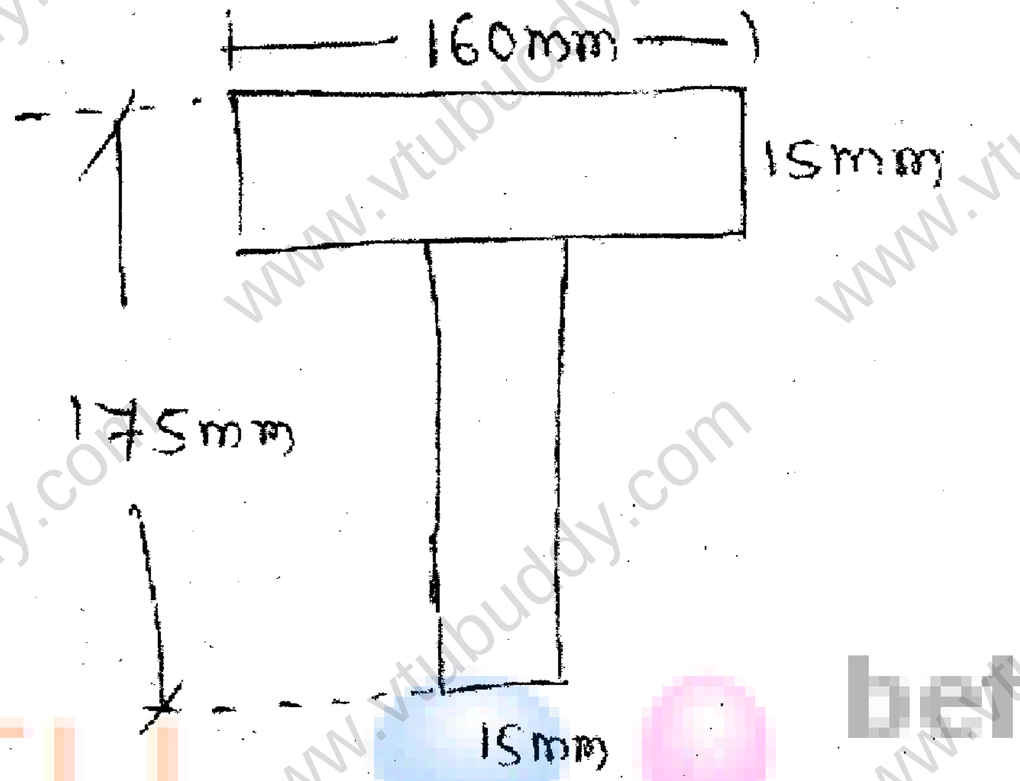

Fig.Q 3(c)

(10 Marks)

6 a. Derive the Euler – Bernoulli differential equation for flexure. **(06 Marks)**

b. A simply supported beam of span L is subjected to a uniformly distributed load of intensity w kN /m throughout the span. Find the maximum slope and deflection if EI = constant. **(14 Marks)**

7 a. State the assumptions made in the theory of pure torsion. **(05 Marks)**

b. Derive the expression for power transmitted by the shaft. **(05 Marks)**

c. A solid shaft has to transmit 120 kW of power at 160 rpm. If the shear stress is not to exceed 60 MPa and the twist in a length of 3 m must not exceed 1^0, find the suitable diameter of the shaft. Take G = 80 GPa. **(10 Marks)**

8 a. Define slenderness ratio. Explain its engineering significance in designing the columns. **(04 Marks)**

b. Derive the Euler's expression for buckling load for columns with both ends hinged. **(06 Marks)**

c. A solid round bar 4 m long and 50 mm in diameter was found to extend by 4.6 mm long under a tensile load of 50 kN. This bar is used as a strut with both ends pinned. Determine Euler's crippling load for the bar and also the safe load taking factor of safety as 4. **(10 Marks)**

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