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06CV33

Third Semester B.E. Degree Examination, Dec.09/Jan.10
Strength of Materials

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. A rod of length L tapers from diameter d_1, at one end to a diameter d_2 at the other end. If it is subjected to a tensile load P, derive an expression for the extension of the rod. **(10 Marks)**

b. A steel rod having diameter 40mm is loaded as shown in Fig.1(b). Taking E = 200 GPa, determine,
i) The displacement of the free end.
ii) The distance x from the left hand support to a point at which the displacement is zero. **(10 Marks)**

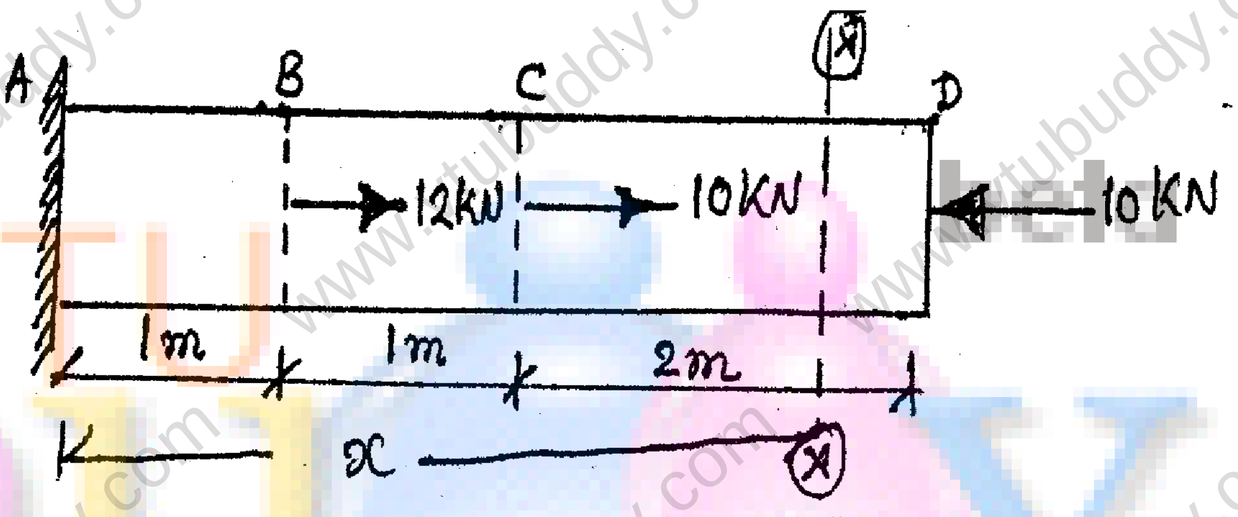

Fig.1(b)

2 a. Derive the relationship between the Young's modulus (E) and bulk modulus (K). **(10 Marks)**

b. A R.C.C. column 300mm×300mm has four reinforcement bars of steel each 20mm in diameter placed one at each corner. Calculate the safe load on the column if the allowable stress in concrete is 4 MPa. Also calculate the shortening of the column, if the column is 3m long. Take, $E_s = 200$ GPa, $E_s = 15\ E_c$. **(10 Marks)**

3 a. For a general two dimensional stress system, derive expressions for principal stresses and principal planes. **(10 Marks)**

b. A cylindrical thin shell 800mm diameter and 3m long is having 10mm metal thickness. The shell is subjected to an internal pressure of 2.5 N/mm^2. Determine
i) change in diameter
ii) change in length and
iii) change in volume. Take $E = 2\times10^5$MPa. **(10 Marks)**

4 a. Explain the terms:
i) Hogging bending moment
ii) Sagging bending moment
iii) Points of contraflexure. **(05 Marks)**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

b. Draw the S.F. and B.M. diagrams indicating principal values for an overhanging beam as shown in Fig.4(b). Locate the point of contraflexure, if any. **(15 Marks)**

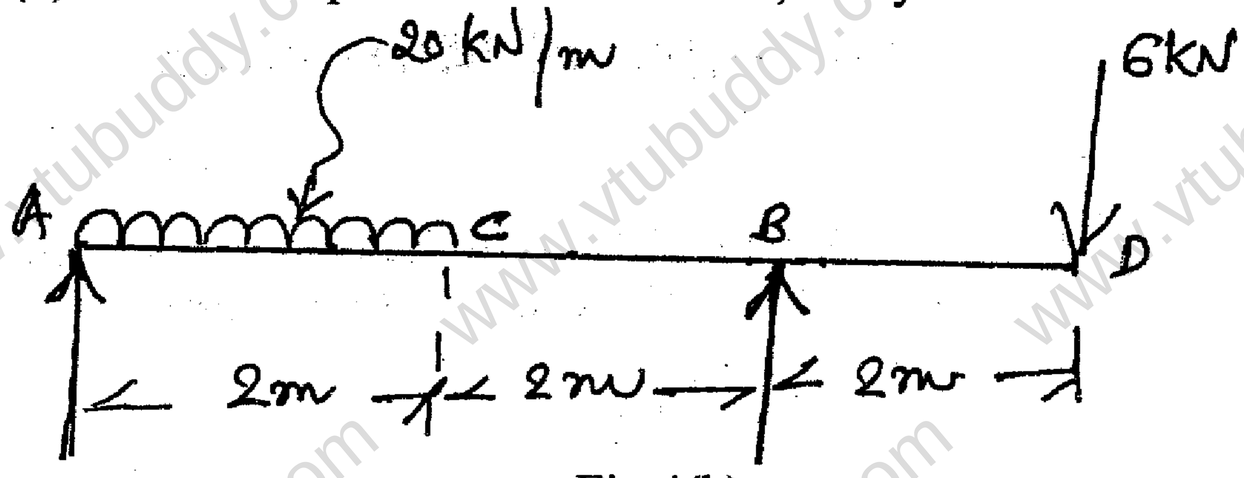

Fig.4(b)

PART – B

5 a. Distinguish between pure bending and ordinary bending. **(05 Marks)**

b. A beam with an I-section consists of 180mm×15mm flanges & a web of 280mm depth×15mm thickness. It is subjected to a bending moment of 120 kN.m and a shear force of 60 kN. Sketch the bending and shear stress distribution along the depth of the section. **(15 Marks)**

6 a. Establish the relation $EI\frac{d^2y}{dx^2} = M$ with usual notations. **(06 Marks)**

b. A simply supported steel beam having uniform cross section is 14m span and is simply supported at its ends. It carries a concentrated load of 120 kN and 80 kN at two points 3m and 9.5m from left end respectively. If the moment of inertia of the section is $160\times10^7 mm^4$ and E = 210 GPa, calculate the deflection of the beam at loaded points. **(14 Marks)**

7 a. Derive Euler's equation for crippling load of a column whose both ends are hinged. **(10 Marks)**

b. There are two columns, one a solid cast iron column 150mm in diameter and another hollow circular C.I. column of the same cross sectional area with a wall thickness of 25mm. Both the columns have the same length and are pinned at the ends. Show that the hollow column can withstand 4.55 times greater load than the solid column. **(10 Marks)**

8 a. A solid shaft of 60mm diameter runs at 160 R.P.M. Find the power that the shaft can transmit if the permissible shear stress is 80 N/mm^2 and the maximum torque is likely to exceed 30% over the average torque. Also find the angle of twist in degrees for a length of 8000 mm. Take G = 80 GPa. **(08 Marks)**

b. Compare the torsional strength and the angle of twist of the two shafts of the same length, weight and material, one of which is solid, and other is hallow with diameter ratio (d/D=0.5) for the same maximum shear stress. **(12 Marks)**

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