BTS 165 (D)

B.Tech. Degree III Semester (Supplementary) Examination in Mechanical Engineering, June 2002

ME 304 MECHANICS OF SOLIDS

(1998 Admissions)

Time: 3 Hours ME *Max. Marks: 100*

I a) Derive an expression for elongation due to self weight of a bar of uniform cross section and of length 'L', hanging vertically. (6)

b) A copper rod, 25mm in diameter is encased in steel tube 30mm internal diameter and 35mm external diameter. The ends are rigidly attached. The composite bar is 500mm long and is subjected to an axial pull of 30 kN. Find the stresses induced in the rod and the tube. Take E for steel = 2×10^5 N/mm^2 and E for copper = 1×10^5 N/mm^2. (14)

OR

II a) A body is subjected to two mutually perpendicular normal stresses accompanied by simple shear stress. Explain the method of construction by Mohr's circle for determining the principal stresses. (10)

b) At a point in a stressed material, tensile stresses acting on two mutually perpendicular planes are 100 N/mm^2 and 50 N/mm^2. There is a shear stress of 40 N/mm^2 also across these planes. Find the principal stresses and principal planes. (10)

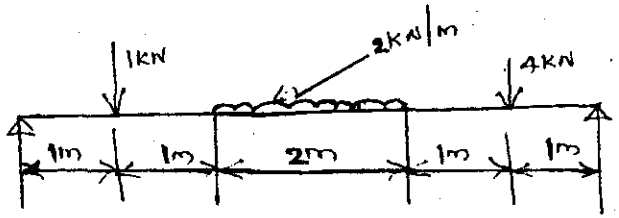
III a) Explain the assumptions used in theory of simple bending. (4)

b) A beam 30cm deep of symmetrical section has I = 8000 cm^4 and is simply supported over a span of 8m. Calculate
(i) the uniformly distributed load it may carry
(ii) a concentrated load it may carry at the centre, if the maximum bending stress is not to exceed 110 N/mm^2.

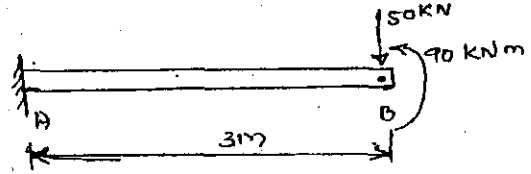
OR

(P.T.O.)

IV Draw shear force and bending moment diagram and mark salient values. (20)

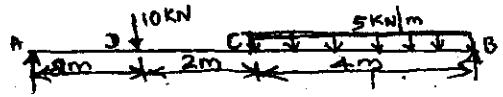


V Determine the slope and deflection at end B of prismatic cantilever beam AB when it is loaded as shown in fig. knowing that the fluxural rigidity of the beam is EI = 10MNm^2. Use moment area method. (20)



OR

VI A beam AB of 8m span is simply supported at its ends and is loaded as shown in fig. Determine (i) deflection at C (ii) Maximum deflection and (iii) slopes at end A Take E = 2 x 10^5 N/mm^2 and I = 1000 cm^4. (20)



VII a) What are the assumptions used for deriving Torsion Formula? (4)

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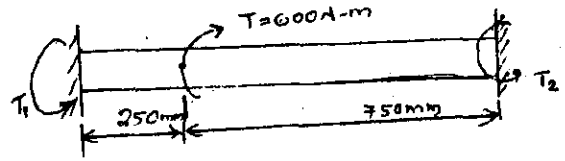
VII b) A steel shaft of 3cm diameter and 1 metre long is rigidly fixed at the ends. A twisting moment of 600 N-m is applied at a distance of 250mm from one end. Calculate (i) the fixing couples at the ends, (ii) maximum shear stress, (iii) the angle of twist of the section where the twisting moment has been applied. Take N = 0.82 x 10^5 N/mm^2 (16)



OR

VIII a) Derive the expression for power transmitted by a shaft of circular section subjected to a twisting moment T. (4)

b) A shaft has to transmit 375 kw power at 80 rpm. The shaft must not be stressed beyond 75 N/mm^2 and must not twist more than 1° in a length of 4m. Select a suitable diameter. Take N = 0.82 x 10^5 N/mm^2. (16)

IX a) Derive the expression for crippling load of a column both ends hinged.

b) Compare the ratio of the strength of a solid steel column to that of a hollow of the same cross-sectional area. The internal diameternal diameter of the hollow column is 3/4 of the external diameter. The columns have the same length and are pinned at the ends. (20)

OR

X a) Derive the expression for longitudinal stress and circumferential stress for a thin cylindrical shell. (6)

b) A boiler of 2m diameter is made of 20mm thick mild steel plates. Taking efficiency of longitudinal rivetted joint as 75%, calculate the permissible steam pressure in the boiler if the maximum tensile stress in the plate section through the rivets is not to exceed 100 N/mm^2. Calculate the circumferential stress in the solid plate section at this pressure and also the longitudinal stress in the plate section through the rivets of a circumferential joint if the efficiency is 65%. (14)

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