BTS (C) 065(D)

B.Tech Degree III Semester Examination November 2002

ME 304 MECHANICS OF SOLIDS

(1999 Admissions onwards)

Time: 3 Hours Max.Marks: 100

I. (a) Derive an expression between modulus of elasticity and modulus of rigidity. (8)

(b) A reinforced concrete column 50 cm x 50 cm in section is reinforced with 4 steel bars of 2.5 cm diameter, one in each corner. It is supporting a load of 200 KN. Determine the stresses developed in the concrete and steel rods. (12)

OR

II. (a) Derive an expression for the stresses on an oblique plane of a prismatic bar subjected to direct stresses on two mutually perpendicular directions. (8)

(b) At a point in an elastic body, there are two mutually perpendicular tensile stresses of 400 N/mm^2 and 300 N/mm^2. There is also a shear stress of 200 N/mm^2 . Determine by Mohr's circle the magnitudes of principal stresses. (12)

III. (a) With reference to the bending of beams explain the following terms:
(i) Neutral axis (ii) Moment of resistance. (8)

(b) A beam 20 mm wide and 100 mm deep is simply supported over a span of 5 m. If the safe bending stress is not to exceed 8 N/mm^2 determine the maximum uniformly distributed load that the beam can carry without failure. (12)

OR

IV. A beam 5.5m long rests on supports 3.75m apart. The overhangs at the left side and right side are 0.75m and 1m respectively. A concentrated load of 2 KN acts at the left free end and another concentrated load of 3 KN acts at the right free end. The beam also carries a uniformly distributed load of 1 KN/m over the supported span. Construct the S.F. and B.M. diagrams and indicate the points of contraflexures. (20)

V. Derive an expression for the slope and deflection of a cantilever uniformly loaded. (20)

OR

VI. Abeam of uniform cross section is simply supported over a span of 6m.
Two concentrated loads 45 KN and 50 KN act at 1m and 3m, respectively from the left hand support. Determine the position and magnitude of the maximum deflection .
Take E = 200 GN/m^2 and I of the section of the beam = 85 x 10^{-6} m^4. (20)

VII. A 5 cm diameter aluminium solid shaft 100 cm long is replaced by a tubular steel shaft of same length and outside diameter of 5 cm. Determine the inside diameter of the hollow steel shaft, if both the shafts should have the same angle of twist per unit torsional moment over the total length. Assume modulus of rigidity of steel to be three times that of aluminium. (20)

OR

VIII. A solid shaft simply supported between bearings 150 cm apart is to transmit 100 KW at 250 rpm. It also carries a central concentrated load of 20 KN. Design the shaft diameter if the permissible shear stress and normal stress in the shaft material are 60 N/mm^2 and 90 N/mm^2 respectively. (20)

IX. (a) What are the assumptions in the Euler's column theory ? (8)

(b) Compare the strength of a solid steel column to that of a hollow column of the same cross-sectional area. The ratio of the diameters of the hollow column is 0.6. Both the columns have the same length and are pinned at the ends. (12)

OR

X. A pipe of 50 cm inside diameter and 15 cm thick is subjected to an internal pressure of 8 MPa. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. (20)

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