BT – MRE-III– 08 – 044

B.Tech Degree III Semester Examination in Marine Engineering, December 2008

MRE 304 MECHANICS OF SOLIDS

Time : 3 Hours Maximum Marks : 100

I. (a) Derive the equation for the elongation of a uniformly tapering bar of length L and diameter d_1 and d_2 at the ends. The bar is hanging freely with its larger diameter end fixed at top. (10)

(b) A composite member consists of a steel tube of external diameter 20 cm and wall thickness 2 mm, filled with concrete. Young's modulus of steel and concrete is $2x10^5 N/mm^2$ and $0.2 \times 10^5 N/mm^2$ respectively. Find the stresses in steel and concrete when the member is subjected to axial compression of 10 kN. (10)

OR

II. (a) Write down the general equation for strain energy and deduce the expression for strain energy for an axially loaded truss member from that. (4)

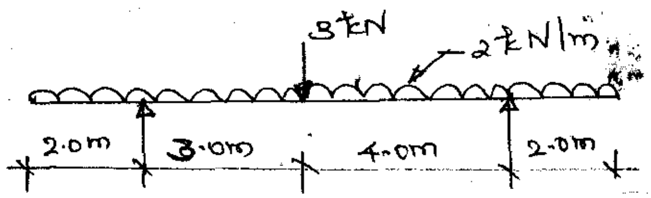
(b) Write down the expressions for shear modulus and bulk modulus in terms of Young's modulus and Poisson's ratio. (4)

(c) What is the significance of principal stress in the design of a member? (4)

(d) Explain the use of strain rosette for the calculation of principal stress. (8)

III. (a) Write down the assumptions.on simple bending of beams and explain the implications of these. (8)

(b) Draw the bending moment diagram and shear force diagram of the beam shown in Fig. (12)

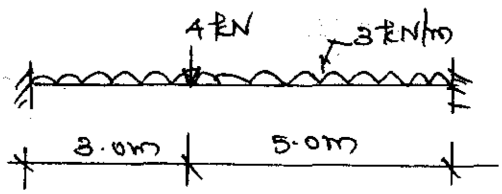


OR

IV. Calculate the stresses in the extreme fibre of a simply supported beam which has its cross section as an 'I' of upper flange 200 mm x 12 mm, web 400 mm x 14 mm and bottom flange 300 mm x 10 mm. The beam has span 8.0 m and carries a udl of 1t/m and a central concentrated load of 2 kN. Neglect self weight of the beam. (20)

V. (a) Explain the Macaulay's method of successive integration for the calculation of the deflection of beams. (6)

(b) Draw the bending moment diagram and shear force diagram of the fixed beam shown in Fig. (14)



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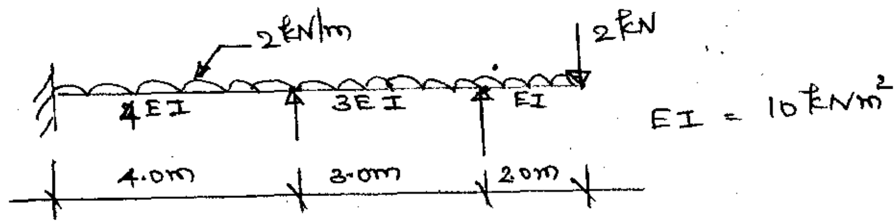
OR

VI. Analyse the continuous beam shown in Fig. using Clapeyron's three moment equation. (20)



VII. A steel bar 20 mm diameter is encased in a closely fitting brass tube of 30 mm external diameter, securing fixity at both ends. The compound shaft is subjected to a torque of 500 Nm and the angle of twist produced on a gauge length of 250 mm was 2^o. If the modulus of rigidity for steel is 80 GN/m^2, calculate the modulus of rigidity of brass. (20)

OR

VIII. (a) A close coiled helical spring has wire diamater 10 mm, and mean diameter 120 mm. Find the maximum shear strain in the wire when the spring is subjected to a pull of 400 N. Find the deflection of the spring if it has 12 turns and shear modulus of the material is 80 GN/m^2. (10)

(b) Compare the strain energy per unit volume of a solid shaft and a hollow shaft when subjected to pure torsion. (10)

IX. Write short notes on ***any four*** of the following: (4 x 5 = 20)

(a) Determination of membrane stresses in a thin shell.
(b) Lame's theorem for thick cylindrical shells.
(c) Assumptions made in Euler theory of column buckling.
(d) Influence of boundary conditions of the column on the Euler buckling load.
(e) Rankine – Gordan formula.
(f) Analysis of wire wound cylindrical shells.
(g) Maximum shearing stress theory of failure.
(h) Maximum Principal stress theory of failure.

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