BT-MRE-III/12.17-1718 Reg. No. | | | | | | | | |

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B.Tech. Degree III Semester Examination in Marine Engineering December 2017

MRE 1304 MECHANICS OF SOLIDS

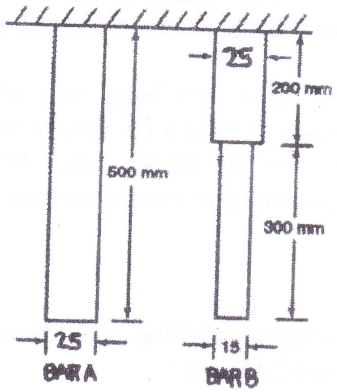
(2013 Scheme)

Time: 3 Hours Maximum Marks: 100

(5 × 20 = 100)

I. (a) Explain the terms shear stress, shear strain, Young's modulus, modulus of rigidity and Poisson's ratio. (5)

(b) An axial blow applied to bar A shown in figure produced instantaneous extension of 0.25 mm. What will be the instantaneous stress and extension in the bar B if same blow is applied axially? The bars are having circular cross section. Take $E = 2 \times 10^5 N/mm^2$. (15)



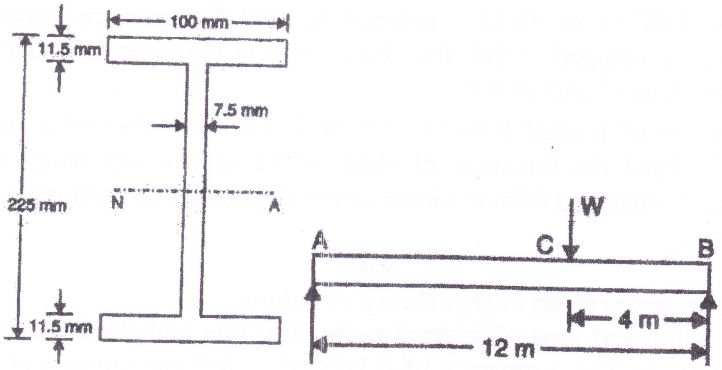
OR

II. (a) Explain Mohr's circle. (5)

(b) A rectangular block is subjected to two perpendicular stresses of 10 MPa tension and 10 MPa compression. Determine the stresses on planes inclined at (i) 30° (ii) 45° and (iii) 60° with the plane of compressive stress. (15)

III. (a) Derive the bending equation for a beam subjected to simple bending. (8)

(b) An I-section shown in figure is simply supported over a span of 12 m. If the permissible bending stress is 80 N/mm^2, what concentrated load can be carried at a distance of 4 m from one support? (12)

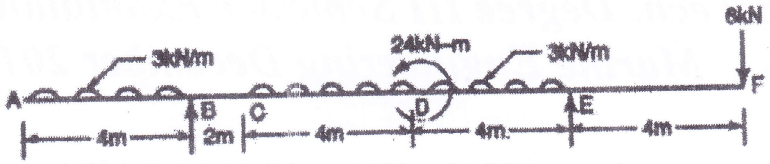


OR

(P.T.O.)

IV. (a) Define the terms 'shear force' and 'bending moment'. How are they considered positive and negative? (5)

(b) Draw the shear force and bending moment diagram for the beam given below: (15)



V. (a) What is the relationship between slope, deflection and radius of curvature of a simply supported beam? (5)

(b) A beam is 10 m long and is simply supported at the ends. It carries concentrated loads of 100 kN and 60 kN at distances of 2 m and 5 m respectively from left end. Calculate the deflection under each load. Find also the maximum deflection. Take $I = 18 \times 10^8$ mm^4 and $E = 200$ kN/mm^2. (15)

OR

VI. A fixed beam AB of span 6 m is carrying a uniformly distributed load of 4 kN/m over the left half of span. Find the fixing moments and support reactions. (20)

VII. (a) A solid circular shaft is to transmit 300 kW at 100 rpm. If shear stress is not to exceed 80 N/mm^2, find the diameter of shaft. What is the percentage in saving, if the shaft is replaced by a hollow one, whose internal diameter is equal to 0.8 of the external diameter, the length, the material and the allowable maximum shear stress being the same? (10)

(b) A steel rod of 25 mm diameter is tightly fitted to a brass tube of internal diameter 25 mm and external diameter 40 mm to form a composite bar. If the permissible stresses in brass and steel are 50 N/mm^2 and 80 N/mm^2 respectively, find the maximum torque the composite section can resist. Take $G_b = 40$ N/mm^2 and $G_s = 80$ kN/mm^2. (10)

OR

VIII. (a) Explain strain energy in torsion. (5)

(b) A bumper is to be designed to arrest a wagon weighing 500 kN moving at 18 km/h. Specifications of buffer springs available are : (15)

Diameter	=	30 mm
Mean radius	=	100 mm
Number of turns	=	18
Modulus of rigidity	=	80 kN/mm^2
Maximum compression permitted	=	225 mm

Find the number of springs required for the buffer.

IX. (a) A thin cylindrical shell, 2 m long has 200 mm diameter and thickness of metal 10 mm. It is filled completely with a fluid at atmospheric pressure. If an additional 25000 mm^3 fluid is pumped in, find the pressure developed and hoop stress developed. Find also the change in diameter and length. Take $E = 2 \times 10^5$ N/mm^2 and $\mu = 0.3$. (10)

(b) The diameter of riveted boiler is 1.5 m, it has to withstand a pressure of 2 N/mm^2. Find the thickness of plates to be used if efficiency is 85% in longitudinal joints and 40% in circumferential joints. The permissible stress is 150 N/mm^2. (10)

OR

X. (a) Explain maximum strain energy theory of failure. (8)

(b) A thick cylindrical pipe of internal radius 100 mm and thickness 100 mm is subjected to fluid at a pressure of 6 N/mm^2. Find maximum and minimum hoop stress across the section. (12)

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