INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR

DEPARTMENT OF OCEAN ENGINEERING AND NAVAL ARCHITECTURE

Date : 24.02.10 AN | **Full Marks : 30**

Mid Spring Semester 2009- 2010 | **Time : 2 Hrs.**

Subject No. : NA21004 | **2nd.yr. B.Tech., Dual Degree B.Tech.**

Subject Name : Ship Strength

No. of Students : 33

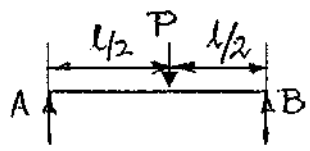
Instructions : Answer Any Five Questions

Q.1.a).Derive the expressions for strain energy for the following two cases:

i). Axial loading

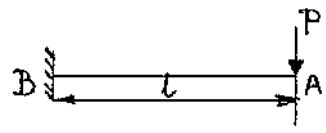
ii).Bending 4

b).A beam of span *'l'* carries a concentrated load *'P'* at mid span. Find the central deflection. *See Fig.* 2



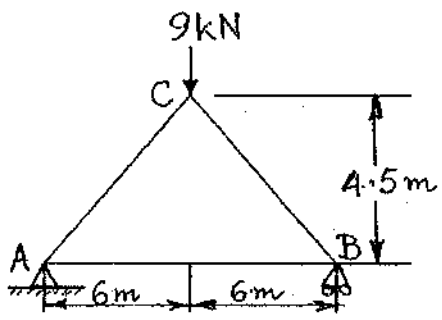
Q.2.a). State and explain the first theorem of Castigliano. 4

b). Use Castigliano's theorem to find the deflection at the free end of a cantilever carrying a concentrated load at the free end. *See Fig.* 2



Q.3.a). Discuss Maxwell's method for determining the deflection of truss joints. 2

b). Find the vertical and horizontal deflections of the joint C of the pin jointed truss shown in the following figure. The cross sectional area of the horizontal member is 150mm^2 and the cross sectional areas of the members AC and BC are 200mm^2 each. E = 200 kN/mm^2. *See Fig.* 4



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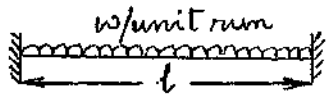
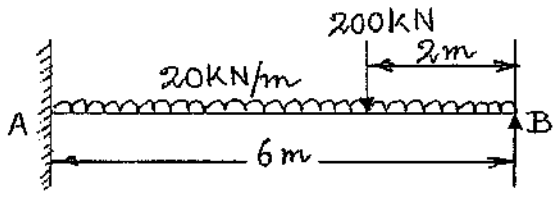
Q.4.a).For a beam fixed at both ends give the procedure for deriving the fixed end moments. 2

b).For a beam fixed at both ends and carrying a uniform distributed load of 'w' per unit run over the whole span find the expressions for fixed end moments 'M_a' and 'M_b' and calculate the deflection 'y_c' at mid span. Also draw the SF and BM diagrams. *See Fig.* 4

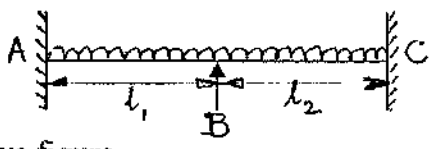


Q.5.a).State and explain the second theorem of Castigliano. 2

b).Find the reaction at the prop for the loaded propped cantilever shown in the figure. 4

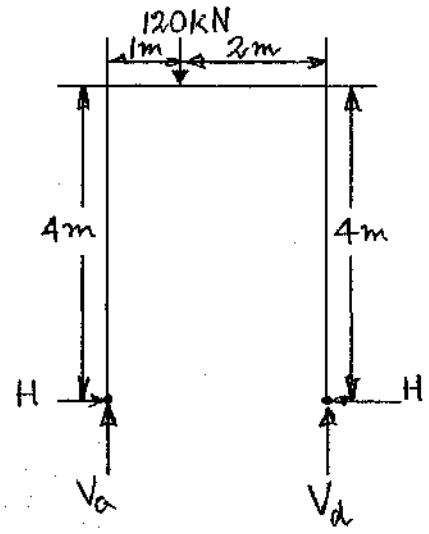


Q.6.a).Derive the Clapeyron's relation of three moments for the beam with distributed



load shown in the above figure. 2

b).A two hinged rectangular portal frame ABCD of uniform flexural rigidity consists of columns of 4 metres height and a beam of 3 metres length. The frame carries a point load of 120 kN on the beam at a distance of 1 metre from B. Find the horizontal thrust and draw the BM diagram for the frame shown in the figure.



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