SE - Sem - III - Mechanical - Old

SOM

3/12/15

(OLD COURSE) **QP Code : 1139**

(3 Hours) **[Total Marks : 100**

N. B. 1) Question No. 1 is compulsory.
2) Attempt any four questions from remaining six questions
3) Assume suitable data if required

1. Answer any **four** of the following **[4x5=20]**

a) Define Poisson's ratio, Bulk modulus. Write the relationship among the elastic constants.

b) Define columns and struts. What are the assumptions made in Euler's theory of columns?

c) Derive an expression for strain energy stored in shear.

d) Derive torsion formula.

e) A material has Young's Modulus of 2×10^5 N/mm^2 and Poison's ratio of 0.32. Calculate the Modulus of Rigidity and Bulk Modulus of material.

f) derive flexural equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notations

2 (a) A simply supported beam of 8 m span carries a U.D.L. over the entire span. If the maximum permissible bending stress in tension is 30 MN/m^2 and in compression is 45 MN/m^2. Find the U.D.L. intensity and the bending stresses. The cross section is I – Section with, Top flange 100 x 30; Web 30 x 120; Bottom flange 120 x 50 (all dimensions in mm). **[10]**

(b) A hollow cylindrical column is fixed at both ends. The length of the column is 4 m and carries an axial load of 250 KN. Design the column by Rankine's formula. Take F.O.S.= 5.The internal diameter may be taken as 0.8 times the external diameter. Take σ_c=550 N/mm^2 and α=1/1600 in Rankine's formula **[10]**

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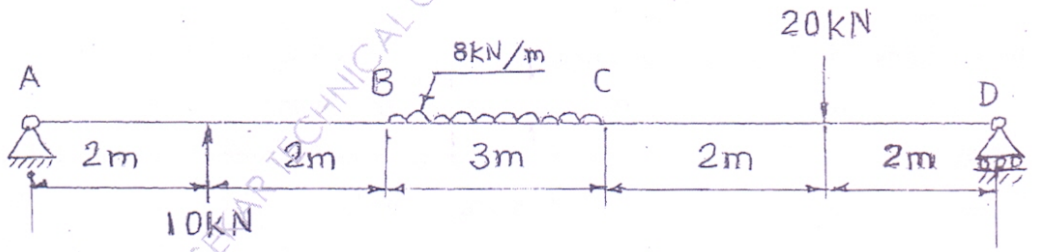
3. (a) A symmetrical I-section with flanges 250mm x 20 mm has a web160 mm X 10 mm. If the shear force acting on the section is 80 KN, find maximum shear stress developed in the section and draw shear stress distribution diagram. [10]

(b) A closed cylindrical vessel made of steel plates 6 mm thick with plane ends carries fluid under a pressure of 6 N/mm^2. The diameter of the cylinder is 210 mm and the length is 750 mm. Calculate the longitudinal and hoop stresses in the cylinder wall and determine the changes in diameter, length and volume of the cylinder. Take 1/m = 0.35 and E= 2.1 X 10^5 N/mm^2 [10]

4 (a) Find the maximum and minimum stress intensities at the base of a uniform circular chimney, having external and internal diameters as 5m and 3m. The height of the chimney is 25m and it is subjected to wind pressure of 1.5 kN/m^2 . The density of masonry may be taken as 21 kN/m^3. [10]

(b) Determine the deflection at B and slope D for a simply supported beam shown in the Fig. and also find the maximum deflection and its location. Take E = 2 x 10^5 N/mm^2, I = 300 x 10^8 mm^4 [10]



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5. **(a)** A steel bar is placed between two copper bars each having the same area and length as steel bar at 25^0. At this stage they are rigidly connected together at both ends. When the temperature is raised to 325^0C then the length of the bars is increased by 1.5mm. Determine the original length and final stresses in the bar.

$E_{ST} = 2.1 \times 10^5$ N/mm^2; $E_{CU} = 1 \times 10^5$ N/mm^2;

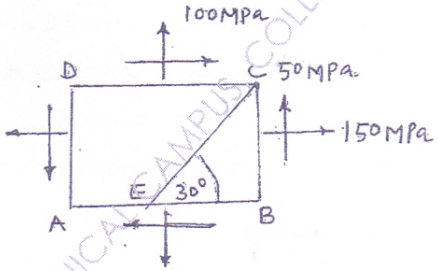
$\alpha_{ST} = 12 \times 10^{-6} / {}^0$C; $\alpha_{CU} = 17.5 \times 10^{-6} / {}^0$C [10]

(b) Determine the diameter of a solid shaft, which will transmit 300 KW at 250 rpm. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1^0 in a shaft of length 2 m. Take modulus of rigidity = 1×10^5 N/mm^2 [10]

6 **(a)** A plane element is subjected to the stresses as shown in figure. [10]

(i) Determine the principle stresses and their planes

(ii) The magnitude and directions of the maximum shear stresses.



(b) A tube of aluminium 40 mm external diameter and 20 mm internal diameter is fitted on a solid steel rod of 20 mm diameter. The composite bar is loaded in compression by an axial load P. Find the stress in aluminum, when the load is such that the stress in steel is 70 N/mm^2, also find the value of P.

$E_s = 2 \times 10^5$ N/mm^2 and $E_{Al} = 7 \times 10^4$ N/mm^2 [10]

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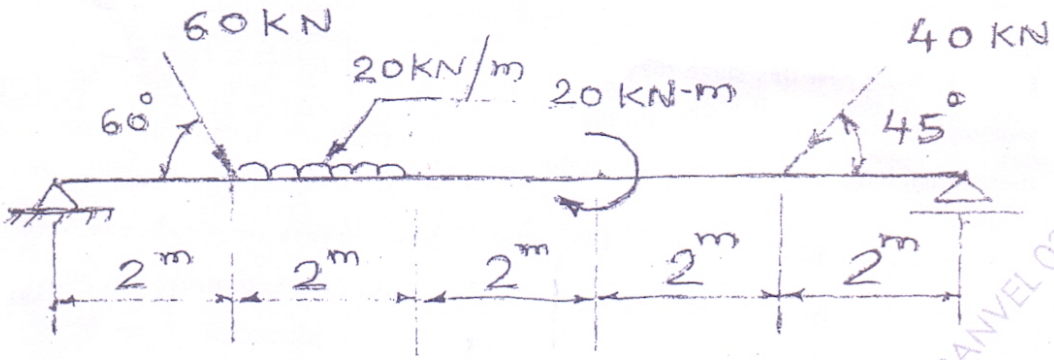
7(a) For the beam shown below, draw S.F, BM and AF diagrams. [10]



(b) An unknown weight falls through 8 mm on a collar rigidly attached to the lower end of a solid vertical bar, 4m long and 40 mm x 20 mm in section. If the maximum instantaneous extension is known to be 3 mm, what is the corresponding stress and the value of the unknown weight. Take $E = 2 \times 10^5$ N/mm^2 [10]