SEM - III - CBGS - Mechanical - SOM

Date: 26/05/2015

50.

QP Code :4779

(3 Hours) [Total Marks : 80

N. B. : (1) Question No.1 is **compulsory**.
(2) Answer any **three** questions from remaining **five** questions.
(3) Assume suitable data wherever required but justify the same.
(4) Answer to the questions showed be grouped and written together.

1. Answer any **four** questions:– 20
(a) Draw stress strain curve for ductile material & explain salient point on it.
(b) What is sagging and hogging moment in bending moments gives its sign conventions.
(c) Derive flexural formula

$$\frac{M}{I}=\frac{F}{Y}=\frac{E}{R} \text{ OR } \frac{M}{I}=\frac{6}{Y}=\frac{E}{R}$$

State assumption made in simple bending.
(d) What are the assumption made in theory of pure torsion & derive equation of Torsion.
(e) What are the assumptions made in the analysis of struts & column by Euler's buckling theory? What are its limitations?

2. (a) A copper rod 36 mm diameter is encased and rigidly attached at the end of a steel tube which is 50 mm external diameter, thickness of metal being 5mm. The composite section is subjected to an axial pull of 100 KN. Find the stress induced in each metal & the extension on the length of 1.5 m.Take Es= 2 x10^5N/mm^2 and Ec= 1.1 x 10^5N/mm^2. 10
(b) Determine the value of load W, if support reactions are equal. Also draw shear force diagram and bending moment diagram for the beam loaded as shown in fig.l. 10

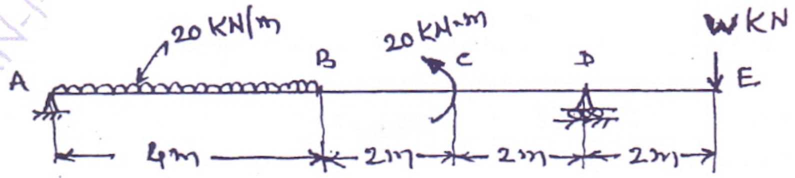

Fig. 1

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3. (a) A cast iron beam section is of I section with top flange 80mm x 20mm thick, bottom flange 160 mm x 40 mm thick and the web 200mm deep and 20 mm thick. The beam is freely supported on a span of 5 meter. If the tensile stress is not to exceed 20 N/mm^2, find the safe uniformly distributed load, which the beam can carry, .also find the maximum compressive stress. **10**

   (b) A solid shaft is required to transmit 330KW at 120 rpm. The shear stress of material must not exceed 80 N/mm^2, find the diameter of shaft required, if the above shaft is to be replaced by hollow one with diameter ratio 3:5 and maximum shear stress remain unchanged. Calculate the percentage saving in weight that could be obtained. **10**

4. (a) Show that the strain energy equation in a simply supported beam carrying a UDL w/m is given by , **10**

$$U = \frac{W^2L^5}{240EI}$$

   (b) Determine slope at the supports and deflection under other points. Also find maximum slope and its position for fig. 2 Take EI = constant. **10**

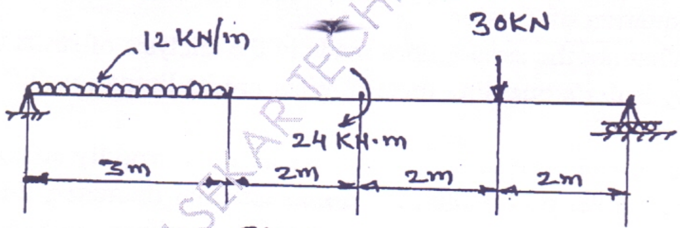

Fig.2.

5. (a) A cylindrical vessel with hemispherical ends is 1m long on its cylindrical portion and has 0.5 m diameter. Thickness of wall on cylindrical portion is 6 mm .Taking internal pressure as 1MPa, E = 200GPa & μ = 1/m =0.3. **10**

   Determine

   1. Thickness of wall of hemispherical portion
   2. Change in volume of vessel

   (b) A hollow column of C.I. whose outside diameter is 200 mm and has a thickness of 20mm, it is a 4.5 m long and is fixed at the both ends. calculate the safe load by Rankin's formula using a factor of safety of 4. Calculate slenderness ratio and the ratio of Euler's and Rankin's critical load. Take 6c= 550 N/mm^2, a=1/1600 and E = 8 x 10^4 N/mm^2 **10**

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6. (a) An area in the form of L section is shown in the fig. 3 (i) find the moment of inertia I_{xx}, I_{yy} and I_{xy} about its centroidal axes. (ii) Also determine the principal moment of inertia. **10**

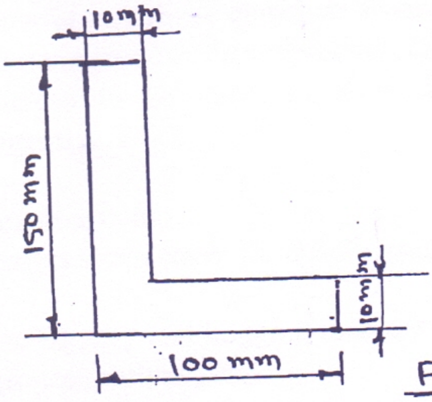

Fig-3

(b) A steel bar is placed between two copper bars each having the same area and length, as the steel bar at 15°. At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315°, the length of the bars inceases to 1.5mm. Determine the original length and the final stresses in the bars. **10**
Take $E_s = 2.1 \times 10^5$ N/mm², $E_c = 1 \times 10^5$ N/mm², $\alpha_s = 0.000012$ per ^{0}c, $\alpha_c = 0.0000175$ per ^{0}c.

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