Prod

SE-III / Strength of materials

03.12.15

QP Code : 5156

TIME- 3 Hrs **Total Marks-80**

N.B. : 1. Question No **1** is **compulsory**
2. Attempt any **Three** questions from the remaining five questions.
3. Assume any **suitable data** if necessary with justification.
4. Figures to the right indicates full marks

Q.1 Attempt any **four** of the following questions. **20**

a) Draw and explain Mohr's circle for two perpendicular unlike direct stress.

b) Obtain an expression for strain energy stored due to suddenly applied load with impact.

c) A bar of 20 mm diameter is subjected to a pull of 50 KN. The measured extension over a gauge length of 20 cm is 0·1 mm and the change in diameter is 0·0035 mm. Calculate the Poisson's ratio and modulus of elasticity.

d) Draw the shear force and bending moment diagram for a simply supported beam of length L, subjected to clockwise couple M at the centre of the beam.

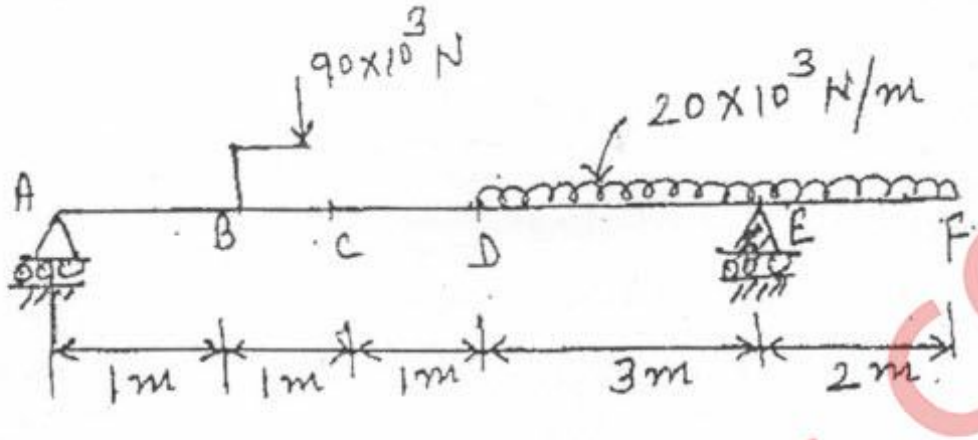
e) A cantilever 1.5 m long carries a UDL over the entire length. Find the deflection at the free end if the slope at the free end is 1.5^0.

Q. 2 a) A steel bar is placed between two copper bars each having the same area and length as the steel bar at 15°C. At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315°C, the length of the bars increases by 1·5mm. Determine the original length and final stresses in the bars. **10**

Take $E_S = 2.1 \times 10^5$ N/mm^2 $E_{Cu} = 1 \times 10^5$ N/mm^2

$\alpha_S = 12 \times 10^{-6}/^0$ C $\alpha_{Cu} = 17.5 \times 10^{-6}/^0$ C.

b) Draw the shear force and bending moment diagram. **10**



Q. 3 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. **10**

The cross section is as below: (all dimensions in mm).

Top flange 100 x 30

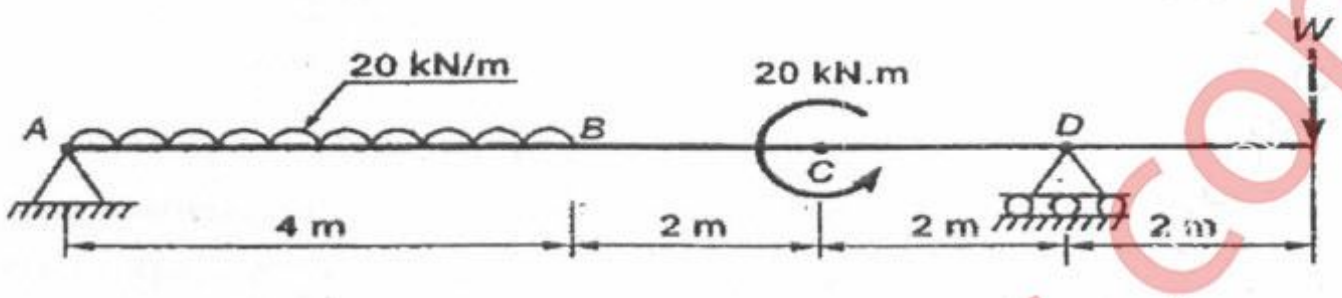
Web 30 x 120

Bottom flange 120 x 50

b) A square column of 400 mm X 400 mm size is subjected to an axial load of 400 KN. In addition to this, a load of 40 KN is acting at an eccentricity of 20 mm about both x-x and y-y axes. Find the stresses at all four corners. **10**

Q.4 a) A hollow shaft of diameter ratio *3/5* is to transmit 250 kW at 70 rpm. The maximum torque being 20% greater than mean. The shear stress is not to exceed 60 N/mm^2 and twist in a length of 4 m is not to exceed 3 degrees. Calculate the external and internal diameters which would satisfy both the above conditions. Take $C = 8 \times 10^4$ N/mm^2. **10**

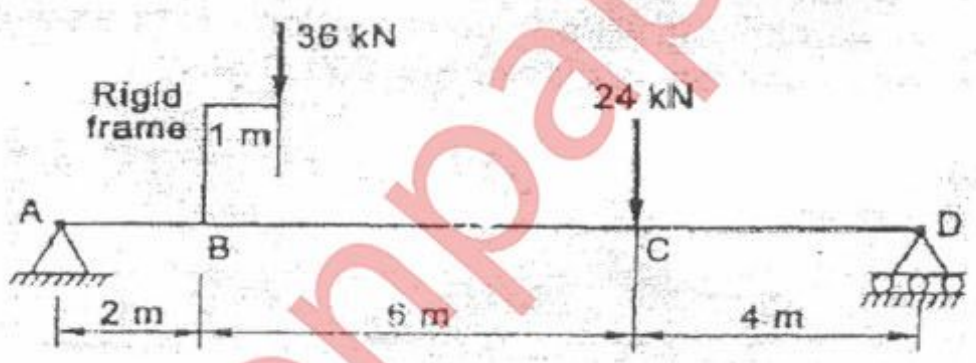
b) A beam ABCDE is supported at A & D and is loaded as shown in **figure**. Determine the value of W so that reaction at A & D are equal. For this value of W draw shear force and bending moment diagrams. 10



Q.5 a) A 12 m long beam is simply supported and is subjected to forces as shown in **figure.** 10

Determine the (i) Deflection at points Band C and

(ii) Maximum deflection. Flexural rigidity is EI.



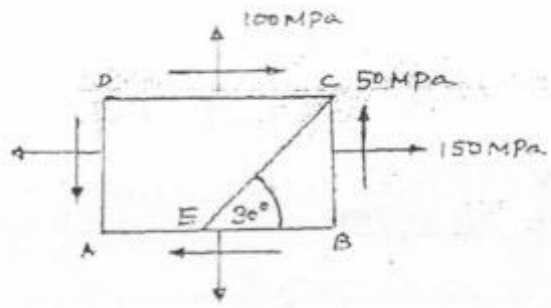
b) A simply supported beam carries a UDL of intensity 2.5 KN/m over a span of 5m.The cross-section is T-section having flange 125 mm x 25 mm. Calculate maximum shear stress for the section of the beam. Also draw the shear stress distribution marking important values. 10

Q.6 a) A plane element is subjected to the stresses as shown in figure. 10

Determine (a) the principle stresses and their planes

(b) the magnitude of normal and shear stress on inclined plane and

(c) the magnitude and directions of the maximum shear stresses.



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**