SE-III / Strength of Materials / 02-12-14

PROD

Q.P. NO : 14599

(3 Hours) **[Total Marks : 80**

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

1. Answer any **four** of the following :–

(a) If a round bar of 37.5 mm diameter 2.4 m length is stretched by 2.5mm, find its bulk modulus and lateral contraction. Take young's modulus = 110GPa shear modulus 42 GPa for the material of the bar. 5

(b) Derive the flexure formula. 5

$$\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$$

(c) Draw Shear Force and Bending moment diagram for the comtilever beam shown below - 5

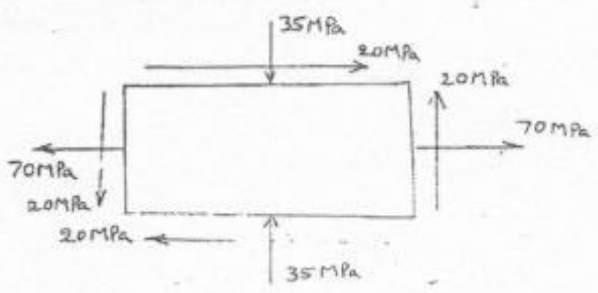
(d) Find the maximum power that can be transmitted through a 50 mm diameter at 150 rpm, if the maximum permissible shear stress in the shaft is 80N/mm². 5

(e) For a rectangular section show that the maximum shear stress is 1.5 times the average shear stress. 5

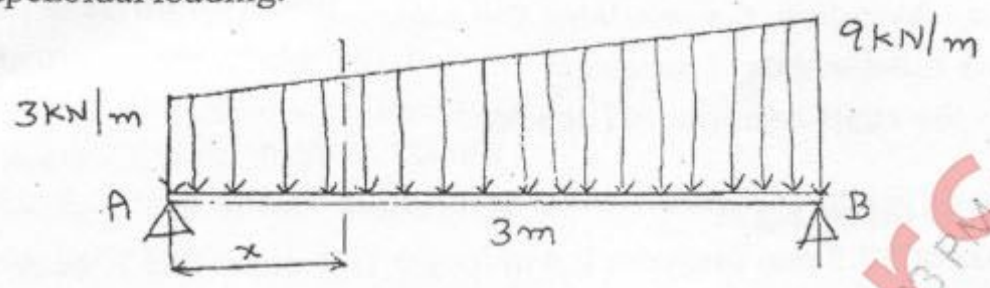
2. (a) Composite section made up of copper tube of 150 mm diameter enclosed with steal tube 150 mm internal diameter and 12 mm thick. Length of assembly is 500 mm is fastened at both ends. Now temperature of assembly is raised by 75°C. Find the stress developed in each material and change in length of assembly. 10

Take $E_s = 2 \times 10^5$ MPa $\alpha_s = 12 \times 10^{-6}/^0c$
$E_c = 1 \times 10^5$ MPa $\alpha_c = 18 \times 10^{-6}/^0c$

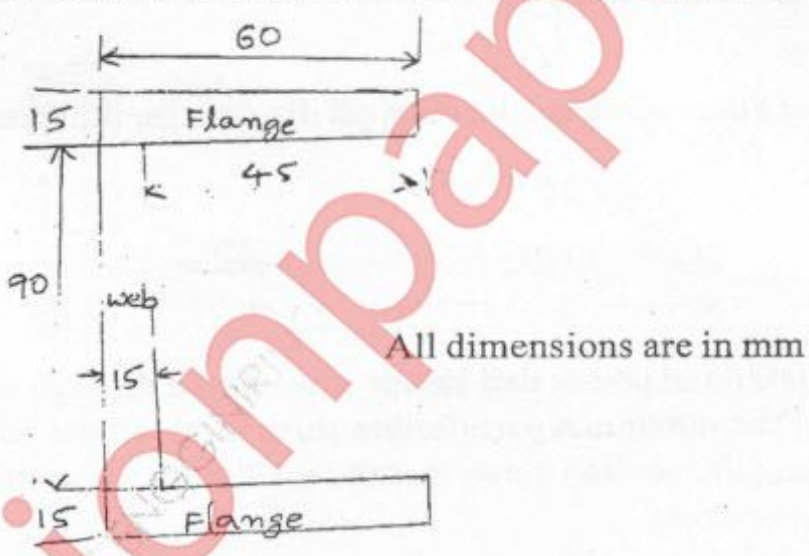
(b) A strained material is subjected to stress system as shown in figure. Determine the principle planes and principle stresses. Also determine the maximum shear stress and the plane on which it acts. 10



3. (a) Draw the SFD and BMD for the simply supported beam shown in figure subjected to a trapezoidal loading. 10

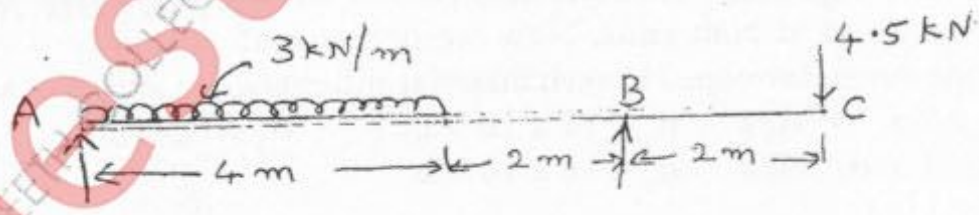


(b) A beam of channel section 120 mm x 60 mm has uniform thickness of 15 mm. Draw shear stress distribution diagram for a vertical section where shearing force is 50 KN. Find the ratio between maximum and mean shear stresses. 10



All dimensions are in mm

4. (a) Determine the deflection at the free and C for the overhanging beam ABC supported and loaded as shown in figure. Take E = 200 GPa and I = 13.5 x $10^{-6}m^4$ 10



(b) What do you mean by 'Limit of Electricity'? Derive an expression for care of section of circular and rectangular sections. 10

5. (a) A hollows shaft of external diameter 120 mm transmits 30 kw power at 200 r.p.m . Determine the maximum internal diameter, if maximum stress in the shaft is not to exceed 60N/mm². 10

(b) Find the Euler Crushing load for a hollow cylindrical cast iron coloumn 200 mm external diameter and 25 mm thick., if it is 6 m long and hinged at both ends. Take $E = 1.2 \times 10^6$ N/mm². Compare the load with the crushing load as given by Rankine formula, take $f_c = 550$ N/mm² and $\alpha = \frac{1}{1600}$ 10

6. (a) A 200 kg weight is dropped on to a collar at the lower end of a Vertical bar of 3 m long and 28 mm diameter. Calculate the height of drop, if the maximum instantaneous stress is not to exceed 120 N/mm² . What is the corresponding instantaneous elongation ? Take $E = 2.0 \times 10^5$ N /mm². 10

(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 125x 25 mm and web 175 X 25 mm, total depth of 200 mm. Calculate maximum compressive and tensible bending stresses and draw bending stress distribution diagram at mid-span. 10
