B.E. / B.Tech. Civil Engineering (Model Curriculum) Semester-IV

# PCC-CE404 - Strength of Materials

P. Pages : 2 **GUG/S/25/13718**

Time : Three Hours * 2 1 9 3 * Max. Marks : 80

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Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

**1.** a) Explain stress strain behaviour of mild steel bar under tension with neat sketch. **8**

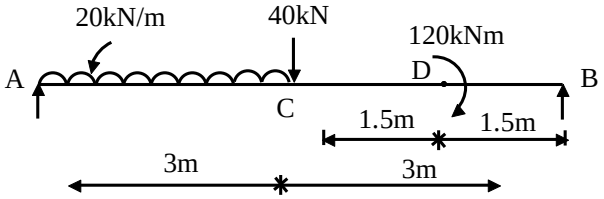
b) A circular rod of diameter 20mm and 500mm long is subjected to a tensile force 45kN. The modulus of elasticity for steel may be taken as 200 kN/mm$^2$. Find stress, strain and elongation of the bar due to applied load and also find same for tensile force 30 kN. **8**

**OR**

**2.** a) Derive relationship between E, G & K. **8**

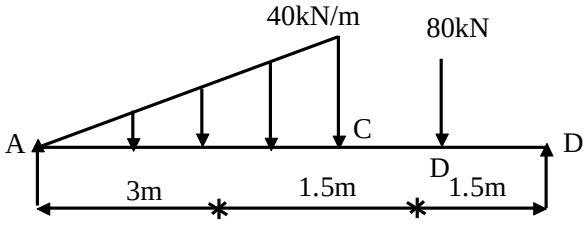
b) A circular rod of 100mm diameter and 500mm long is subjected to a tensile force of 1000kN. Determine modulus of rigidity bulk modulus & change in volume. If Poisson's ratio is 0.3 & Young's modulus $E = 2x10^5 N/mm^2$ **8**

**3.** Draw shear force and bending moment diagram for the beam shown in fig. below **16**




**OR**

**4.** Draw shear force and bending moment diagram for the beam shown in fig. **16**




**5.** A cost iron beam has an I section with top flange 80mm x 40mm, web 120mm x 20mm & bottom flange 160mm x 40mm. If the tensile stress is not to exceed 30 N/mm$^2$ and compressive stress 90 N/mm$^2$, What is the maximum uniformly distributed load the beam can carry over a simply supported span of 6m, if the larger flange is in tension. **16**

**OR**

**6.** a) A beam of unsymmetrical I section has the following details. **10**
Top flange : 200mm x 20mm, web: 200mm x 10mm.
Bottom flange : 100mm x 10mm. The centroid of the section is at a distance of 157.86 mm from the base & $I_{XX} = 50.2 \times 10^6 \text{ mm}^4$ . Draw shear stress distribution diagram at a section, where the shear force is 100 kN.

b) For square section with one of its diagonal horizontal, determine maximum shear stress in terms of mean shear stress. **6**

**7.** a) Derive the torsional formula **8**

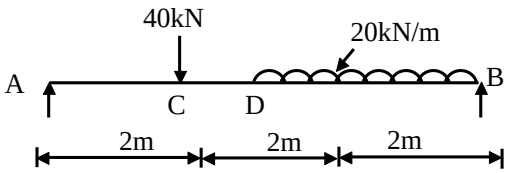
$$\frac{T}{J} = \frac{q}{r} = \frac{G\theta}{L}$$

b) Determine the diameter of a solid shaft which will transmit 440 kW at 280 rpm. The angle of twist should not exceed one degree per meter, length and the maximum torsional shear stress is to be limited to 40 $\text{N/mm}^2$ Assume G = 84 $\text{kN/mm}^2$ **8**

**OR**

**8.** Find the maximum deflection & the maximum slope for a beam loaded as shown below **16**

$EI = 15 \times 10^9 \text{ kN.mm}^2$




**9.** At a point in strained material there is a tensile stress of 80 $\text{N/mm}^2$ upon a horizontal plane and a compressive stress of 40 $\text{N/mm}^2$ upon a vertical plane. There is also a shear stress of 48 $\text{N/mm}^2$ upon each of these planes. Determine the planes of maximum shear stress at a point. Determine also the resultant stress on the planes of maximum shear stress. **16**

**OR**

**10.** a) Explain concept of shear centre with help of neat sketch. **6**

b) Determine the differential equation of equilibrium stress in two-dimensional state of stress. **10**

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