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

PCCCE404 - Strength of Materials

P. Pages : 3 **GUG/W/23/13718**

Time : Three Hours * 7 3 0 4 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Diagrams and Chemical equation should be given wherever necessary.
4. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Derive relation between modulus of elasticity (E) modulus of rigidity (G) Bulk modulus (K) and Poisson's ratio (μ). **6**

b) The ultimate stress, for a hollow steel column which carries an axial load of 1.9MN is 480 N/mm^2. If the external diameter of the column is 200mm. Determine the internal diameter. Take the factor of safety as 4. $\left[P = 1.9MN = 1.9x10^6 N\right]$ **10**

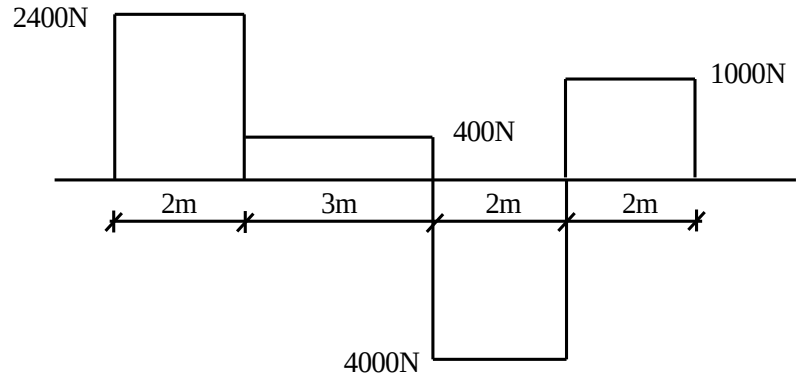
OR

2. a) Explain stress strain (relationship) behaviour of ductile materials under tension. Explain its salient features. **8**

b) A rectangular bar made of steel is 2.8m long and 15mm thick. The rod is subjected to an axial tensile load of 40 kN. The width of the rod varies from 75mm at one end to 30mm at the other. Find the extension of the rod if $E = 2x10^5\ N/mm^2$ **8**

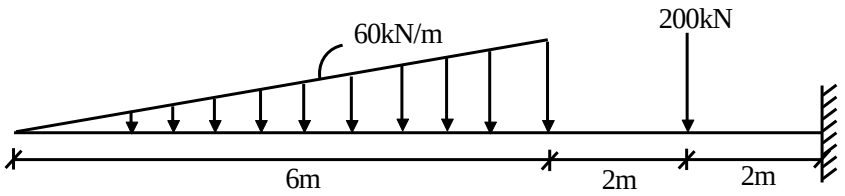
3. a) What is point of contra flexure? Explain the step by step procedure to locate it? **6**

b) Draw moment and load diagram corresponding to the given shear diagrams specify values at all change of load positions and at all points of zero shear. **10**



OR

4. a) Write the shear and moment equation for the cantilever beam carrying uniformly varying load and concentrated lead. Also sketch the shear and moment diagram. **16**



5. a) Derive the bending stress formula. **8**

b) A simply supported beam carries a udl of 40 kN/m over entire span of 8m. Calculate maximum stress developed due to bending. Assume cross section is a T-section with a flange 160x20mm and web 180mm x 20mm **8**

OR

6. a) For the same bending stress compare the moment of resistance of a beam of square section when placed. **8**

1) With two sides of square horizontal

2) With one of its diagonal horizontal.

b) A circular beam of 120 mm diameter is simply supported over a span of 10m and carries udl of 1000 N/m. Find the maximum bending stress produced. **8**

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

$$\frac{T}{I_P} = \frac{J_S}{R} = \frac{C_Q}{L}$$

b) A solid circular shaft and a hollow shaft whose inside diameter is $\frac{3}{4}$ of the outside diameter, are of the same material, of equal lengths and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stress developed in the two shaft are same. **8**

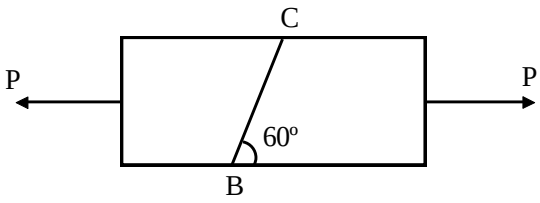
OR

8. A beam of length 5m and of uniform rectangular section is supported at its ends and carries uniformly distributed load over the entire length. Calculate the depth of the section if the maximum permissible bending stress is $8 N/mm^2$ and central deflection is not to exceed 10 mm. **16**

Take value of $E = 1.2x10^4 \ N/mm^2$

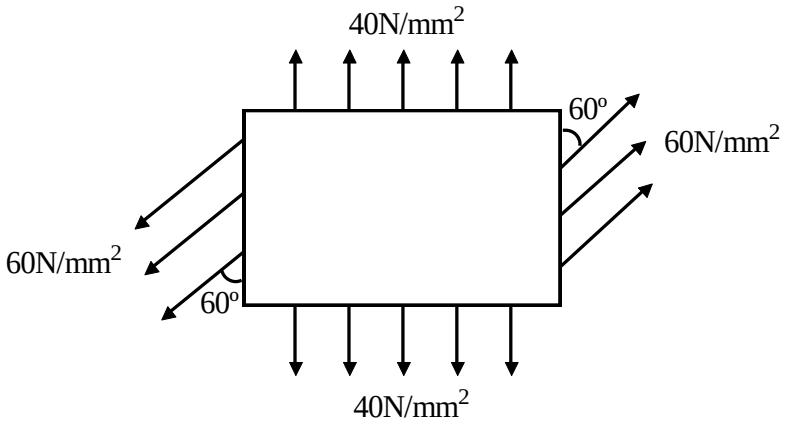
9. a) State major difference in Mohr's circle for stress and strain. **8**

b) A rectangular bar of cross sectional area of 11000 mm^2 is subjected to a tensile load P. The permissible normal and shear stresses on the oblique plane BC are given as 7 N/mm^2 and 3.5N/mm^2 respectively. Determine safe value of P **8**



OR

10. A point in a strained material is subjected to the stresses as shown in figure locate the principal planes, and evaluate the principal stresses **16**



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