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

PCCCE404 - Strength of Materials

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

Time : Three Hours * 2 4 5 4 * Max. Marks : 80

Notes : 1. All questions carry equal marks.
2. Due credit will be given to neatness and adequate dimensions.
3. Assume suitable data wherever necessary.

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

b) Three bars made of copper, zinc & aluminium are of equal length and have a cross section of 500, 7500 and 1000 mm^2 respectively. They are rigidly connected at their ends. If the compound member is subjected to a longitudinal pull of 250kN. Estimate the proportion of load carried an each rod and induced stresses. **10**

Take $E_C = 1.3 \times 10^5 N/mm^2$

$E_Z = 1 \times 10^5 N/mm^2$ & $E_{al} = 0.8 \times 10^6 N/mm^2$

OR

2. a) Explain with a neat sketch, stress-strain diagram for ductile & Brittle material. **8**

b) Compute the total elongation caused by an axial load of 100kN, apply to a flat bar 20mm thick, tapering form with of 120mm to 40mm in a length of 10m. As shown in figure. 1 Assume E = 200 GPa. **8**

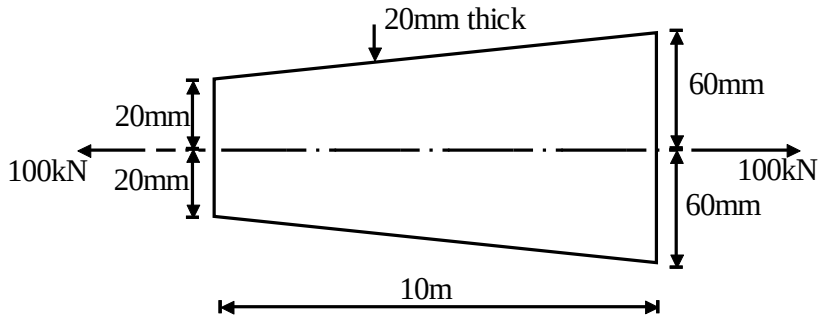


Fig. 1

3. a) Define shear force, shear force diagram, bending moment & bending moment diagram. **4**

b) For the beam loaded and supported as shown in fig. draw SFD and BMD indicating all values. **12**

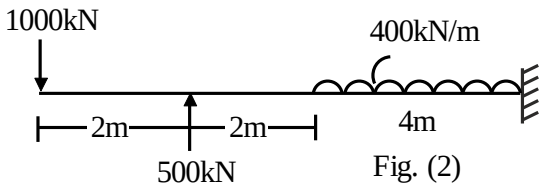


Fig. (2)

OR

4. Draw SFD and BMD for the beam shown in figure (3). **16**

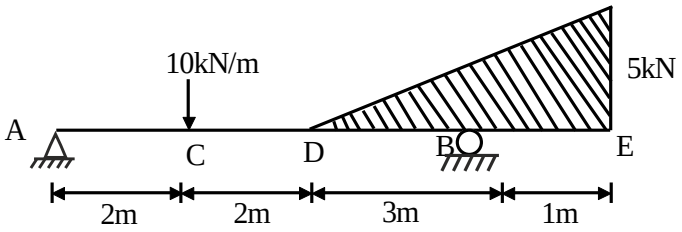


Figure (3)

5. a) Derive the bending stress formula with suitable assumption. **8**

b) A simply supported beam of span 5m is subjected to udl of 20kN/m. The beam has T-Cross section with flange 100mm x 20mm with web 10 x 300 mm. Plot maximum bending stress distribution in section at 40mm interval. **8**

OR

6. The T-section shown in figure below is the cross section of beam formed by joining of two react angular pieces of wood together. The beam is subjected to maximum shearing force of 60kN. Show that NA is 34mm from the top and that $I_{NA} = 10.57 \times 10^6 mm^4$ using these values. Determine the shearing stress. **16**

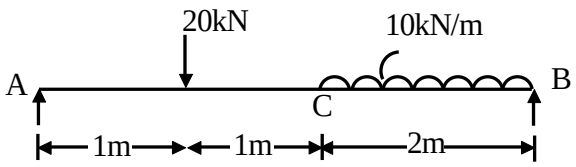
a) At the neutral axis

b) At the junction between two pieces of wood and then draw shear stress distribution curve.

7. a) Derive the relation between torsion, diameter of shaft, shearing stress and Polar moment of inertia. **6**

b) A beam AB of 4m span is simply supported at the end and is loaded as shown in figure. Determine: **10**

a) Deflection at C & b) Maximum deflection



OR

8. a) A steel propeller shaft is to transmit 4.5 MW at 3Hz without exceeding a shearing stress of 50MPa or twisting through more the 1º in length of 26 diameters. Compute the proper diameter if G = 83 GPa. **8**

b) For the beam and loading shown, determine the deflection at point D. Take E = 200 GPa, $I = 28.9 \times 10^6 mm^4$. **8**

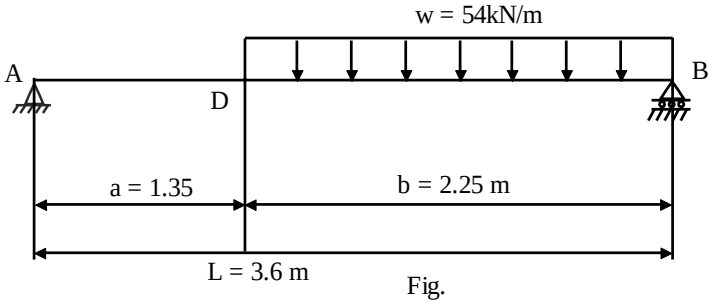


Fig.

9. a) A reactangular block of a material is subjected to a tensile stresses of $80\,N/mm^2$ on one plane and tensile stresses of $40\,N/mm^2$ on plane at right angle together with shear stress of $50\,N/mm^2$ on same plane. Calculate: **16**

1) The direction of the principal plane.
2) Magnitude of the principal stresses.
3) Magnitude of shear stress.

OR

10 a) Explain the concept of shear centre with the help of example. **6**

b) At a point in a material under stress. The intensity of resultant stress on a certain plain is $50MN/m^2$ inclined at 30º to the normal at that plane. The stress on the plane at right angle to this has a normal tensile component of intensity $30MN/m^2$. **10**

Find :

i) Resultant stress on second plane.
ii) Principal plane and stresses.
iii) Plane of maximum shear stress and its intensity.

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