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

PCCCE404 : Strength of Materials

P. Pages : 3 **GUG/W/22/13718**

Time : Three Hours * 2 9 8 8 * 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.
4. Diagrams and Chemical equation should be given wherever necessary.
5. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) Explain stress strain behaviour of ductile materials under tension. Explain its salient features. **7**

b) For a compound bar consting of steel, aluminum and copper at temperature of 20ºC, determine the final stresses if the temperature is raised to 80ºC. Take **9**

$E_s = 2\times10^5\ N/mm^2$, $Eal = 1\times10^5\ N/mm^2$

$E_c = 1.2\times10^5\ N/mm^2$, $\alpha_s = 12\times10^{-6}/^oC$, $\alpha_{al} = 18\times10^{-6}/^oC$, $\alpha_c = 20\times10^{-6}/^oC$.

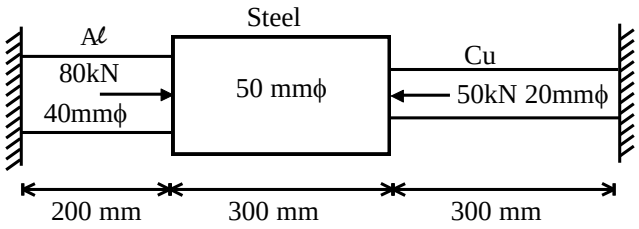

Fig. 1

OR

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

b) A factory boiler shell of length 10m. and internal diameter 4m is subjected to a uniform internal pressure of $2N/mm^2$. The thickness of plate is 20mm. Calculate- **8**
(1) hoop stress, (2) longitudinal stress (3) circumferential stress, (4) longitudinal strain
(5) maximum shear stress, (6) change in length (7) change in diameter (8) change in volume
(9) volumetric strain. Take $E = 2\times10^5\ N/mm^2$ and m = 4.

3. a) Determine the reaction at the supports of the beam shown in figure. Draw shear force and bending moment diagrams. **12**

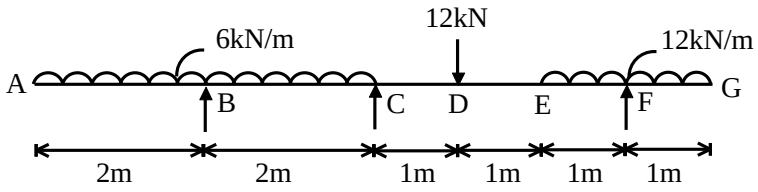

Fig. 2

b) What is point of contraflexure? Explain the step by step procedure to locate it. **4**

OR

4. a) Draw S.F and BM diagrams for the beam ABCDE. **8**

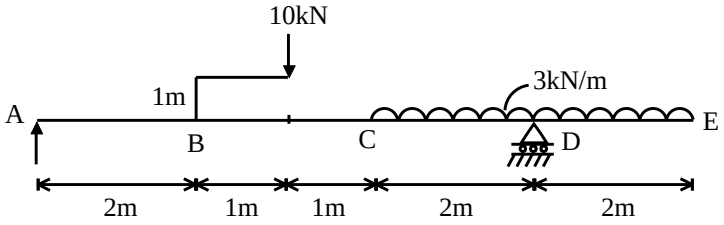

Fig. 3

b) Draw the Bending moment and load diagrams corresponding to the given shear diagrams. **8**

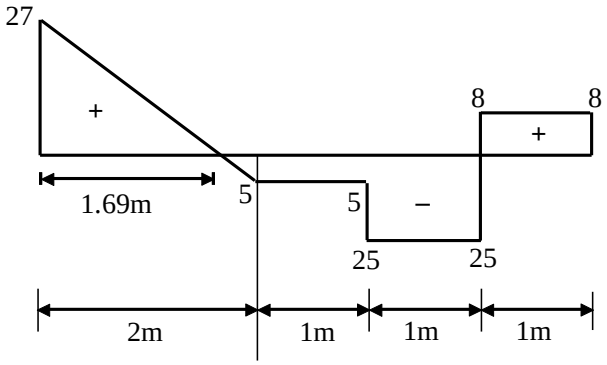

Fig. 4

5. A I section beam 120mm deep has the following cross sectional details – Top flange: $60mm \times 10mm$, Bottom flange: $120mm \times 10mm$ & web thickness is 10mm. The beam is 5m long simply supported over a span of 3m, overhanging both supports by the same amount & carries a load of 2kN at each end find the bending stress in the material. **16**

OR

6. For the same bending stress, compare the moment of resistance of a beam of square section when placed. **16**

i) With two sides of square horizontal
ii) With one of its diagonal horizontal
iii) Also find the ratio of the flexural strength of the section in the two position.

7. a) Derive the torsional formula. **6**

$$\frac{T}{I_p} = \frac{J_s}{R} = \frac{C_Q}{L}.$$

b) A solid circular shaft is to transmit a power of 300kw at 120 rpm. If the shear stress and angle of twist not to exceed 60MPa & 1°, Calculate the diameter of the shaft. The maximum torque exceeds by 20% to that of mean torque. The length of the shaft is 1m. Assume $G = 0.5 \times 10^5 \, N/mm^2$. **10**

OR

8. A solid circular shaft is to transmit 300kN at 100 rpm. If the shear stress is not to exceed 80MPa, find the diameter of the shaft. What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, the material & maximum shear stress being the same. **16**

9. A point in a strained material is subjected to the stresses as shown in figure. **16**

a) Locate the principal planes and evaluate the principal stresses.

b) Final the principal strain assuming.

$\frac{1}{m} = 0.25,\ E = 2\times10^5\ N/mm^2$.

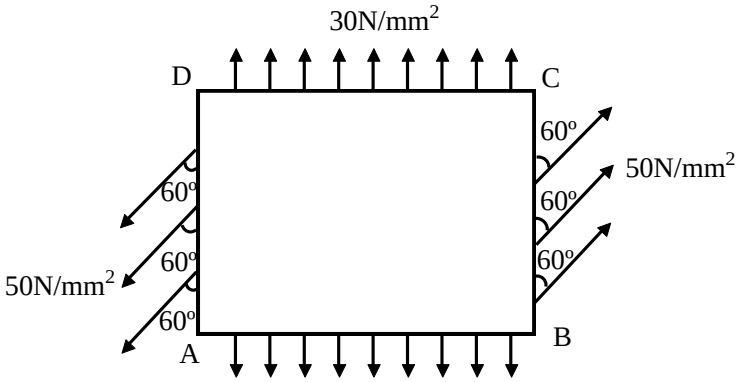

Fig. 5

OR

10. The principle stresses at a point in a strained material are P_1 and P_2. Show that the resultant stresses P_r on the plane carrying the maximum shear stress is given by. **16**

$$P_r = \left(\frac{P_1^2 + P_2^2}{2}\right)^{1/2} .$$

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