B.E. Third Semester (Civil Engineering) (C.B.S.)

Strength of Materials

P. Pages : 4 | **NKT/KS/17/7208**

Time : Three Hours | Max. Marks : 80

Notes :
1. All questions carry marks as indicated.
2. Solve Question 1 OR Questions No. 2.
3. Solve Question 3 OR Questions No. 4.
4. Solve Question 5 OR Questions No. 6.
5. Solve Question 7 OR Questions No. 8.
6. Solve Question 9 OR Questions No. 10.
7. Solve Question 11 OR Questions No. 12.
8. Due credit will be given to neatness and adequate dimensions.
9. Assume suitable data whenever necessary.
10. Illustrate your answers whenever necessary with the help of neat sketches.
11. Use of non programmable calculator is permitted.

1. a) Derive the relation between three elastic constant E, G & K. **7**

b) Find the force P acting at C in the bar shown in fig. 1. Find the extension of the bar if $E = 2\times10^5\,\text{MPa}$ **7**

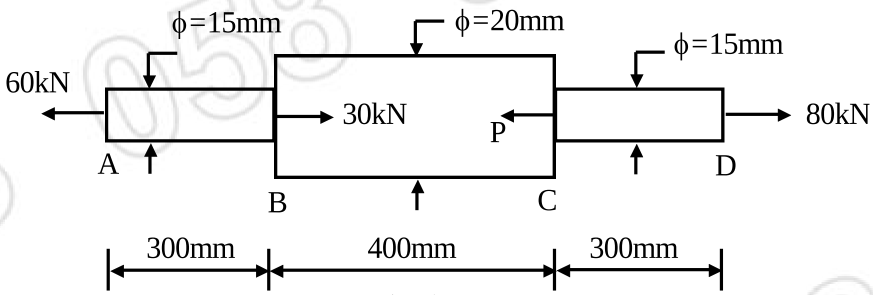

Fig. 1

OR

2. a) A bar of brass 25mm in dia. is enclosed in a steel tube of 50mm external dia. & 25mm internal dia. The bar and the tube are both initially 1.5m long & are rigidly fastened at both ends using 20mm dia. pins. Find the stresses in the two materials when temperature rises from 30ºC to 100ºC. E for steel $= 200\,\text{kN/mm}^2$, E for brass$=100\,\text{kN/mm}^2$, $\alpha_s = 11.6\times10^{-6}\,/^\circ\text{C}$, $\alpha_b = 18.7\times10^{-6}\,/^\circ\text{C}$. Also find the shear stress induced in the pins. **10**

b) With the help of strain-stress curve for mild steel, explain the following terms:- **4**
- i) Limit of proportionality.
- ii) Yield point.
- iii) Ultimate stress.
- iv) Breaking point.

3. Shear force diagram in fig. 2 for a beam which rests on two supports, one being on the left hand end Deduce directly form the shear force diagram. **13**

i) The bending moment at 2m interval along the beam

ii) The loading on the beam

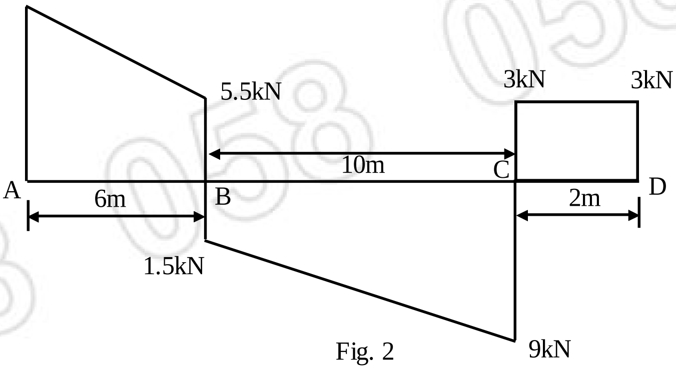

Fig. 2

OR

4. Draw shear force & bending moment diagram for the beam shown in fig. 3. & define point of contra-flexure. **13**

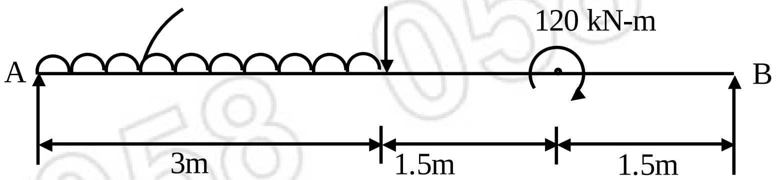

Fig. 3

5. Derive the Bending formula & give the assumptions in theory of simple bending. **13**

OR

6. A simply supported beam carries a udl of 30kN/m over a span of 1.0m. The cross-section of beam is a T section having diamensions as shown in fig. 4. Calculate the maximum shear stress for the section of the beam. **13**

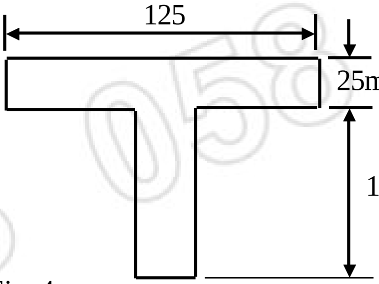

Fig. 4

7. A shaft is required to transmit 245 kw power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed $40 N/mm^2$ & the twist 1^o per meter length. Determine the diameter required if **13**

a) The shaft is solid.

b) The shaft is hollow with external diameter twice the internal diameter

Take modulus of rigidity = $80 kN/mm^2$.

OR

8. a) A hollow shaft of circular cross section is to have an inside dia. one half of outside dia. shaft is to be designed to transmit 60kw at 500 rpm. The allowable shear stress is $35 N/mm^2$ for this shaft calculate **10**

i) External diameter

ii) Angle of relative twist in degrees between two sections 2m apart.

iii) Percentage difference in the weight of hollow shaft as compared with the weight of solid shaft designed for the same condition

$G = 8.4 \times 10^4 \ N/mm^2$.

b) Explain Assumptions in the theory of pure torsion. **3**

9. Beam AB simply supported at both ends carries load as shown in figure 5 **13**

Calculate :

a) Slope at pt 'A'

b) Deflection at pt 'D'

c) Maximum deflection.

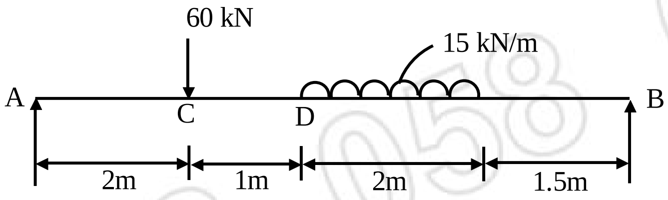

Fig. 5

OR

10. Calculate the deflection under point load for the beam shown in fig 6. by Macauley's method in terms of EI. **13**

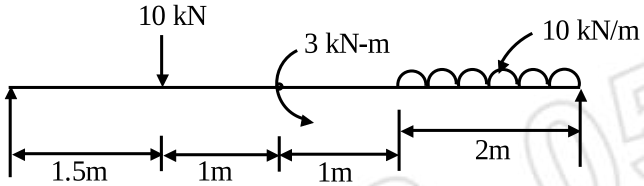

Fig. 6

11. A mild steel plate is stressed as shown in fig. 7 Before stressing, a circle of 300mm dia. is drawn on the plate. Determine the lengths & directions of the major & minor axes of the ellipse into which the circle deforms after stressing. Poisson's ratio = 0.3, modulus of elasticity $= 200 \ kN/mm^2$. **14**

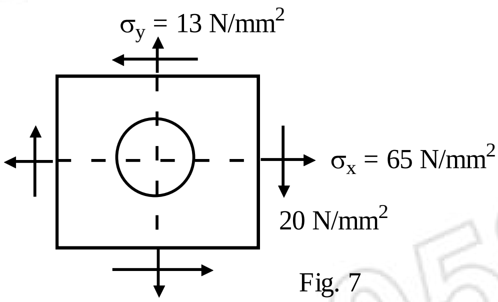

Fig. 7

OR

12. A point in strained material is subjected to stress as shown find **14**

i) Principal stress & its position

ii) Maximum shear stress & its position

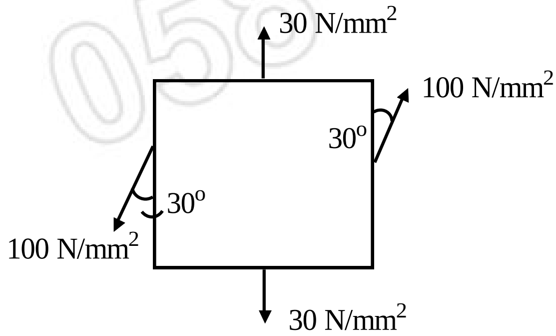

Fig. 8

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