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

Strength of Materials

P. Pages : 3 **NJR/KS/18/4348**

Time : Three Hours * 0 1 0 9 * 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. Use of non programmable calculator is permitted.

1. a) Define Poisson's ratio and state the relation between three elastic constants E, G and K. **7**

b) A thin cylindrical shell 0.75m in diameter and 2.5m long has a metal thickness 10mm. It is subjected to an internal fluid pressure of 2.5 MPa find the circumferential and longitudinal stresses in the wall. Also determine the changes in length, diameter and volume of the cylinder. Take E = 210 GPa and $\mu = 0.3$. **7**

OR

2. a) With the help of stress-strain curve for mild steel, explain the following terms :- **5**

i) Limit of proportionality. ii) Yield point.
iii) Ultimate stress. iv) Breaking point.

b) The composite bar consisting of steel and aluminium components shown in fig. 1.

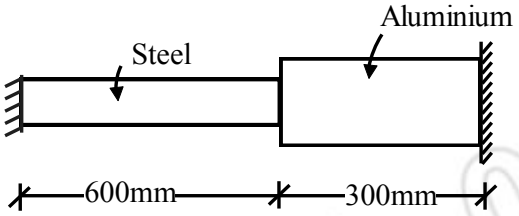

Fig.1

is connected to two grips at the ends at a temperature of 50ºC. Find the stresses in the two rods when the temperature falls to 15ºC.

i) If the ends do not yield. **4**

ii) If the ends yield by 0.20mm. **5**

Take $E_s = 2x10^5 N/mm^2$; $E_a = 0.70x10^5 N/mm^2$

$\alpha_s = 1.17 x 10^{-5} per°/C$, $\alpha_a = 2.34x10^{-5} per°/C$.

$A_s = 225 mm^2$, $A_a == 350 mm^2$.

3. a) Write properties of shear force diagram. **3**

b) Write properties of bending moment diagram. **3**

c) Derive the relationship between load, shear force and bending moment. **7**

OR

4. Draw shear force and bending moment diagram for the beam shown in fig. 2 and locate the point of contraflexure if any. **13**

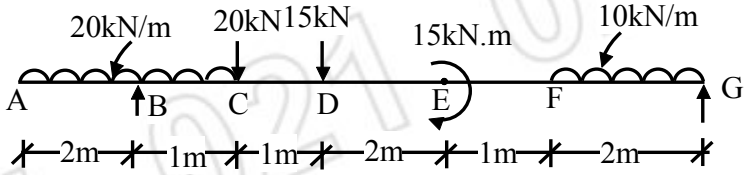

Fig. 2

5. A bar of T section symmetrical about the vertical Centre line has a 160mm wide and 20mm thick flange and a 120mm deep and 20mm thick web. The member is acted upon by a longitudinal pull P which acts on the section at a point on the vertical central line and is 50mm from the bottom edge of the web. Determine the magnitude of the maximum pull which can be applied if the maximum allowable tensile stress on the section is 80 MPa. Also find the minimum stress on the section when the pull P is transmitted. **13**

OR

6. a) Derive the bending formula and give the three assumption in theory of simple bending. **9**

b) Draw a typical shear stress distribution over following beam section subjected to a shear force. **4**

i) I-beam. ii) T-beam.

7. A solid shaft transmits 100kW at 150rpm. Determine the suitable diameter of the shaft if the maximum torque transmitted exceeds the mean by 20% in each revolution. The shear stress is not to exceed 60MPa. Also find the maximum angle of twist in a length of 4m of the shaft. G = 80 GPa. **13**

OR

8. Two solid shafts AC and BC of aluminium and steel are rigidly connected at "C" and attached to rigid supports at A and B. Shaft AC is 75mm in diameter and having length 2m. Shaft BC is 55 mm diameter and having length 1m. A torque of 200N-m was applied at junction "C". Compute the maximum shearing stress in each material. What is the angle of twist at the junction? **13**

$G_{al} = 3\times10^4\ N/mm^2$ and $G_{st} = 9\times10^4\ mm^2$.

9. Calculate slope at A and deflection at B for the beam shown in fig. 3 in terms of EI. **13**

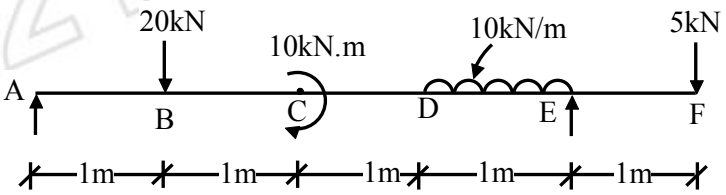

Fig. 3

OR

10. A simply supported beam of 8m length carries two point loads of 60kN and 45kN at 1m and 4m respectively from the left hand end. **13**
Find the deflection under each load and maximum deflection.
E = 210 GPa and I = 180 x 10^{-6} mm^4.

11. A point in strained material is subjected to stress as shown in fig. 4. **14**
Find
i) Principal stress and its position.
ii) Maximum shear stress and its position.

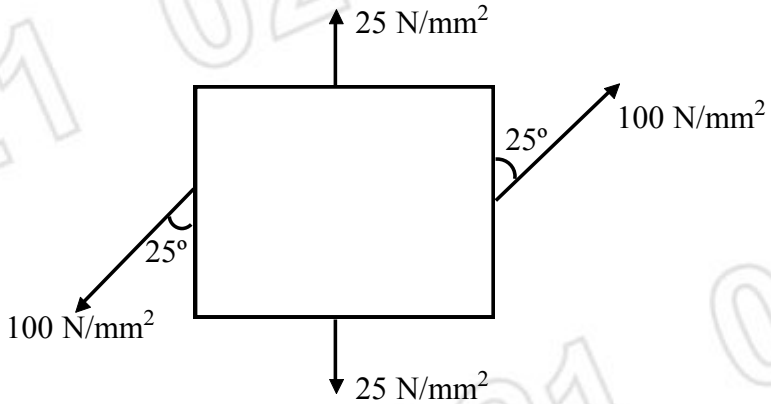

Fig.4

OR

12. For the stressed element as shown in fig. 5 find the following. **14**
i) Normal and tangential stresses on the inclined plane making 30º clockwise with X-axis.
ii) Principal stresses and principal planes location.
iii) Maximum shear stress and its location.

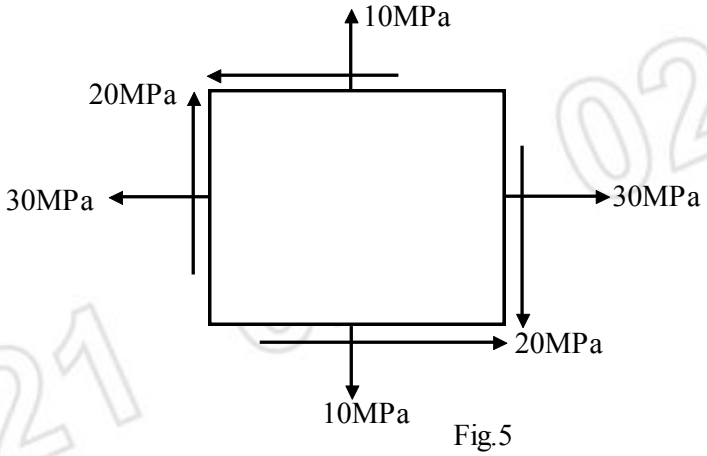

Fig.5

****