B.Tech. Third Semester (Chemical Engineering) (C.B.S.)

Strength of Materials Paper- I

P. Pages : 2 **TKN/KS/16/7816**

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) Explain Stress-Strain diagram for mild steel. **7**

b) A concrete block of size 300mm x 300mm is carrying a load of 350 kN. The block is reinforced by 8 bars of 15mm diameter. Find the stresses in concrete and steel, if the modulus of elasticity for steel is 18 times that a concrete. **6**

OR

2. A rectangular block 500mm x 250mm x 100mm is subjected to axial loads as follows : **13**
600 kN tensile in the direction of its length,
500 kN tensile on the 500mm x 100mm faces,
400 kN compressive on the 500mm x 250mm faces.
Assuming Poisson's ratio as 0.3 and E = 2 x 10^5 N/mm^2,
find the values of modulus of rigidity and bulk modulus for the material of the block. Also calculate the changes in the dimensions and volume of the block.

3. Draw S.F.D. and B.M.D. for the beam loaded as shown in figure 3. **13**

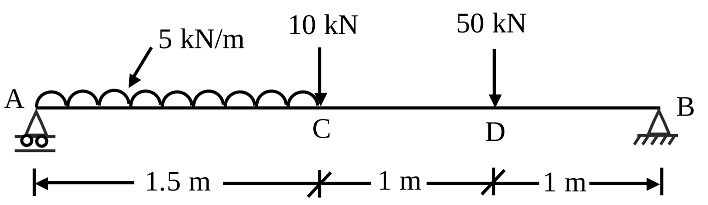

Fig. 3

OR

4. a) A timber beam of rectangular section of span 4m is freely supported with a uniformly distributed load of 10 kN/m over the entire span. If depth of the beam section is twice the width, and maximum stress is not to exceed 8 N/mm^2, find the dimensions of the beam section. **6**

b) A flitched beam consists of a timber joist 200mm wide and 350mm deep, reinforced by two vertical plates 300mm deep and 20mm thick, one on each side and arranged symmetrically. If the stresses in timber and steel are not to exceed 7 N/mm^2 and 160 N/mm^2 respectively, find the moment of resistance of the section. Take Es = 18 Ew. **7**

5. Determine the deflections at point B and C for the simply supported beam as shown in figure 5. Take $E = 2 \times 10^5$ N/mm^2 and $I = 7.33 \times 10^7$ mm^4. **14**

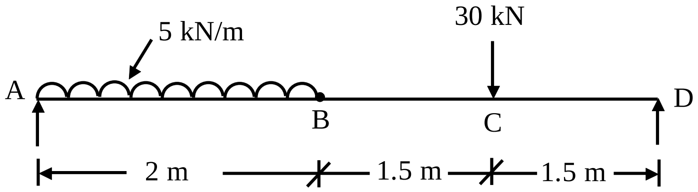

Fig. 5

OR

6. Write short notes on **any three.** **14**

i) Shear stress distribution in beam sections.

ii) Temperature stresses.

iii) Equivalent steel section.

iv) End conditions of column.

7. a) What is Section Modulus? **5**

b) A hollow rectangular masonry pier 800mm x 600mm with wall thickness of 250mm, carries a vertical load of 100 kN at an eccentricity of 150mm in the plane bisecting 800mm width. Calculate the extreme stress intensities in the section. **8**

OR

8. a) Define working stress, ultimate stress and factor of safety. **3**

b) A tabular steel column 3m long, having 60mm outer diameter and 10mm wall thickness, is hinged at both the ends. Compare the crippling loads by Euler's and Rankine's formulae. Take fc = 350 N/mm^2, $\alpha = \frac{1}{2100}$ and $E = 2 \times 10^5$ N/mm^2. **10**

9. a) State and explain the terms in the torsion equation. **5**

b) A hollow shaft with diameter ratio 3/5 is required to transmit 500 KW at 130 rpm with a uniform twisting moment. The shearing stress in the shaft must not exceed 65 N/mm^2 and the twist in a length of 3m must not exceed 1º. Calculate the minimum external diameter of the shaft satisfying these conditions. Take $C = 8 \times 10^4$ MPa. **8**

OR

10. It is required to design a close coiled helical spring which shall deflect 1mm under an axial load of 110 N at a shear stress of 85 N/mm^2. The spring is to be made out of round wire having modulus of rigidity 8×10^4 N/mm^2. The mean diameter of coils is to be 10 times the diameter of the wire. Find the diameter and length of the wire necessary to form the spring. **13**

11. A cylindrical shell 800mm internal diameter, 1000mm long with 4mm of metal thickness is filled with an incompressible fluid at an atmospheric pressure. If an additional 15000mm^3 of fluid is pumped into the cylinder, calculate the pressure exerted by the fluid on the wall of the cylinder. Also calculate circumferential and longitudinal stresses induced in the section. Take $E = 2 \times 10^5$ N/mm^2 and $1/m = 0.3$. **14**

OR

12. a) Explain nominal diameter and effective diameter of rivets. **4**

b) A double riveted single cover butt joint is made in 18 mm thick plates with 22mm diameter rivets at 100 mm pitch. The permissible stresses are $P_s = 80$ MPa, $P_b = 160$ MPa and $P_t = 100$ MPa. Find the pull per pitch length of the joint and efficiency of the joint. **10**

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