

**DEPARTMENT OF CIVIL ENGINEERING**  
**GOVERNMENT POLYTECHNIC, BALASORE**  
**SUBJECT- STRUCTURAL MECHANIC**  
**SEMESTER -3<sup>RD</sup> SEM (CIVIL ENGG.)**  
**BY-FRANKAN KUMAR BASA**

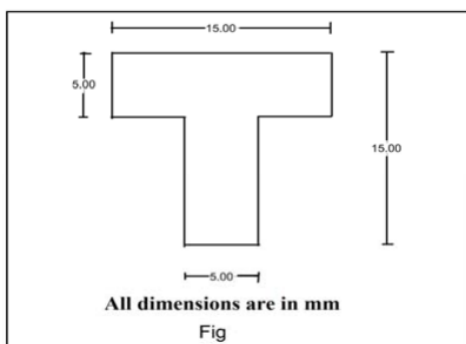
**QUESTION BANK**

**SHORT QUESTION :-**

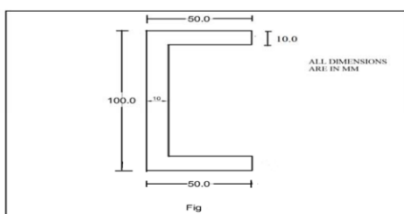
1. What is Volumetric Strain ?
2. What is Compressive Strain?
3. Write Bulk Modulus elasticity?
4. What is Poisson ratio?
5. Write Hooke's Law?
6. Define strain energy and Modulus of resilience. ?
7. Calculate Modulus of rigidity for a member having  $E=2 \times 10^5 \text{ N/mm}^2$  and  $\mu=0.25$ ?
8. Define volumetric strain along with its expression ?
9. Give relation between average and maximum shear stress for rectangular and circular cross-section ?
10. Along with expression define slenderness ratio ?
11. Define a point of contra flexure?
12. A simply supported beam of span  $L_m$  has to carry a u.d.l. of  $w \text{ kN/m}$  throughout the span. Calculate maximum S.F. and B.M. induced ?
13. State any four assumptions made in the theory of simple bending ?
14. Sketch shear stress distribution diagram for hollow rectangular section ?
15. Define effective length of column and slenderness ratio ?
16. For any two condition of column state effective length ?
17. Define M.I. giving its S.I. unit
18. State the M.I. of a triangular section about its horizontal axis passing through C.G.
19. Define elasticity and elastic limit.
20. Define shear stress and shear strain.

**LONG QUESTION :-**

1. Along with expression state parallel axis theorem and perpendicular axis theorem ?
2. Determine MI about both the axis for a semicircle and quarter circle having 300 mm as diameter ?
3. Calculate the moment of inertia of a T-section about both the axis passing through the centre of gravity for a section as shown in Figure ?



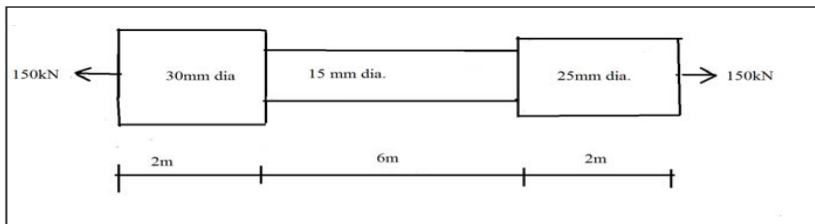
4. Calculate MI for following section ?



5. A circular bar of 20 mm diameter and 3m long is subjected to a tensile load of 50kN shows an elongation of 65mm. Determine stress, strain and Modulus of elasticity ?

6. A bar 4m long is fixed at one end and there is a gap of 2mm between the other end and the support. Calculate the stress induced if it is heated through i) 25°C and ii) 50°C if  $\alpha = 12 \times 10^{-6} / ^\circ\text{C}$ ?

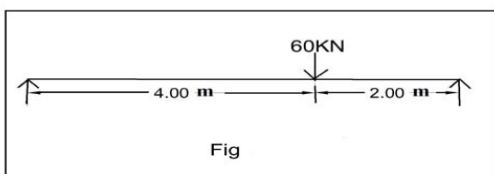
7. A bar having cross section as given in fig is subjected to a tensile load of 150kN Calculate the change in length of each part along with the total change in length if  $E = 2 \times 10^5 \text{ N/mm}^2$  ?



8. For a certain material if  $E = 2 \times 10^5 \text{ N/mm}^2$  and  $G = 8 \times 10^4 \text{ N/mm}^2$ , determine  $\mu$  and  $K$  ?

9. A cube of 120mm side is subjected to a direct load of 48 kN on all faces. Determine change in volume if  $E = 200 \text{ GPa}$  and  $\mu = 0.25$ ?

10. Draw S.F.D. and B.M.D. for a simply supported beam as shown in figure ?



11. A cast iron column 4m long with both ends fixed carries a safe compressive load of 800 kN. Using Euler's equation, calculate the diameter of column. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  and Factor of safety = 4.?

12. A 3m long hollow circular column with 200 mm as external diameter and 150mm as internal diameter is fixed at both the ends. Determine the Rankine's crippling load if  $\alpha =$  and  $f_c = 320 \text{ N/mm}^2$  ?

13. A simply supported beam 150×300 mm deep has span of 4m. It carries u.d.l. of 10kN/m throughout the span. Find minimum and maximum stresses induced in the section ?

14. A steel column 30mm in diameter has to carry a load of 250 kN with one end fixed and other end hinged. Determine the length of column using Euler's formula. Take  $E = 2 \times 10^5 \text{ N/mm}^2$  ?

15. In a biaxial stress system, the stresses along two perpendicular directions 70N/mm<sup>2</sup> tensile in nature and 40 N/mm<sup>2</sup> compressive in nature. Calculate the strains along these two directions. Consider  $E = 200 \text{ GPa}$  and  $\mu = 0.25$ ?