3RD SEM./CIVIL./ 2024(W)

TH1 Structural Mechanics

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

   a. Define Elasticity.

   b. Define volumetric strain.

   c. What is the maximum bending moment of a simple supported beam of length 'l'& udl 'w'/unit run throughout.

   d. What is point of contraflexure?

   e. Define slenderness ratio .

   f. Define neutral axis.

   g. Write down the relation between elastic modulus and rigidity modulus.

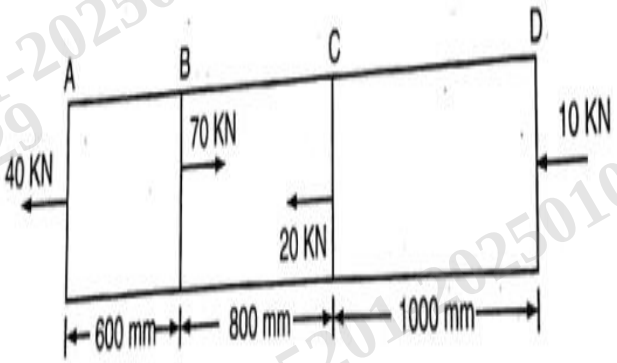
   h. Write down the condition of static equilibrium.

   i. Define centre of gravity.

   j. Write down the equation for number of members in case of a perfect frame.

2. Answer **Any Six** Questions 5 x 6

   a. A brass bar having cross sectional area of 900mm^2 is subjected to a axial force as shown in the figure . Find the total change in the length of the bar. Take E =1 $\times 10^5$ N/mm^2.



   b. Derive limit of eccentricity for rectangular and circular section.

   c. Derive relationship between shear force, bending moment & rate of loading.

   d. Write down the assumptions in pure bending.

   e. A simply supported beam of span 3.0 m is subjected to a central point load of 20 kN. Determine the maximum slope and deflection at the center of the beam. Take EI for the beam as 5x10^{10}N/mm^2.

f. A circular shaft of 60mm diameter is rotating at a speed of 150rpm .If the shear stress is not to exceed 50 Mpa, find the power which can be transmitted by the shaft.

g. A round bar 4 m long and 60 mm in diameter is used as a strut with both ends hinged. Determine the crippling load. Take $E = 2 \times 10^5$ N/mm^2.

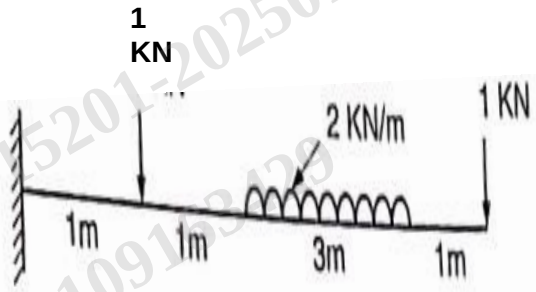
Answer **Any Three** Questions

3. Derive briefly the relation between E(elastic modulus) K(bulk modulus) & C(shear modulus). 10

4. Find I_{xx} and I_{yy} for unequal angle section 100x80x20mm. 100mm and 80mm are outer dimensions of angle section. 10

5. a) Define principal stress and principal plane. 5+5
b) A beam of rectangular cross section is 300mm wide and 500mm deep. If the section is subjected to a maximum shear force of 50 KN, Find the maximum shear stress and draw the shear stress distribution along the depth of the beam.

6. Draw the S. F and B.M diagram of the cantilever loaded as in the figure. 10



7. A rectangular beam 300mm deep is simply supported over a span of 4m. what uniformly distributed load per meter the beam may carry if the bending stress is not to exceed 120N/mm^2 ? Take I = 8x10^6 mm^4. 10