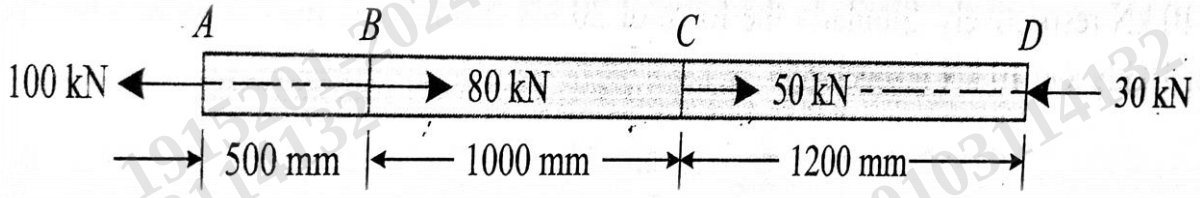
3RD SEM./CIVIL /2023 (W) NEW
Th-1 Structural Mechanics

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

Answer any five questions including Q.N. 1&2
Figures in the right-hand margin indicates marks

1. Answer **All** Questions. 2 X 10
   a. Define Poisson's Ratio.
   b. Write down the application of Mohr's circle.
   c. What is point of contraflexure.
   d. Write down the value of maximum bending moment in case of a simply supported beam of length 'l' carrying a point load of 'P' at its Centre.
   e. Define propped cantilever beam with neat sketch.
   f. Differentiate between stable and unstable trusses.
   g. What is malleability.
   h. Define yield stress.
   i. What is principal plane and principal stress.
   j. Define polar moment of inertia.

2. Answer **Any Six** Questions. 6 X 5
   a. Draw the neat sketch of stress strain diagram for mild steel and explain the salient points in detail.
   b. An I-Section has the following dimensions in mm units:
      Bottom Flange=300 x 100
      Top Flange=150 x 50
      Web=300 x 50
      Determine mathematically the position of Centre of Gravity of the section.
   c. A brass bar, having cross-section area of $500mm^2$ is subjected to axial forces as shown in fig.



      Find the total elongation of the bar. Take E=80 GPa.
   d. Write down the assumption of pure torsion.
   e. A circular beam of 100mm diameter is subjected to a shear force of 30 KN. Calculate the value of maximum shear stress and sketch the variation of shear stress along the depth of beam.
   f. A steel rod 5 m long and of 40mm diameter is used as a column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take E as 200GPa.
   g. Derive briefly the relation between E (Elastic Modulus), K (Bulk Modulus) & C (Shear Modulus).

3. The stresses at point of a machine component are 150 MPa and 50 MPa both tensile. Find the intensities of normal, shear and resultant stresses on a plane inclined at an angle of 55^{o} with the axis of major tensile stress. Also find the magnitude of the maximum shear stress in the component. 10

4.

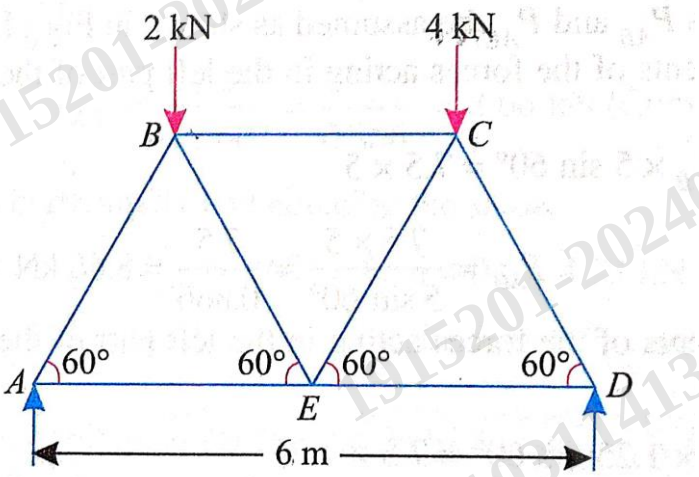
a. A simply supported beam of 6 m long is carrying a uniform distributed load of 5KN/m over a length of 3 m from the right end. Draw the S.F. and B.M. diagrams for the beam. Also calculate the maximum B.M. on the section. 7

b. Write down the assumptions in the theory of pure bending. 3

5. A rectangular strut is 150mm and 120mm thick. It carries a load of 180KN at an eccentricity of 10mm in a plane bisecting the thickness. Find the maximum and minimum intensities of stress in the rectangular section. 10

6. Derive the slope and deflection of a simply supported beam with a uniformly distributed load throughout the span by using double integration method. 10

7. Figure shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points. 10



The girder is loaded at B and C as shown in figure. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile.