III-SEM./CIVIL ENGINEERING/2021(W)

TH-I 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 perpendicular axis theorem.

b. Define poisson's ratio.

c. State Hooke's law.

d. Write down the value of maximum B.M in case of a simple supported beam of length l carrying a point load of W at its center.

e. Draw the shear stress distribution diagram for a rectangular section and I section.

f. Define section modulus.

g. Define modulus of rigidity modulus.

h. What is point of contraflexure.

i. Write down the relation between elastic modulus and bulk modulus.

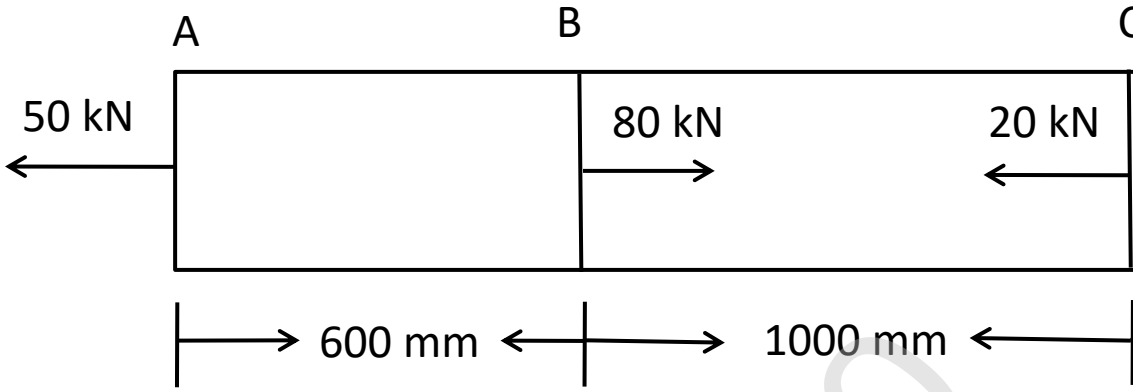
j. Differentiate between statically determinate and statically indeterminate structure.

2. Answer **Any Six** Questions 5X6

a. Draw the neat sketch of stress strain diagram for mild steel and explain the salient points.

b. The modulus of rigidity of a material is $0.8x10^5$ N/mm^2.When a 6mmx6mm rod of this material was subjected to an axial pull of 3600N it was found that the lateral dimension of the rod changed to 5.9991 x 5.9991mm. Find the Poisson's ratio and the modulus of elasticity.

c. A brass bar having cross-sectional area of 1000mm^2 is subjected to an axial force as shown in figure. Find the change in length of the bar. Take E= $1.05x10^5$ N/mm^2.



d. Draw the shear force and bending moment diagram of a cantilever beam of length 'l' carrying a concentrated load W at the free end.

e. Write down the assumptions in pure bending.

f. A timber beam 100mm wide 150mmdeep supports a uniformly distributed load over a span of 2meters.If the safe stresses are 28N/mm^2 in bending and 2N/mm^2 in shear, calculate the maximum load which can be supported by the beam.

g. A steel rod is 5m long & 50mm diameter is used as a column with one end fixed & other end free. Determine the crippling load by Euler's formula. Take E as 200Gpa.

3 A beam AB 10 meters long has supports at its ends A and B. It carries a point load of 5 KN at 3 meters from A and a point load of 5 KN at 7meters from A and a uniformly distributed load of 1KN per meter between the point loads. Draw SF and BM diagrams for the beam. 10

4 Find the moment of inertia of a T- section with flange as 150mm x150mm and web as 150mm x50mm about x-x and y-y axis through the centre of gravity of the section. 10

5 Derive the formula for slope and deflection for a simply supported beam AB of span l carrying a uniformly distributed load of w per unit run over the whole span. Also find the maximum deflection and slope at A. 10

6 a) Define principal stress and principal plane. 10
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.

7 a) Write down the assumptions in pure torsion. 10
b) A solid shaft of 200mm diameter has the same cross sectional area as that of a hollow shaft of the same material with the inside diameter 150mm. Find the ratio of power transmitted by the two shafts at the same speed.