3RD SEM. / CIVIL / 2022(W)
Th-1 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 Hook's law.

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. What is the section modulus of a rectangular section of depth 'd' and width 'b'.

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

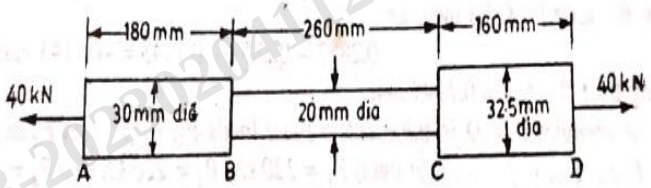
h. Write down the condition of static equilibrium.

i. Define rigidity.

j. Differentiate between statically determinate and statically indeterminate structure.

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

a. The figure shows a bar consisting of three lengths. Find the stress in three parts and the total extension of the bar for an axial pull of 40 kN. Take E = $2x10^5 N/mm^2$.



b. A cantilever beam is rectangular in section having 80mm width and 120mm depth. If the cantilever is subjected to a point load of 6kN at the free end and the bending stress is not to exceed 40 MPa, find the span of the cantilever beam.

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

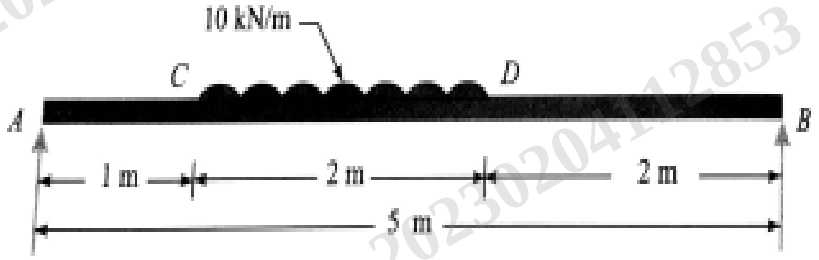
d. Write down the assumptions of pure torsion.

e. A simply supported beam of span 2.4m subjected to a central point load of 15KN. What is the maximum slope and deflection at the centre of the beam? Take EI for the beam as $6x10^{10} N/mm^2$.

f. A circular beam of 100mm diameter is subjected to a shear force of 30KN.Calculate the value of maximum shear stress and sketch the variation of shear stress along the depth of the beam.

g. A steel rod 5m long and 40mm diameter is used as column, with one end fixed and the other free. Determine the crippling load by Euler's formula. Take E as 200 Gpa.

3	Derive briefly the relation between E(elastic modulus) K(bulk modulus) & C(shear modulus).	10
4	An 'I'section has the following dimension in mm units: Bottom flange = 300x100 Top flange = 150x50 Web = 300x50 Determine mathematically the position of centre of gravity and MI of the section about horizontal axis passing through the C.G of the section.	10
5	A hollow rectangular masonry pier is 1.2mx0.8m wide and 150mm thick. A vertical load of $2x10^6$N is transmitted in a vertical plane bisecting 1.2m side and at an eccentricity of 100mm from the geometric axis of the section calculate the maximum and minimum stress intensity in the section.	10
6	A simply supported beam 5m long is loaded with a uniformly distributed load of 10kN/m over a length of 2m as in the figure.	10



7	A rectangular beam 60mm wide and 150m deep is simply supported over a span of 4m. If the beam subjected to uniformly distributed load of 4.5kn/m find the maximum bending stress induced in the beam.	10