S.Y. Diploma : Sem. III

[CE/CS/CR/CV]

Mechanics of Structure

Time: 3 Hrs.] Prelim Question Paper **[Marks : 70**

Instructions : (1) All questions are compulsory.
(2) Illustrate your answers with neat sketches wherever necessary.
(3) Figures to the right indicate full marks.
(4) Assume suitable data if necessary.
(5) Preferably, write the answers in sequential order.

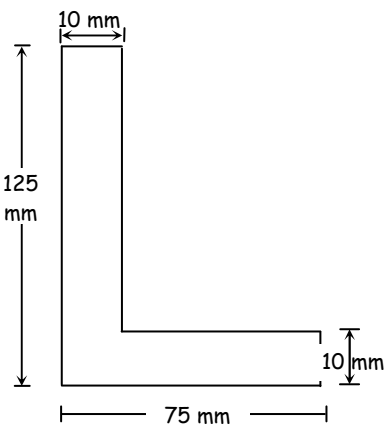
1. Attempt any **FIVE** of the following. **[10]**

(a) Define moment of Inertia. State MI of triangular section about its base.
(b) If polar moment of inertia of circular section is 2000 mm^4 then calculate diameter of the section.
(c) Define elastic body, giving two examples.
(d) State Hooke's law.
(e) Define slenderness ratio.
(f) Define Resilience and modulus of resilience.
(g) State meaning of effective length of column.

2. Attempt any **THREE** of the following : **[12]**

(a) Determine moment of Inertia about the centroidal axes X-X and Y-Y of an Unsymmetrical I section with following details.
Top flange - 100 mm $\times$ 20 mm
Bottom flange - 160 mm $\times$ 20 mm
Web - 80 mm $\times$ 20 mm

(b) Find the least moment of Inertia about the centroidal axes X–X and Y–Y of an unequal angle section 125 mm $\times$ 75 mm $\times$ 10 mm as shown in figure.

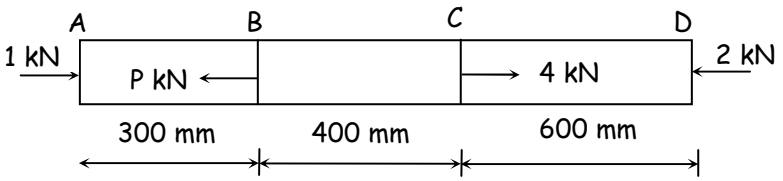


(c) Find the least M.I. of a symmetrical I-section having following details:
Flanges : 100 mm $\times$ 20mm Overall depth : 280 mm
Thickness of web : 10 mm

(d) A column having diameter 200 mm is of length 3 meters. Both ends of a column are hinged. Find Euler's crippling load. Take E = 2×10^5 MPa.

3. Attempt any **THREE** of the following : **[12]**

(a) A bar of uniform cross sectional area 100 mm^2 is subjected to axial forces as shown in Fig. Calculate the net change in length of the bar. Take E = 2×10^5 N/mm^2.



(b) A steel tube with 40 mm inside diameter and 4 mm thickness is filled with concrete. Determine load shared by each material due to axial thrust of 60 kN.
Take E_{steel} = 210×10^3 N/mm^2
$E_{concrete}$ = 14×10^3 N/mm^2

(c) Draw stress-strain curve for mild steel under tensile loading showing important points on it.

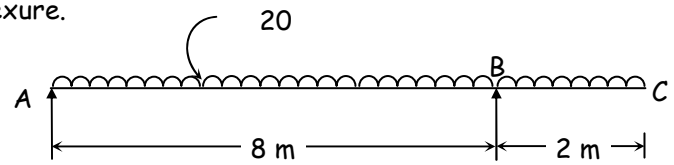
(d) State any four assumptions made in theory of pure bending.

4. Attempt any **THREE** of the following : **[12]**

(a) A cube of 200 mm side is subjected to a compressive force of3600 kN on all its faces. The change in the volume of cube is found to be 5000 mm^3. Calculate the Bulk modulus. If μ = 0.28, find the Young's modulus.

(b) An over changing beam ABC is such that AB = 4m, BC = 1 m, is supported at A and B. The beam ABC is subjected to vdl of 30 kN/m over the entire length ABC. It is subjected to point load 50 kN at the free end C. Draw SFD and BMD with calculations and locate the point of contra flexure.

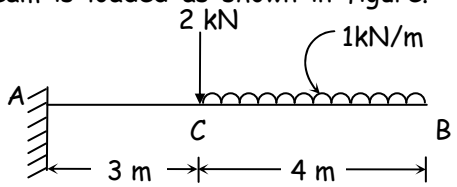
(c) Draw SFD and BMD of a beam as shown in figure. Also find the point of contra flexure.



(d) State the flexural formula, giving meaning of the symbols used in it.

5. Attempt any **TWO** of the following : **[12]**

(a) A cantilever beam is loaded as shown in figure. Draw the S.F.D. and B.M.D.



(b) AT-section beam having flange 160 mm wide and 20 mm thick and web 180 mm long and 20 mm thick carries udl of 500 kN/m over an effective span of 8 metres. Calculate the maximum stresses induced due to bending. Also draw bending stress variation diagram.

(c) A metal rod 20 mm diameter and 2 m long when subjected to tensile force of 60 kN shows an elongation of 2 mm and reduction in diameter 0.006 mm. Calculate the modulus of elasticity and modulus of rigidity.

6. Attempt any **TWO** of the following : **[12]**

(a) (i) A simply supported beam of span `L' carries central point load `W'. Draw SED and BMD

(ii) Define shear force and bending moment. Write unit of each. Also state relation between them.

(b) A cast iron column 100 mm external diameter and 80 mm internal diameter is 2 m long. It is fixed at one end and hinged at other end. Calculate the safe axial load by Rankine's formula taking factor of safety 3. Assume σ_c = 550 N/mm^2 and Rankine's constant $\alpha = \frac{1}{1600}$.

(c) A beam has hollow rectangular section with external dimensions 80 mm $\times$ 160 mm and uniform thickness of section is 10 mm. Draw shear stress variation diagram. It section is subjected to the shear force 70 kN. Also determine ratio of maximum shear stress and average shear stress.

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S.Y. Diploma Sem-III: Paper Discussion Schedule

Branches	Date	Day	Timing	Centres
Mechanical Group & Civil Group	8 Nov. 2018	Thursday	9 a.m. to 11 a.m.	Kalyan, Borivali
	8 Nov. 2018	Thursday	12 a.m. to 2 p.m.	Thane
	8 Nov. 2018	Thursday	3 p.m. to 5 p.m.	Dadar