

**University of Mumbai**  
**Examination: First Half 2022 (May-June 2022)**

Program: **Civil Engineering**  
Curriculum Scheme: **R2019 (C Scheme)**  
Examination: **SE** Semester: **III**

Course Code: **CEC302**

Time: **2 Hour 30 Minutes**

Course Name: **Mechanics of Solids**

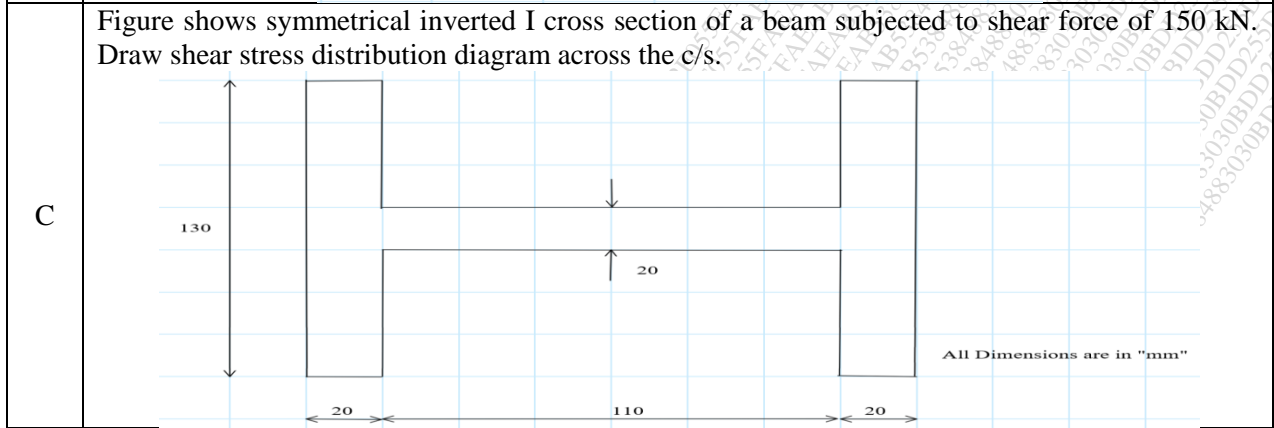
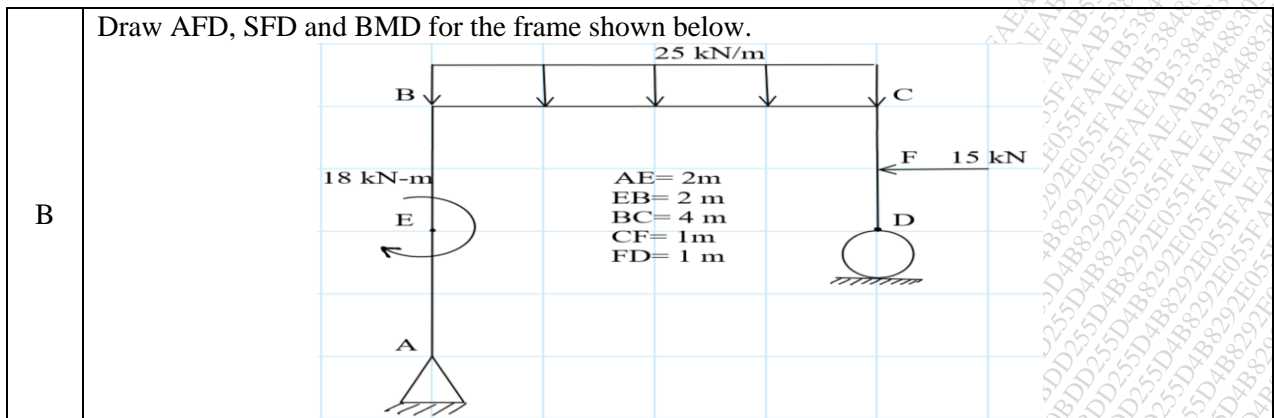
Max. Marks: **80**

<b>Q1.</b>	<b>Choose the correct option for the following questions. All the Questions are compulsory and carry 2 marks each.</b>
1.	A thin cylinder of inner radius 0.5 m and thickness 15 mm is subjected to an internal pressure of 1.5 MPa. The average circumferential (hoop) stress in MPa is
Option A:	25
Option B:	50
Option C:	100
Option D:	200
2.	<p>Shear Force and Bending moment at B is _____ &amp; _____.</p>
Option A:	31.25 kN & 67.71 kN.m (Hogging)
Option B:	31.25 kN & 67.71 kN.m (Sagging)
Option C:	21.25 kN & 67.71 kN.m (Hogging)
Option D:	21.25 kN & 67.71 kN.m (Sagging)
3.	Elongation of steel rod is ..... if length and c/s of rod is 900 mm and 600 mm <sup>2</sup> respectively, subjected to an axial pull of 40 kN. Take E= 200 GPa.
Option A:	0.1 mm
Option B:	0.2 mm
Option C:	0.3 mm
Option D:	0.4 mm
4.	Moment of Inertia about the bottom of a triangle with base B and height H is _____
Option A:	BH <sup>3</sup> /36
Option B:	BH <sup>3</sup> /12
Option C:	BH <sup>3</sup> /48
Option D:	BH <sup>3</sup> /24
5.	Maximum shear stress developed on the surface of a solid circular shaft under pure torsion is 240 MPa. If the shaft diameter is doubled then the maximum shear stress developed corresponding to the same torque will be
Option A:	120 MPa
Option B:	60 MPa
Option C:	30 MPa
Option D:	15 MPa
6.	For a circular shaft of diameter d subjected to torque T, the maximum value of the shear stress is
Option A:	(64T) / (πd <sup>3</sup> )
Option B:	(32T) / (πd <sup>3</sup> )
Option C:	(16T) / (πd <sup>3</sup> )
Option D:	(8T) / (πd <sup>3</sup> )

7.	A simply supported beam of span (L) m is subjected to a point load (W) kN at the center. Maximum deflection in beam is _____ m.
Option A:	$\frac{5WL^4}{384 EI}$
Option B:	$\frac{WL^3}{48 EI}$
Option C:	$\frac{5WL^4}{348 EI}$
Option D:	$\frac{WL^3}{84 EI}$
8.	A simply supported beam of span length 6 m and 75 mm diameter carries a uniformly distributed load of 2 kN/m. The maximum bending stress is
Option A:	72.43 MPa
Option B:	217.30 MPa
Option C:	325.15 MPa
Option D:	651.90 MPa
9.	A rectangular beam 100 mm wide and 250 mm deep is subjected to a shear force of 50 kN. What will be the maximum shear stress at the neutral axis?
Option A:	1.5 MPa
Option B:	3 MPa
Option C:	4.5 MPa
Option D:	6 MPa
10.	A solid round bar of 3 m long and of 50 mm diameter is used as a column with both ends hinged. Crippling load by Eulers is _____, If $E = 2 \times 10^5$ MPa
Option A:	67.29 kN
Option B:	57.29 kN
Option C:	62.29 kN
Option D:	70.29 kN

Q2.	Solve any 4 out of 6	5 marks each
A	With usual notations, establish the relation between E, G, K and $\mu$ .	
B	A thin cylindrical shell 3.2 m long is having 1.2 m internal diameter and it is 15 mm thick. Calculate hoop stress, longitudinal stress and maximum shear stress if internal fluid pressure is 1.6 MPa.	
C	Draw SFD and BMD for a simply supported beam AB of span "L" m carrying a triangular load of zero intensity at the support A and (W) kN/m at the support B.	
D	Define core or kernel of the section. Locate core of the solid rectangular section having width of 300 mm and depth of 400 mm.	
E	A steel rod of 16 mm diameter and 5 m long is connected to two grips, one at each end at a temperature of $120^{\circ}\text{C}$ . Find the pull exerted when the temperature falls to $40^{\circ}\text{C}$ . i. If the ends do not yield. ii. If the ends yield by 1 mm Take $E = 2 \times 10^5 \text{ N/mm}^2$ and $\alpha = 12 \times 10^{-6} / ^{\circ}\text{C}$ .	
F	An unknown weight falls through 15 mm on a collar rigidly attached to the lower end of the bar 4 m long and $800 \text{ mm}^2$ in area. If the maximum instantaneous elongation is 3 mm, find the corresponding stress and the value of unknown weight. Take $E = 2 \times 10^5 \text{ N/mm}^2$	

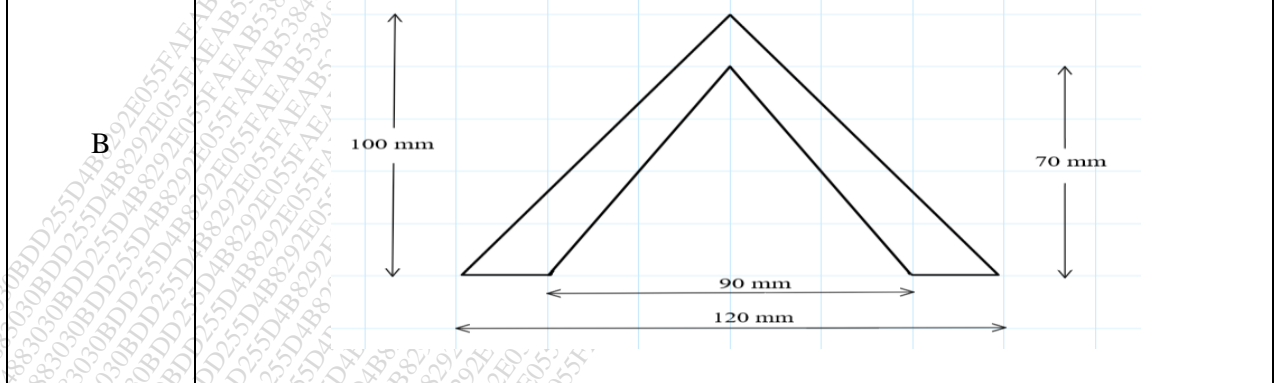
Q3	Solve any 2 Questions out of 3	10 marks each
A	In an experiment, a bar of 40 mm diameter and 200 mm in length is subjected to a pull of 70 kN. Change in length and diameter is 0.09 mm and 0.0039 mm respectively. Calculate the Poisson's ratio, Modulus of Elasticity, Shear Modulus and Bulk Modulus.	



**Q4** Solve any 2 Questions out of 3 **10 marks each**

**A** A hollow circular steel shaft of 6 m length has to transmit 180 kW power at 150 rpm. If internal diameter is 0.6 times external diameter, total angle of twist is not to exceed  $4^\circ$  and shear stress is limited to  $50 \text{ N/mm}^2$ , determine diameter of the shaft. Take  $G = 84 \text{ kN/mm}^2$ .

**B** A beam of 6 m span is loaded with a UDL of  $15 \text{ kN/m}$ . The given fig. is symmetrical about Y-Y axis. Determine and draw the maximum tensile and compressive bending stresses across the section.



**C** For the S/S beam shown, calculate slope at supports and maximum deflection by using Macaulay's method. Take EI constant.

