

## University of Mumbai

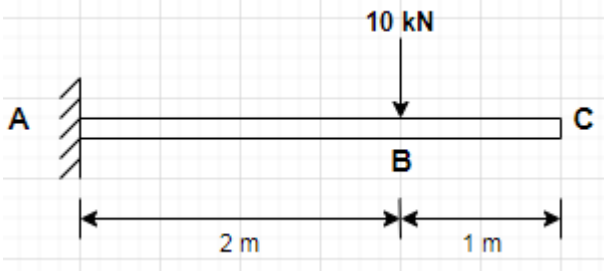
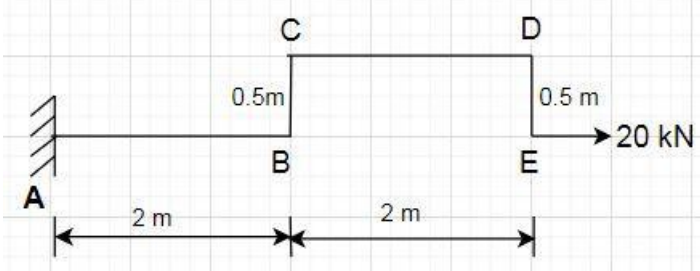
Program: **CIVIL ENGINEERING**

Curriculum Scheme: Rev2019

Examination: SE Semester III

Course Code: CE302 and Course Name: MECHANICS OF SOLIDS

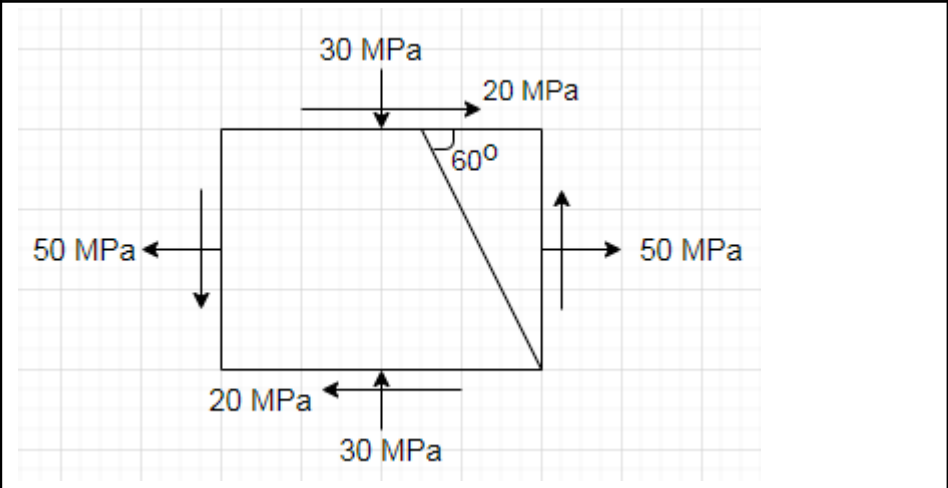
Time: 2hour 30 minutes Max. Marks: 80

Q1.	<b>Choose the correct option for following questions. All the Questions are compulsory and carry equal marks</b>
1.	A thin cylindrical shell having diameter 'd', internal pressure 'p' and shell thickness 't', the Longitudinal stress is given as
Option A:	$pd/8t$
Option B:	$pd/4t$
Option C:	$pd/2t$
Option D:	$pd/t$
2.	A cylinder is said to be thin if the ratio of its thickness to diameter is less than
Option A:	1/25
Option B:	1/20
Option C:	1/15
Option D:	1/10
3.	The beam ABC as shown in fig. Shear Force and Bending moment at <b>B</b> is <div style="text-align: center;">  </div>
Option A:	SF= 10 kN and BM = 20 kN-m
Option B:	SF= 10 kN and BM = Zero
Option C:	SF= Zero and BM = Zero
Option D:	SF = Zero and BM = 20 kN-m
4.	The bending moment at A in given frame is <div style="text-align: center;">  </div>
Option A:	80 kNm
Option B:	100 kNm

Option C:	10 kNm
Option D:	Zero
5.	A diagram which shows the variation of the axial load for all sections of the length of beam is called as
Option A:	Bending moment diagram
Option B:	Shear force diagram
Option C:	Thrust diagram
Option D:	Stress diagram
6.	A cantilever beam of length 4 carries clockwise couple of 20 kN-m. at free end, the shearing force at mid length is ----
Option A:	80 Kn
Option B:	40 Kn
Option C:	20 kN
Option D:	Zero
7.	The point of contra-flexure is indicate the location of
Option A:	Maximum Bending moment
Option B:	Maximum shear force
Option C:	Bending moment changes sign
Option D:	Shear force changes sign
8.	A portal frame ABCD, AB and CD vertical each 4 m. and BC horizontal 6 m. Support A is Hinged and support D is roller with roller base horizontal. At C, 10 kN Force acting vertically downward, the vertical reaction at support A is -----
Option A:	Zero
Option B:	10 Kn
Option C:	40 Kn
Option D:	60 kN
9.	The radius of Mohr's circle for two equals unlike principal stresses of magnitude p is
Option A:	P
Option B:	0.5 p
Option C:	Zero
Option D:	1.5 p
10.	If an element is subjected to pure shearing stress ' $\tau$ ' then the maximum principle stress is equal to
Option A:	4 $\tau$
Option B:	3 $\tau$
Option C:	2 $\tau$
Option D:	T

<b>Q2</b>	<b>Solve any Four out of Six 5 marks each</b>
A	A thin cylindrical shell 1.00 m diameter and 3 m in length has metal thickness of 8 mm. if it is subjected to internal pressure 2.5 MPa, determine change in length. Take $E = 200 \text{ GPa}$ and Poisson's ratio 0.3
B	Derive the relation between shear force, bending moment and rate of loading
C	In a strained body, Normal stresses are 100 Mpa and 50 MPa (both tensile) acted on two mutually perpendicular planes accompanied with shear stress of 20 MPa. Determine the Principle stresses using Mohr's circle method
D	Calculate the instantaneous stress produced in a bar of $15 \text{ cm}^2$ in area and 4 m long by suddenly application of tensile load of unknown magnitude, if the extension of bar due to suddenly applied load is 2 mm. also determine the suddenly applied load. Take $E = 2 \times 10^5 \text{ N/mm}^2$ .
E	Find maximum shear stress induced in a solid circular shaft of diameter 150 mm, when it transmits 120 kW power at 200 rpm.
F	A square steel bar of side 4 cm and length 3 m. is subjected to an axial pull of 128 kN, if $E = 200 \text{ GN/m}^2$ Calculate energy stored in the bar.

<b>Q3.</b>	<b>Solve any Two Questions out of Three 10 marks each</b>
A	<p>Draw AFD, SFD and BMD for following frame</p>
B	In a strained material stresses are as shown. Find resultant stress in magnitude and direction on oblique plane

	
C	<p>A hollow shaft 1.6 m long has an outer diameter of 42 mm and is subjected to a torque of 900 Nm. If the permissible shear stress is 75 N/mm<sup>2</sup> and angle of twist shall not exceed 4 degree, find largest internal diameter take <math>C = 77 \text{ GPa}</math></p>

<b>Q4.</b>	<b>Solve any Two Questions out of Three 10 marks each</b>
A	<p>A square column of 400 mm × 400 mm size is subjected to an axial load of 400 kN. In addition to this a load of 40 kN is acting at an eccentricity of 20 mm about both x-x and y-y axes. Find stresses at all four corners</p>
B	<p>An element in a stressed material has tensile stress of 500 MN/m<sup>2</sup> and compressive stress of 350 MN/m<sup>2</sup> acting on two mutually perpendicular planes and equal shear stresses of 100 MN/m<sup>2</sup> on these planes. Find principal stresses and position of the principal planes. Find also maximum shear stress. Use either analytical or graphical method.</p>
C	<p>A shaft is rotating at 150 rpm. And transmits a power of 300 kw. The diameter of the shaft is 100 mm. Maximum torque is 25% more than the mean torque. What is the Magnitude of torsional shear stress and twist 9 length of shaft is 1.5m. <math>G = 85 \text{ Gpa}</math>.</p>