P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

November 2022

SECV2102 Advanced Solid mechanics

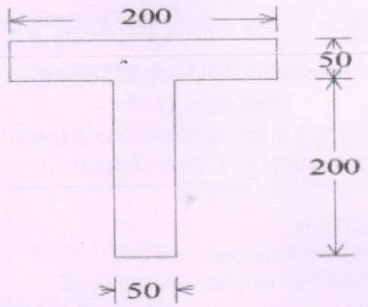
26.11.2022, Saturday **Time: 10:00 a.m. To 12:30 p.m.** **Maximum Marks: 60**

Instructions:

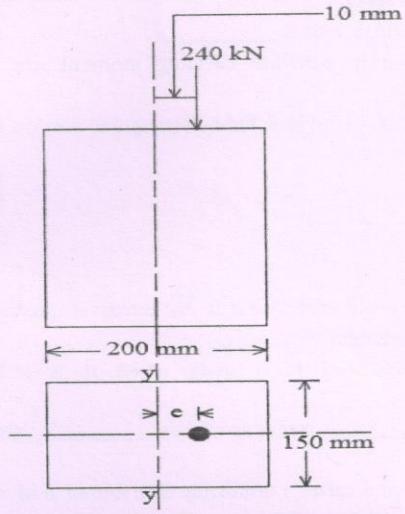
1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator is allowed.

SECTION – I

Q - 1	Answer the Following: (Any Five)	**[05]**	**CO**	**BTL**
(i)	The bending stress on the neutral axis is _____.		**1**	**5**
(ii)	The stresses produced due to constant bending moment are known as _____.		**1**	**1**
(iii)	The maximum shear stress is at the N.A. for a rectangular section is given by _____. (a) $q_{max} = 1.2\ q_{avg}$ (b) $q_{max} = 1.5\ q_{avg}$ (c) $q_{max} = 1.7\ q_{avg}$ (d) $q_{max} = 2.0\ q_{avg}$		**2**	**5**
(iv)	In case of triangular section, the sear stress is not maximum at the N.A. The shear stress is maximum at a height of _____.		**2**	**1**
(v)	Direct stress alone is produced in a body when it is subjected to _____ or _____.		**3**	**2**
(vi)	Eccentric load produces _____ stress as well as _____ stress.		**2**	**2**
(vii)	Define section modulus.			**1**
Q - 2 (a)	A beam is simply supported and caries a uniformly distributed load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is $7 \times 10^8\ mm^4$, find the span of the beam.	**[05]**	**1**	**5**
Q - 2 (b)	An I-section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section.	**[05]**	**2**	**5**
	OR			
Q - 2 (a)	A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. $E = 2 \times 10^5\ N/mm^2$.	**[05]**	**1**	**5**
Q - 2 (b)	The T-Shaped cross section of a beam shown in figure below is subjected to vertical shear force of 100 kN. Calculate the shear stress at the neutral axis and at the junction of the web and the flange. Moment of inertia about the horizontal neutral axis is $1.134 \times 10^8\ mm^4$. All dimension are in mm.	**[05]**	**2**	**4**



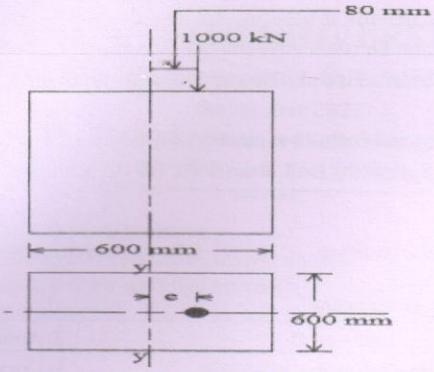
Q - 3 (a) A rectangular column of width 200 mm and of thickness 150 mm carries a point load of 240 kN at an eccentricity of 10 mm as shown in figure below. Determine the maximum and minimum stresses on the section. **[05] 3 5**



Q - 3 (b) A short column of external diameter 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross-section. **[05] 3 5**

OR

Q - 3 (a) A short masonry pillar is 600 mm x 600 mm in section. The pillar carries a point load of 1000 kN acting on the centroidal axis of the section shown in figure below and at an eccentricity of 80 mm from the longitudinal axis. Find the maximum and minimum stresses on the section. **[05] 3 5**



Q - 3 (b)	A tie road of uniform circular cross-section is required to withstand a maximum tension of 500 kN, but the end fixing is such that the line of action is off the axis of the member by 7.5 mm. Find the minimum diameter of the rod if the maximum allowable stress is 125 N/mm^2.	[05]	3	5
Q - 4	Attempt any one/two.	[05]		
(i)	Determine the maximum uniform distributed load, a simply supported 40 cm deep and 20 cm wide timber beam can carry over a span of 4m. The maximum permissible bending stress for the timber is 2 N/mm^2.		4	4
(ii)	An I-beam has 10 cm wide and 1 cm thick flange and a 12 cm high and 1 cm thick web. If this section is subjected to a bending moment of 10kNm and a shearing force of 10 kN, find the maximum tensile and shear stress in it.		4	5

SECTION – II

Q - 1	Answer the following (Any Five)	[05]	
(i)	Euler's formula holds good only for_____ .		1
(ii)	If the slenderness ratio for a column is 100, then it is said to be a _____ column.		1
(iii)	A masonry dam may fail due to _____.		2
(iv)	Define : Column.		4
(v)	Define : Slenderness Ratio.		4
(vi)	Define : kernel or core.		4
(vii)	Define: radius of gyration.		4
Q - 2 (a)	Derive Rankin's formula for crippling load.	[07]	4
Q - 2 (b)	A rectangular column 400 mm wide and 300 mm deep is fixed at both the ends. The length of column is 6 m. E = 1.2 * 10^5 N/mm^2. Find Euler's Crippling load.	[05]	5
	OR		
Q - 2 (a)	Derive Euler's formula for crippling load.	[07]	4
Q - 2 (b)	A hollow circular section is having internal diameter 60 mm and 10 mm thickness. Calculate radius of gyration.	[05]	5
Q - 3 (a)	A masonry trapezoidal dam 4m height, 1m wide at it's top and 3m wide at it's bottom retains water on it's vertical face. Determine the maximum and minimum stresses at the base (i) when the reservoir is full, and (ii) When the reservoir is empty. Take the weight density of masonry as 19.62 kN/m^2	[08]		5
Q - 3 (b)	A hollow mild steel tube 6 m long 4 cm internal diameter and6 mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. E = 2.0 X 10^5 N/mm^2.	[05]		5
	OR			

Q - 3	A masonry dam 6 m high, 3 m wide at base and 1.2 m wide at top, retains water on vertical face for full height. Considering density of masonry as 17kN/m^3 and density of water as 10 kN/m^3, Find out maximum and minimum pressure intensities at the base.	**[08]**	**5**
Q - 3 (b)	A solid round bar 3 m long and 5 cm in diameter is used as a strut with both ends hinged. Determine the crippling load. Take E = 2.0 X 10^5 N/mm^2.	**[05]**	**4**

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CO : Course Outcome Number BTL : Blooms Taxonomy Level

Level of Bloom's Revised Taxonomy in Assessment

1: Remember	2: Understand	3: Apply
4: Analyze	5: Evaluate	6: Create