DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Supplementary Examination – Summer 2022

Course: B. Tech. **Branch : Civil Engineering** **Semester :IV**

Subject Code & Name: Mechanics of Solids **(BTCVC302)**

Max Marks: 60 **Date:** **Duration: 3 Hr.**

Instructions to the Students:

1. *All the questions are compulsory.*
2. *The level of question/expected answer as per OBE or the Course Outcome (CO) on which the question is based is mentioned in ( ) in front of the question.*
3. *Use of non-programmable scientific calculators is allowed.*
4. *Assume suitable data wherever necessary and mention it clearly.*

		(Level/CO)	Marks
Q. 1	**Solve Any Two of the following.**		
A)	Plot stress strain diagram for mild steel. Explain its salient features.	**CO1**	**06**
B)	A metal wire of diameter 3 mm is subjected to an axial tensile force of 2 kN. The extension measured was 4 mm over a length of 1500 mm. Find the modulus of elasticity of the metal.Using the calculated value of modulus of elasticity; find the maximum axial tensile force that can be applied on the wire if the strain is limited to 0.001.	**CO1**	**06**
C)	Define the following terms a) Poissons's ratio b)Elasticity c)Hooks law	**CO1**	**06**
Q.2	**Solve Any Two of the following.**		
A)	A 10 m long simply supported beam carries two point loads of l0kN and 6kN at 2m and 9m respectively from the left end. It also carries a uniformly distributed load of 4kN/m run for the length between 4m to 7m from the left end. Draw shears force and bending moment diagrams.	**CO2**	**06**
B)	A cantilever beam of span L, fixed at the left end, carries a gradually varied load from zero at free end to w per m length at fixed end. Draw the SFD and BMD.	**CO2**	**06**
C)	Obtain the relationship between bending moment, shear force and load intensity at any section of a beam.	**CO4**	**06**
Q. 3	**Solve Any Two of the following.**		
A)	A masonry pillar square in section 600 mm x 600 mm is subjected to point load of 1800 kN at an eccentricity of 200 mm along one of the centroidal axis of cross section. Find the stresses at four corners. Also determine the maximum eccentricity, if the permissible tensile stress in masonry is limited to 2 N/mm^2.	**CO3**	**06**
B)	Find the diameter of a solid shaft which will transmit 150 kW power at 200 r.p.m. if the permissible shear stress is 60 N/mm_2. Find also the length of shaft, if the permissible angle of twist is 1° over the entire length. Take, shear modulus = 80 x 10_3 N/mm^2	**CO3**	**06**

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C)	A hollow shaft is of external diameter 70 mm and diameter ratio 0.8. It transmitsa power of 2 HP at 25 rpm. If the maximum torque exceeds the average torque by 25%, draw the shear stress distribution across the section of the shaft indicating the values.	CO3	06
Q.4	**Solve Any Two of the following.**		
A)	Derive Rankine's formula for finding the critical load of columns.	CO4	06
B)	A circular bar is subjected to a tensile force of 20 kN along with a transverse shear force of 10 kN. Determine the diameter of bar using Maximum Principal Stress, Maximum Principal Strain, and Maximum Shear Stress failure theory. Take: Yield strength = 250MPa, factor of safety = 2, and Poisson's ratio = 0.3	CO3	06
C)	Using Euler's equation for long columns, determine the critical stresses for a compression member of slenderness ratio 80, 120, 160, and 200. The compression member has following end conditions (i) both ends hinged, and (ii) one end hinged and other end fixed.E = 2×10^5 N/mm^2.	CO4	06
Q. 5	**Solve Any Two of the following.**		
A)	An elemental cube is subjected to tensile stresses of 30N/mm2 and 15N/mm2 acting on two mutually perpendicular planes and a shear stress of 25N/mm2 on these planes. Determine magnitude and directions of principal stresses.	CO4	06
B)	Find analytically Principal stresses and Principal planes for an element. The element is subjected to two mutually perpendicular stresses 100 N/mm2 and 50 N/mm2 both tensile in X and Y direction, respectively along with a shear stress of 30 N/mm2 (upwards on a plane of 100 N/mm2 stress). Find also the maximum shear stress.	CO4	06
C)	Explain: The Rankine's failure theory.	CO1	06
	***** End *****		

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