DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

End Semester Examination – Winter 2018

Course: B. Tech. in Civil Engineering | **Sem:** III
Subject Name: Mechanics of Solids | **Subject Code:** BTCVC302
Date: 03/12/2018 | **Max Marks:** 60 | **Duration:** 3 Hrs.

Instructions to the Students:

1. *Solve **ANY FIVE** questions out of the following.*
2. *The level 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.*

		COs	Marks
Q. 1	**Solve Any Two of the following:**		
A)	Define the following properties of materials: Elasticity, Ductility, and Brittleness.	CO1	(6)
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	(6)
C)	A thin tyre made up of mild steel is to be shrunk on to a rigid wheel of 1200 mm diameter. Calculate (i) internal diameter of tyre if the hoop stress is limited to 50 N/mm^2, and (ii) the least temperature to which the tyre must be heated above that of the wheel before it could be slipped on. For the tyre the coefficient of thermal expansion (α) is 12×10^{-6} per °C and $E = 2 \times 10^5$ N/mm^2.	CO1	(6)
Q.2	**Solve the following.**		
)	Write the assumptions made in the theory of pure bending.	CO2	(4)
	OR		
A)	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 = 80×10^3 N/mm^2	CO2, CO4	(4)
B)	A simply supported beam AB is 10 m long. It carries a uniformly distributed load of 20 kN/m over a distance of 5m from the left end A, a clockwise moment of 50 kN-m at 5m and a point load of 40 kN at a distance of 8 m from the left end A. Find shear force & bending moment at important locations and draw S.F.D. and B.M.D for the beam.	CO2	(8)

Q. 3 Solve 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.	CO1, CO4	(6)
B)	Find analytically Principal stresses and Principal planes for an element. The element is subjected to two mutually perpendicular stresses 100 N/mm^2 and 50 N/mm^2 both tensile in X and Y direction, respectively along with a shear stress of 30 N/mm^2 (upwards on a plane of 100 N/mm^2 stress). Find also the maximum shear stress.	CO1, CO4	(6)

Q.4 Solve the following.

A)	Obtain an expression for maximum slope and deflection for a simply supported beam subjected to a central point load.	CO3	(4)
B)	A simply supported beam AB of span 6 m is loaded with three point loads 50 kN, 100 kN, and 50 kN each at 1 m, 3 m, and 5 m respectively from left support. Calculate the deflection under each load. Take, $E = 2 \times 10^5$ N/mm^2 and $I = 20 \times 10^8$ mm^4.	CO3	(8)

Q. 5 Answer the following.

A)	Obtain an expression for Euler's critical load for a column hinged at both the ends.	CO4	(6)
B)	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. $E = 2 \times 10^5$ N/mm^2.	CO4	(6)

Q. 6 Answer the following.

A)	Explain: The Rankine's failure theory.	CO1, CO4	(6)
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 = 250 MPa, factor of safety = 2, and Poisson's ratio = 0.3	CO1, CO4	(6)

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