Reg. No.															

Question Paper Code	14286

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025

Fourth Semester

Civil Engineering

20CEPC402 - STRENGTH OF MATERIALS II

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What is the formula for strain energy stored in a body due to axial loading? (a) $U=\sigma^2V/2E$ (b) $U=P^2/2AE$ (c) $U=1/2P\delta$ (d) All of the above	1	K1	CO1
2.	The principle of virtual work states that: (a) The work done by virtual forces equals the virtual strain energy (b) The virtual work done by internal forces equals the work done by external forces (c) Work done in a system is independent of the path (d) None of the above	1	K1	CO1
3.	Which of the following methods can be used to compute deflections in determinate beams? (a) Moment-area method (b) Unit load method (c) Castigliano's theorem (d) All of the above	1	K2	CO2
4.	The Williot-Mohr's diagram is primarily used to determine: (a) Deflection of beams (b) Displacement in trusses (c) Stress in columns (d) Shear force in beams	1	K2	CO2
5.	The fixed end moment for a beam subjected to a uniform load www over the entire span L is: (a) $wL^2/8$ (b) $wL^2/12$ (c) $wL^2/16$ (d) $wL^2/24$	1	K2	CO3
6.	The theorem of three moments applies to: (a) Simply supported beams (b) Continuous beams (c) Cantilever beams (d) Fixed beams	1	K1	CO3
7.	Euler's formula is valid for: (a) Long columns (b) Short columns (c) Columns under eccentric loading (d) None of the above	1	K1	CO4
8.	Thin spherical shells subjected to internal pressure develop: (a) Hoop stresses only (b) Longitudinal stresses only (c) Hoop and longitudinal stresses (d) Radial stresses only	1	K1	CO4
9.	Stress invariants are quantities that: (a) Depend on the orientation of the axes (b) Are equal to principal stresses (c) Remain constant under coordinate transformation (d) Are always zero	1	K1	CO5
10.	The point in a cross-section through which the resultant shear force acts is called: (a) Neutral axis (b) Shear center (c) Centroid (d) Centre of gravity	1	K2	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

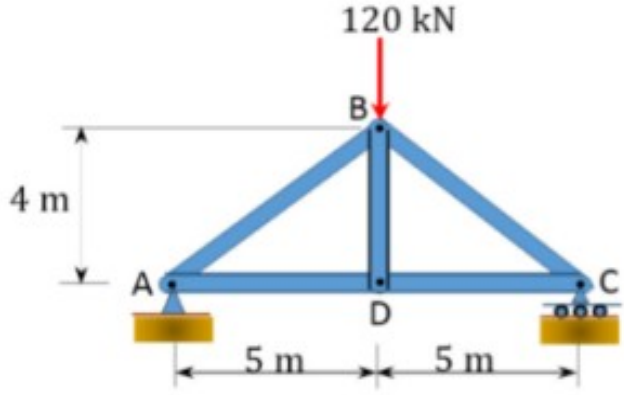
11.	Define the terms: Proof resilience and Modulus of resilience.	2	K1	CO1
12.	Write the formula for the strain energy stored in a body, when the load is gradually applied.	2	K2	CO1
13.	Define unit load method.	2	K1	CO2
14.	Compare the unit load method and Castigliano's first theorem.	2	K2	CO2
15.	Differentiate the statically determinate structures and statically indeterminate structures.	2	K2	CO3

16.	Write down the Clapeyron's three moment equations for the continuous beam with sinking at the supports.	2	K2	CO3
17.	Define: Column and strut.	2	K1	CO4
18.	Write the Euler's formula for different end conditions.	2	K2	CO4
19.	Give the expressions for Maximum and Minimum Principal stresses on a plane.	2	K2	CO5
20.	State the maximum principal stress theory of failure.	2	K1	CO5
21.	Write the expression for position of neutral axis in case of curved bars.	2	K2	CO6
22.	State the principal Axes and Principal Moment of inertia.	2	K1	CO6

PART - C (6 × 11 = 66 Marks)

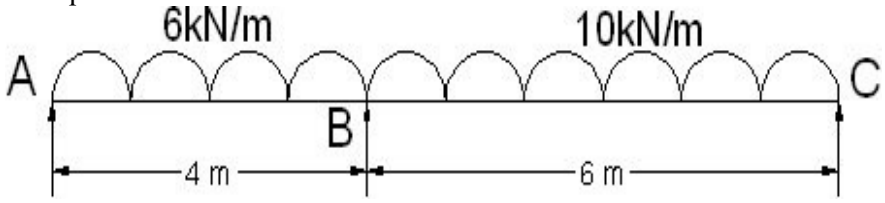
Answer ALL Questions

23.	a)	A tensile load of 60 kN is gradually applied on a circular bar of 4 cm in diameter and 5 m long. Calculate the strain energy in the rod if E = $2x10^5$ N/mm^2.	11	K2	CO1
		OR			
	b)	A beam of length L is simply supported at the ends with eccentric point load W at a distance of 'a' from left end. Take EI as constant, Find the strain energy and deflection of the beam.	11	K2	CO1
24.	a)	Using the virtual work method, determine the vertical deflection at joint B of the truss shown in fig below. Take E = 200 Gpa and A = 5 cm^2	11	K3	CO2



OR

	b)	Using the method of virtual work, examine the deflection at the free end of the cantilever beam carrying uniformly distributed load 25 kN/m throughout the length of 12m. Take E = 2 x 10^5MPa, I =825 x 10^7mm^4.	11	K3	CO2
25.	a)	A fixed beam of 6 m span is loaded with point loads of 150 kN at distance of 2m from each support. Draw the bending moment diagram and shear force diagram. Also find the maximum deflection.	11	K3	CO3
		OR			
	b)	Draw the S.F. and B.M. diagrams for the beam shown in the fig. Use three moment equation.	11	K3	CO3



26.	a)	A pipe of 200 mm internal diameter and 50 mm thickness carries a fluid at a pressure of 10 MPa. Calculate the maximum and minimum intensities of circumferential stress across the section. Also sketch the radial stress distribution and circumferential stress distribution across the section.	*11*	*K2*	*CO4*
		OR			
	b)	What are the assumptions made in Euler's Column theory? and derive the Euler's crippling load for a column with both ends hinged.	*11*	*K2*	*CO4*
27.	a)	In a steel member, at a point the major principal stress is 200 MN/m2 and the minor principal stress is compressive. If the tensile yield point of the steel is 235 MN/m^2, find the value of the minor principal stress at which yielding will commence, according to each of the following criteria of failure i) Maximum shearing stress. ii) Maximum total strain energy and iii) Maximum shear strain energy. Take Poisson Ratio = 0.26.	*11*	*K3*	*CO5*
		OR			
	b)	The state of stress (Cartesian components of stress) at a point in three-dimensional stress system are σ_{xx}= 7 MPa, σ_{yy}= 6 MPa, σ_{zz}= 5 MPa, τ_{xy}= 2 MPa, τ_{yz}= -2 MPa and τ_{xz}= 0 MPa. Determine the principal stresses at the given point.	*11*	*K3*	*CO5*
28.	a)	A beam of rectangular section, 80 mm wide and 120 mm deep is subjected to a bending moment of 20 kN.m. The trace of the plane of loading is inclined at 45^o to the YY axis of the section. Locate the neutral axis of the section and calculate the bending stress induced at each corner of the beam section.	*11*	*K3*	*CO6*
		OR			
	b)	A curved beam of rectangular cross section is subjected to pure bending with a moment of 400 N-m. The beam has width of 20 mm, depth of 40 mm and is curved in plane to the depth. The mean radius of curvature is 5 mm. Determine the position of neutral axis and the ratio of maximum to the minimum stress. Also, plot the variation of the bending stress across the section.	*11*	*K3*	*CO6*