Reg. No.															

Question Paper Code	13639

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2025

Third Semester

Civil Engineering

20CEPC301 - STRENGTH OF MATERIALS - I

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	If a part is constrained to move and heated it will develop (a) Principal stress (b) Tensile stress (c) Compressive stress (d) Shear stress	1	K1	CO1
2.	Which of following is correct representation of poisson ratio (a) Lateral strain/Longitudinal strain (b) Lateral stress/Longitudinal strain (c) Lateral strain/Longitudinal stress (d) Lateral stress/Longitudinal stress	1	K1	CO1
3.	Shear stress on mutually perpendicular planes are (a) Zero (b) Maximum (c) Equal (d) Minimum	1	K1	CO2
4.	Principal stress at a point in a plane stressed element are $\sigma_x = \sigma_y = 500N/mm^2$. Normal stresses on the plane inclined at 45 deg to the x axis will be (a) 0 (b)$500N/mm^2$ (c) $1000N/mm^2$ (d) $707N/mm^2$	1	K2	CO2
5.	A simply supported beam of length 6m, carries point load of 3kN and 6kN at distances of 2m and 4m from the left end. What is the value of Bending Moment at the point where 3 kN load is acting? (a) 4kNm (b) 6kNm (c) 8kNm (d) 10kNm	1	K2	CO3
6.	Greater portion of shear force in a beam of I-section is shared by (a) Flange (b)Web (c) Both flange and web (d) None of the above	1	K1	CO3
7.	Which of the following method is used to determine the slope and deflection at a point? (a) Arithmetic increase method (b) Mathematical curve setting (c) Macaulay's method (d) Lacey's method	1	K1	CO4
8.	The deflection of a beam may be reduced by (a) decreasing the depth of beam (b) increasing the span (c) providing greater end restrains (d) any of the mentioned methods	1	K1	CO4
9.	Buffer spring is used in _____. (a) Cars (b) Elevators (c) Guns (d) All of the mentioned	1	K1	CO5
10.	Which of the following material is not used in making trusses? (a) Wooden struts (b) Metal bars (c) Channel (d) Concrete	1	K1	CO6

PART - B (12 × 2 = 24 Marks)

Answer ALL Questions

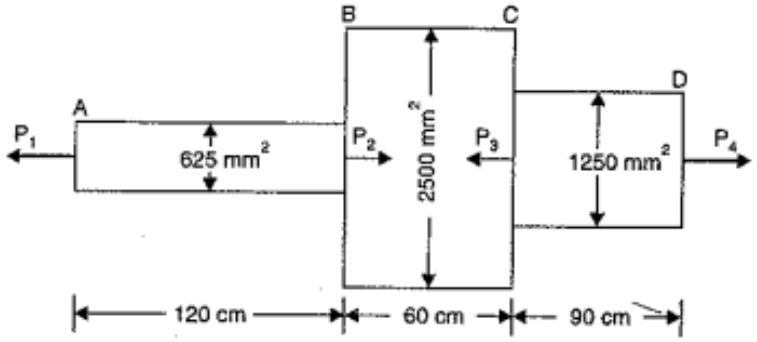
		Marks	K – Level	CO
11.	Recall the formulae for modulus of elasticity and rigidity modulus.	2	K1	CO1
12.	Define thermal stress and strain.	2	K1	CO1
13.	A rectangular bar of cross section 20,000 mm^2 is subjected to axial load of 30kN, section is inclined at an angle of 45 deg with normal cross section of the bar, what will be shear stress on the section.	2	K2	CO2
14.	If the principal stress problem $\sigma_1 = 100Mpa$ and $\sigma_2 = 40Mpa$ the magnitude of maximum shear stress will be?	2	K2	CO2
15.	What is meant by section modulus?	2	K1	CO3
16.	Demonstrate the term Flitched Beams.	2	K2	CO3
17.	How do you determine the maximum deflection in a simply supported beam?	2	K1	CO4

18.	A cantilever beam of 2m span is subjected to a point of 2kN at its free end. Compute the slope at its free end. Assume EI =2 x 10^4 kN-m^2.	*2*	*K2*	*CO4*
19.	Define stiffness.	*2*	*K1*	*CO5*
20.	Define the terms: Torsion and torsional rigidity.	*2*	*K1*	*CO5*
21.	What are the different types of trusses?	*2*	*K1*	*CO6*
22.	Define 'Tension coefficient'.	*2*	*K1*	*CO6*

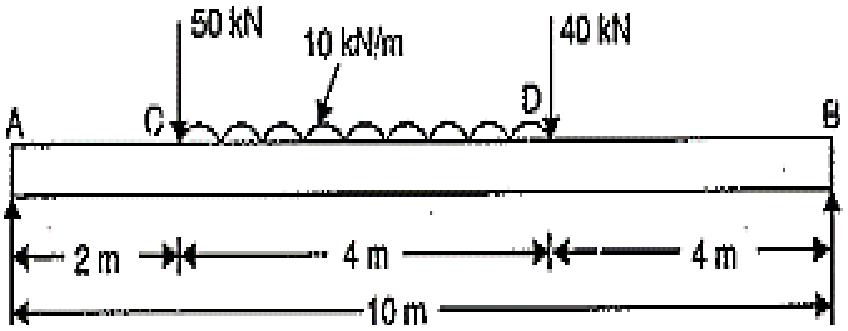
PART - C (6 × 11 = 66 Marks)

Answer ALL Questions

23.	a)	Three bars made of copper, zinc and aluminum are of equal length and have cross section 555 mm^2, 705 mm^2 and 1020 mm^2 respectively. They are rigidly connected at their ends. If this compound member is subjected to a longitudinal pull of 255kN, estimate the proportional of the load carried on each rod and the induced stresses. Take the value of E for copper = 1.3×10^5 N/mm^2, for zinc = 1×10^5 N/mm^2 and for aluminum = 0.8×10^5 N/mm^2.	*11*	*K3*	*CO1*
		OR			
	b)	A member ABCD is subjected to point loads P_1,P_2,$P_3$and P_4 as shown. Find P_2 required for necessary equilibrium, if P_1 = 45kN, P_3 = 450kN and P_4=130kN. Determine the total elongation of the member.	*11*	*K3*	*CO1*

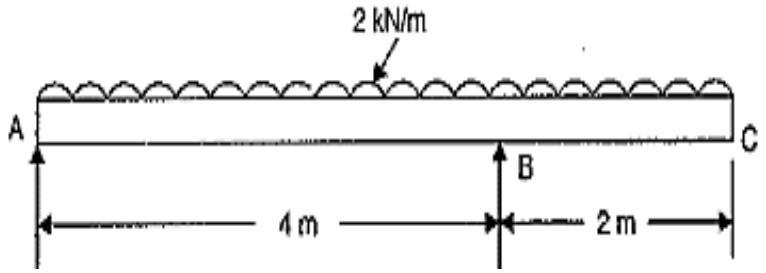


24.	a)	An element in a stressed material has tensile stress of 500MN/m^2 and compressive stress of 350MN/m^2 acting on two mutually perpendicular planes and equal shear stress of 100MN/m^2 on these planes. Find the principal stress and position of principal planes. Find also maximum shearing stress.	*11*	*K3*	*CO2*
		OR			
	b)	The principal stress at a point in a bar are 160 N/mm^2(tensile), 80N/mm^2(compressive). Determine the resultant stress in magnitude and direction on a plane 60 deg to axis of major principal stress. Also determine the maximum intensity of shear stress in the material at the point.	*11*	*K3*	*CO2*
25.	a)	A simply supported beam of length 10m carries the uniformly distributed load and two point loads as shown in fig. Draw the SFD and BMD for the beam and also calculate maximum bending moment.	*11*	*K3*	*CO3*



OR

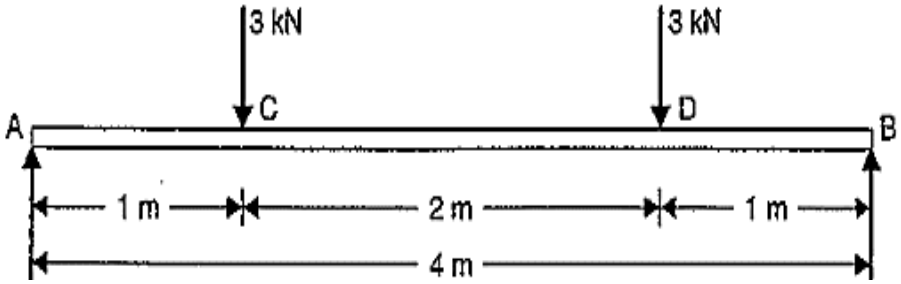
b) Draw Shear Force Diagram and Bending Moment Diagram for the overhanging beam shown below. Also locate the point of contra flexure. *11 K3 CO3*



26. a) A Cantilever beam of length 2m carries a load of 20 kN at the free end and 30 kN at a distance 1m from the free end. Find the slope and deflection at the free end by Moment area method. Take E = 2 x 10^5 N/mm^2 and I = 1.5 x 10^8 mm^4. *11 K3 CO4*

OR

b) A simply supported beam of length 4 m carries a point load of 3 kN at a distance 1 m from each end. If E = 2 x 10^5 N/mm^2 and I = 10^8 mm^4 for the beam, the using Macaulay method determine (i) slope at each end and under each load. (ii) Deflection under each load. *11 K3 CO4*

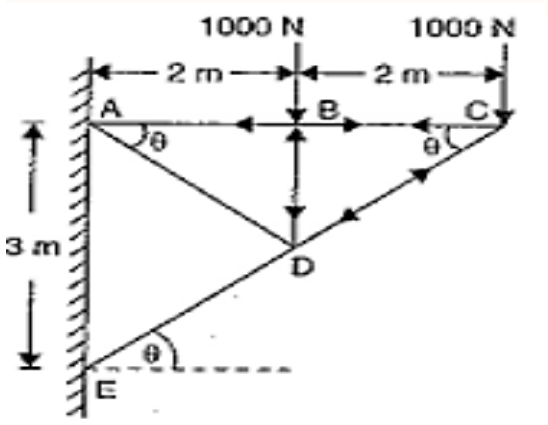


27. a) A hollow circular shaft is required to transmit 600 kW power at 110 r.p.m. The maximum torque is 20% more than the mean torque. Assume that the diameter ratio as 3/8 and Modulus of Rigidity G = 80 kN/mm^2. Determine the external and internal diameters of the shaft. *11 K3 CO5*

OR

b) A closed coiled helical spring is made out of 10mm diameter steel rod the coil consist of 10 complete turns with mean diameter 120mm. the spring carries axial pull of 200N find the maximum shear stress induced in the section of the rod. If C=80GN/m^2 find the deflection in the spring, stiffness and strain energy stored in the spring. *11 K3 CO5*

28. a) Find the force in all the member of cantilever truss. *11 K3 CO6*



OR

b) Analyze and predict the forces in all members of the truss shown in figure by using any one analytical method. *11 K3 CO6*