Reg. No.												

Question Paper Code	13965

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025
Third Semester
Civil Engineering
24CEPC301 - SOLID MECHANICS
Regulations - 2024

Duration: 3 Hours   Max. Marks: 100

PART - A (MCQ) (10 × 1 = 10 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	The unit of stress in S.I. unit is	1	K1	CO1
	(a) MN/m² (b) kN/mm² (c) N/mm² (d) all of the above			
2.	………. load is one which is considered to act at a point.	1	K1	CO1
	(a) Triangular (b) Uniformly distributed (c) Point (d) None of the above			
3.	If a member is subjected to a uniform bending moment (MMM), the radius of curvature of the deflected form of the member is given by	1	K2	CO2
	(a) M/I = E/R (b) M/R = I/E (c) M/I = R/E (d) all of the above			
4.	The bending moment on a section is maximum where shearing force is	1	K2	CO2
	(a) minimum (b) maximum (c) zero (d) equal			
5.	Which assumption is **NOT** valid in truss analysis?	1	K2	CO3
	(a) Joints are frictionless (b) Members are pin-connected			
	(c) Loads are applied at joints (d) Members resist bending			
6.	In method of joints, number of equilibrium equations at each joint is:	1	K2	CO3
	(a) 1 (b) 2 (c) 3 (d) 6			
7.	The bending moment at the fixed end of a cantilever carrying a point load W at free end is:	1	K2	CO4
	(a) WL (b) WL/2 (c) $WL^2/2$ (d) WL^2			
8.	A fixed beam of span 6 m carries a central load of 60 kN. The fixed end moment at each support is:	1	K2	CO4
	(a) 30 kNm (b) 60 kNm (c) 45 kNm (d) 90 kNm			
9.	A hollow circular column has inner radius 100 mm and outer radius 200 mm. The core radius is:	1	K2	CO5
	(a) 25 mm (b) 50 mm (c) 100 mm (d) 200 mm			
10.	Plane stress $\sigma x=60$, $\sigma y=30$, $\tau=20$. Max principal stress?	1	K2	CO6
	(a) 65 (b) 70 (c) 50 (d) 80			

PART - B (12 × 2 = 24 Marks)
Answer ALL Questions

11.	Define Stress and Strain. List the types of stress and strain.	2	K1	CO1
12.	Sketch the stress strain curve for Mild steel.	2	K2	CO1
13.	What is the maximum bending moment for a simply supported beam subjected to udl load and where it occurs?	2	K2	CO2
14.	Differentiate between hogging and sagging moment.	2	K2	CO2
15.	What are the methods used to analyse the plane & space frames?	2	K2	CO3
16.	What are the hints to be followed while analysing a cantilever truss using method of joints?	2	K2	CO3
17.	Write down the Clapeyron's three moment equations for the continuous beam with sinking at the supports.	2	K2	CO4
18.	Find the fixed end moments of a fixed beam subjected to a point load at the center.	2	K2	CO4
19.	What are the assumptions followed in Euler's equation?	2	K1	CO5
20.	What are the factors that affect the strength of column?	2	K2	CO5
21.	Which theory of failure is suitable for brittle materials? Why?	2	K2	CO6

K1 – Remember; K2 – Understand; K3 – Apply; K4 – Analyze; K5 – Evaluate; K6 – Create   **13965**

22. State the Maximum Shear Stress Theory of failure.   *2   K1   CO6*

**PART - C (6 × 11 = 66 Marks)**
Answer ALL Questions

23. a) A tensile test was conducted on a mild steel bar. The following data was obtained   *11   K3   CO1*
    from the test:
    a) Diameter of the steel bar = 40 mm
    b) Gauge length of the bar = 220 mm
    c) Load at elastic limit = 250 kN
    d) Extension at a load of 160 kN = 0.235 mm
    e) Maximum load = 390 kN
    f) Total extension = 70 mm
    g) Diameter of rod at failure = 23.5 mm
    Determine: a) The Young's modulus b) The stress at elastic limit (c) The percentage of elongation d) The percentage decrease in area.

OR

b) A tensile test is conducted on a mild steel bar. The following data was obtained   *11   K3   CO1*
    from the test : diameter of the steel bar= 3cm, Gauge Length of the bar = 20cm, Load at Elastic limit= 250kN, Extension at a load of 150kN= 0.21 mm, Maximum Load = 380kN, Total Extension= 60mm, Diameter of the rod at failure=2.25cm, Determine young's modulus, Stress at Elastic limit, Percentage of elongation & percentage decrease in area.

24. a) A Cantilever beam of span 5 m carries concentrated loads of 1 kN, 3 kN and 2 kN   *11   K3   CO2*
    at 2m, 3m and 5 m from the fixed end respectively. Draw Shear Force Diagram and Bending Moment Diagram.

OR

b) A flitched beam consists of a wooden joist 100 cm wide and 20 cm deep   *11   K3   CO2*
    strengthened by two steel plates 10 mm thick and 20 cm deep as shown in figure. If the maximum stress in the wooden joist is 7 N/mm^2, find the corresponding maximum stress attained in steel. Find also the moment of resistance of the composite section. Take E = 2x 10^5 N/mm^2 and for wood = 1 x 10^4 N/mm^2.
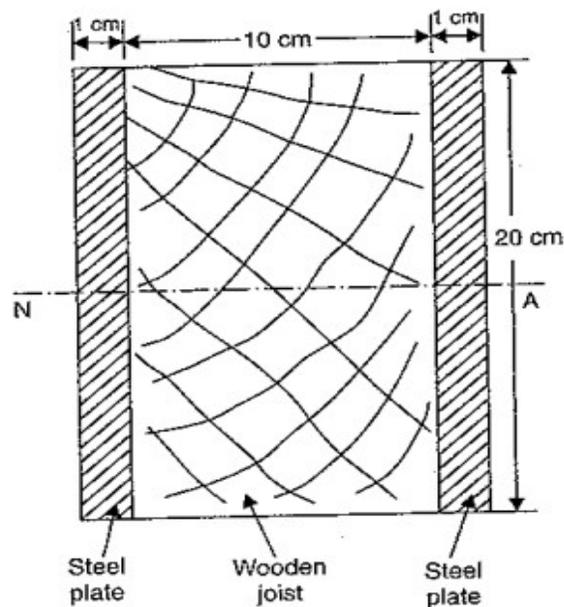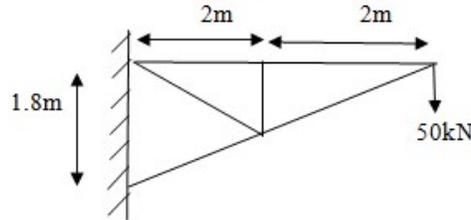
25. a) Determine the forces in all the members of the truss shown in Fig using method of joints.   *11   K3   CO3*
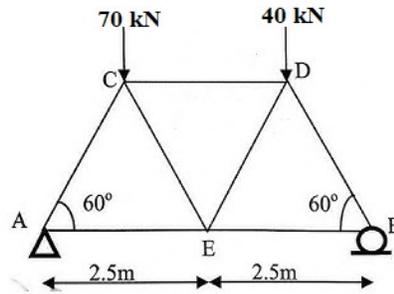
OR

b) Analyze the cantilevered truss shown in figure by method of tension co-efficient.   *11   K3   CO3*

26. 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   CO4*

OR

b) A beam ABCD 16 m long is continuous over three spans; AB = 6 m, BC = 6m and CD = 6 m, the supports being at the same level. There is a uniformly distributed load of 20 kN/m over BC. On AB, there is a point load of 80 kN at 2 m from A. On CD there is a point load of 60 kN at 3m from D. Calculate the moments and reactions at the supports using theorem of three moments.   *11   K3   CO4*

27. a) Derive the Euler"s crippling load for a column with one end fixed and the other end free.   *11   K3   CO5*

OR

b) 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   K3   CO5*

28. a) Determine the principal stresses and direction cosines of principal stresses and maximum shear stress for the following 3D- stress field.   *11   K3   CO6*

$$\begin{bmatrix} 30 & 15 & 20 \\ 15 & 20 & 25 \\ 20 & 25 & 40 \end{bmatrix}$$

OR

b) A cylindrical shell 1.2m diameter is to be made of mild steel plates. It is subjected to an internal pressure of 1.5 MN/m^2. If the material yields at 200 kN/m^2, calculate the thickness of the plate on the basis of following theories of failure assuming a FOS of 2 in each case. Maximum principal stress theory and Maximum principal strain theory.   *11   K3   CO6*