GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY, ODISHA, GUNUPUR
(GIET UNIVERSITY)

B. Tech (Fourth Semester - Regular) Examinations, April – 2025

23BCVPC24001 – Structural Analysis I

(Civil Engineering)

Time: 3 hrs Maximum: 60 Marks

Answer ALL questions

(The figures in the right hand margin indicate marks)

PART – A **(2 x 5 = 10 Marks)**

		CO #	Blooms Level
Q.1.	Answer ***ALL*** questions		
a.	Explain Maxwell's reciprocal theorem and Betti's reciprocal theorem.	CO4	K2
b.	Construct an influence line diagram for the bending moment and shear force of a cantilever beam.	CO2	K2
c.	What will be the deflection at the centre of a simply supported beam of length l carrying a point load (w) at the centre?	CO4	K2
d.	Write the Euler crippling load of a column, when		
	i. Both ends hinged	CO5	K2
	ii. One end fixed and the other end free		
e.	Define the equation of equilibrium.	CO1	K2

PART – B **(10 x 5 = 50 Marks)**

		Marks	CO #	Blooms Level
	Answer ***ALL*** the questions			
2. a.	Evaluate the degree of static and kinematic indeterminacy of the plane frame. Refer Fig. A.	5	CO1	K3

Fig. A

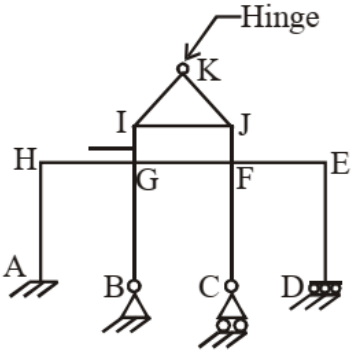
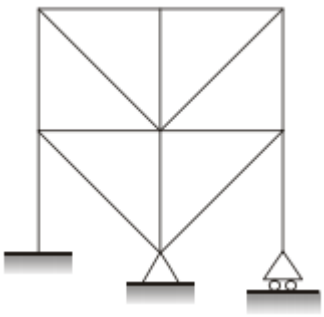
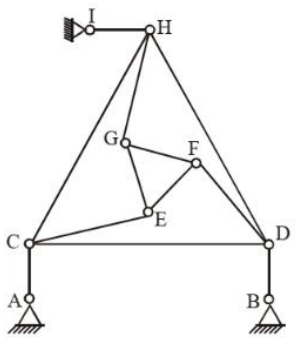
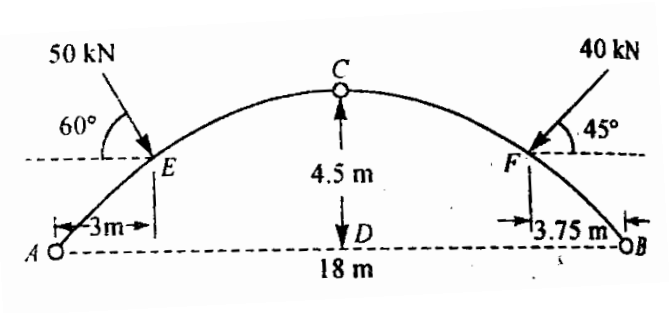
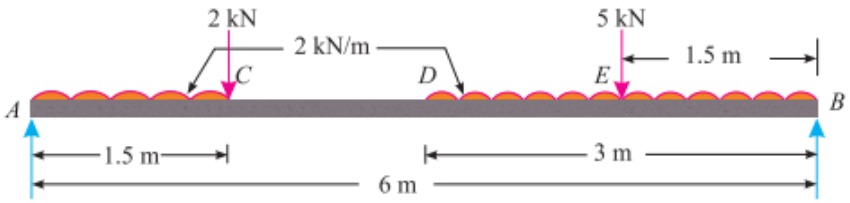


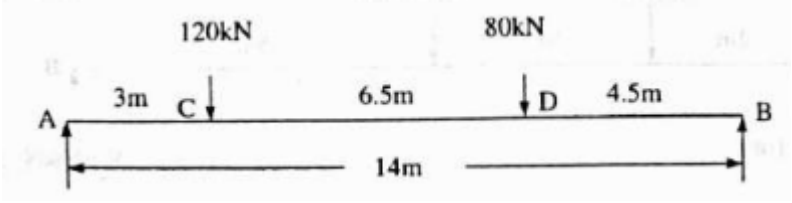
Fig. B



b.	Evaluate the degree of static and kinematic indeterminacy of the plane frame. Refer Fig. B.	5	CO1	K3
	(OR)			
c.	Evaluate the degree of static and kinematic indeterminacy of the plane frame.	5	CO1	K3

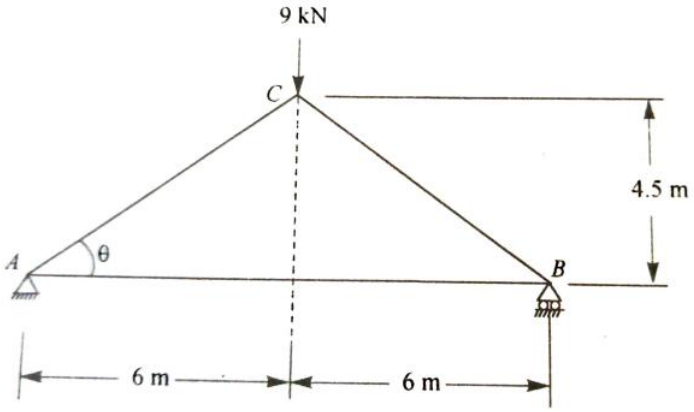


d.	Illustrate short notes on i. Static indeterminacy ii. Kinematic indeterminacy	5	CO1	K2
3.a.	A three-hinged parabolic arch has a span of 25 m and a central rise of 5m. It carries a UDL of 25 kN/m over the left half portion. Evaluate the following: i. Reactions at the supports ii. Bending moment, Normal thrust, and Radial shear at a section 10m from the left support.	10	CO3	K3
	(OR)			
b.	A circular segmental three-hinged arch is shown in the figure. Evaluate the i. Reactions at the supports ii. Bending moments at the loaded points. 	10	CO3	K3
4.a.	Evaluate the deflection at the free end of a cantilever beam of length L carrying a load w at the free end using i. Castigliano's method. ii. Strain Energy method	10	CO4	K3
	(OR)			
b.	A long column of 2m length is hinged at both ends. Yielding on outer fibres starts when the central deflection is equal to 15mm. Evaluate the breadth and depth of rectangular section with (b/d) = 0.4. Take $E = 200\ GPa$ *and* $f_y = 250\ MPa$	5	CO5	K3
c.	Derive Euler's crippling load of a column when both ends are fixed.	5	CO5	K3
5.a.	Four wheel loads of 200, 150, 300 and 100 KN spaced 1.0, 1.5, and 2 meters apart respectively cross a girder of 10 m span from the left to right with 100 KN wheel leading. Compute the i. Reactions, ii. Shear force, and bending moment when the 300kN load is at 6m iii. The maximum B.M. at 5m.	10	CO2	K3
	(OR)			
b.	Derive and construct the influence line diagram for shear force, and bending moment of a simply supported beam of length L.	5	CO2	K3
c.	Evaluate the shear force and bending moment at 2m from the left support using the influence line diagram. 	5	CO2	K3
6.a.	Evaluate the deflection at C and D using the double integration method. Take I $=16 \times 10^8 mm^4$ and E = 200 GPa.	10	CO5	K3



(OR)

b. Evaluate the horizontal deflection at joint B of the pin-jointed truss shown in the figure using the Unit load method. The area of the horizontal member is 150 $mm^{2,}$ and the areas of the members' AC and BC are 200 mm^2 each. Take E = 200 kN/mm^2. 10 CO5 K3



--- End of Paper ---