

Gandhi Institute of Engineering and Technology University, Odisha, Gunupur (GIET University)



B. Tech (Fourth Semester – Regular/Supplementary) Examinations, April 2026

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)

Q.1. Answer **ALL** questions

- a. Define degree of static indeterminacy.
- b. Draw the influence line diagram for shear force and bending moment of a cantilever beam.
- c. Determine the bending moment at the crown of a three-hinged arch of span 20m and rise 6m carrying a 20 kN point load at 5m from the left support.
- d. Define Castigliano's second theorem.
- e. What are the boundary conditions for a cantilever beam?

CO #	Blooms Level
CO1	K2
CO2	K2
CO3	K2
CO4	K2
CO5	K2

PART – B

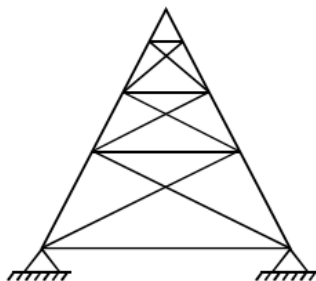
(10 x 5 = 50 Marks)

Answer **ALL** the questions

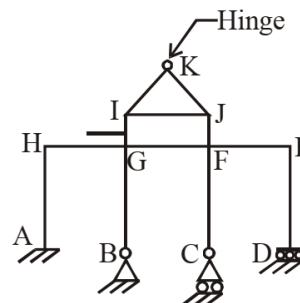
2. a. Determine the degree of static and kinematic indeterminacy of the truss.
(Fig. 1.)
- b. Determine the degree of static and kinematic indeterminacy of the structure.
(Fig. 2)

Marks	CO #	Blooms Level
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5	CO1	K3
5	CO1	K3



(Fig. 1)

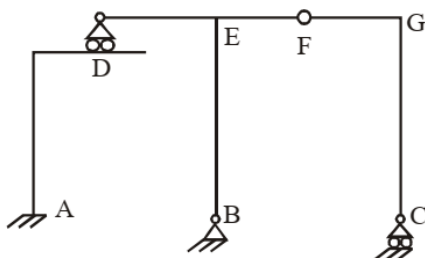


(Fig. 2)

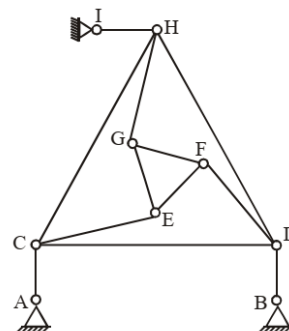
(OR)

- c. Determine the degree of static and kinematic indeterminacy of the structure.
(Fig. 3)
- d. Determine the degree of static and kinematic indeterminacy of the structure.
(Fig. 4)

5	CO1	K3
5	CO1	K3



(Fig.3)



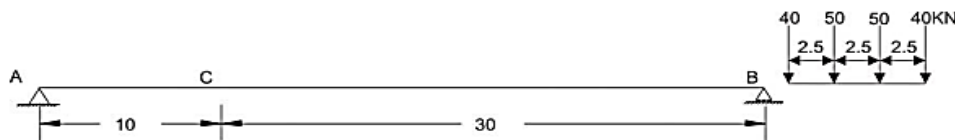
(Fig. 4)

- 3.a. A UDL of 4kN/m covers left half span of 3-hinged parabolic arch of span 36m and central rise 8m. Determine the followings:
- Horizontal thrust
 - Bending moment at 9m
 - Normal thrust and Radial shear at 9m
 - Maximum bending moment

(OR)

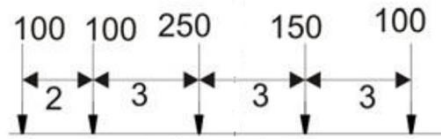
- b. A circular (three hinged) arch of span 25 m with a central rise of 5 m is hinged at the crown and the end supports. It carries a point load of 100 kN at 6 m from the left support. Calculate
- The reaction at the supports
 - Bending moment, Radial shear and Normal thrust at 5m from left support.

- 4.a. The beam is loaded with concentrated loads, which are moving from right to left as shown in figure. Compute the maximum shear force and bending moment at the section C. Also, determine the absolute maximum bending moment.



(OR)

- b. Compute the absolute maximum bending moment for the simply supported beam having span of 30 m and loaded with a series of concentrated loads moving across the span as shown in figure. Also, determine the maximum bending moment at 16 m from the left support.



- 5.a. Determine the central deflection of a simply supported beam of length L carrying a load w at center using the following methods:
- Castigliano's 2nd theorem
 - Strain energy method

(OR)

- b. Compute the deflection at free end of a cantilever beam of span 8 m and moment of inertia $4.75 \times 10^8 \text{ mm}^4$ by Unit Load method. The load at free end is 5 kN. Consider $E = 200 \text{ kN/m}^2$.

- 6.a. A beam of uniform rectangular section 200 mm wide and 300 mm deep is simply supported at its ends. It carries a uniformly distributed load of 9 kN/m run over the entire span of 5 m. if the value of E for the beam material is 10 GPa, determine the slope at the supports and maximum deflection.

(OR)

- b. A cantilever of length 3 m is carrying a point load of 25 kN at the free end. If $I = 10^8 \text{ mm}^4$ and $E = 210 \text{ GPa}$, determine the slope and deflection at the free end.

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