**Q. Code: 166961**

**Reg. No.** | | | | | | | | | | | | | |

# B.E. / B.TECH. DEGREE EXAMINATIONS, MAY 2024

Fourth Semester

## CE22401 – STRUCTURAL ANALYSIS I

*(Civil Engineering)*

**(Regulation 2022)**

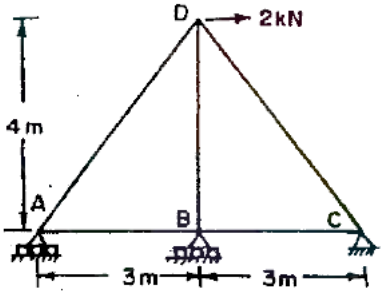
**TIME: 3 HOURS** **MAX. MARKS: 100**

| COURSE OUTCOMES | STATEMENT | RBT LEVEL |
|---|---|---|
| **CO 1** | Analyze the pin-jointed and rigid jointed frames using consistent deformation method | **3** |
| **CO 2** | Analyse the continuous beams and rigid frames by slope deflection method | **3** |
| **CO 3** | Apply the concept of moment distribution and analyse continuous beams and rigid frames with and without sway | **3** |
| **CO 4** | Analyse two and three hinged parabolic and circular arches for given loading | **3** |
| **CO 5** | Analyse the cable structures and suspension bridges with stiffening girders | **3** |

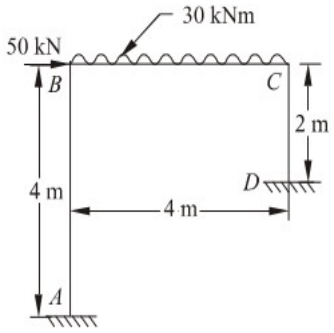
### PART- A (20 x 2 = 40 Marks)

(Answer all Questions)

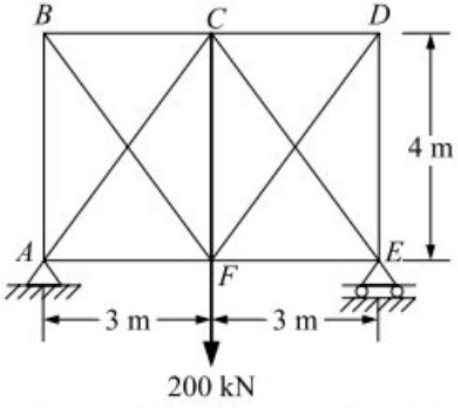
| | | CO | RBT LEVEL |
|---|---|---|---|
| **1.** | Differentiate perfect and imperfect frames with examples. | **1** | **2** |
| **2.** | Determine the degree of indeterminacy for the truss shown in figure. Supports A and B are rollers and the support C is hinged. | **1** | **3** |



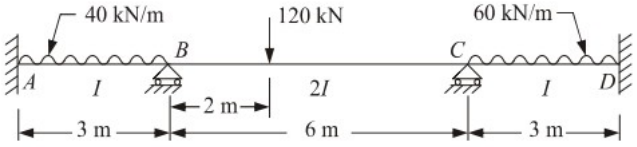

| | | | |
|---|---|---|---|
| **3.** | Determine the degree of indeterminacy of the frame shown in figure. | **1** | **3** |



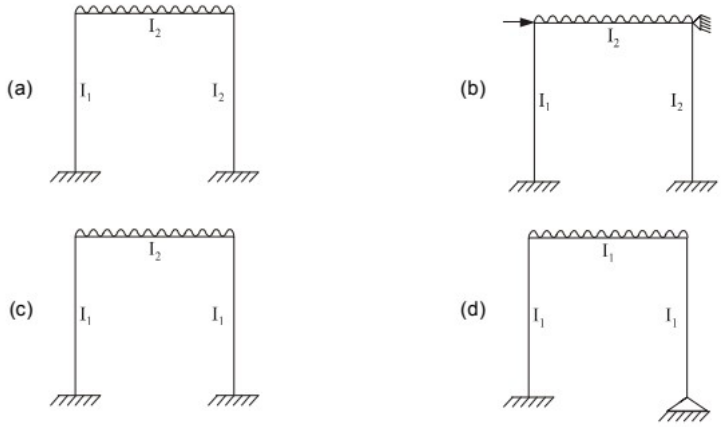
| | | | |
|---|---|---|---|
| **4.** | Determine the degree of indeterminacy for the truss shown in figure. | **1** | **3** |



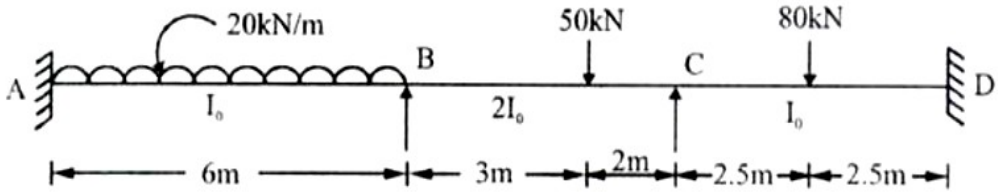

| | | | |
|---|---|---|---|
| **5.** | What are the assumptions made in slope deflection method? | **2** | **2** |
| **6.** | Calculate the fixed end moments of the spans AB and BC of the continuous beam shown in figure. | **2** | **3** |




| | | | |
|---|---|---|---|
| **7.** | What are the joint equilibrium equations that are used to analyze the continuous beam given in Question No:6 and Why? | **2** | **2** |
| **8.** | Which one of the frames shown in the figure below does not sway and why? | **2** | **2** |



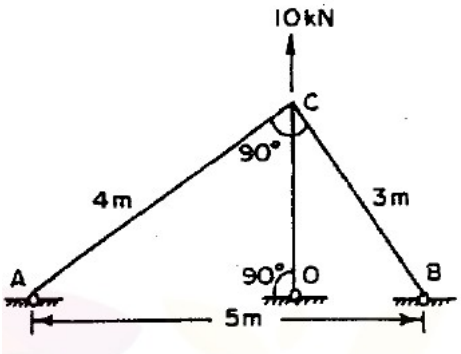

| | | | |
|---|---|---|---|
| **9.** | In a continuous beam ABCD, if the portion CD is overhanging, the distribution factors at C are<br>a) $DF_{CB} = 0.5$and $DF_{CD} = 0.5$<br>b) $DF_{CB} = 0$ and $DF_{CD} = 1.0$<br>c) $DF_{CB} = 0.75$ and $DF_{CD} = 0.25$<br>d) $DF_{CB} = 1.0$ and $DF_{CD} = 0$ | **3** | **3** |
| **10.** | If four members meet at a joint and if the stiffness of the members 1,2,3 and 4 are $K_1 = 2EI$, $K_2 = EI$, $K_3 = 1.5EI$ and $K_4 = 0.5EI$ respectively, determine the distribution factor of the third member. | **3** | **3** |
| **11.** | Determine the distribution factors at the joints B and C of the continuous beam shown in figure. | **3** | **3** |




| | | | |
|---|---|---|---|
| **12.** | When the sway analysis is needed in frames? | **3** | **2** |
| **13.** | Classify arches based on shapes and support conditions. | **4** | **2** |
| **14.** | State the advantages of arches over beams. | **4** | **2** |
| **15.** | List the internal forces acting in an arch section with a diagram. | **4** | **2** |
| **16.** | Determine the radius of a circular arch of span 25m and a central rise of 5m which is hinged at the crown and springings. | **4** | **3** |
| **17.** | A Suspension cable of span 45 m and central dip 3m carries a uniformly distributed load of 60kN/m over the entire span. Find the horizontal thrust developed. | **5** | **3** |
| **18.** | The bending moment is zero at any point of the cable. Explain. | **5** | **2** |
| **19.** | A light flexible cable of length 18m is supported at two ends that are 16m apart. Find the central dip of the cable if it is subjected to a udl on the entire span. | **5** | **3** |
| **20.** | What are the functions of stiffening girders? | **5** | **2** |

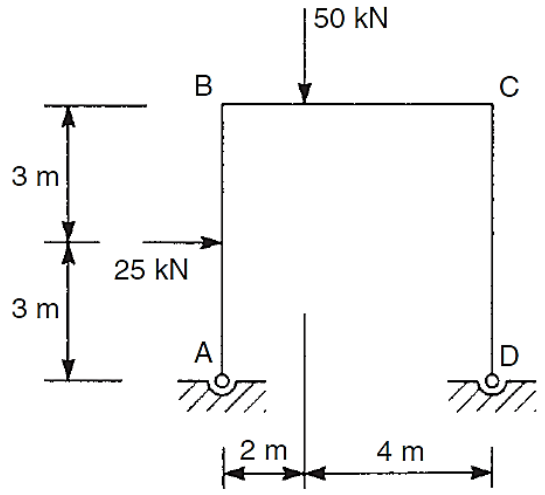
## PART- B (5 x 10 = 50 Marks)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **21. (a)** | Determine the forces in the members of the pin jointed frame shown in figure using consistent deformation method. | **10** | **1** | **3** |

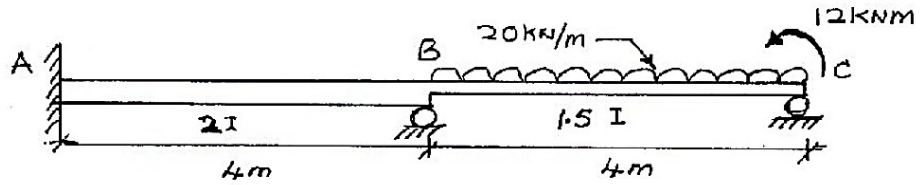



**(OR)**

**(b)** The frame shown in figure is pinned to the foundation of A and D and has members whose flexural rigidity is *EI*. Use consistent deformation method to calculate the moments in the members and draw the bending moment diagram. **10 1 3**

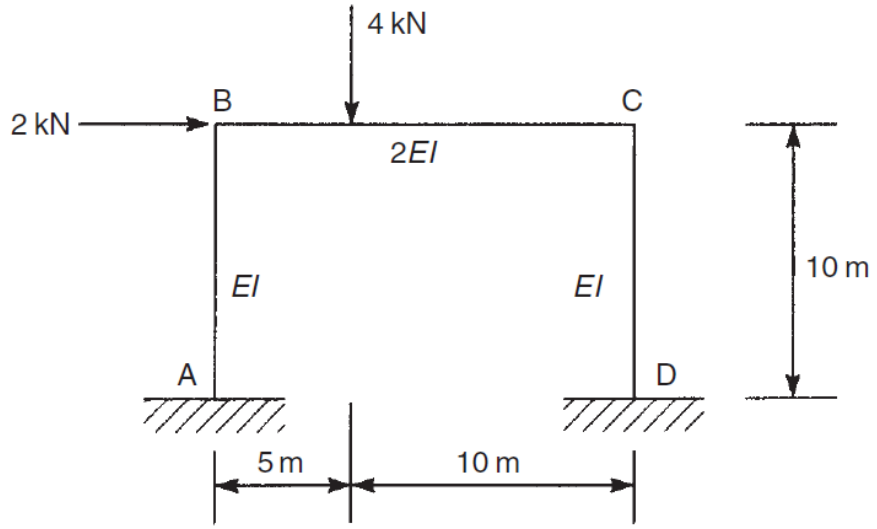



**22. (a)** Analyse the continuous beam shown in figure using slope deflection method and draw the bending moment diagram. The end support C is subjected to an anticlockwise moment of 12 kNm. **10 2 3**

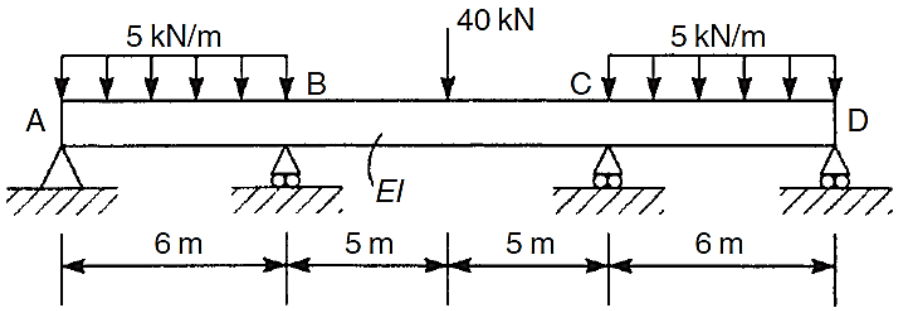



**(OR)**

**(b)** Analyse the frame shown in figure using slope deflection method and draw the bending moment diagram. **10 2 3**

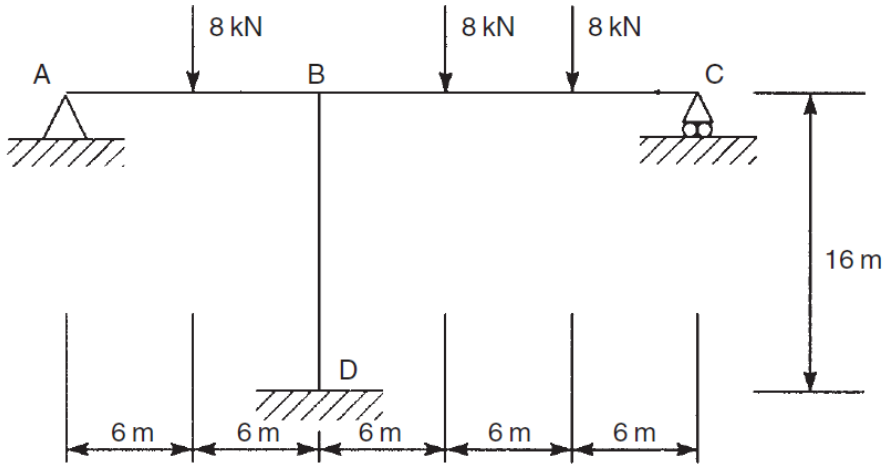



**23. (a)** Analyse the continuous beam shown in figure using moment distribution method and draw the bending moment diagram. **10 3 3**




**(OR)**

**(b)** Analyse the frame shown in figure using moment distribution method and draw the bending moment diagram. **10 3 3**




**24. (a)** A three hinged parabolic arch hinged at the supports and at the crown has a span of 24m and a central rise of 4m. It carries a concentrated load of 50 kN at 18m from the left support and an udl of 30 kN/m over the left half portion. Determine the moment, thrust and radial shear at a section 6m from the left support. **10 4 3**

**(OR)**

**(b)** A three hinged circular arch has a span of 36m and a central rise of 6m. It carries a concentrated load of 60 kN at 27m from the left springing and an udl of 30 kN/m over the left half portion. Determine the reactions at the supports and also find the bending moment, thrust and radial shear at a section 9m from the left support. **10 4 3**

**25. (a)** A cable of horizontal span 28m is to be used to support six equal loads of 60 kN each at 4m spacing. The central dip of the cable is limited to 4m. Find the total length of the cable. **10 5 3**

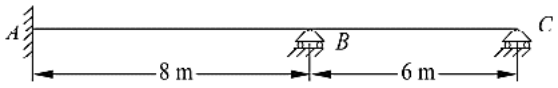
**(OR)**

**(b)** A three hinged stiffening girder of a suspension bridge of 140 m span subjected to twopoint loads 20 kN each placed at 40 m and 60 m, respectively from the left hinge. Determine the bending moment and shear force in the girder at section 50m from each end. Also determine the maximum tension in the cable which has a central dip of 12 m. **10 5 3**

## PART- C (1 x 10 = 10 Marks)

(Q.No.26 is compulsory)

| | | Marks | CO | RBT LEVEL |
|---|---|---|---|---|
| **26.** | Analyse the continuous beam shown in figure by slope deflection method and draw the bending moment diagram if the support B sinks by 10mm. The flexural rigidity EI is 6000 $kNm^2$. | **10** | **2** | **3** |

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