OR iii. Analyse the continuous beam shown in the Fig. No. 5, by moment distribution method. **8**

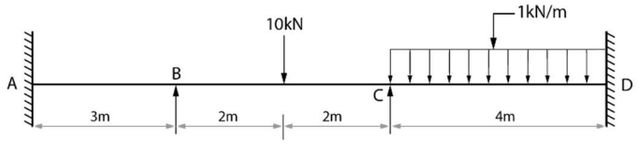

FIG. NO. 5

Q.6 i. Why are arches used over beams? **2**

ii. A three hinged circular arch hinged at the springing and crown points has a span of 40 m and a central rise of 8 m. It carries a uniformly distributed load 20 kN/m over the left half of the span together with a concentrated load of 100 kN at the right quarter span point. Find the reactions at the supports, normal thrust and shear at a section 10 m from left support. **8**

OR iii. A bridge cable is suspended from towers 80 m apart and carries a load of 30 kN/m on the entire span. If the maximum sag is 8 m, calculate the maximum tension in the cable. If the cable is supported by saddles which are stayed by wires inclined at 30 degrees to the horizontal, determine the forces acting on the towers. If the same inclination of back stay passes over the pulley, determine the forces on the towers. **8**

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Total No. of Questions: 6 *Total No. of Printed Pages:4*

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-2022

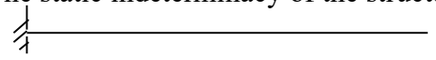
CE3CO06 Structural Analysis -I

Programme: B.Tech. Branch/Specialisation: CE

Duration: 3 Hrs. **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. The static indeterminacy of the structure is- **1**



(a) 1 (b) 2 (c) 0 (d) 3

ii. A frame is said to be perfect if (symbols have their usual meaning) **1**

(a) m=2j-3 (b) m=3j-3 (c) 2m=j-3 (d) None of these

iii. What is the strain energy stored in a simply supported beam due to bending moment? **1**

(a) $\int (M^2\, dx/EI)$

(b) $\int (M^2\, dx/2EI)$

(c) $\int (M\, dx/2EI)$

(d) $\int (2Mdx/EI)$

iv. The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in- **1**

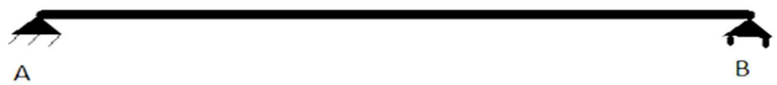
(a) Vertical direction

(b) Horizontal direction

(c) Inclined direction

(d) The direction in which the deflection is required

v. In the simply supported beam shown below, the shape of ILD for the reaction at A would be- **1**



(a) Triangular (b) Rectangular (c) Parabolic (d) None of these

P.T.O.

vi. When a uniformly distributed load, shorter than the span of the girder, moves from left to right, then the conditions for maximum bending moment at a section is that- **1**

(a) The head of the load reaches the section.
(b) The tail of the load reaches the section.
(c) The load position should be such that the section divides it equally on both sides.
(d) The load position should be such that the section divides the load in the same ratio as it divides the span.

vii. In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always- **1**

(a) Zero (b) Less than 1 (c) 1 (d) Greater than

viii. Moment Distribution Method is also known as- **1**

(a) Clapeyron's Method (b) Hardy Cross Method
(c) Willot's Method (d) None of these

ix. What is the degree of indeterminacy of a two hinged arch? **1**

(a) 1 (b) 2 (c) 3 (d) 4

x. Top most part of an arch is called _____. **1**

(a) Sofit (b) Crown (c) Center (d) Abutment

Q.2 i. Define kinematic indeterminacy. **2**

ii. Analyse the continuous beam shown in the Fig. No. 1 using Clapeyron's theorem of three moments. **8**

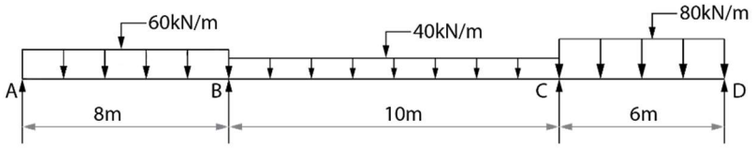


FIG. NO. 1

OR iii. Find the forces in the members of the truss shown in the Fig. No. 2. **8**

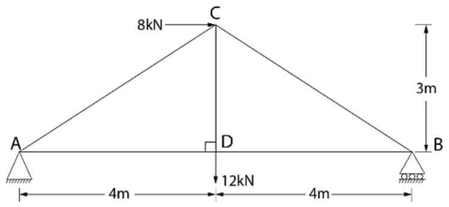


FIG. NO. 2

Q.3 i. State the Betti law of reciprocal deflections. **3**

ii. State and prove Maxwell law of reciprocal deflections. **7**

OR iii. Find the vertical and horizontal deflections of point B of the quadrant ring AB having radius 'R' shown in the Fig. No. 3 by unit load method. Take EI constant. **7**

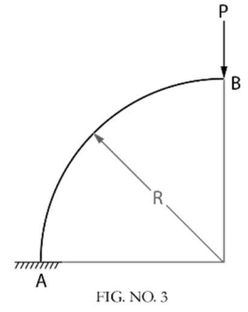


FIG. NO. 3

Q.4 i. Define influence line diagram. **2**

ii. When a uniformly distributed load, shorter than the span of the girder, moves from left to right, then derive the condition for maximum bending moment at a section. **8**

OR iii. A simply supported beam has a span of 15 m. An UDL of 40 kN/m and 5 m long crosses the girder from left to right. Draw the influence line diagram for the shear force and bending moment at a section 6 m from the left end, use these diagrams to calculate the maximum shear force and bending moment at this section. **8**

Q.5 i. Define distribution factor. **2**

ii. Find the support moments and draw BMD for the continuous beam shown in the Fig. No. 4, by slope deflection method. **8**

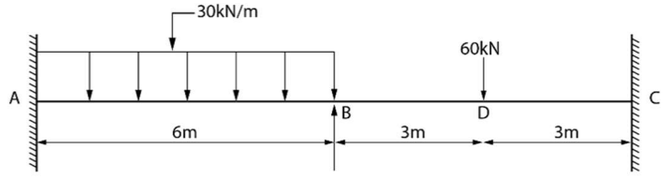


FIG. NO. 4

P.T.O.

Marking Scheme
CE3CO06 Structural Analysis -I

Q.1	i.	The static indeterminacy of the structure is- (c) 0		**1**
	ii.	A frame is said to be perfect if (symbols have their usual meaning) (d) None of these		**1**
	iii.	What is the strain energy stored in a simply supported beam due to bending moment? (b) $\int (M^2\, dx/2EI)$		**1**
	iv.	The deflection at any point of a perfect frame can be obtained by applying a unit load at the joint in- (d) The direction in which the deflection is required		**1**
	v.	In the simply supported beam shown below, the shape of ILD for the reaction at A would be- (a) Triangular		**1**
	vi.	When a uniformly distributed load, shorter than the span of the girder, moves from left to right, then the conditions for maximum bending moment at a section is that- (a) The load position should be such that the section divides the load in the same ratio as it divides the span.		**1**
	vii.	In moment distribution method, the sum of distribution factors of all the members meeting at any joint is always- (c) 1		**1**
	viii.	Moment Distribution Method is also known as- (b) Hardy Cross Method		**1**
	ix.	What is the degree of indeterminacy of a two hinged arch? (a) 1		**1**
	x.	Top most part of an arch is called _____. (b) Crown		**1**
Q.2	i.	Define kinematic indeterminacy.	2 Marks	**2**
	ii.	Clapeyron's theorem of three moments.	2 Marks	**8**
		Support moments		
		Mb=-401.67KN-m, Mc=-321.98KN-m	4 Marks	
		BMD	2 Marks	
OR	iii.	Reactions Ra=3 kN, Rb=9kN	3 Marks	**8**
		Forces AC-5kN(c), AD-12kN (c), BC-15kN (c)		
		BD-12kN 9(c), CD-12kN(c)	1 Mark each (1 Mark*5)	
Q.3	i.	As per the explanation	3 Marks	**3**
	ii.	Statement	2 Marks	**7**
		Proof	5 Marks	
OR	iii.	Putting correct values in unit load method equation	3 Marks	**7**
		Vertical deflection-$P\pi R^3/4EI$	2 Marks	
		Horizontal deflection-$PR^3/2EI$	2 Marks	
Q.4	i.	As per the explanation	2 Marks	**2**
	ii.	Ordinates at head and tails of udl, y1=y2	4 Marks	**8**
		x/d=z/L	4 Marks	
OR	iii.	ILD, SF	1 Mark	**8**
		ILD, BM	1 Mark	
		Max +SF 86.67 kN	1 Mark	
		Max -SF 46.67 kN	1 Mark	
		Max BM 600.00 kN-m	4 Marks	
Q.5	i.	As per the explanation	2 Marks	**2**
	ii.	FEMs	2 Marks	**8**
		Writing slope deflection equation	2 Marks	
		Support moments M_A=-101.25 kN-m, M_B=+/- 67.50 kN-m		
		M_C=+33.75 kN-m	2 Marks	
		BMD	2 Marks	
OR	iii.	FEMs	1 Mark	**8**
		DFs	1 Mark	
		Support moments M_A=+1.69 kN-m, M_B=+/- 3.53 kN-m		
		M_C=+/- 3.79 kN-m, M_D=+0.146 kN-m	4 Marks	
		BMD	2 Marks	
Q.6	i.	As per the explanation	2 Marks	**2**
	ii.	Reactions:		**8**
		V_A=325Kn, V_B=175kN, H=312.5kN	2 Marks	
		Radius=29m, slope=20.17deg	2 Marks	
		Normal thrust = 336.44 kN	2 Marks	
		Shear=9.57 kN	2 Marks	
OR	iii.	H=3000 kN	1 Mark	**8**

Tmax=3231.1 kN	1 Mark
Θ=21.80deg	1 Mark
When cable on saddle T_1=3464.7 kN	1 Mark
Vertical force on tower=2931.98	2 Marks
When cable on pulley	
Vertical force on tower=2815.48kN	1 Mark
Horizontal force on tower=201.82 kN	1 Mark