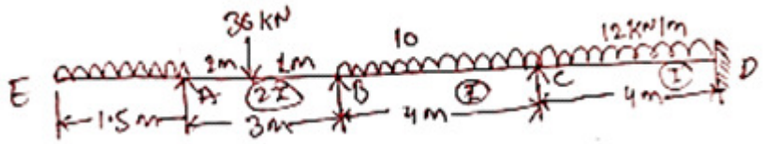
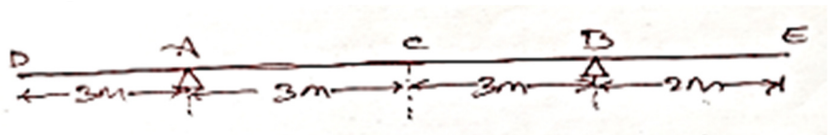
OR iii. Determine the moments at the support of the continuous beam shown in figure. Draw also B.M. diagram for the beam (solve by Slope Deflection method) **7**



Q.5 i. Find the expression for ILD of shear force at any section due to ULD crossing over simply supported span. **3**

ii. A Uniformly distributed load of intensity 5 KN/m and span 6 m crossing a beam of span 20 m from left to right. Find the maximum bending moment of at a point with exist at 5 m from the left support using ILD. **7**

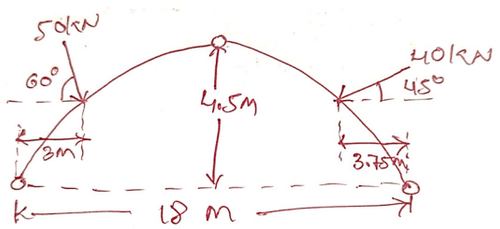
OR iii. Two wheel loads 200 kN and 80 kN spaced 0.8 m apart roll on the girder shown in figure. Find the maximum positive and negative bending moments that can occur at the section C. **7**



Q.6 i. Find the expression for horizontal reaction of 3 hinged semicircular arch loaded with UDL in overall span **3**

ii. A two hinged parabolic arch of span 120 m and rise 4 m carries a uniformly distributed load of 50 kN per meter on the left half of the span. Find the reaction at the support and the position and amount of maximum bending moment **7**

OR iii. A circular segmental 3 hinged arch at the ends and at the crown has a span of 18 m and a rise of 4.5 m. The arch carries the loads are shown in figure find the reaction at the supports and the bending moment at the loaded points. **7**



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

Enrollment No.....

Faculty of Engineering
End Sem Examination May-2024
CE3CO23 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. Assume suitable data if necessary. Notations and symbols have their usual meaning.

Q.1 i. A simply supported beam carries uniformly distributed load of 20 kN/m over the length of 5 m. If flexural rigidity is 30000 kN.m^2, what is the maximum deflection in the beam? **1**

(a) 5.4 mm (b) 1.08 mm (c) 6.2 mm (d) 8.6 mm

ii. The equilibrium of force in a structure can be satisfied- **1**

(a) Approximately
(b) To the desired accuracy
(c) Exactly
(d) Even without using equations of static

iii. Principle of superposition is applicable when- **1**

(a) The material does not obey Hook's law
(b) Material obeys Hook's law
(c) Deflections are linear function of applied force
(d) The actions of applied force will be affected by small deflection of the structure

iv. Unit load method is applicable to- **1**

(a) Trusses only (b) Trusses and beams
(c) Frames only (d) Trusses , beams, and frames

v. In cantilever beam, slope and deflection at free end is _____. **1**

(a) Zero (b) Maximum
(c) minimum (d) 1

vi. Deflection of a simply supported beam when subjected to central point load is given as _____. **1**

(a) (Wl /16 EI) (b) (Wl^2 /16 EI)
(c) (Wl^3 /48 EI) (d) (5Wl^4 / 384EI)

vii. If an assembly of load crossing over a span then maximum bending moment will occur at- **1**
(a) At point of application of resultant
(b) Beneath the maximum load in the assembly
(c) Beneath the adjacent greater load on either side of the point of resultant of the assembly
(d) Can't say

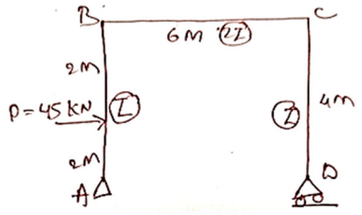
viii. Carryover factor is defined as- **1**
(a) Applied moment / carryover moment
(b) Carryover moment /applied moment
(c) Carryover moment/2
(d) None of these

ix. If the load acting on the crown of a semicircular arch then H equals to- **1**
(a) W/π (b) $W\cos\beta$ (c) $W/\cos\beta$ (d) $W\cos^2\beta/R$

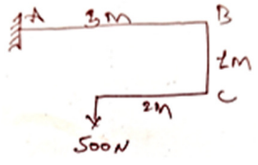
x. Numbers of reaction by a hinged support is- **1**
(a) 2 (b) 1 (c) 3 (d) 0

Q.2 i. What do you mean by indeterminacy? Write any two differences between static and kinematic indeterminacy. **3**

ii. Find the horizontal movement of the roller end D of the portal frame shown in figure Take E= 2 x 10^8 KN/m2 and I = 3 x 10^4 m^4. The moment of inertia of the column section is I while that of the beam is 2I. **7**

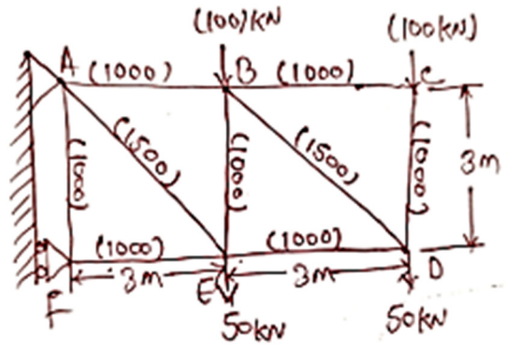


OR iii. A mild steel bar 100 mm diameter is bent a shown in figure. It is fixed horizontally at A and a load of 500 N hangs at D. Draw the bending moment diagram for the parts AB, BC and CD indicating the maximum values. Find the maximum bending stresses. Find also the deflection at D take E= 2 x 10^5 N/mm^2. **7**



Q.3 i. State the 2nd theorem of castigliano and find the expression of strain energy for a member under axial load. **3**

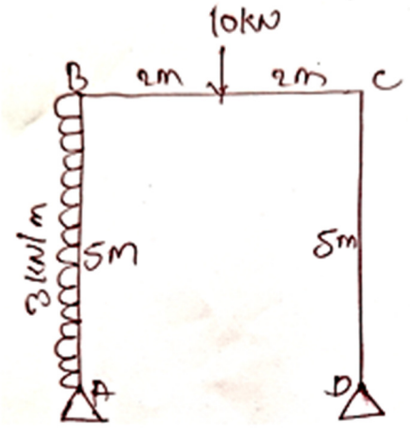
ii. In fig shows a cantilever truss of span 6 meter and depth 3 meters. The cross-sectional area in sq mm of the various members are noted alongside of each member. Find the vertical deflection of the joint D. Take E= 200 kN/mm^2. **7**



OR iii. A continuous beam consists of 3 successive spans of 8 m 10 m and 6 m and carries load of 60 kN per metre and 40 kN per meter and 80 kN per meter respectively on the spans. Determine the bending moments and reaction at the supports. **7**

Q.4 i. Define the joint stiffness and sway moment for a frame and their significance **3**

ii. A Portal frame ABCD hinged at the base is loaded as shown in figure. The vertical member AB and DC are of the same section and $I_{bc} = 2I_{bc}$. Analyse the frame and draw BM diagram (solve by moment distribution method). **7**



Scheme of Marking
CE3CO23 Structural Analysis-I

Q.1	i)	5.4 mm	**1**
	ii)	c exactly	**1**
	iii)	Deflections are linear function of applied force	**1**
	iv)	d-Trusses , beams, and frames	**1**
	v)	Maximum	**1**
	vi)	**c.** (Wl^3 /48 EI)	**1**
	vii)	c) beneath the adjacent greater load on either side of the point of resultant of the assembly	**1**
	viii)	b) Carryover Moment /Applied Moment	**1**
	ix)	(a) W/π	**1**
	x)	a) 2	**1**
Q.2	i.	1 Marks for statement 2 marks for expression	**3**
	ii.	1 marks for loading diagram 4 marks for steps 2 marks for deflection	**7**
OR	iii.	**3 Marks for BM** BM at part AB = 1000 Nm BM at part CB = 1000 Nm BM at part CD = -1000 Nm BM at D = 0 BM at A - -500 Nm Maximum BM = 1000 Nm **1 Marks for Bending stress** M/Z = 10.18 N/mm^2 **1 Marks for deflection** D = 4.92 mm **2 marks for BM diagram**	**7**
Q.3	i.	1 Marks for statement 2 marks for expression	**3**

	ii.	**1 marks for horizontal reaction** H_f = 450 kN Ha = 450 kN Va = 300 kN 2 marks for P_{fe}= 450 kN P_{fa}= 0 kN P_{ae}= 300* 2^1/2 kN P_{ab}= 150 kN P_{eb}= 250 kN P_{ed}= 150 kN P_{db}= 150* 2^1/2 kN P_{cd}= 100 kN **1 marks for diagram** **2 marks for K value** **1 marks for Deflection** = 34.5 mm	**7**
OR	iii.	**3 marks for moments** Ma = Md= 0 Mc = 321.98 kNm Mb = 401.67 kNm Max Moment at AB = 480 kNm Max Moment at BC = 500 kNm Max Moment at CD = 360 kNm **2 Marks for reaction** Vd = 186.3 kN Vc = 485.7 kN **2 marks for SF and BM diagram**	**7**
Q.4	i.	1 marks for joint 2 marks for sway	**3**
	ii.	**1 Marks for distribution table** **3 Marks for table and horizontal force** (Non sway analysis) Ha = -5.754 kN H_D = -0.178 kN Force left to right = 15kN Force right to left = 9.068 kN **ii) Sway analysis (2 marks)** Horizontal reaction H_A = -10.29kN H_D = -4.71 kN Vertical reaction V_d = 14.375 kN V_a = 4.375 kN **1 marks for BM diagram**	**7**
OR	iii.	**2 marks for fixed end moments** **1 marks for equilibrium condition** Eli_b= -2.1595 Eli_c= 1.873 **3 marks for final moment** M_{ba} = 14.56kNm M_{bc} = -14.56kNm	**7**

M_{cb} = 14.13kNm
M_{cd} = -14.13kNm
M_{dc} = 16.94kNm
1 marks BM diagram for

Q.5 i. 2 Marks for expression **3**
1 marks for diagram
ii. 4 Marks for BM **7**
1 Marks load diagram
2 marks for BM diagram

OR iii. 2 Marks for each BM at C
Positive = 473.26 kNm
Negative = -443.66 kNm

2 Marks for Positive and Negative BM diagram
1 Marks for height of ILD

Q.6 i 1 marks for diagram
2 marks for horizontal reaction

ii 1 Marks for loading diagram **7**
1 Marks for BM diagram
3 Marks for reaction force
Va = 375 kN Vb = 125 kN H = 312.5 kN
2 marks for maximum bending moment
Section AC M_{max} = 312.5 kNm
Section BC M_{max} = -312.5 kNm

iii **7**

1) **1 marks for each**
inclined load replace by vertical and horizontal load component
For 50 KN – Horizontal 25KN and Vertical 43.301 KN
For 40 KN – Horizontal 28.284KN and Vertical 28.284 KN

2) **1 marks for each**
Vb = 28.422 KN
Va = 43.163 KN
Ha = 18.959 KN
Hb = 15.675 KN

3) **1 for marks for both**
BM at E = 77.048 KNm
BM at F = 56.432 KNm

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