Course Code: 20CE0115 **R20**

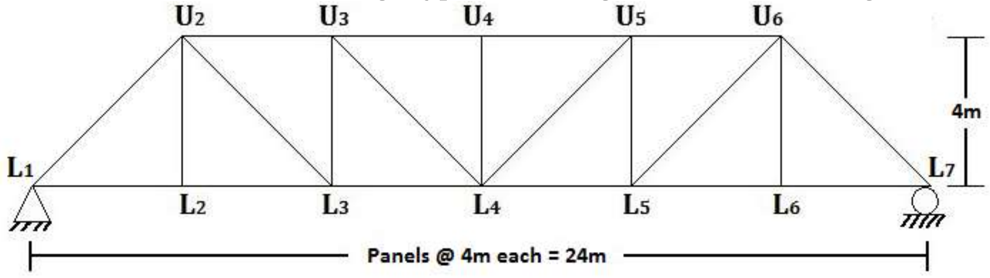
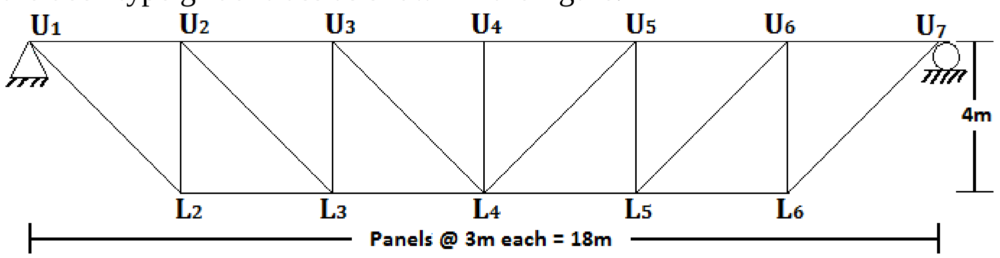
SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
Siddharth Nagar, Narayanavanam Road – 517583

QUESTION BANK (DESCRIPTIVE)

Subject with Code: Structural Analysis (20CE0115) **Course & Branch**: B.Tech - Civil
Year & Sem: II-B.Tech & II-Sem **Regulation:** R20

UNIT –I
INFLUENCE LINES & MOVING LOADS

1	What is meant by Influence Line Diagram (ILD)? State some of the benefits of it.	[L2][CO2]	**[3M]**
	A simply supported beam AB is subjected to a point load W. Derive an expression and draw the ILD for reaction at A, reaction at B, shear force & bending moment at a distance of x from support.	[L2][CO2]	**[9M]**
2	Derive an expression for maximum positive/negative shear force and maximum bending moment for a simply supported beam subjected to two point loads W_1 and W_2 with a constant spacing between them.	[L2][CO2]	**[12M]**
3	Two point loads of 100kN and 200kN spaced 3m apart cross a girder of 15m from left to right with the 100kN leading first. Draw the influence line for shear force and bending moment and find the value of maximum shear force and bending moment at a section D, 6m from the left hand support. Also, find the absolute maximum bending moment due to the given load system.	[L3][CO2]	**[12M]**
4	A simple girder of 20m span is traversed by a moving udl of 6m length with an intensity of 20 kN/m from left to right. Analyze for maximum bending moment, maximum +ve/ –ve shear force at a section of 4m from left support. Also find the absolute maximum bending moment that occur anywhere in the girder	[L3][CO2]	**[12M]**
5	In a simply supported girder AB of span 20m, determine the maximum bending moment and maximum shear force at a section 5m from A, due to the passage of a uniformly distributed load of intensity 20kN/m, longer than the span. Also find the location and magnitude of absolute maximum bending moment.	[L3][CO2]	**[12M]**
6	Derive an expression for maximum positive/negative shear force and maximum bending moment for a simply supported beam subjected to multiple wheel loads with a constant spacing between them.	[L2][CO2]	**[12M]**
7	Four point loads of 120kN, 160kN, 160kN and 80kN spaced 2m between consecutive loads move on a girder of 25m span from left to right with 120kN load leading. Calculate the maximum bending moment, maximum +ve & –ve shear force at a point of 10m from the left support. Also calculate the position & value of absolute maximum bending moment	[L3][CO2]	**[12M]**

8	What do you mean by Equivalent Uniformly distributed load (EUDL)	[L1][CO2]	**[2M]**
	Derive an expression for EUDL for bending moment and shear force for a simply supported beam subjected to single concentrated load and a UDL shorter than the span.	[L2][CO2]	**[10M]**
9	Draw the influence line diagrams for the forces in top chord, bottom chord & vertical members of the through type truss bridge as shown in the figure. 	[L4][CO2]	**[12M]**
10	Draw the influence lines for the top chord, bottom chord & vertical members of the deck type girder truss as shown in the figure. 	[L4][CO2]	**[12M]**

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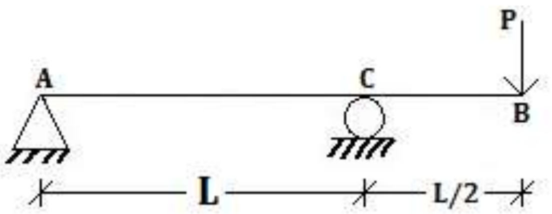
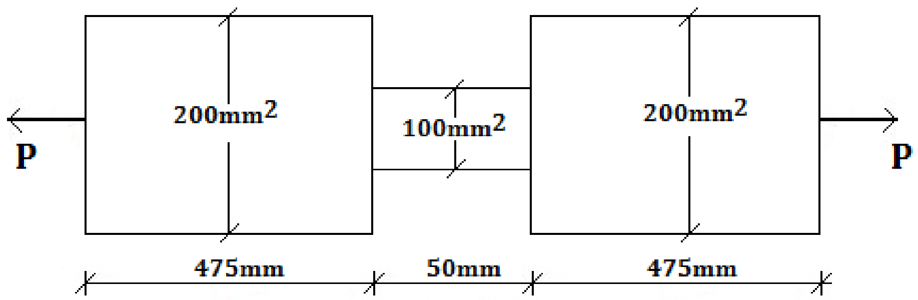
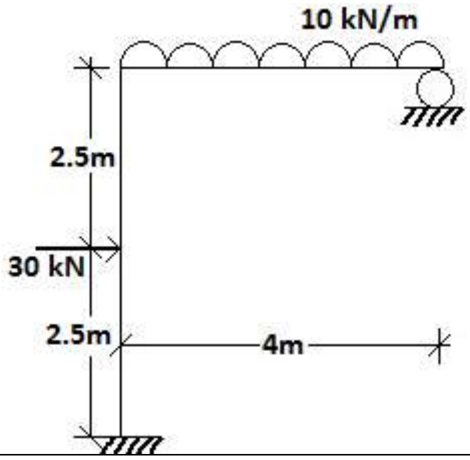
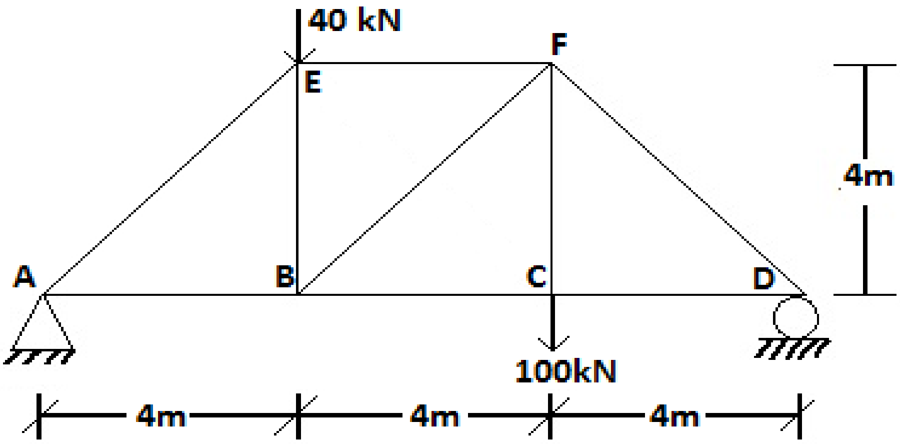
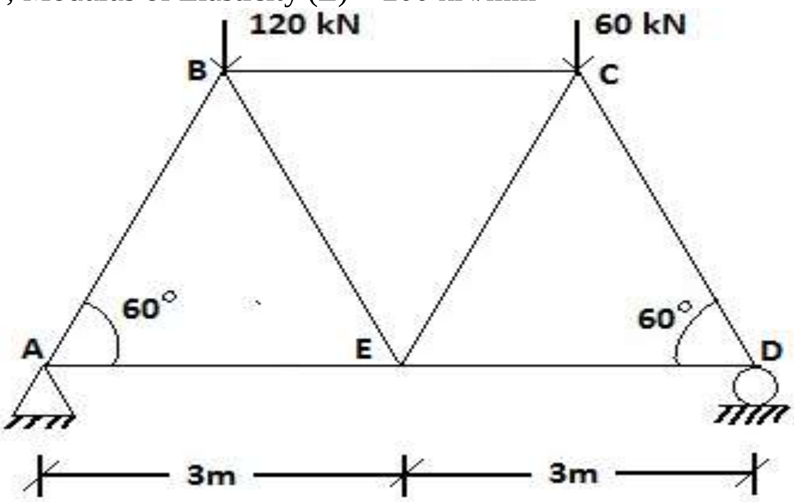
UNIT –II
ENERGY METHODS

1	Define the term a) Strain Energy b) Resilience c) Proof Resilience d) Modulus of Resilience	[L1][CO3]	**[4M]**
	Derive an expression for strain energy stored in a beam due to axial loading and due to bending.	[L2][CO3]	**[8M]**
2	Determine the support reaction for the over-hanging beam using principle of virtual work done. 	[L3][CO3]	**[6M]**
	A simply supported beam of span *l* carries a concentrated load *P* eccentrically placed on the beam. Using strain energy method, determine the deflection at the point of application of the load.	[L3][CO3]	**[6M]**
3	The maximum stress produced by a pull in a bar of length 1m is 150 N/mm^2. The area of cross-sections and length are shown in the figure. Calculate the strain energy stored in the bar if E = 2 x 10^5 N/mm^2 	[L3][CO3]	**[12M]**
4	State and derive Castigliano's first theorem	[L2][CO3]	**[12M]**
5	Find the deflection at the centre of a simply supported beam using Castigliano's theorem carrying a uniformly distributed load of *w* per unit length over the entire span.	[L3][CO3]	**[7M]**
	Using Castigliano's theorem, find the deflection at the free end of a cantilever beam carrying a uniformly distributed load of *w* per unit length over the entire span.	[L3][CO3]	**[5M]**
6	State and derive Maxwell-Betti's reciprocal theorem	[L2][CO3]	**[12M]**
7	A simply supported beam of span 6m is subjected to a concentrated load of 45kN at 2m from the left support. Calculate the deflection under the load point. Take E = 200 x 10^6 kN/m^2 and I = 14.0 x 10^{-6} m^4 using method of virtual work.	[L4][CO3]	**[12M]**

8	Using the method of virtual work, determine the horizontal displacement of a point C of the frame shown in the figure. Take E = 2 x 10^5 N/mm^2 and I = 4 x 10^6 mm^4. 	[L4][CO3]	**[12M]**
9	Determine the vertical deflection of the joint 'B' for the truss shown in the figure. Take the sectional area of each member as 1800mm^2 and E = 200 kN/mm^2 	[L4][CO3]	**[12M]**
10	Find the vertical deflection of the joint 'E' of the truss shown in the figure. Area of each horizontal member = 1200mm^2; Area of other members = 1500mm^2; Modulus of Elasticity (E) = 200 kN/mm^2 	[L4][CO3]	**[12M]**

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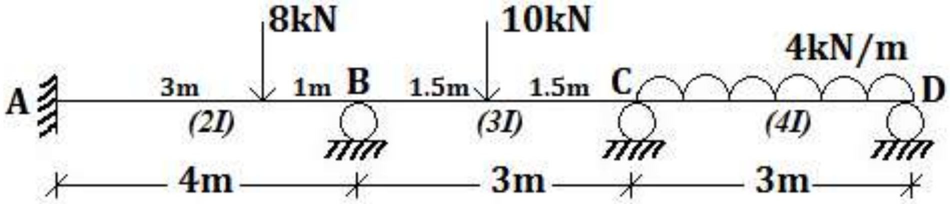
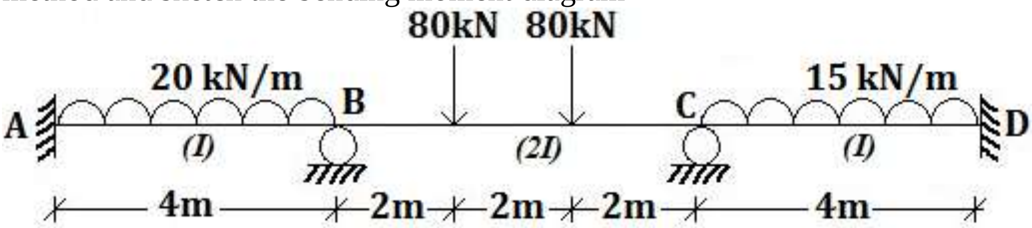
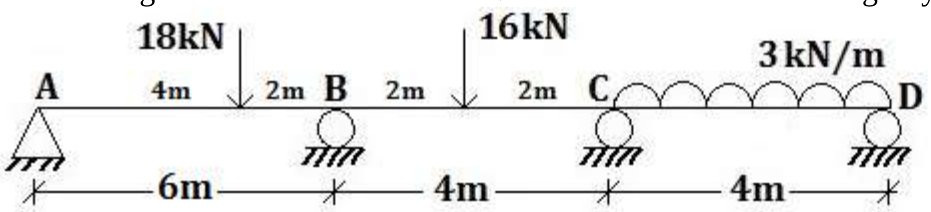
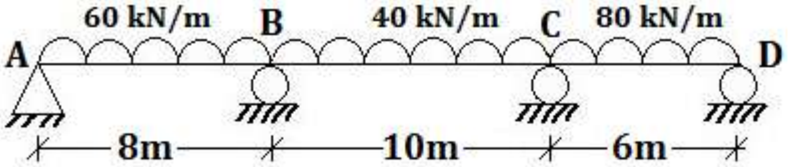
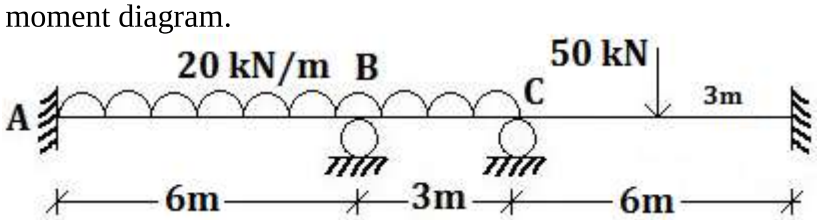
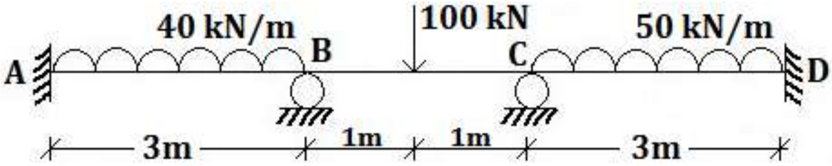
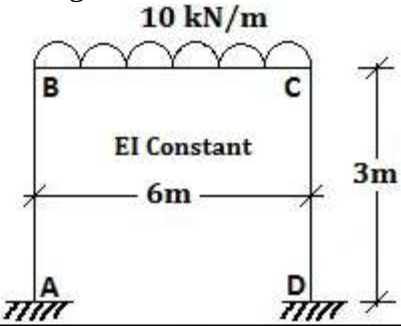
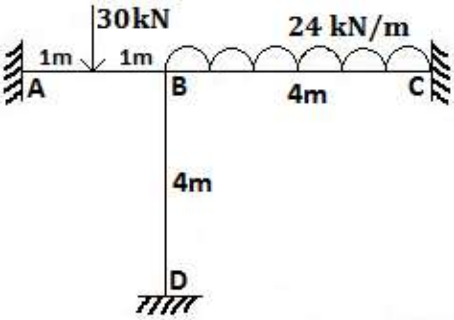
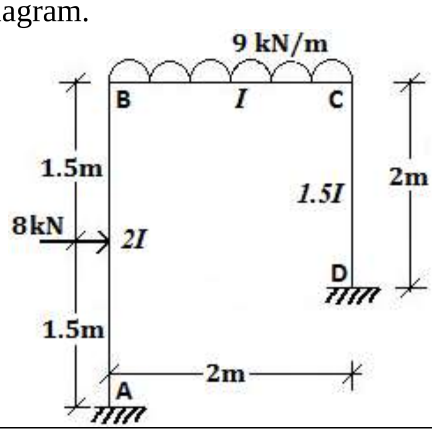
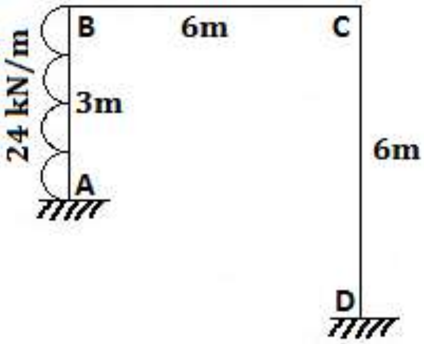
UNIT –III
SLOPE DEFLECTION METHOD

1	Determine the support moments for the continuous beam as shown in the figure and draw the bending moment diagram using slope deflection method. 	[L4][CO4]	**[12M]**
2	Analyse the continuous beam loaded as shown in the figure by slope deflection method and sketch the bending moment diagram 	[L4][CO4]	**[12M]**
3	Determine the moments and reactions at the supports of the continuous beam as shown in the figure & draw the SFD/BMD. Assume uniform flexural rigidity. 	[L4][CO4]	**[12M]**
4	Determine the support moments for the continuous beam shown in the figure and draw the bending moment diagram. 	[L4][CO4]	**[12M]**
5	Analyse the continuous beam using slope-deflection method if the support B sinks by 10mm. Take E = 2 x 10^5 N/mm^2 and I = 16 x 10^7mm^4 and sketch the bending moment diagram. 	[L4][CO4]	**[12M]**

6	Determine the support moments for the continuous girder as shown in the figure, if the support B sinks by 2.50mm. For all members, $I = 3.50 \times 10^7$ mm^4 and $E = 200$ kN/mm^2 	[L4][CO4]	**[12M]**
7	Analyse the portal frame loaded as shown in the figure using slope-deflection method and sketch the bending moment & shear force diagrams 	[L4][CO4]	**[12M]**
8	Analyse the frame shown below. Assume uniform flexural rigidity 	[L4][CO4]	**[12M]**
9	Analyse the frame shown in the figure using slope deflection method and draw the bending moment diagram. 	[L4][CO4]	**[12M]**
10	Determine the moments, reactions at the supports and draw the BMD for the frame. Take flexural rigidity EI = 43500 kN/m^2 & also find the deflection at B. 	[L4][CO4]	**[12M]**

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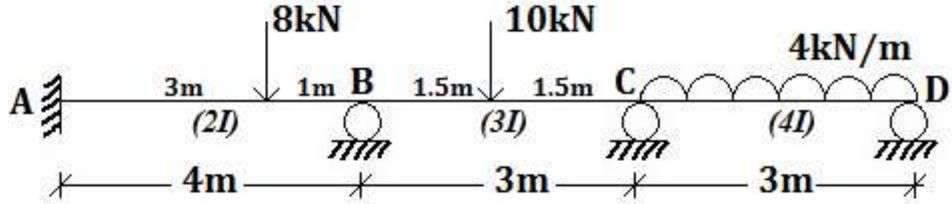
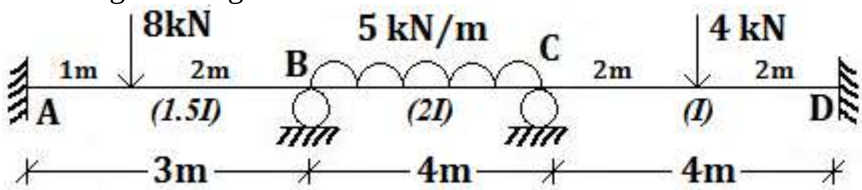
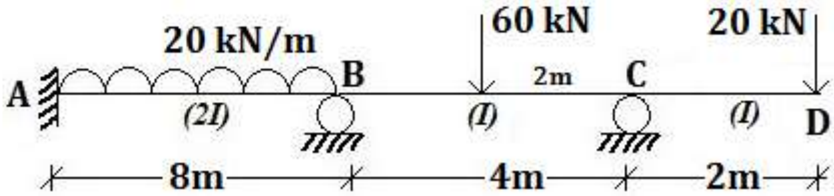
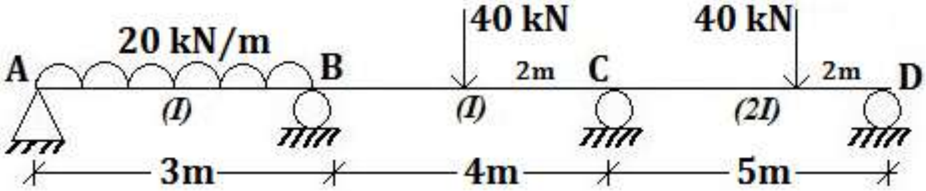
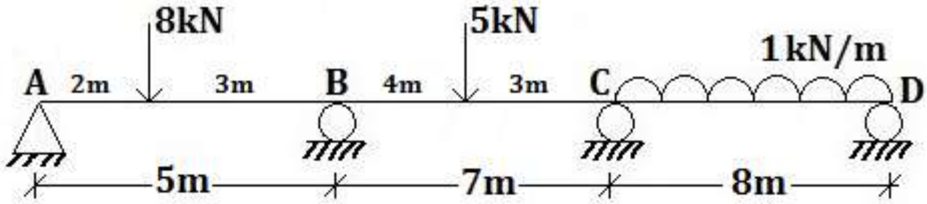
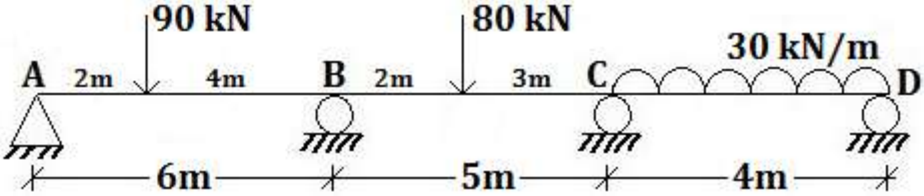
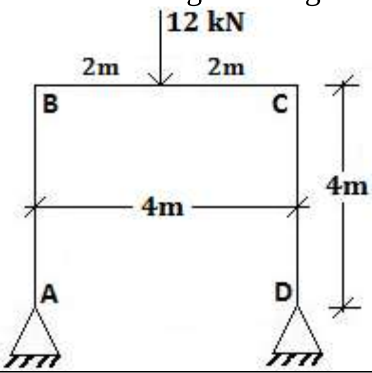
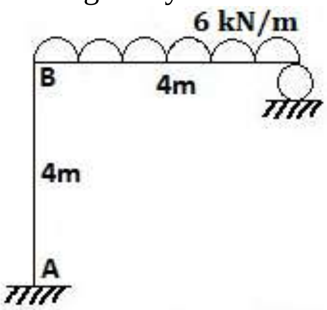
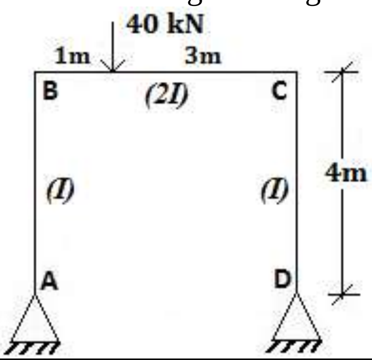
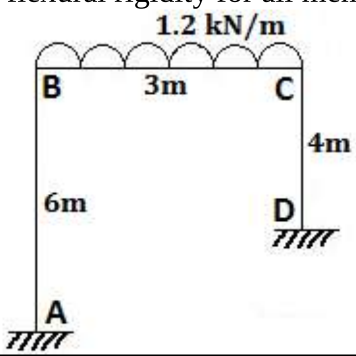
UNIT –IV
MOMENT DISTRIBUTION METHOD

<table>
<tr><td>1</td><td>Determine the support moments for the continuous beam as shown in the figure and draw the bending moment diagram using moment distribution method.

</td><td>[L4][CO5]</td><td>[12M]</td></tr>
<tr><td>2</td><td>Determine the support moments at A, B, C and D for the continuous girder shown in the figure using moment distribution method.

</td><td>[L4][CO5]</td><td>[12M]</td></tr>
<tr><td>3</td><td>Analyse the beam ABCD shown in the figure by moment distribution method.

</td><td>[L4][CO5]</td><td>[12M]</td></tr>
<tr><td>4</td><td>Analyse the continuous beam ABCD shown in the figure by moment distribution procedure.

</td><td>[L4][CO5]</td><td>[12M]</td></tr>
<tr><td>5</td><td>A continuous beam ABCD, 20m long is simply supported at its ends and is loaded as shown in the figure. If support ‘B’ sinks by 10mm, analyse the beam by moment distribution method and sketch the bending moment diagram. Take $E = 2.1 \times 10^5$ N/mm^2 and $I = 85 \times 10^5$ mm^4

</td><td>[L4][CO5]</td><td>[12M]</td></tr>
</table>

6	Draw the bending moment diagram for the beam loaded as shown in the figure when support ‘B’ sinks by 10mm below the levels of A,C and D. Assume E = 200 GPa, I = 132 x 10^6 mm^4 for all the members. Use moment-distribution method. 	[L4][CO5]	**[12M]**
7	Analyse the portal frame shown in the figure using moment distribution method 	[L4][CO5]	**[12M]**
8	Analyse the frame shown in the figure by moment distribution method. 	[L4][CO5]	**[12M]**
9	Analyse the portal frame shown in the figure using moment distribution method 	[L4][CO5]	**[12M]**
10	Analyse the portal frame shown in the figure using moment distribution method. Assume uniform flexural rigidity for all members. 	[L4][CO5]	**[12M]**

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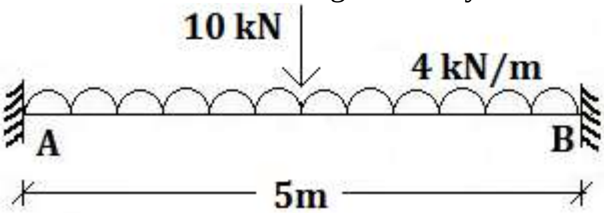
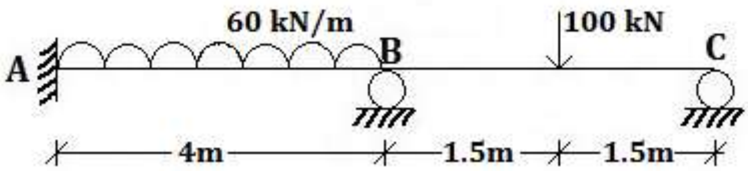
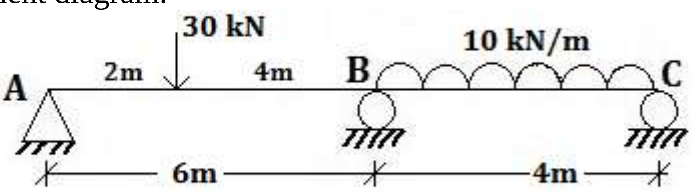
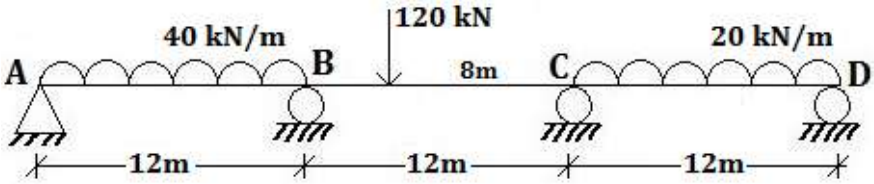
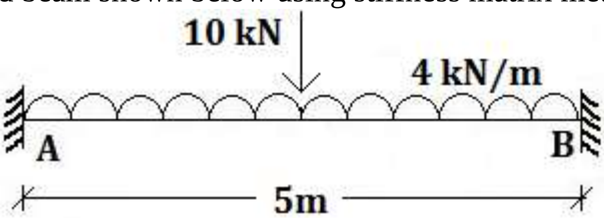
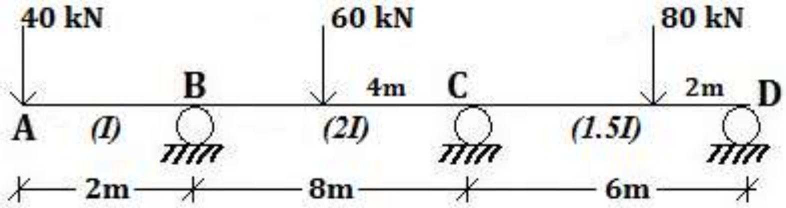
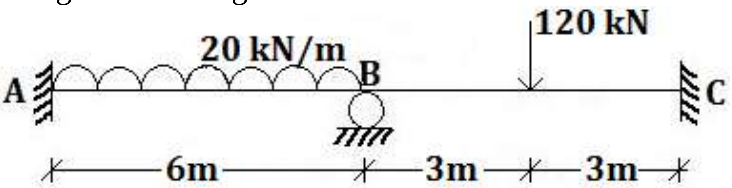
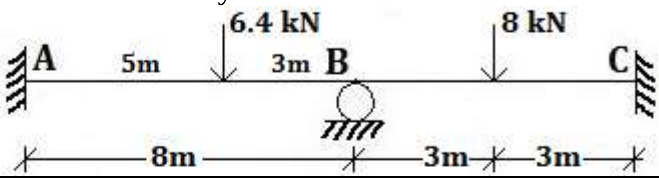
UNIT –V
MATRIX METHOS OF STRUCTURAL ANALYSIS

1	Explain the steps involved in Flexibility matrix method of analysis Explain the steps involved in Stiffness matrix method of analysis.	[L2][CO6]	**[12M]**
2	Analyse the fixed beam shown below using flexibility matrix method 	[L4][CO6]	**[12M]**
3	Analyse the continuous beam shown in the figure using flexibility matrix method. 	[L4][CO6]	**[12M]**
4	Analyse the continuous beam shown below by flexibility method and draw the bending moment diagram. 	[L4][CO6]	**[12M]**
5	Analyse the continuous beam shown in the figure by flexibility matrix method 	[L4][CO6]	**[12M]**
6	Analyse the fixed beam shown below using stiffness matrix method 	[L4][CO6]	**[12M]**

7	Analyse the continuous beam shown in the figure using displacement method.  	[L4][CO6]	**[12M]**
8	Analyse the fixed continuous beam shown in the figure by stiffness method and draw the bending moment diagrams  	[L4][CO6]	**[12M]**
9	Analyse the continuous beam by matrix stiffness method  	[L4][CO6]	**[12M]**
10	Define the term a) Static determinacy b) Kinematic indeterminacy and c) Generalised co-ordinates	[L1][CO6]	**[5M]**
	Derive the relationship between flexibility matrices and stiffness matrices	[L2][CO6]	**[7M]**

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