Course Code: 23CE0113

R23

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR (AUTONOMOUS)

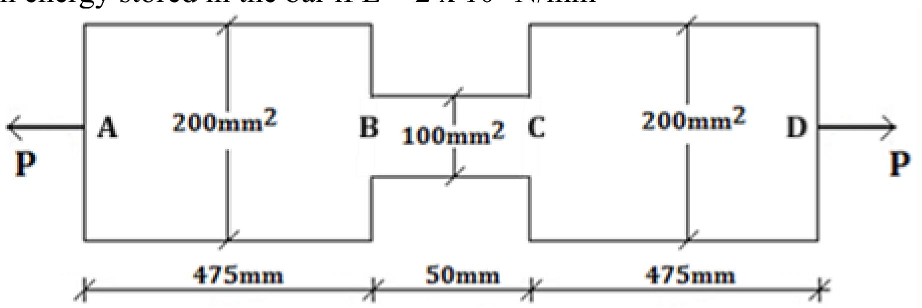
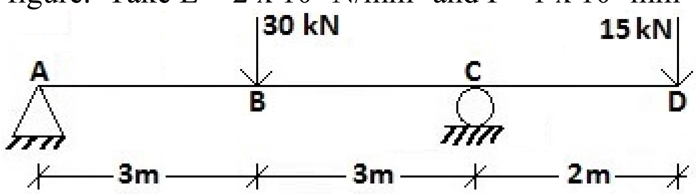
Siddharth Nagar, Narayanavanam Road – 517583

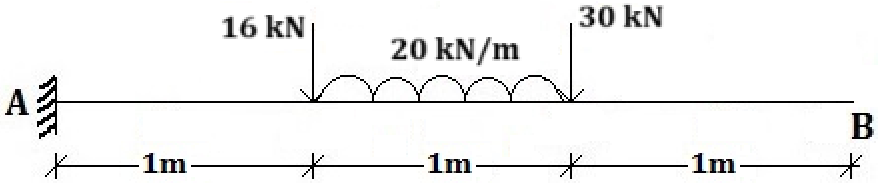
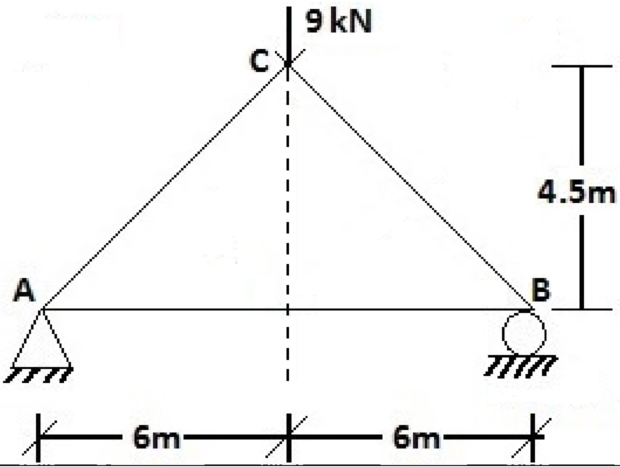
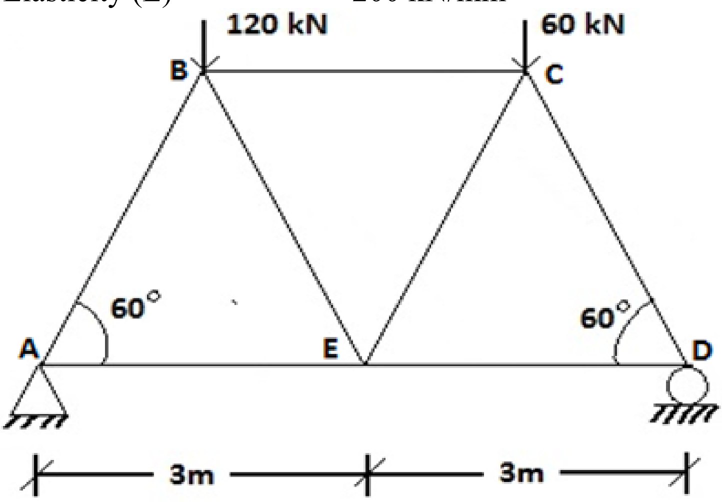
QUESTION BANK (DESCRIPTIVE)

Subject with Code: Structural Analysis (23CE0113) **Course & Branch**: B.Tech - Civil

Year & Sem: II-B.Tech & II-Sem **Regulation:** R23

UNIT – I
ENERGY THEOREMS

1	a. Define the term strain energy	**[L1][CO1]**	**[2M]**
	b. Define Proof resilience	**[L2][CO1]**	**[2M]**
	c. Define the term modulus of resilience	**[L3][CO1]**	**[2M]**
	d. What is the strain energy stored in a body when subjected to a i) Bending Moment 'M' ii) Shear stress 'τ'	**[L3][CO1]**	**[2M]**
	e. State Castigliano's first theorem	**[L3][CO1]**	**[2M]**
2	Derive an expression for strain energy stored in a member due to axial loading and due to bending moment.	**[L2][CO1]**	**[10M]**
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][CO1]**	**[10M]**
4	Determine the deflection at the free end of a cantilever beam subjected to a point load 'W' at the free end, using strain energy principle.	**[L3][CO1]**	**[5M]**
	Determine the deflection under load of simply supported beam subjected to an eccentric point load 'W', using strain energy principle.	**[L3][CO1]**	**[5M]**
5	State and prove Castigliano's first theorem	**[L2][CO1]**	**[10M]**
6	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][CO1]**	**[10M]**
7	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][CO1]**	**[10M]**
8	Determine the vertical deflection at the free end 'D' in the over-hanging beam shown in the figure. Take E = 2 x 10^5 N/mm^2 and I = 1 x 10^7 mm^4 	**[L3][CO1]**	**[10M]**

9	Using Castigliano's theorem, determine the deflection at the free end of the cantilever beam shown below. Take EI = 4.9 MNm^2 	**[L3][CO1]**	**[10M]**
10	Find the vertical deflection at the joint 'C' and the horizontal displacement of joint 'B' of the pin jointed truss shown in the figure. The area of member AB = 150 mm^2 and the area of AC and BC is 200 mm^2. Take E = 200 kN/mm^2. 	**[L4][CO1]**	**[10M]**
11	Find the vertical deflection of the joint 'E' of the truss shown in the figure. Area of each horizontal member = 1200 mm^2; Area of other members = 1500 mm^2; Modulus of Elasticity (E) = 200 kN/mm^2 	**[L4][CO1]**	**[10M]**

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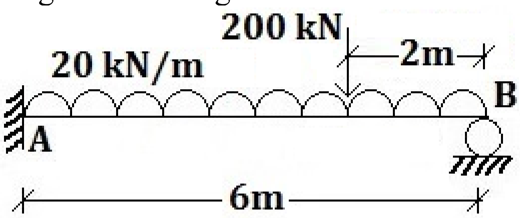
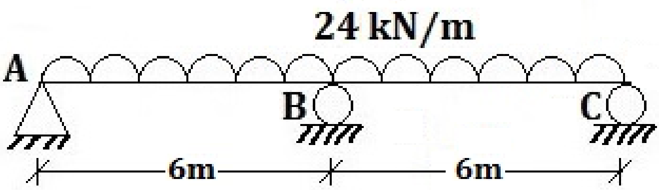
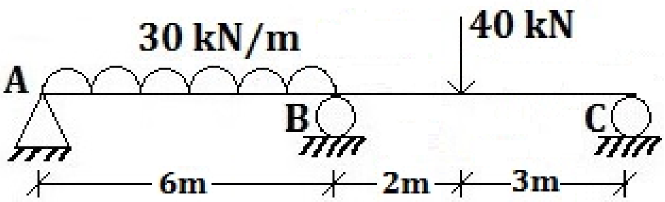
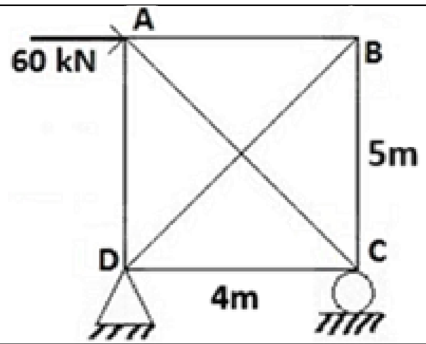
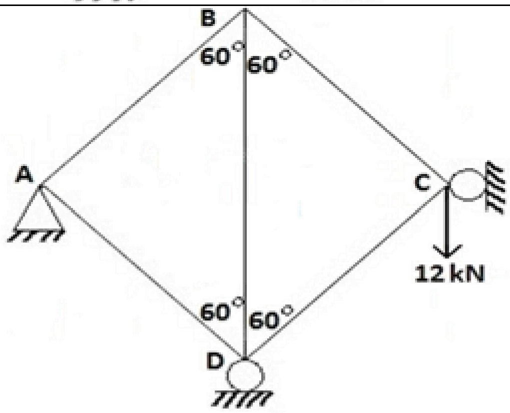
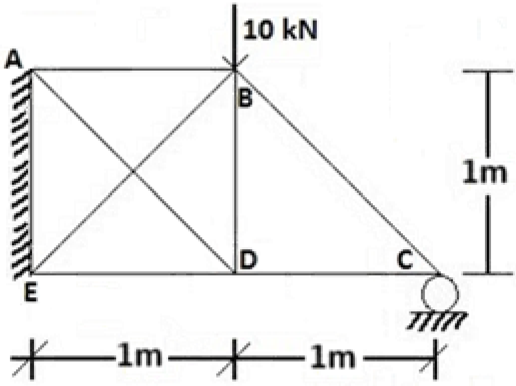
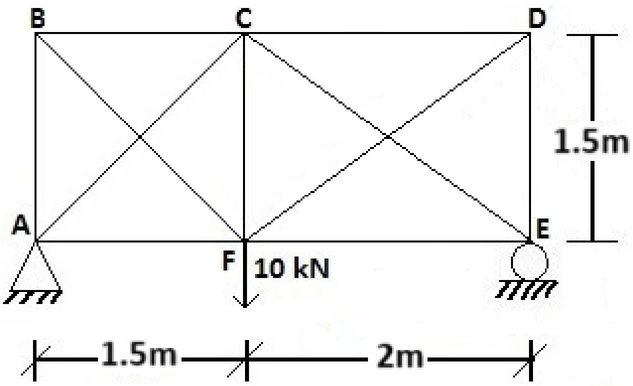
UNIT – II

ANALYSIS OF INDETERMINATE STRUCTURES

1	a. What do you mean by indeterminate structure? Give some example.	**[L1][CO2]**	**[2M]**
	b. Differentiate between static and kinematic indeterminacies.	**[L2][CO2]**	**[2M]**
	c. How do you find the degree of indeterminacy for a truss member.	**[L3][CO2]**	**[2M]**
	d. Differentiate between externally indeterminate & internally indeterminate.	**[L2][CO2]**	**[2M]**
	e. State Castigliano's second theorem	**[L1][CO2]**	**[2M]**
2	A propped cantilever beam of span *l*, fixed at A, propped at B carries a uniformly distributed load of *w* per *m* run over the whole span. Find the reaction at the propped end using Castigliano's theorem.	**[L4][CO2]**	**[10M]**
3	A beam AB 4m long is fixed at A and propped at B. It carries a point load of 16 kN at a distance of 1m from B. Determine the reactions at the supports and also draw the S.F and B.M diagrams	**[L3][CO2]**	**[10M]**
4	Find the reaction at the propped end for the beam loaded below. Also draw the shear force and bending moment diagrams 	**[L3][CO2]**	**[10M]**
5	Analyse the continuous beam shown below using Castigliano's theorem and draw the shear force and bending moment diagrams. 	**[L4][CO2]**	**[10M]**
6	Analyse the continuous beam shown below by Castigliano's theorem and determine the reactions. Also draw the SFD and BMD. 	**[L4][CO2]**	**[10M]**
7	Explain with an example on how redundant trusses are analysed using Castigliano's II-theorem. Write down the steps followed.	**[L2][CO2]**	**[10M]**

8	 Determine the forces in the members of the truss shown below. The cross-sectional areas for Vertical members = 1200mm^2, Horizontal members = 900mm^2 and for inclined member = 1500mm^2.	**[L3][CO2]**	**[10M]**
9	 Determine the reactions at the supports and the forces in the members of the truss shown below. The sectional area for AB and BC = 900mm^2 and for AD, BD and CD = 1200mm^2.	**[L3][CO2]**	**[10M]**
10	Analyse the truss shown below. All members have the same sectional area and same modulus of elasticity 'E'. Assume the joint A & E is hinged and the member AE is fixed. Take the area of cross-section is same for all members. 	**[L4][CO2]**	**[10M]**
11	Analyse the truss shown below. The area of each member is 1000mm^2. 	**[L4][CO2]**	**[10M]**

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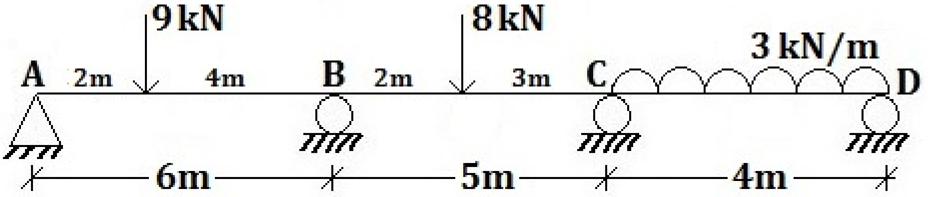
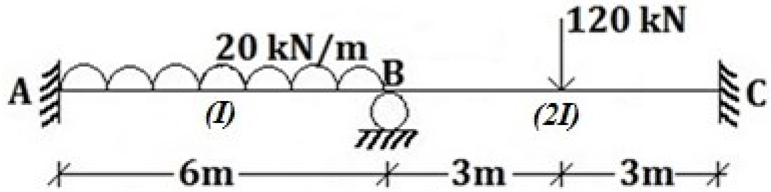
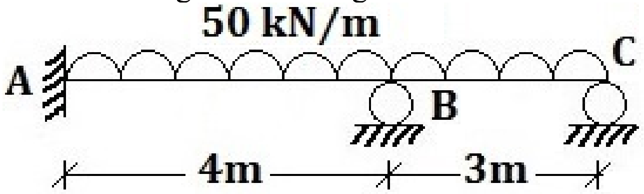
UNIT – III
FIXED BEAMS & CONTINUOUS BEAMS

1	a. What is meant by fixed end moment?	**[L1][CO3]**	**[2M]**
	b. What is the value of fixed end moments when subjected to a point load at the mid-span and uniformly distributed load over the entire span.	**[L1][CO3]**	**[2M]**
	c. State some of the disadvantages of fixed beams.	**[L1][CO3]**	**[2M]**
	d. Write down the Claypeyron's theorem of three moments.	**[L1][CO4]**	**[2M]**
	e. How Claypeyron's theorem of three moments is applied to fixed continuous beam? Explain with an example.	**[L2][CO4]**	**[2M]**
2	A fixed beam AB of span 6m carries two-point loads of 100 kN and 75 kN at a distance of 2m from A and B respectively. Find the fixing moments at the ends and the reaction at the support. Also draw the shear force and bending moment diagrams	**[L3][CO3]**	**[10M]**
3	A fixed beam of span 5m carries a uniformly distributed load of 4 kN/m over the entire span and a point load of 10 kN at the mid-span. Determine the support moment for the beam and also draw the SFD and BMD.	**[L3][CO3]**	**[10M]**
4	A beam AB of span 5m is built-in at its both ends. It carries a gradually varying load from zero at 'A' to 4 kN/m at 'B'. Determine the fixed end moments and the reactions at both the ends of the beam and also draw the SFD and BMD.	**[L3][CO3]**	**[10M]**
5	A fixed beam of 6m span is subjected to a concentrated couple of 150 kN.m applied at a section of 4m from the left end. Find the end moments and draw the shear force and bending moment diagrams.	**[L3][CO3]**	**[10M]**
6	A beam AB of 8m span is fixed at its both ends. When a uniformly distributed load of 20 kN/m is placed on the beam, its support 'B' sinks by 12mm below the support 'A'. Determine the support moments for the beam, if second moment of area I = 98.75 x 10^6 mm^4 and E = 200 GPa.	**[L3][CO3]**	**[10M]**
7	A fixed beam AB of length 3m carries a point load of 45 kN at a distance of 2m from 'A'. If the flexural rigidity (EI) of the beam is 1 x 10^4 kNm^2, determine i) Fixed end moments at A and B iii) Maximum deflection ii) Deflection under the load iv) position of maximum deflection	**[L3][CO3]**	**[10M]**
8	A continuous beam ABCD, simply supported at A, B, C and D, is loaded as shown in the figure. Find the moments over the beam and draw the bending moment and shear force diagrams.  	**[L3][CO4]**	**[10M]**

9	Analyse the continuous beam shown below using Claypeyron's theorem and sketch the bending moment diagram 	**[L3][CO4]**	**[10M]**
10	A continuous beam ABC, shown below carries a uniformly distributed load of 50 kN/m on AB and BC. The support 'B' sinks by 5mm below 'A' and 'C'. If E = 200 GPa and I = 332 x 10^6 mm^4, find the bending moment at supports 'A' and 'B' and draw the bending moment diagram. 	**[L3][CO4]**	**[10M]**
11	A continuous beam ABC of constant moment of inertia is simply supported at A, B and C. The beam carries a central point load of 4 kN in the span AB of 10m length and a central clockwise couple of moment 30 kN.m in the span BC of 15m length. Find the support moment and draw the SFD and BMD.	**[L3][CO4]**	**[10M]**

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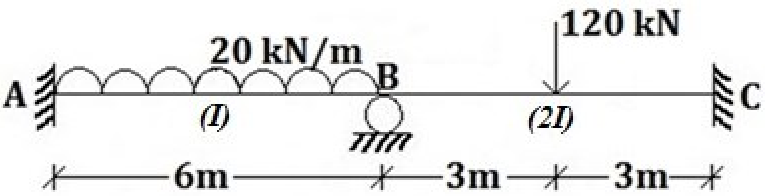
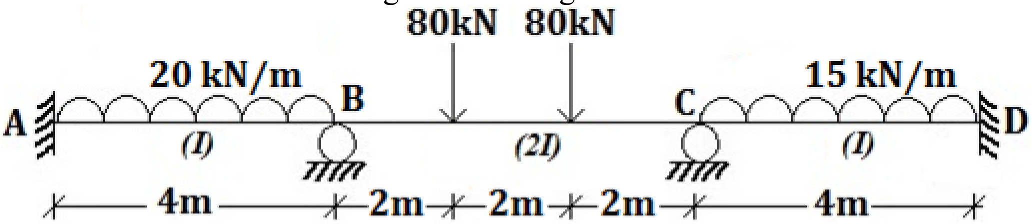
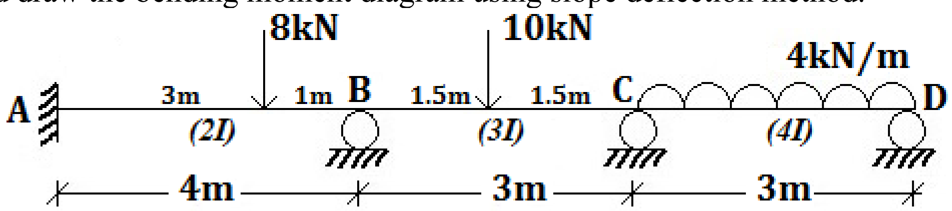
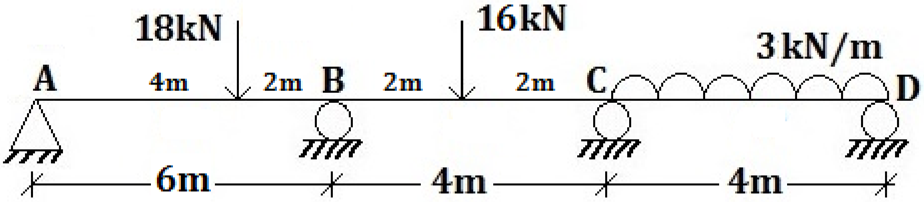
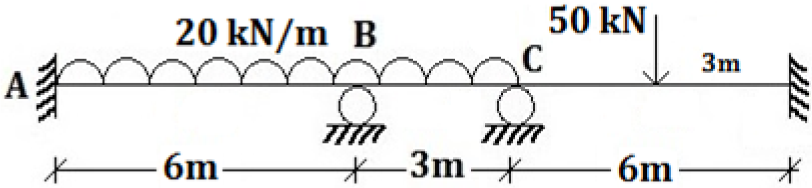
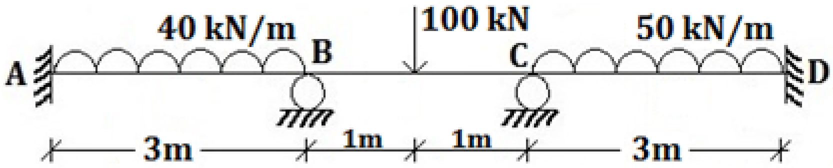
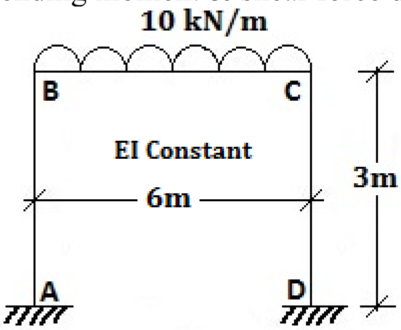
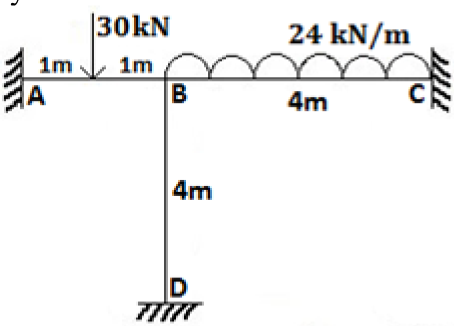
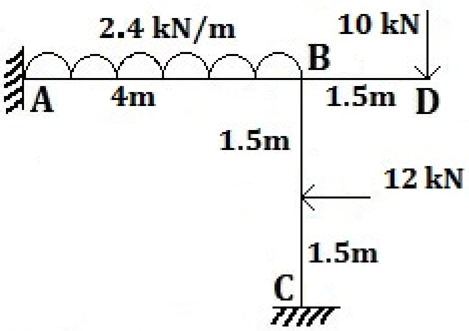
UNIT – IV
SLOPE DEFLECTION METHOD

1	a. State the assumption made in the slope deflection method.	**[L1][CO5]**	**[2M]**
	b. How sign convention is adopted in slope deflection method?	**[L2][CO5]**	**[2M]**
	c. Write down the slope deflection equation and mention the terms.	**[L1][CO5]**	**[2M]**
	d. How joints are analysed in slope deflection method?	**[L2][CO5]**	**[2M]**
	e. Give some of the limitations in using slope deflection method	**[L1][CO5]**	**[2M]**
2	State the assumption and derive an expression for slope deflection method	**[L2][CO5]**	**[10M]**
3	Analyse the continuous beam shown below using slope deflection method and sketch the shear force and bending moment diagram 	**[L4][CO5]**	**[10M]**
4	Analyse the continuous beam loaded as shown in the figure by slope deflection method and sketch the bending moment diagram 	**[L4][CO5]**	**[10M]**
5	Determine the support moments for the continuous beam as shown in the figure and draw the bending moment diagram using slope deflection method. 	**[L3][CO5]**	**[10M]**
6	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. 	**[L3][CO5]**	**[10M]**

7	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 $10^7 mm^4$.  	[L4][CO5]	[10M]
8	Determine the support moments for the continuous girder shown in figure using slope deflection method, if the support B sinks by 2.50 mm. For all members, I = 3.50 x 10^7 mm^4 and E = 200 kN/mm^2  	[L3][CO5]	[10M]
9	Analyse the portal frame loaded as shown in the figure using slope-deflection method and sketch the bending moment & shear force diagrams  	[L4][CO5]	[10M]
10	Analyse the frame shown below using slope deflection method, by assuming uniform flexural rigidity  	[L4][CO5]	[10M]
11	Analyse the frame shown below using slope deflection method. Assume uniform flexural rigidity  	[L4][CO5]	[10M]

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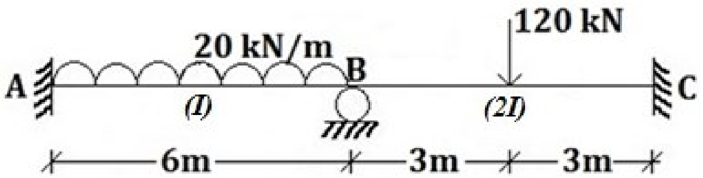
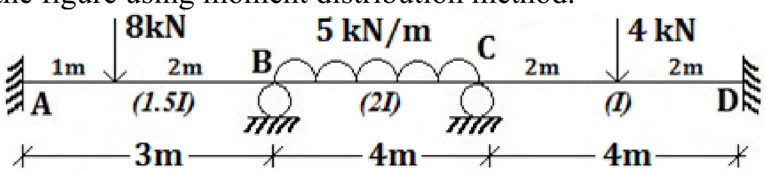
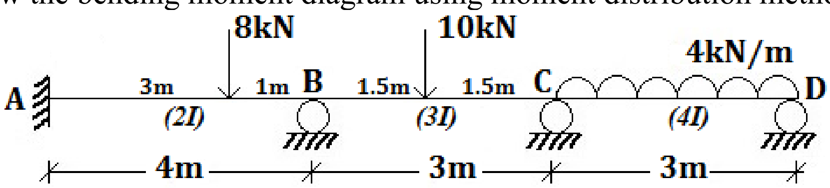
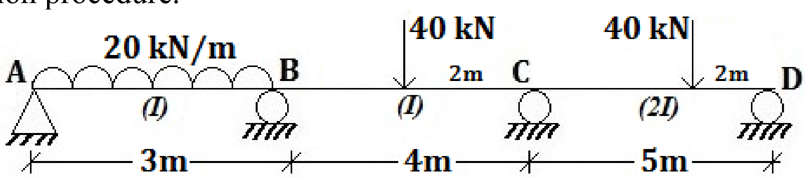
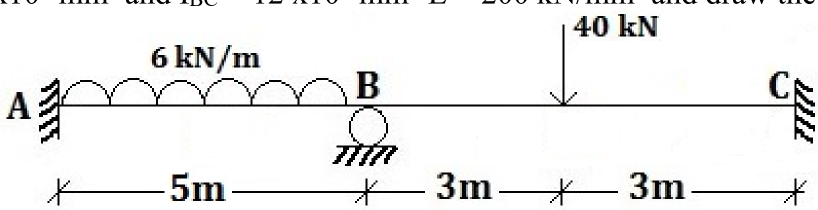
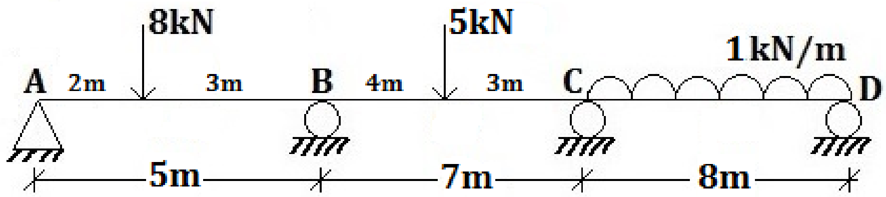
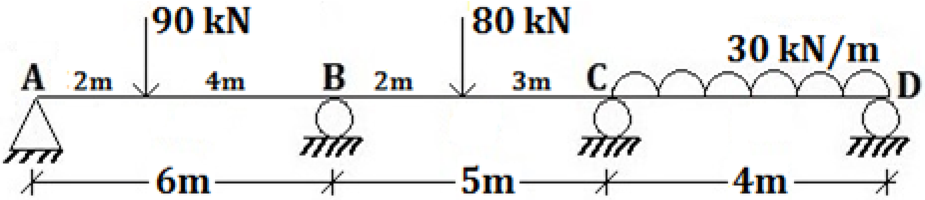
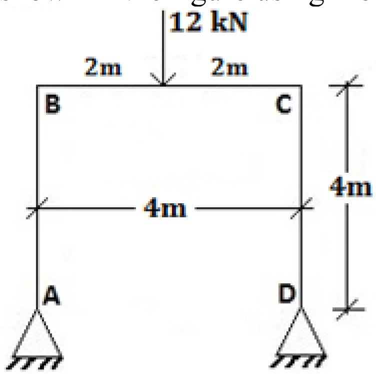
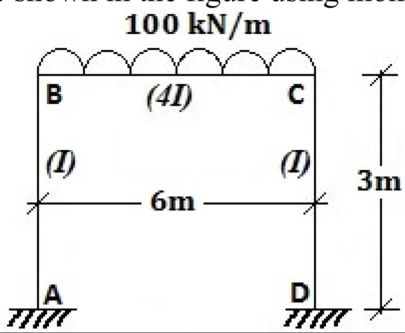
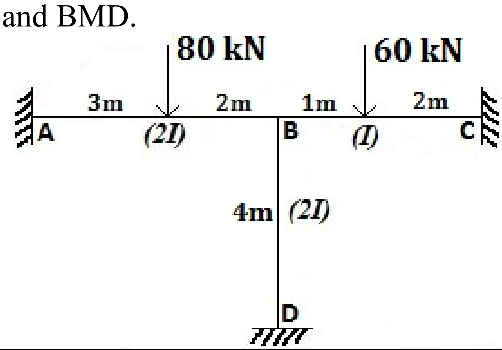
UNIT – V
MOMENT DISTRIBUTION METHOD

1	a. What does the distribution theorem state?	[L2][CO6]	[2M]
	b. Define stiffness.	[L2][CO6]	[2M]
	c. What is meant by carry over moment?	[L2][CO6]	[2M]
	d. Define the term distribution factor	[L2][CO6]	[2M]
	e. State the condition when a portal frame will be subjected to sway	[L1][CO6]	[2M]
2	Analyse the continuous beam shown below using moment distribution method and sketch the shear force and bending moment diagram 	[L4][CO6]	[10M]
3	Determine the support moments at A, B, C and D for the continuous girder shown in the figure using moment distribution method. 	[L3][CO6]	[10M]
4	Determine the support moments for the continuous beam as shown in the figure and draw the bending moment diagram using moment distribution method. 	[L3][CO6]	[10M]
5	Analyse the continuous beam ABCD shown in the figure by moment distribution procedure. 	[L4][CO6]	[10M]
6	Determine the support moments for the continuous beam shown in the figure using moment distribution method, if the support 'B' sinks by 12mm. Given, $I_{AB} = 9 \times 10^6\ mm^4$ and $I_{BC} = 12 \times 10^6\ mm^4$ $E = 200\ kN/mm^2$ and draw the BMD. 	[L3][CO6]	[10M]

7	A continuous beam ABCD, 20m long 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. Take E = 2.1 x 10^5 N/mm^2 & I = 85 x 10^5 mm^4 	[L4][CO6]	[10M]
8	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][CO6]	[10M]
9	Analyse the portal frame shown in the figure using moment distribution method 	[L4][CO6]	[10M]
10	Analyse the portal frame shown in the figure using moment distribution method 	[L4][CO6]	[10M]
11	Analyse the structure loaded as shown below by moment distribution method and sketch the SFD and BMD. 	[L4][CO6]	[10M]

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