INSTITUTEOFAERONAUTICALENGINEERING

(Autonomous)
Dundigal,Hyderabad-500043

CIVIL ENGINEERING

TUTORIAL QUESTION BANK

Course Name	:	**STRUCTURAL ANALYSIS - II**
Course Code	:	**A60131**
Class	:	III B. Tech II Semester
Branch	:	Civil Engineering
Year	:	2017 – 2018
Course Coordinator	:	Mrs. S Bhagyalaxmi, Assistant Professor
Course Faculty	:	Dr. M Venu, Professor Mrs.S Bhagyalaxmi, Assistant Professor

COURSE OBJECTIVES

The course will impart to the students the knowledge and skills of:

I. Slope deflection, moment distribution and Kani's methods of analysis of indeterminate frames
II. Analysis of two-hinged arches using energy methods
III. Approximate methods of structural analysis for 2D frame structures for horizontal and vertical loads such as cantilever, portal and substitute frame methods
IV. Matrix methods of structural analysis with stiffness and flexibility matrices to analyze continuous beams, portal frames and trusses
V. Draw the influence line diagrams for indeterminate beams using Muller-Breslau principle
VI. Analysis of indeterminate trusses using energy methods

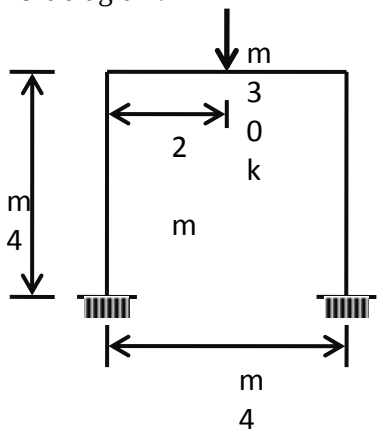
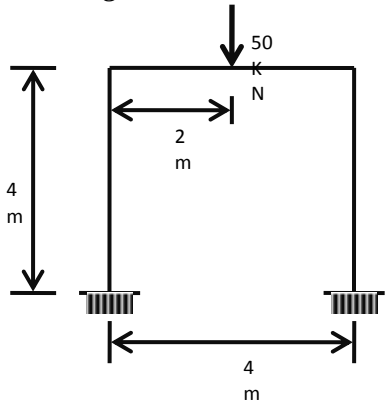
COURSRE OUTCOMES

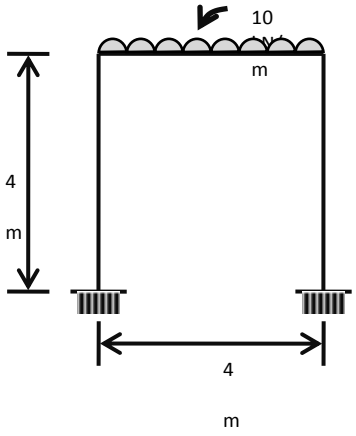
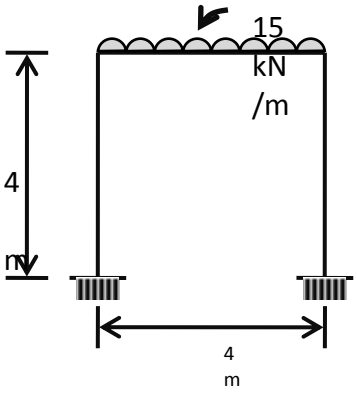
By the end of the course the student is expected to be able to:

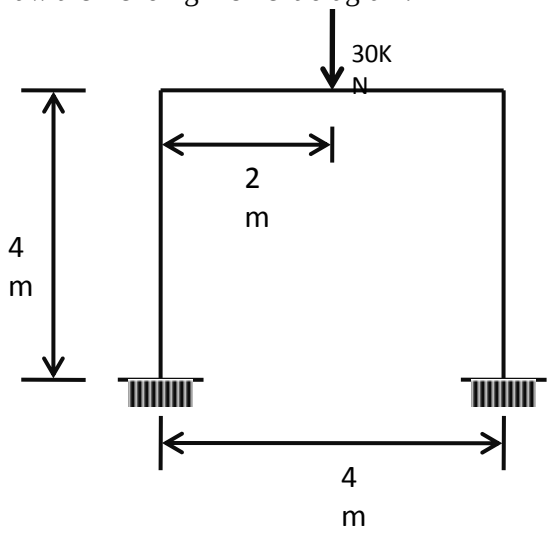
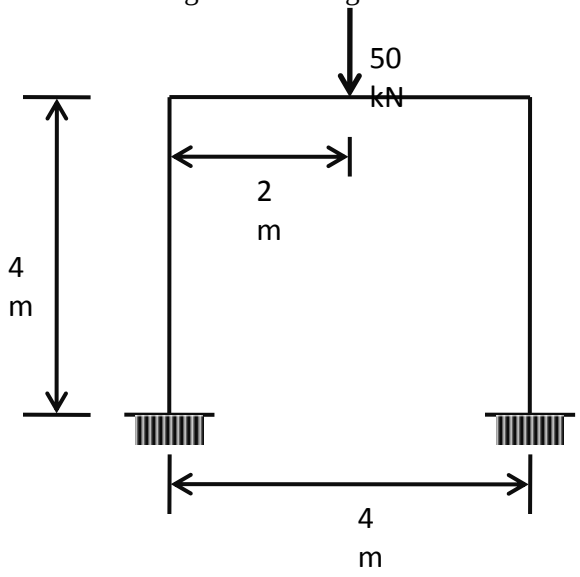
1. Contrast between the concept of force and displacement methods of analysis of indeterminate structures
2. Analyze the methods of moment distribution to carry out structural analysis of 2D portal frames with various loads and boundary conditions.
3. Understand working methodology of Kani's method and compare that with moment distribution method
4. Apply the methods of slope deflection to carry out structural analysis of 2D portal frames with various loads and boundary conditions.
5. Analyse the parabolic arches for the shear forces and bending moments.
6. Execute secondary stresses in two hinged arches due to temperature and elastic shortening of rib.
7. Construct the shear forces and bending moments of 2D portal frames with various loads and boundary conditions.
8. Evaluate the shear forces and bending moments in two-hinged arches using energy methods.
9. Differentiate Static and kinematic Indeterminacy.
10. Analyze 2D frame structures for horizontal and vertical loads by approximate methods such as cantilever and substitute frame methods

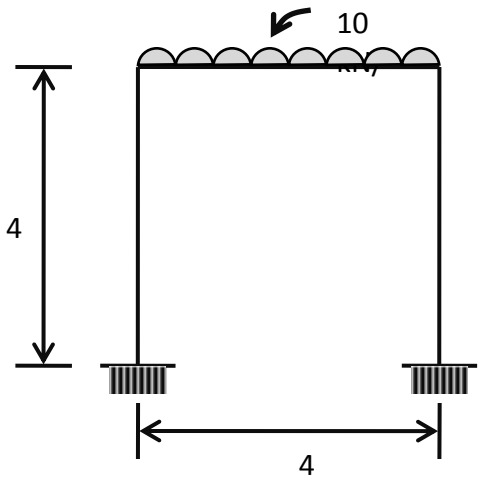
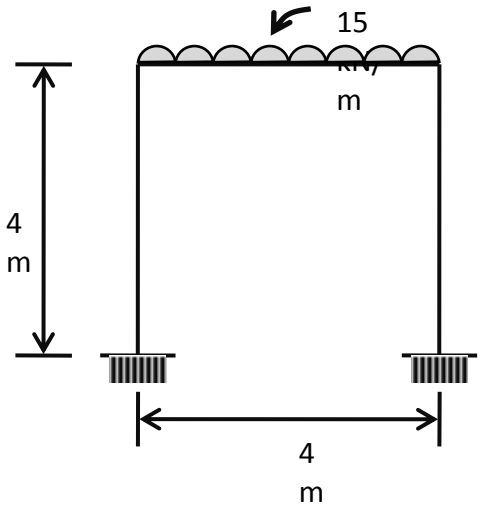
11. Analyze indeterminate structures such as continuous beams, portal frames and trusses using stiffness and flexibility matrix methods.
12. Analyze statically indeterminate structures using stiffness method.
13. Evaluate statically indeterminate structures using flexibility method.
14. Execute 2D frame structure for horizontal and vertical loads by portal method.
15. Understand and compare the different methods to analyze plane frames.
16. Apply the stiffness method to continuous beams, pin-joint frames and portal frames.
17. Construct the influence line diagrams for indeterminate beams using Muller-Breslau principle.
18. Apply the Castigliano's second theorem to evaluate forces in members of indeterminate trusses.
19. Evaluate the shear force and bending moment at a section of an indeterminate beam under moving load.
20. Construct the influence line diagram for the entire beam.

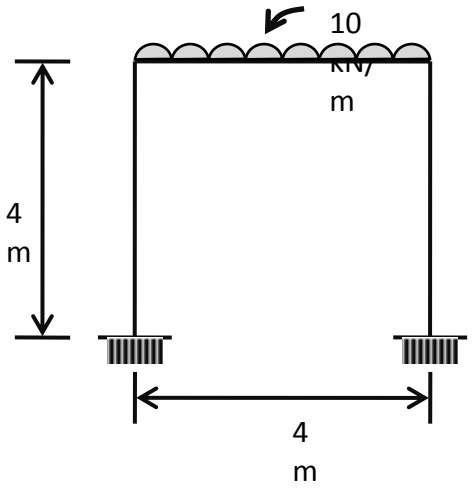
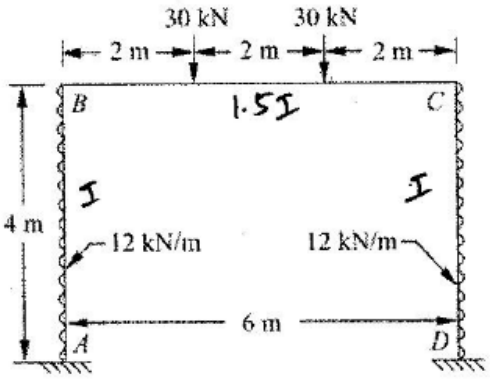
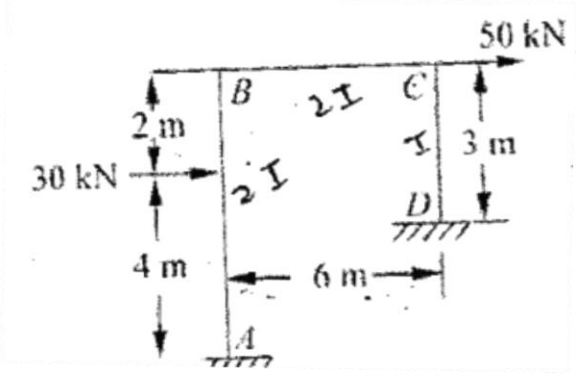
SNo	QUESTION	Blooms taxonomy level	Course Outcomes
	UNIT - I **(A) MOMENT DISTRIBUTION METHOD(B) KANI'S METHOD**		
	Part - A(Short Answer Questions)		
1	What is the concept of moment distribution?	Remember	2
2	Define member stiffness with an example.	Remember	2
3	Differentiate between absolute stiffness and relative stiffness.	Remember	2
4	What is meant by modified stiffness factor?	Remember	2
5	What is distribution factor in moment distribution method?	Remember	2
6	Under which category of indeterminate structural analysis does the moment distribution method fall – Force method or Displacement method? Explain why?	Remember	4
7	What is the value of the sum of the moment distribution factors at a joint in a framed structure? Why?	Remember	2
8	Give the expression for the stiffness factor of a member whose one end connected to a joint and other end is pin-ended support?	Remember	1
9	Give the expression for the stiffness factor of a member whose one end connected to a joint and other end is a fixed support?	Remember	2
10	Four members of equal flexural rigidity and equal lengths meet at a rigid joint in a framed structure. Write their moment distribution factors?	Understand	4
11	In what principle is Kani's method of structural analysis based on?	Remember	2
12	Explain the concept of Kani's method of structural analysis in brief.	Remember	2
13	What is the advantage of Kani's method over Moment Distribution method?	Remember	2
14	What is the advantage of Kani's method over the slope deflection method?	Remember	2
15	For which structures the Kani's method of analysis is useful? Why?	Remember	4
16	Under which category of indeterminate structural analysis does the Kani's method fall – Force method or Displacement method? Why?	Understand	2
17	What is the value of the sum of the rotation factors at a joint in a framed structure? Why?	Understand	1
18	Give the general expression for the Kani's rotation contribution a member AB, neglecting sway in the frame? Describe the terms?	Understand	3
19	Give the general expression for the Kani's rotation contribution a member AB, including sway in the frame? Describe the terms?	Understand	2

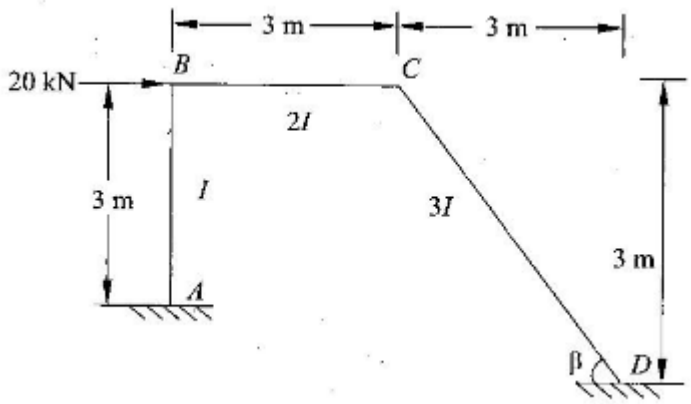
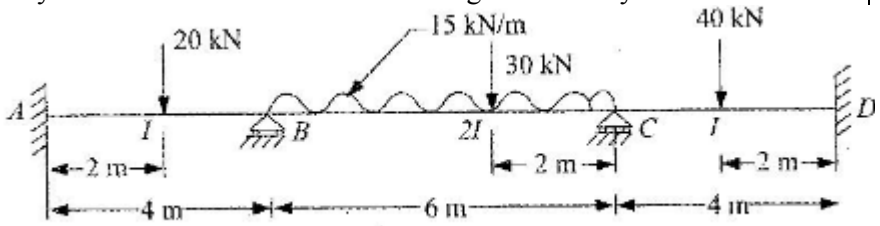
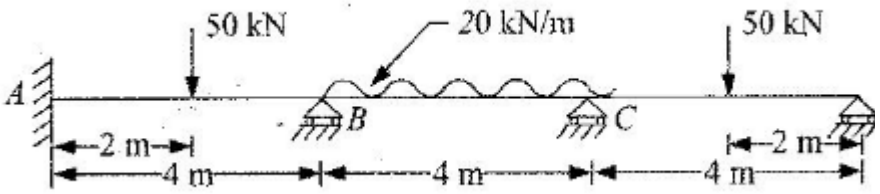
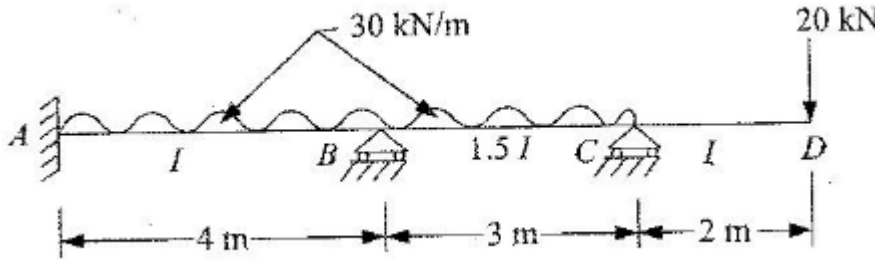
20	Four members of equal flexural rigidity and equal lengths meet at a rigid joint in a framed structure. Write their rotation factors?	Understand	3
	Part - B (Long Answer Questions)		
1	Take a simple example of a frame joint and derive necessary expressions for the distribution factors for the members connected to the joint.	Understand	1
2	Consider a member of a frame as AB. Define and derive expressions for (a) stiffness factor (b) carry over factor.	Understand	1
3	Consider a member of a frame as AB. Define and derive expressions for (a) member stiffness factor (b) relative stiffness factor (c) modified stiffness factor	Understand	3
4	Consider a joint A in a frame with 4 members connected to it, all of same flexural rigidity, but of different lengths, L1, L2, L3, L4. Derive expressions for (a) joint stiffness factor (b) distribution factors?	Understand	1
5	Write the fixed end moments for a member with (a) uniformly distributed load (b) point load at the mid-span (c) point load at a distance of 'a' from one end (d) uniformly distributed load over half-span of the beam	Understand	2
6	Write the fixed end moments for a member with (a) support settlement Δ at one end (b) uniformly varying load (c) two point loads equally spaced over the span (d) three point loads equally spaced over the span	Understand	3
7	Analyze the following frame for end moments by moment distribution method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	2
8	Analyze the following frame for end moments by moment distribution method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	1

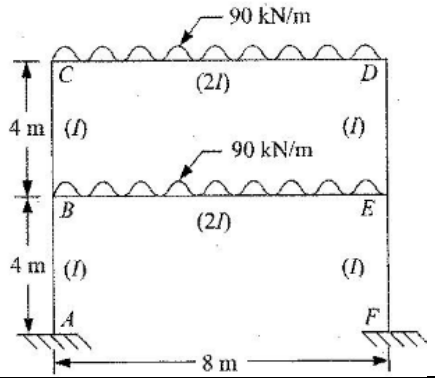
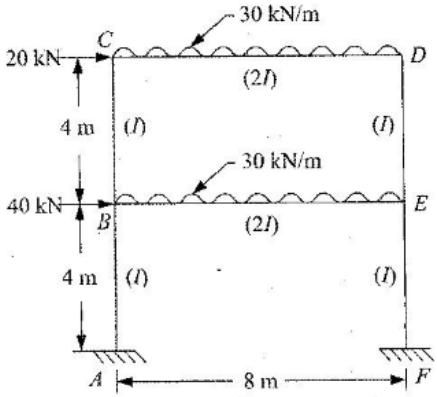
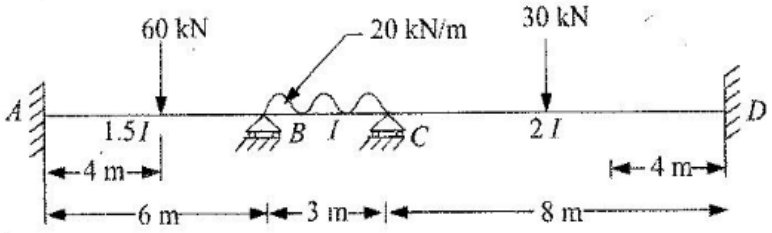
9	Analyze the following frame for end moments by moment distribution method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	2
10	Analyze the following frame for end moments by moment distribution method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	2
11	Write the fixed-end moments for a member with rotation at one of its supports	Remember	2
12	Derive the expression for rotation factor for a member AB at joint A as used in Kani's method for analysis of frames	Understand	2
13	Write the steps for Kani's method of analysis of a portal frame with sway.	Remember	2
14	Write and explain expressions for displacement contribution factors in Kani's method of analysis.	Remember	2
15	Consider a joint A in a frame with 4 members connected to it, all of same flexural rigidity, but of different lengths, L1, L2, L3, L4. Derive expressions for rotation factors for each member?	Remember	2

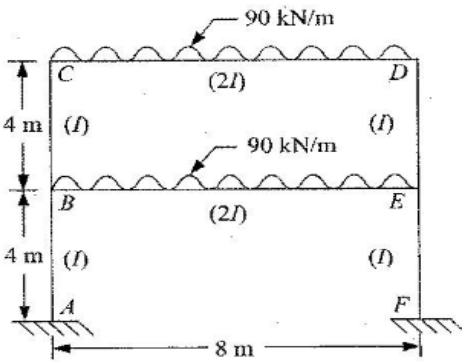
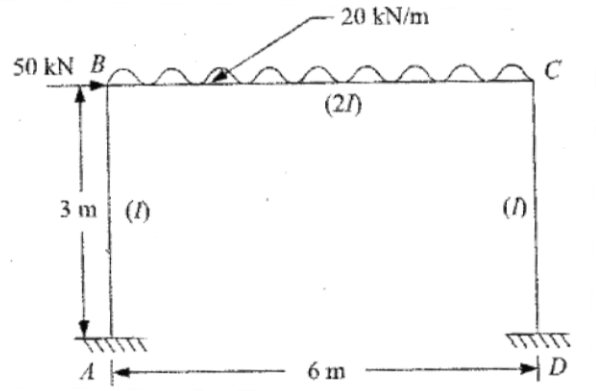
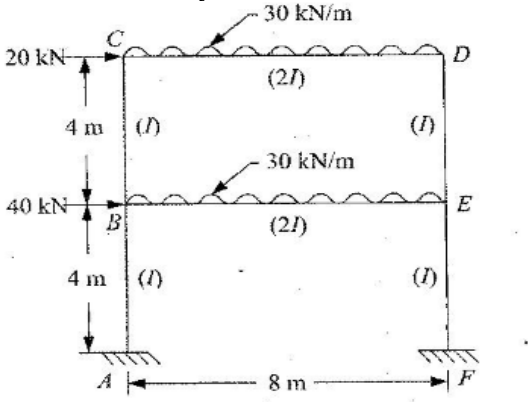
16	Analyze the following frame for end moments by Kani's method of analysis. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Remember	3
17	Analyze the following frame for end moments by Kani's method of analysis. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Remember	3

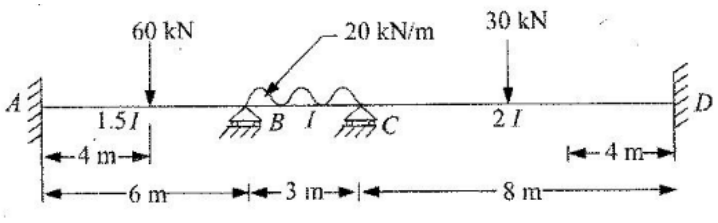
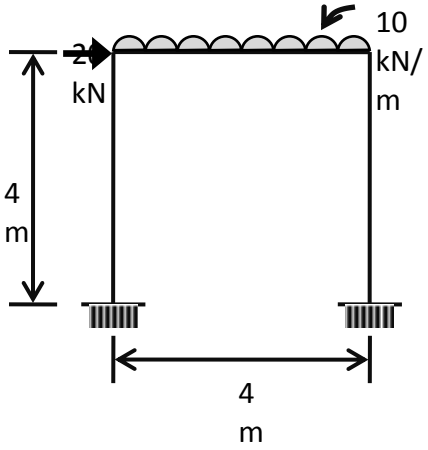
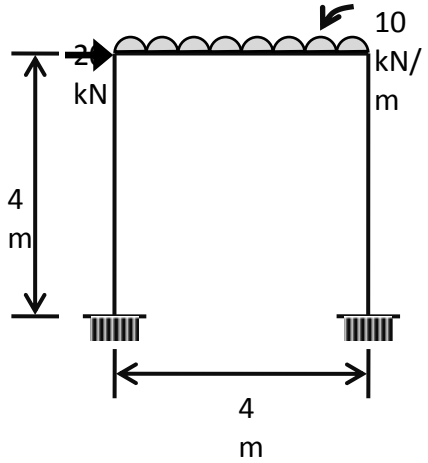
18	Analyze the following frame for end moments by Kani's method of analysis. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Remember	3
19	Analyze the following frame for end moments by Kani's method of analysis. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Remember	3

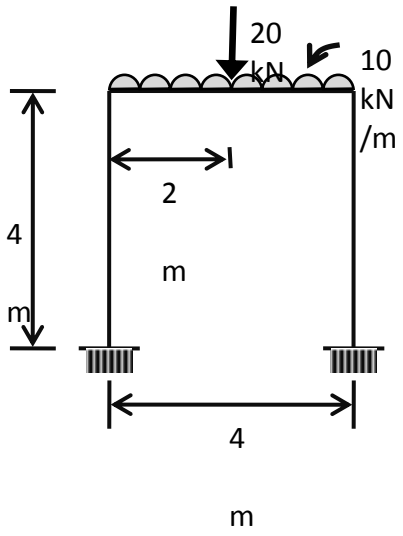
20	Using the concept of symmetry, analyze the following frame for end moments by Kani's method of analysis. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Understand	3
	Part - C (Problem Solving and Critical Thinking Questions)		
1	Analyze the symmetric frame shown in figure given below by moment distribution method. 	Remember	2
4	Analyze the frame shown in the below figure by moment distribution method and sketch bending moment diagram. 	Understand	2

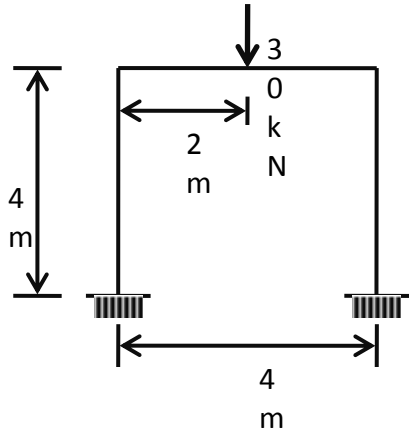
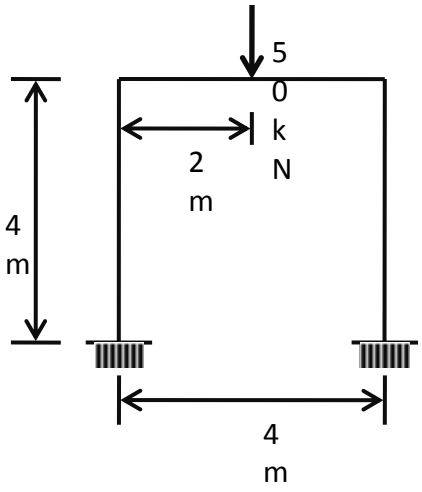
5	Analyze the frame shown below by moment distribution method. 	Understand	2
6	Analyze the continuous beam shown in figure below by Kani's method. 	Understand	3
7	Analyze the continuous beam shown below by Kani's method. Flexural rigidity is constant throughout. 	Understand	3
8	Analyze the continuous beam shown below by Kani's method. 	Understand	3

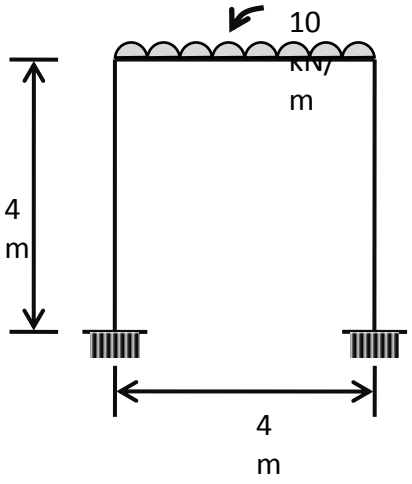
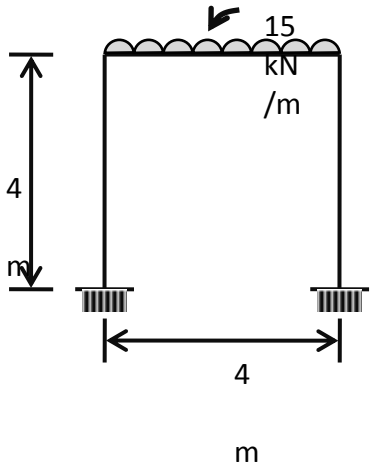
10	Analyze the symmetric frame shown below by Kani's method and indicate the final end moments on the sketch of the frame.  	Understand	3
11	Analyze the frame shown below by Kani's method.  	Understand	3
12	Analyze the continuous beam shown below by Kani's method  	Understand	3

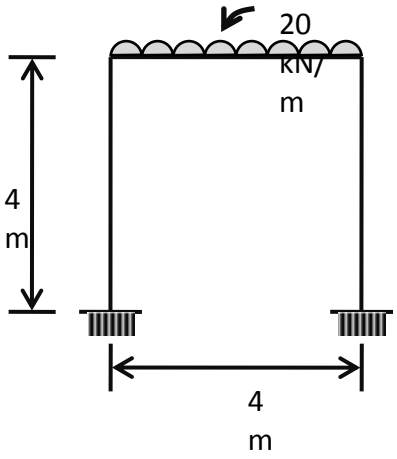
13	Analyze the symmetric frame shown below by Kani's method and indicate the final end moments on the sketch of the frame.  	Understand	3
14	Analyze the rigid jointed frame shown below by Kani's method.  	Understand	3
15	Analyze the frame shown below by Kani's method.  	Understand	3

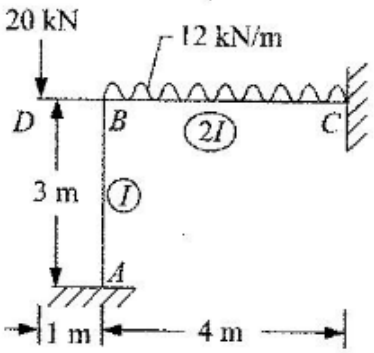
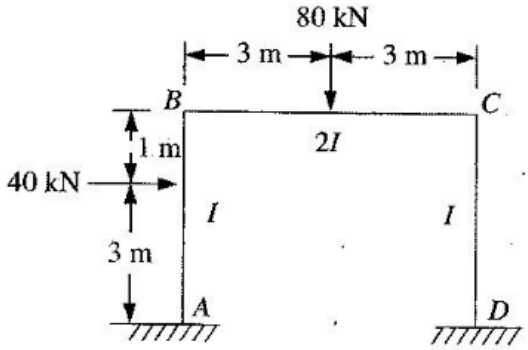
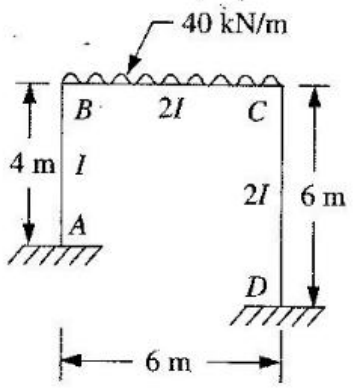
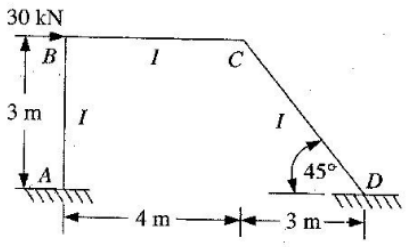
16	Analyze the continuous beam shown below by Kani's method 	Understand	3
18	Carry out the non-sway analysis for the following frame by Moment Distribution Method, and draw the bending moment diagram. Assume constant EI for all members. 	Understand	3
19	Carry out the sway analysis for the following frame by Moment Distribution Method, and draw the bending moment diagram. Assume constant EI for all members. 	Understand	3

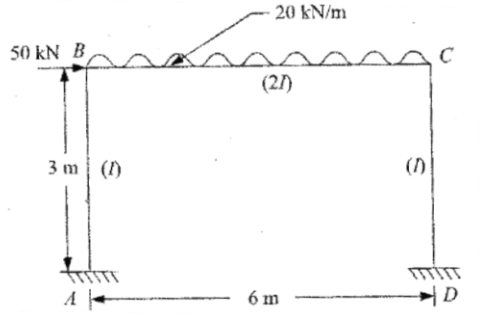
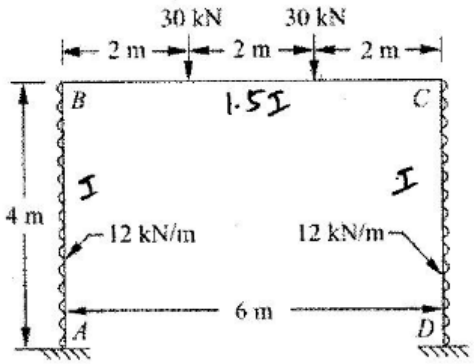
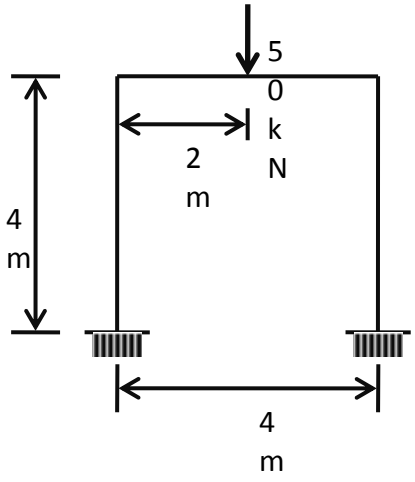
20	Analyze the following frame by Moment Distribution Method, and draw the bending moment diagram. Assume constant EI for all members.  	Understand	3
UNIT-II **(A) SLOPE DEFLECTION METHOD (B) TWO-HINGED ARCHES**			
Part – A (Short Answer Questions)			
1	On what principle is slope-deflection method based on?	Remember	4
2	Explain why is the slope- deflection method so called?	Remember	4
3	What are fixed-end moments?	Remember	4
4	Write the generalized form of slope-deflection equation?	Remember	4
5	What are the limitations of the slope-deflection method?	Remember	4
6	Explain under which circumstances is the slope-deflection method advantageous and when is it cumbersome?	Understand	4
7	What is the relation between kinematic indeterminacy of a framed structure and the number of joint equilibrium equations required in its analysis by slope-deflection method?	Understand	4
8	Under which category of indeterminate structural analysis does the slope deflection method fall – Force method or Displacement method? Explain why?	Understand	4
9	What is the sign convention generally used for the joint moments and joint rotations in the slope-deflection method?	Remember	4
10	State the difference between the force method and displacement method of structural analysis in terms of the (i) unknowns to be solved and (ii) the equations used to solve for the unknowns?	Understand	4
11	Define an arch. How does an arch differ from a beam?	Remember	5
12	What are the different types of arches in terms of their determinacy?	Remember	5
13	What is the load transfer mechanism in an arch?	Remember	5
14	Differentiate beams, cables and arches in their mechanism of transferring loads.	Remember	5
15	When is an arch structure useful as compared to beams? Why?	Remember	5
16	What are the two common types of two-hinged arches?	Understand	5
17	Write the steps for analysis of two hinged arches.	Understand	5
18	What are the effects of temperature rise on the horizontal thrust of atwo-hinged arch? Give the expression for horizontal thrust.	Understand	5

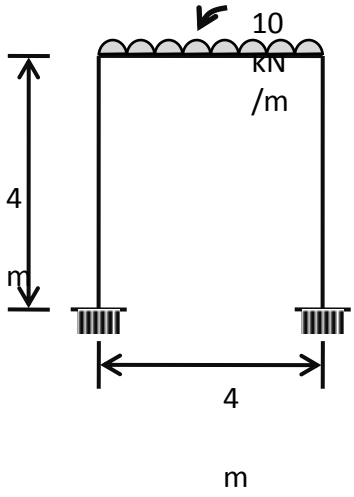
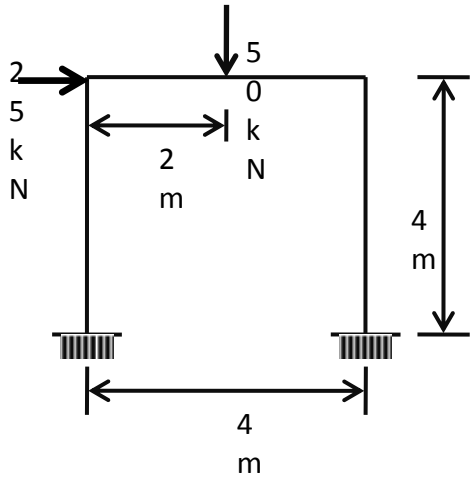
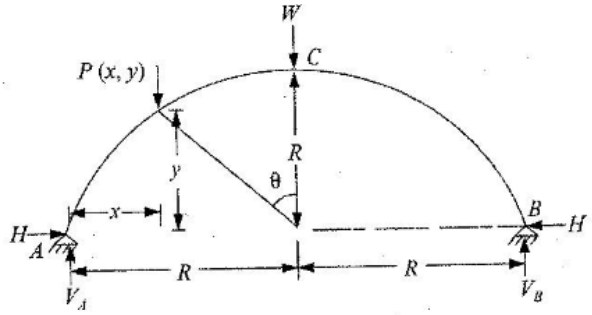
19	What are the effects of elastic rib shortening on the horizontal thrust of a two-hinged arch? Give the expression for horizontal thrust.	Understand	5
20	What are the effects yielding of the supports on the horizontal thrust of a two-hinged arch? Give the expression for horizontal thrust.	Understand	5
	Part - B (Long Answer Questions)		
1	Explain the steps involved in Slope-Deflection method of analysis	Understand	4
2	Derive slope deflection equations of a member which includes member axis rotation (or settlement of one support).	Understand	4
3	Derive the simplified slope-deflection equation for a member with a hinged end.	Understand	4
4	Derive the shear equation in slope-deflection method for the case of a frame with sidesway.	Understand	4
5	Explain the effects of support settlement on indeterminate structure.	Understand	4
6	Analyze the following frame for end moments by Slope-deflection method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Understand	4
7	Analyze the following frame for end moments by Slope-deflection method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram. 	Understand	4

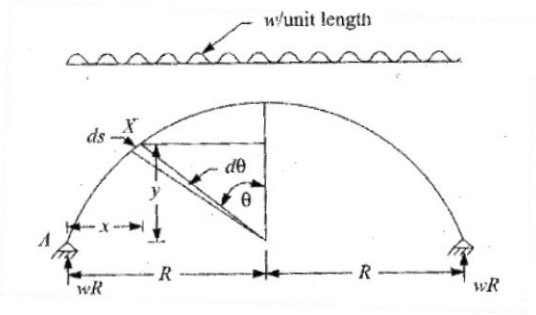
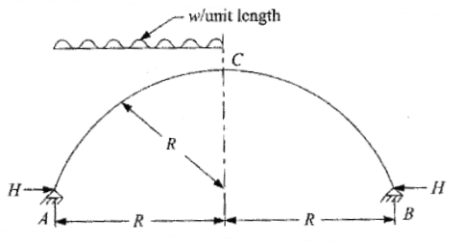
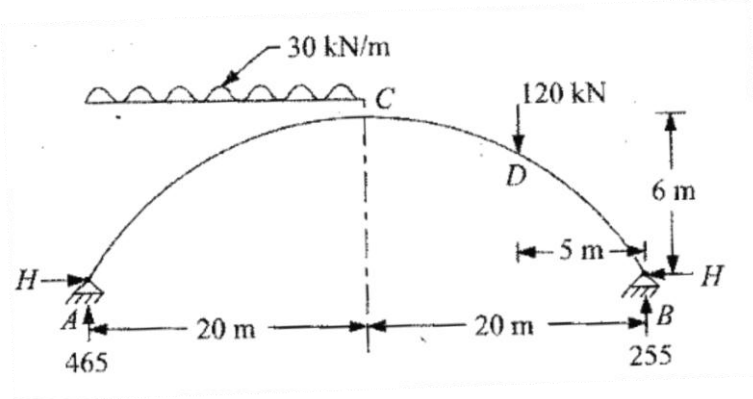
8	Analyze the following frame for end moments by Slope-deflection method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	4
9	Analyze the following frame for end moments by Slope-deflection method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	4

10	Analyze the following frame for end moments by Slope-deflection method. Assume same flexural rigidity (EI) for all members. Do not draw the Bending moment diagram.  	Understand	4
11	Write the expression for the horizontal thrust of a two-hinged arch under the effects of temperature, rib-shortening and support-yielding? Explain the effects of each on the horizontal thrust.	Understand	6
12	Derive the expression for strain energy of an arch.	Understand	6
13	Derive the expression for horizontal thrust of a two hinged arch under a general case of loads, without any other effects.	Understand	6
14	Derive the expression for horizontal thrust of a two hinged arch under the effect of temperature changes.	Understand	7
15	Derive the expression for horizontal thrust of a two hinged arch under the effect of support yielding.	Understand	7
16	Derive the expression for horizontal thrust of a two hinged arch under the effect of elastic shortening of the rib.	Understand	7
17	Determine the horizontal thrust developed in a semi-circular arch of radius 10m subjected to a concentrated load of 40 kN at the crown.	Understand	7
18	A semi-circular arch of radius 10m is subjected to a uniformly distributed load of 10kN/m over the entire span. Assuming EI to be constant, determine the horizontal thrust.	Understand	7
19	A semi-circular arch of radius 12m is subjected to a uniformly distributed load of 20kN/m over the half span. Assuming EI to be constant, determine the horizontal thrust.	Understand	7
20.	A two-hinged parabola arch of span 24m and rise 6m carries a point loads of 60kN at the crown. The moment of inertia varies as the secant of slope. Determine the horizontal thrust.	Understand	7
Part – C (Problem Solving and Critical Thinking)3			

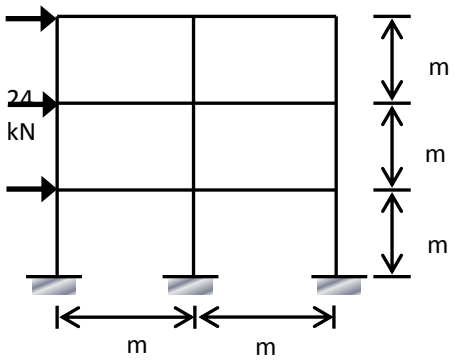
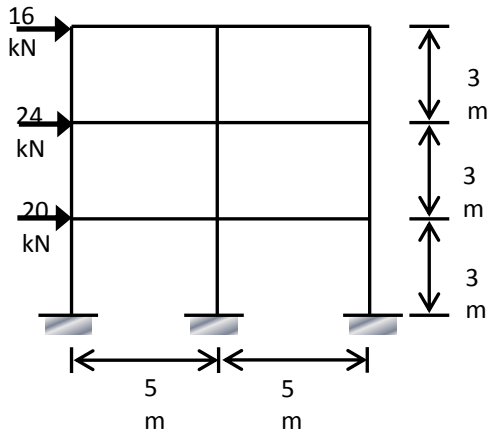
1	Analyze the frame shown below by slope defl3ection method and draw bending moment diagram. 	Understand	4
3	Analyze the frame shown below by slope deflection method. 	Understand	4
4	Analyze the frame shown below and draw bending moment diagram. 	Understand	4
5	Analyze the portal frame shown below by slope deflection method. 	Understand	4

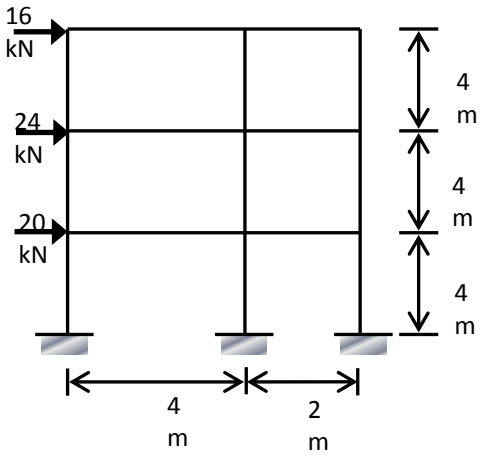
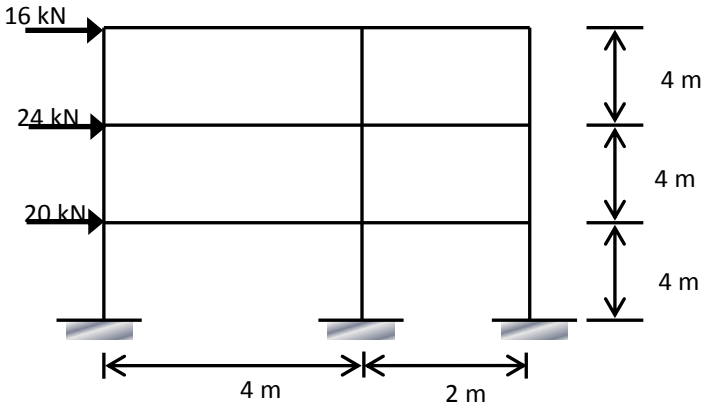
6	Analyze the portal frame shown below by slope deflection method and draw the bending moment diagram. 	Understand	4
7	Analyze the portal frame shown below by slope deflection method and draw the bending moment diagram. 	Understand	4
8	Analyze the portal frame shown below by slope deflection method and draw the bending moment diagram. 	Understand	4

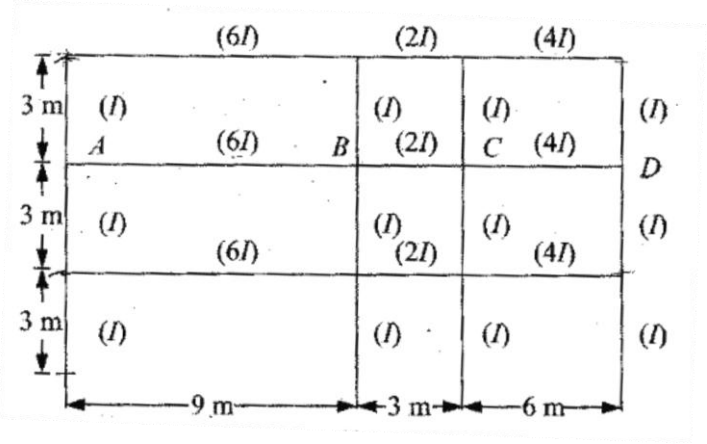
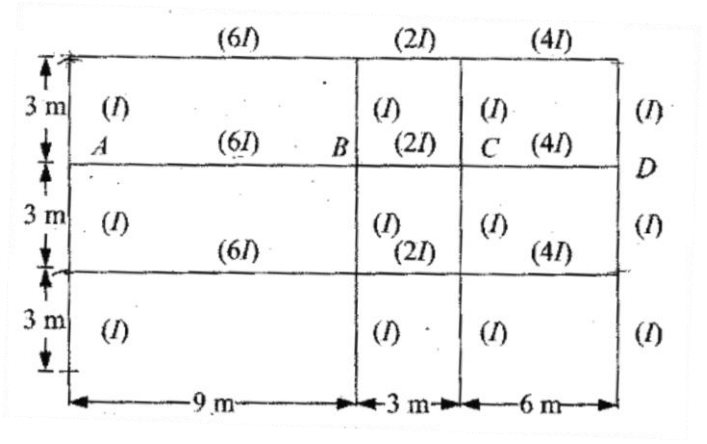
9	Analyze the portal frame shown below by slope deflection method and draw the bending moment diagram. 	Understand	4
10	Analyze the portal frame shown below by slope deflection method and draw the bending moment diagram. 	Understand	1
11	Determine the horizontal thrust developed in a semi-circular arch of radius R subjected to a concentrated load W at the crown. 	Understand	6

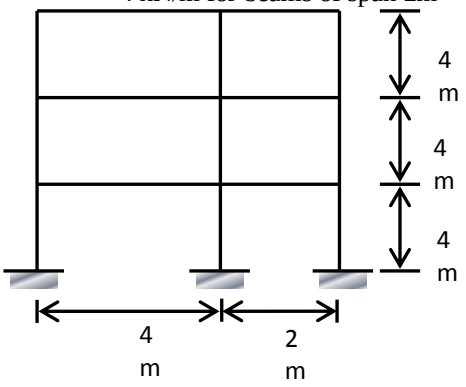
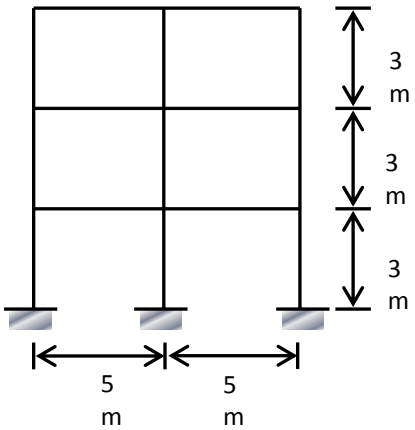
12	A semi-circular arch of radius R is subjected to a uniformly distributed load of w/unit length over the entire span. Assuming EI to be constant, determine the horizontal thrust. 	Understand	8
13	Determine the horizontal thrust developed in a two-hinged semi-circular arch subjected to a uniformly distributed load on only one-half of the arch. *EI* is constant throughout. 	Understand	6
14	A two-hinged parabola arches of span 30m and rise 6m carries two point loads, each 60kN, acting at 7.5 m and 15m from the left end, respectively. The moment of inertia varies as the secant of slope. Determine the horizontal thrust and maximum positive and negative moments in the arch rib.	Understand	6
15	A two-hinged parabolic arch is loaded as shown below. Determine the (a) horizontal thrust, (b) maximum positive and negative moments, (c) shear force and normal thrust at 10m from the left support. Assume $I = I_0\ sec\theta$ where I_0 is the moment of inertia at the crown and θ is the slope at the section under consideration. 	Understand	6

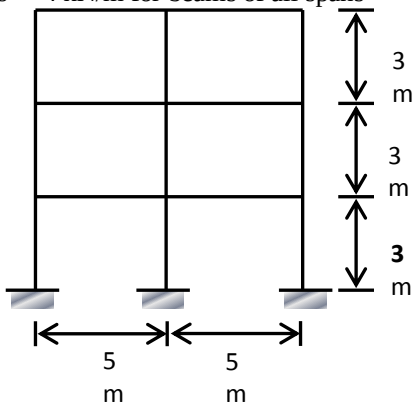
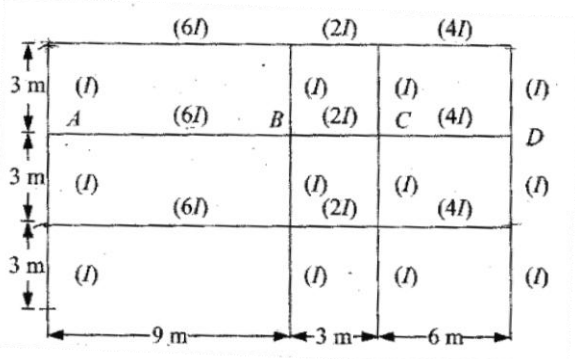
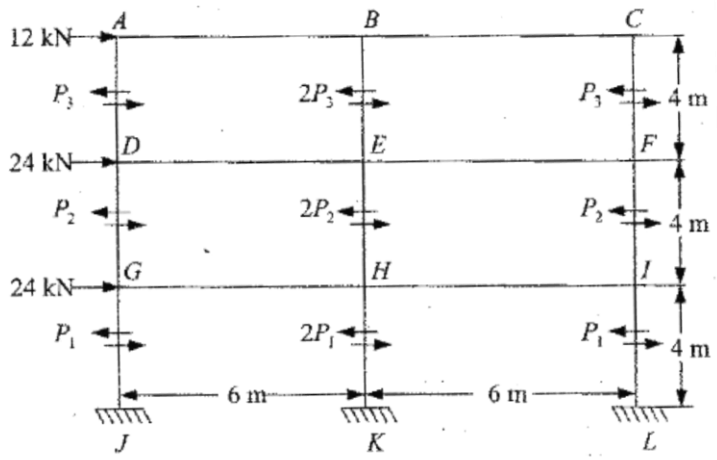
16	Determine the horizontal thrust developed in a two-hinged semi-circular arch of radius 20 m subjected to a uniformly distributed load of 3 kN/m on only one-half of the arch and a concentrated load of 20 kN at the crown. Take *EI*as constant.	Understand	8
17	Determine the horizontal thrust developed in a two-hinged semi-circular arch of radius 10 m subjected to a uniformly distributed load of 2 kN/m throughout the span and a concentrated load of 10 kN at the crown. Take *EI*as constant.	Understand	6
18	A two-hinged parabola arch of span 20m and rise 4m carries two point loads, each 40kN, acting at 5 m from both the ends. The moment of inertia varies as the secant of slope. Determine the horizontal thrust and maximum positive and negative moments in the arch rib.	Understand	7
19	A two-hinged parabola arch of span 30m and rise 6m carries a uniformly distributed load of 4kN/mthroughout the span. The moment of inertia varies as the secant of slope. Determine the horizontal thrust and maximum positive and negative moments in the arch rib.	Understand	8
20	A two-hinged parabola arch of span 24 m and rise 3m carries two point loads, each 50kN, acting at 3 m from each end, and a uniformly distributed load of 3 kN/m throughout the span. The moment of inertia varies as the secant of slope. Determine the horizontal thrust and maximum positive and negative moments in the arch rib.	Understand	8
UNIT-III APPROXIMATE METHODS OF ANALYSIS			
Part - A (Short Answer Questions)			
1	Name the methods of approximate structural analysis of frames for (a) Horizontal loads and (b) Vertical loads.	Understand	9
2	Why do we perform approximate analysis of a framed structure?	Understand	9
3	Under which conditions is the Portal method of approximate analysis for building frames best suited	Understand	10
4	Under which conditions is the Cantilever method of approximate analysis for building frames best suited	Remember	10
5	Under which conditions is the Factor method of approximate analysis for building frames best suited	Remember	10
6	Under which conditions is the substitute frame method of approximate analysis for building frames best suited	Remember	9
7	Write the assumptions used in the Portal method of analysis for multi-storey building frames.	Understand	9
8	Write the assumptions used in the Cantilever method of analysis for multi-storey building frames.	Understand	9
9	Define girder factor in the Factor method of approximate analysis	Understand	10
10	Define column factor in the Factor method of approximate analysis	Understand	10
11	Which method of approximate method of structural analysis is suited for building frames with vertical loads?	Understand	11
12	Why is Substitute Frame method of analysis sometimes called as the two cycle method?	Understand	9
13	Write in brief the steps involved in substitute frame analysis of building frames?	Understand	10
14	What is the assumption made in the substitute frame analysis?	Understand	11
15	What is meant by design moment in substitute frame analysis?	Understand	10
16	Why are the different load cases considered in substitute frame analysis?	Understand	9

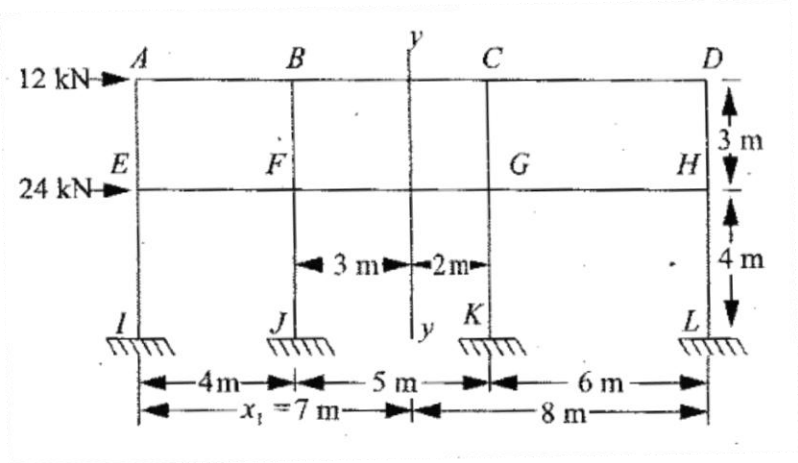
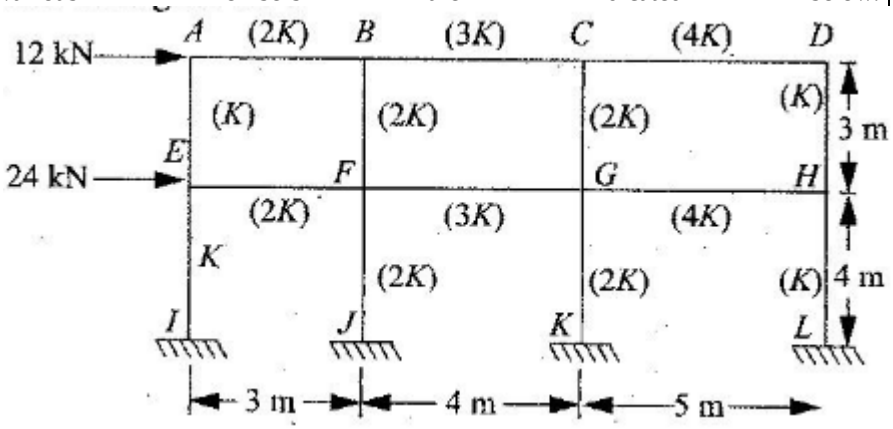
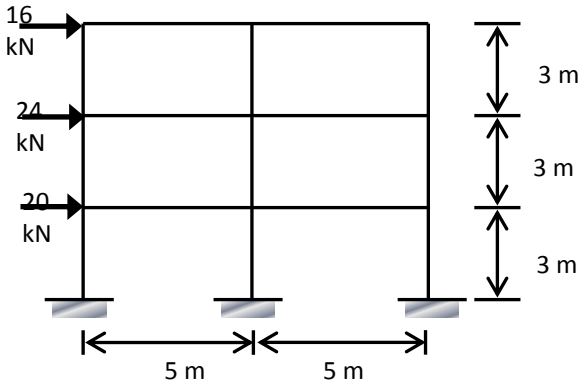
17	What are Mill bents? Show by drawing a figure	Understand	8
18	What are the assumptions used in the analysis of mill bents?	Understand	9
19	For which type of loads are mill bents usually analyzed?	Understand	9
20	Where is the point of inflection taken in the columns of a mill bent when (a) the base is considered fully rigid (b) the base is not considered fully rigid?	Understand	9
Part – B (Long Answer Questions)			
1	Explain the assumptions used in the Portal method of approximate analysis for building frames.	Understand	9
2	Explain the assumptions used in the Cantilever method of approximate analysis for building frames.	Understand	9
3	Explain the concept used in the Factor method of approximate analysis for building frames.	Understand	9
4	Write the steps involved in the Portal method of approximate analysis for building frames.	Understand	9
5	Write the steps involved in the Cantilever method of approximate analysis for building frames.	Understand	9
6	Write the steps involved in the Factor method of approximate analysis for building frames.	Understand	9
7	Calculate the shear forces in the columns of all the storeys of the building frame as per the assumptions of the Portal method. 	Understand	10
8	Calculate the axial forces in the columns of all the storeys of the building frame as per the assumptions of the Cantilever method. 	Understand	10

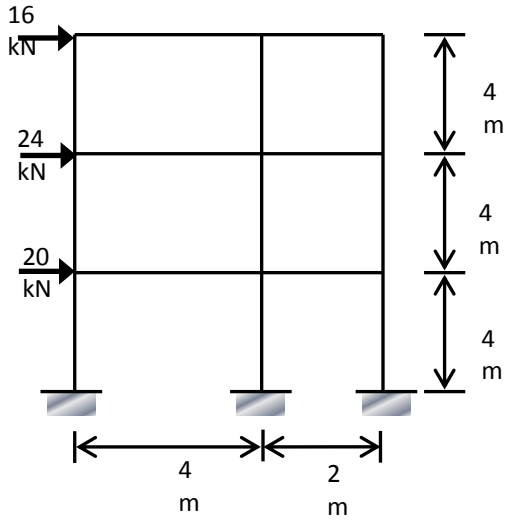
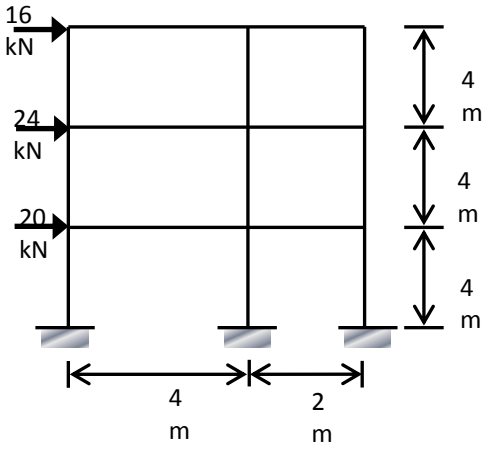
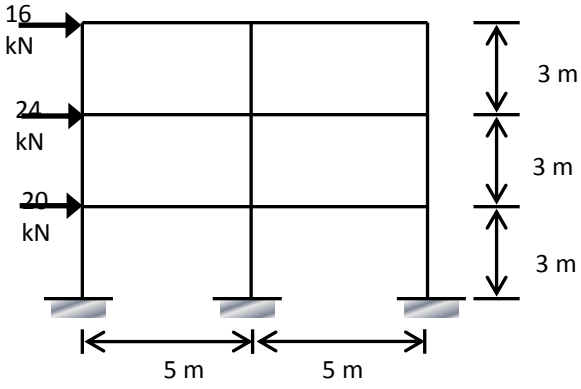
9	Calculate the axial forces in the columns of the first storey from the bottom of the building frame as per the assumptions of the Cantilever method. Assume all areas and elastic constants to be the same.  	Understand	10
10	Find the girder factors and the column factors for the first storey girder (from bottom) and first two storey columns (from bottom) as required in the Factor method. Assume all beams to be of relative stiffness K and all columns to be of relative stiffness 2K.  	Understand	10
11	Write the steps involved in the substitute frame method of approximate analysis for building frames.	Understand	10
12	Why is Substitute Frame method of analysis sometimes called as the two cycle method? Explain.	Understand	10

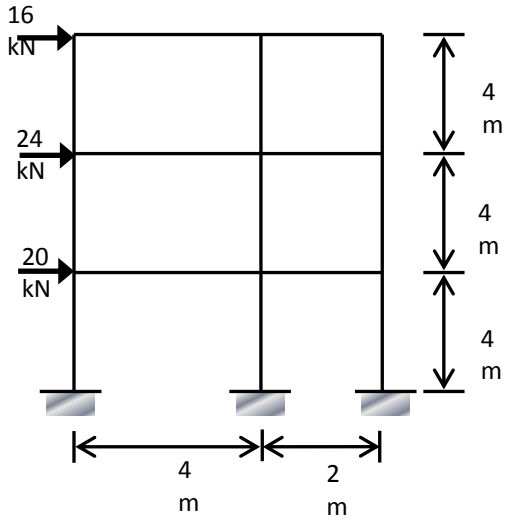
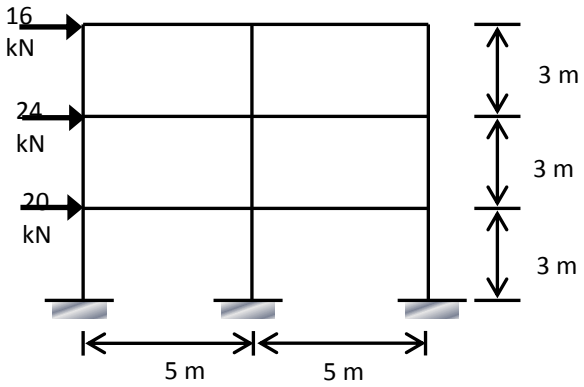
13	For the middle floor intermediate frame of a multistorey frame shown in below figure, calculate the fixed end moments and distribution factors, as required by the substitute frame method. Given spacing of frames 3.6 m DL on floors $= 4kN/m^2$ LL on floors $= 3kN/m^2$ Self-weight of beams = 5kN/m for beams of span 9m = 4kN/m for beams of span 6m = 3kN/m for beams of span 3m 	Understand	10
14	For the middle floor intermediate frame of a multistorey frame shown in below figure, calculate the fixed end moments and distribution factors, as required by the substitute frame method. Given spacing of frames 4 m DL on floors $= 6\ kN/m^2$ and LL on floors $= 2\ kN/m^2$ Self-weight of beams = 4 kN/m for beams of span 9m = 3 kN/m for beams of span 6m = 3 kN/m for beams of span 3m 	Understand	10

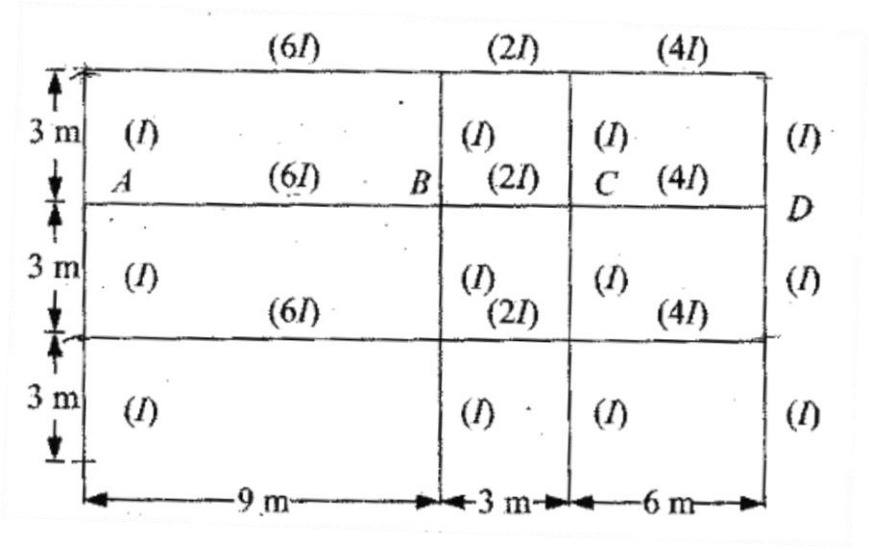
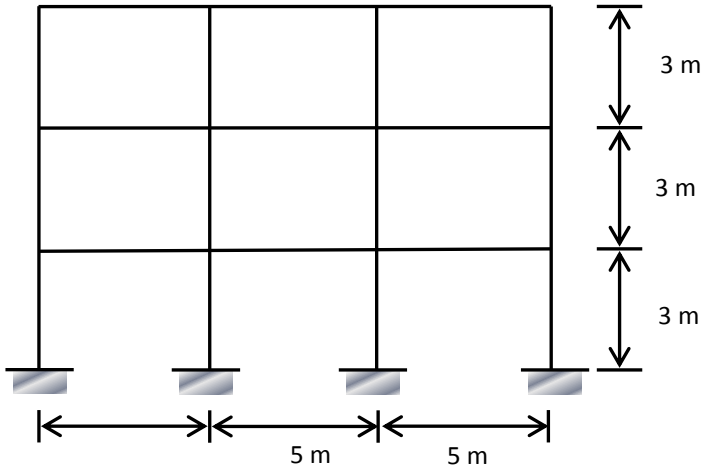
15	For the middle floor intermediate frame of a multistorey frame shown in below figure, calculate the fixed end moments and distribution factors, as required by the substitute frame method. Given spacing of frames 3m DL on floors $= 4\ kN/m^2$ and LL on floors $= 2\ kN/m^2$ Self-weight of beams = 3 kN/m for beams of span 4m = 4 kN/m for beams of span 2m 	Understand	10
16	State the assumptions involved in the substitute frame method of approximate analysis for building frames. Explain how is this analytical useful?	Understand	10
17	Explain the assumptions and method used in analysis of mill-bents.	Understand	10
18	Explain the structural similarity and the difference between a bridge portal and a mill-bent.	Understand	10
19	For the middle floor intermediate frame of a multistorey frame shown in below figure, calculate the fixed end moments and distribution factors, as required by the substitute frame method. Given spacing of frames 3m DL on floors $= 4\ kN/m^2$ and LL on floors $= 2\ kN/m^2$ Self-weight of beams = 3 kN/m for beams of all spans 	Understand	10

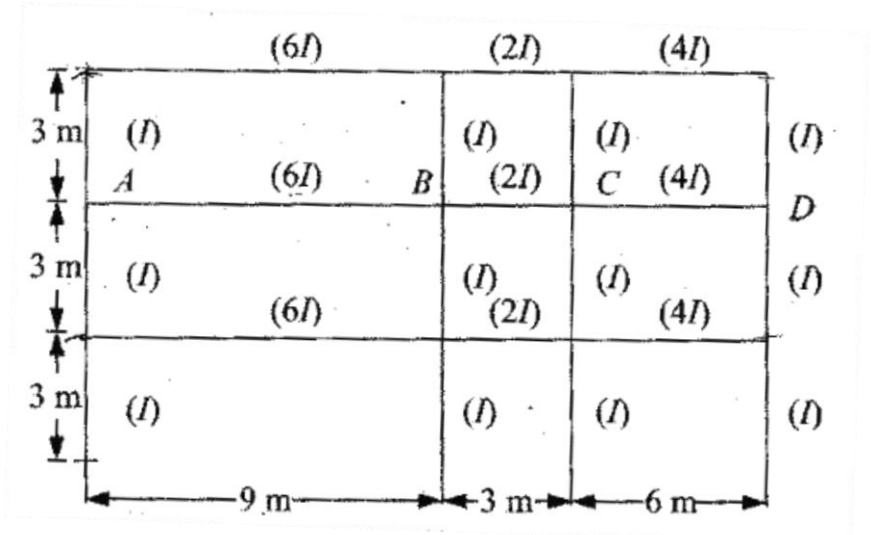
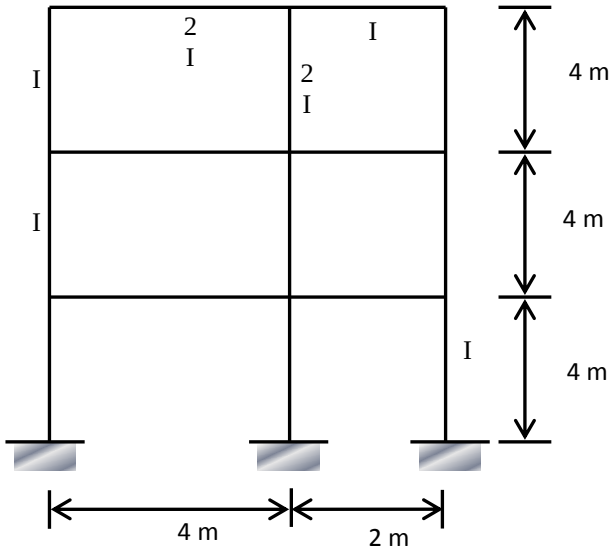
20	For the middle floor intermediate frame of a multistorey frame shown in below figure, calculate the fixed end moments and distribution factors, as required by the substitute frame method. Given spacing of frames 4m DL on floors $= 5\ kN/m^2$ and LL on floors $= 3\ kN/m^2$ Self-weight of beams = 4 kN/m for beams of all spans 	Understand	9
	Part – C (Problem Solving and Critical Thinking)		
1	Compute the girder factor, column factor, Column moment factor and the Girder moment factors for the top most storey beams and columns only as required in Factor method of approximate analysis. 	Understand	9
2	In the below figure, wind loads transferred to joints A, D and G are 12kN, 24kN and 24kN respectively. Analyze the frame by Portal Method. 	Understand	9

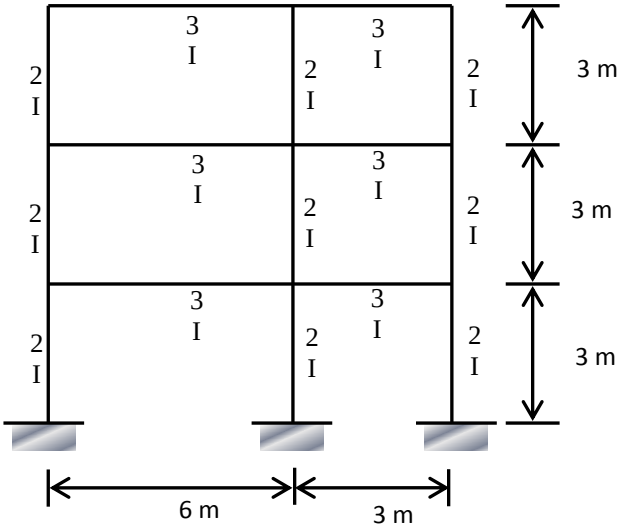
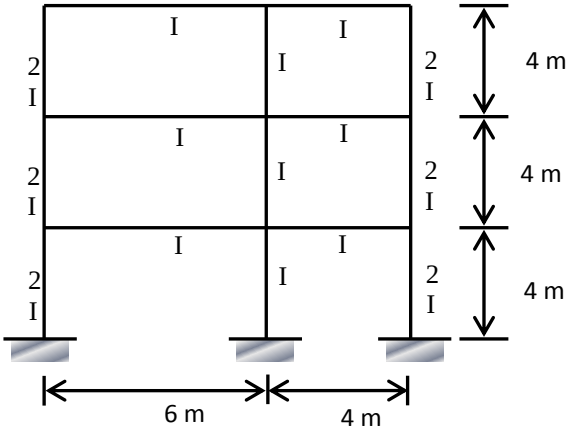
3	Analyze the frame shown in the below figure by cantilever method. Take cross-sectional areas of all columns as the same. 	Understand	9
4	Analyze the frame shown in the below figure by factor method. Stiffness of various members are indicated below. 	Understand	10
5	Analyze the frame by Portal Method. 	Understand	10

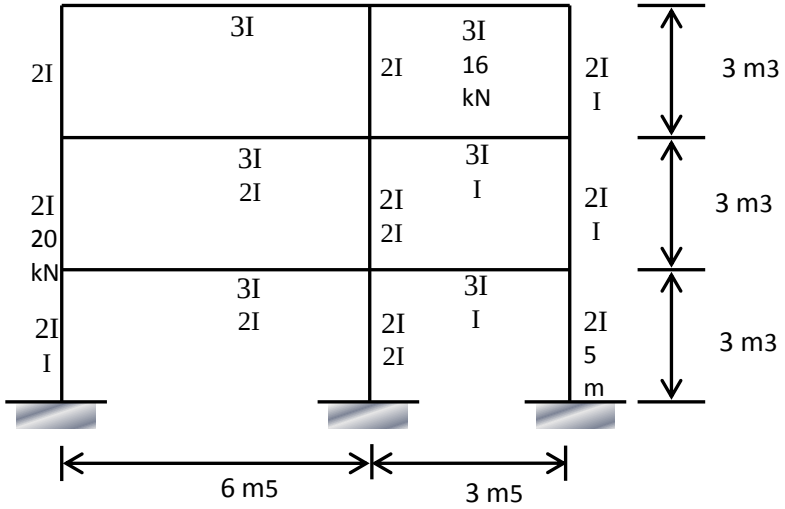
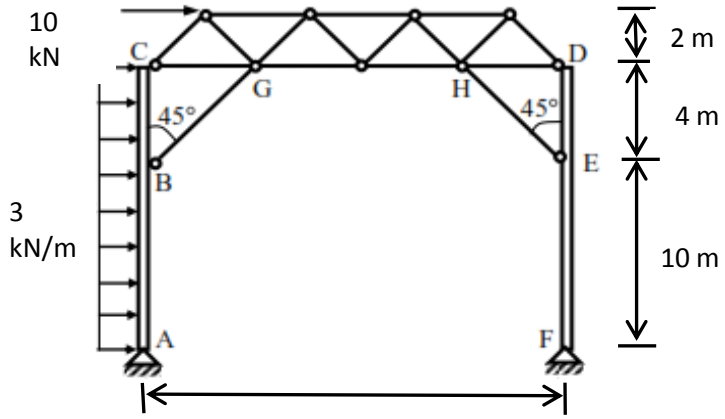
6	Analyze the frame by Cantilever Method. Assume all columns to be of the same cross-sectional area. 	Understand	10
7	Analyze and solve for the topmost storey beam and column moments by Factor method. Assume all beams to be of relative stiffness K and all columns to be of relative stiffness 2K. 	Understand	10
8	Analyze the frame by Cantilever Method. 	Understand	10

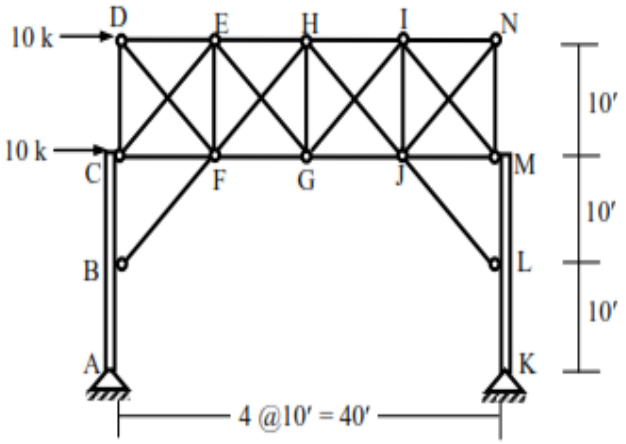
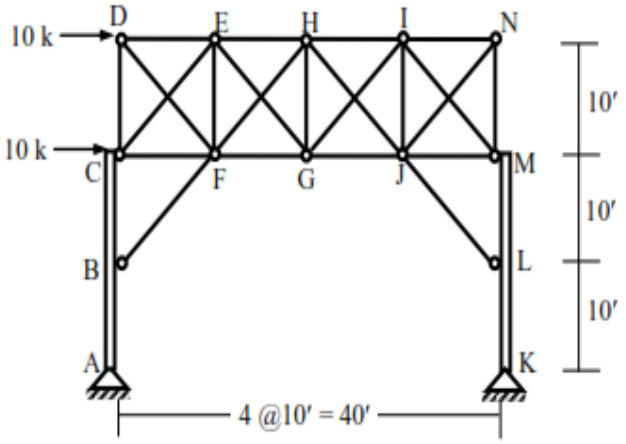
9	Analyze the frame by Portal Method. 	Understand	10
10	nalyze the frame by Factor method. Assume stiffness of all members to be equal. 	Understand	10

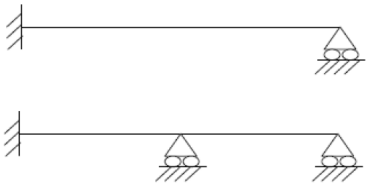
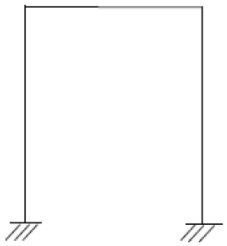
11	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 3.6 m DL on floors $= 4kN/m^2$ LL on floors $= 3kN/m^2$ Self-weight of beams = 5kN/m for beams of span 9m = 4kN/m for beams of span 6m = 3kN/m for beams of span 3m 	Understand	10
12	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 4 m DL on floors $= 4kN/m^2$ LL on floors $= 3kN/m^2$ Self-weight of beams = 4 kN/m for beams of all spans 	Understand	10

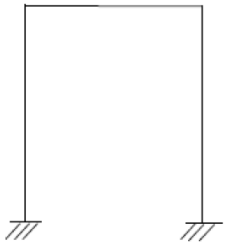
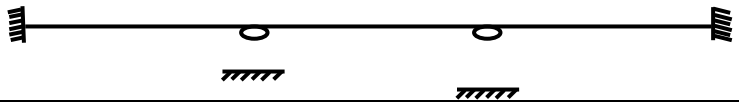
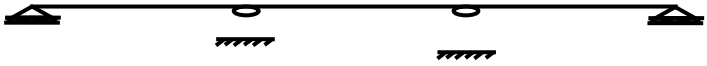
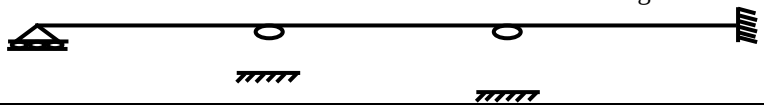
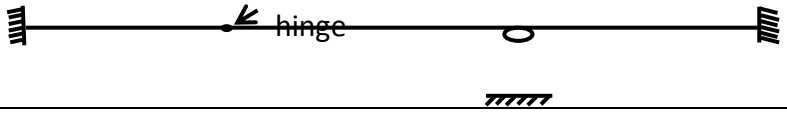
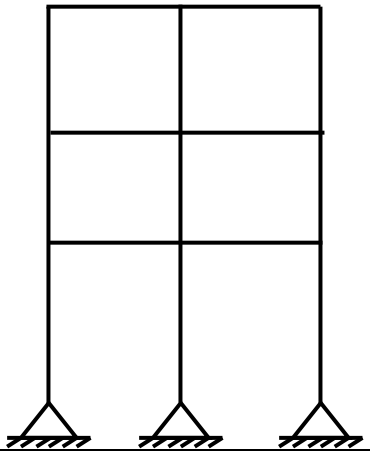
13	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 5 m DL on floors $= 3\ kN/m^2$ LL on floors $= 4\ kN/m^2$ Self-weight of beams = 3 kN/m for beams of span 9m = 4 kN/m for beams of span 6m = 5 kN/m for beams of span 3m 	Understand	10
14	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 4 m DL on floors $= 3\ kN/m^2$ LL on floors $= 2\ kN/m^2$ Self-weight of beams = 4 kN/m for beams of span 4m = 3 kN/m for beams of span 2m 	Understand	10

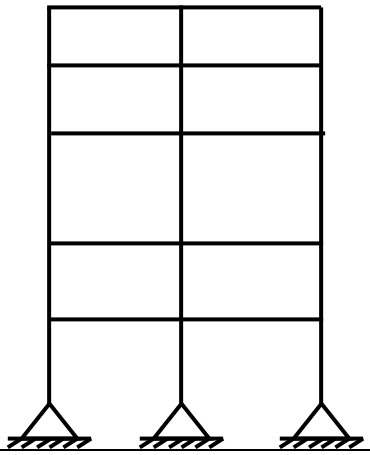
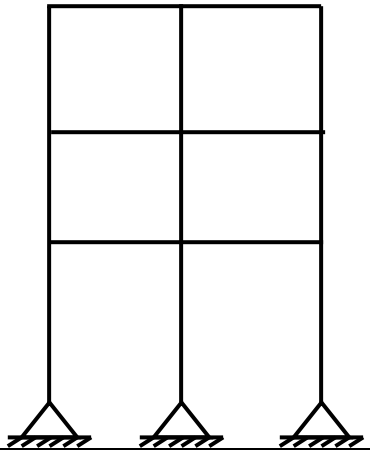
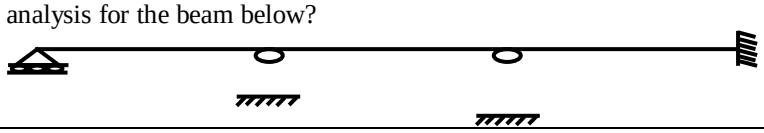
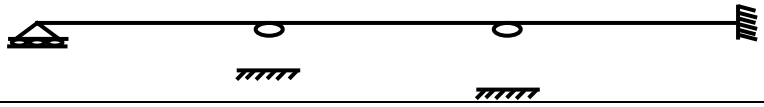
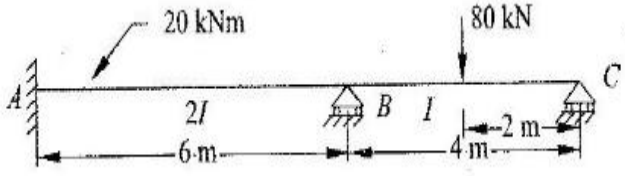
15	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 4.5 m DL on floors $= 5\ kN/m^2$ LL on floors $= 3\ kN/m^2$ Self-weight of beams = 4 kN/m for beams of span 6m = 3 kN/m for beams of span 3m 	Understand	10
16	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 5.4 m DL on floors $= 5\ kN/m^2$ LL on floors $= 3\ kN/m^2$ Self-weight of beams = 3 kN/m for beams of span 6m = 3 kN/m for beams of span 4m 	Understand	10

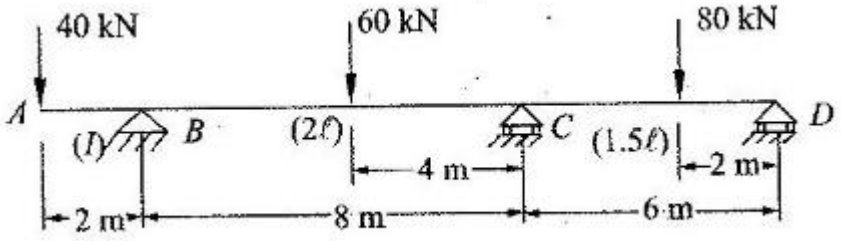
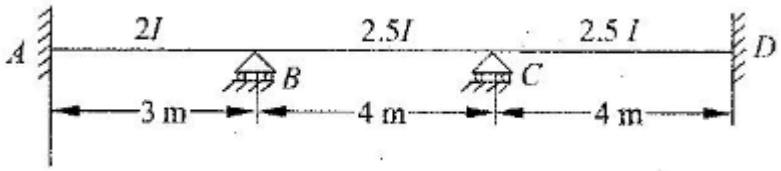
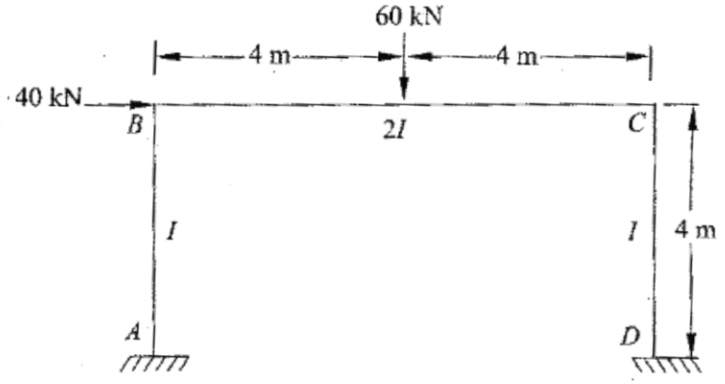
17	Analyze the intermediate frame of a multistorey frame shown in below figure. Given spacing of frames 6 m DL on floors $= 4\ kN/m^2$ LL on floors $= 3\ kN/m^2$ Self-weight of beams = 3 kN/m for beams of span 6m = 2.5 kN/m for beams of span 3m 	Understand	10
18	In the mill bent shown below, use the portal method to calculate the axial forces in members BG and EH and draw the shear force and bending moment diagrams of ABC and DEF. 	Understand	10

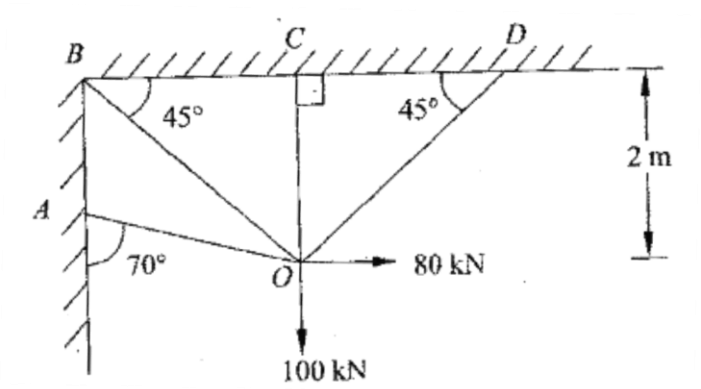
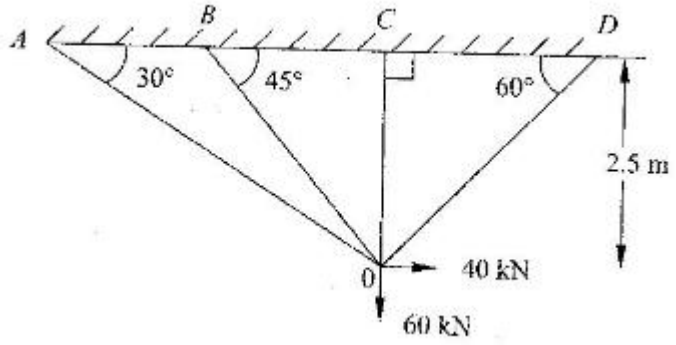
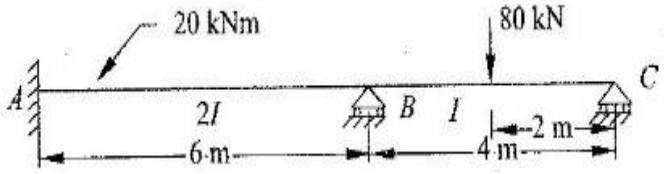
19	In the mill bent shown below, (i) Use the Portal Method to draw the bending moment diagram of the member KLM. (ii) Calculate the forces in EG and FH, assuming them to take equal share of the sectional shear. 	Understand	10
20	In the mill bent shown below, (i) Use the Portal Method to draw the bending moment diagram of the member ABC. (ii) Calculate the forces in CD and DE. 	Understand	10
	UNIT-IV **MATRIX METHOD OF ANALYSIS**		
	Part – A (Short Answer Questions)		
1	Distinguish between determinate and indeterminate structures.	Understand	11
2	Distinguish between static and kinematic indeterminacies.	Understand	11
3	Distinguish between internal and external indeterminacies.	Understand	12
4	Differentiate between pin jointed and rigid jointed plane frames	Understand	12
5	What do you mean by (a) redundancy (b) degree of redundancy (c) redundant frames?	Understand	12
6	What are the other names for flexibility method?	Understand	12
7	What is meant by (a) compatibility and (b) principle of superposition?	Understand	12
8	Distinguish between Force Method and Displacement Method of Analysis of Indeterminate structures	Understand	12
9	List out the different methods of structural analysis you have learnt so far into (a)Force method and (b) Displacement method	Understand	11
10	Under which conditions are (a)Flexibility approach and (b) Stiffness approach suitable	Understand	11

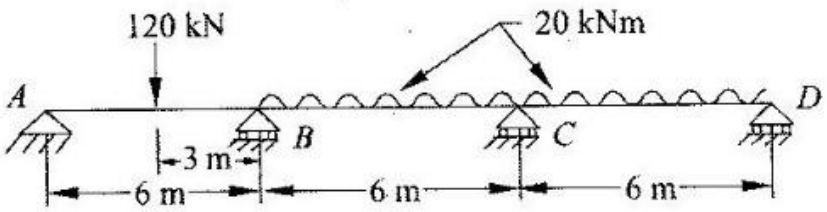
11	What are the basic unknowns in stiffness matrix method?	Remember	12
12	Define stiffness coefficient.	Remember	13
13	What is meant by generalized coordinates?	Remember	12
14	Is it possible to develop the flexibility matrix for an unstable structure?	Remember	13
15	What is the relation between flexibility and stiffness matrix?	Remember	12
16	What are the types of structures that can be solved using stiffness matrix method?	Remember	13
17	Give the formula for the size of the Global stiffness matrix.	Remember	11
18	List the properties of the rotation matrix.	Understand	12
19	Why the stiffness matrix method is also called equilibrium method or displacement method?	Understand	13
20	Why the flexibility method is also called compatibility method (method of consistent deformations) or force method?	Understand	11
Part – B (Long Answer Questions)			
1	How are the basic equations of stiffness matrix method obtained?	Understand	12
2	What is the equilibrium condition used in the stiffness method?	Understand	13
3	Write the element stiffness matrix for a truss element. What is the structure/global stiffness matrix for the same member?	Understand	12
4	Write the element stiffness matrix for a beam element.	Understand	13
5	Compare flexibility method and stiffness method.	Understand	12
6	Define flexibility influence coefficient (fij).	Understand	13
7	Write the element flexibility matrix (f) for a truss member & for a beam element	Understand	11
8	Find the static and kinematic indeterminacies for the beams given below. 	Understand	12
9	Find the static and kinematic indeterminacy for the given rigid plane frame. 	Understand	13
10	Develop the displacement and force transformation matrices for a truss member.	Understand	11

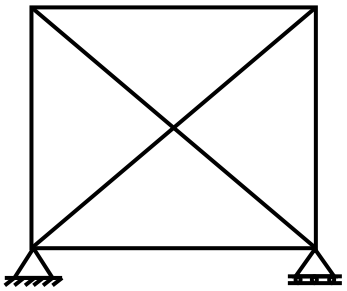
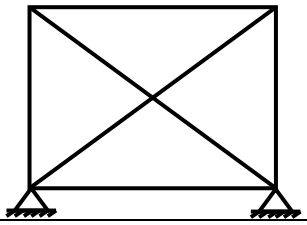
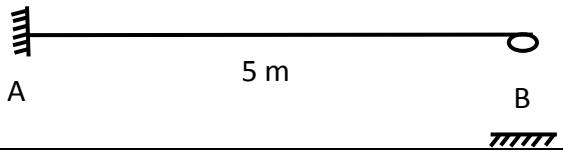
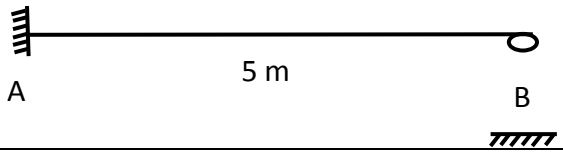
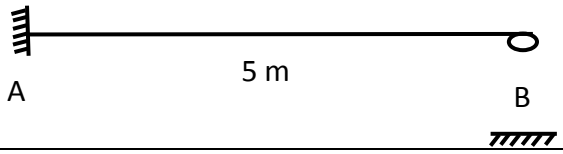
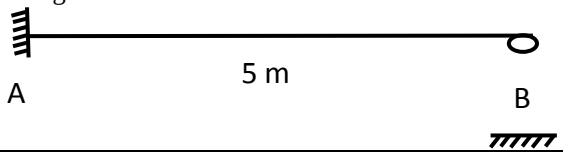
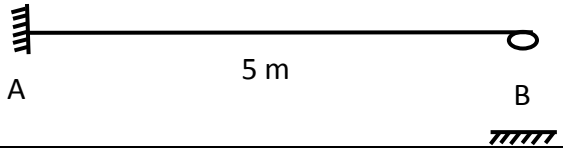
11	Explain the steps involved in matrix stiffness method to solve problems involving the rigid frame below: 	Understand	11
12	Find the static and kinematic indeterminacies for the beam given below. 	Understand	12
13	Find the static and kinematic indeterminacies for the beam given below. 	Understand	13
14	Find the static and kinematic indeterminacies for the beam given below. 	Understand	13
15	Find the static and kinematic indeterminacies for the beam given below. 	Understand	13
16	Find the static and kinematic indeterminacy for the following frame 	Understand	13

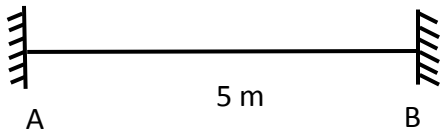
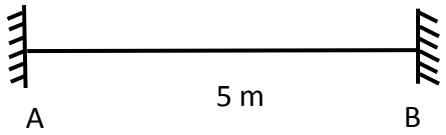
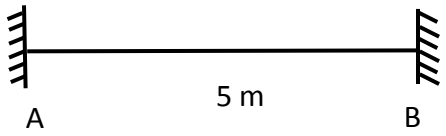
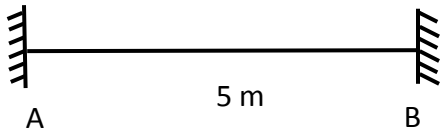
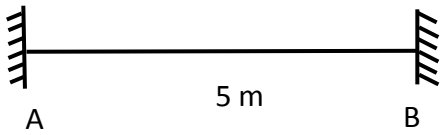
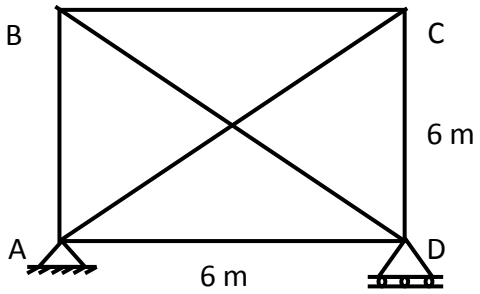
17	Find the static and kinematic indeterminacy for the following frame 	Understand	13
18	What will be the size of the stiffness matrix in the matrix stiffness method of analysis for the frame below? 	Understand	13
19	What will be the size of the stiffness matrix in the matrix stiffness method of analysis for the beam below? 	Understand	13
20	What will be the size of the flexibility matrix in the matrix flexibility method of analysis for the beam below? 	Understand	13
Part – C (Problem Solving and Critical Thinking)			
1	Analyze the continuous beam shown below by flexibility matrix method. 	Understand	14

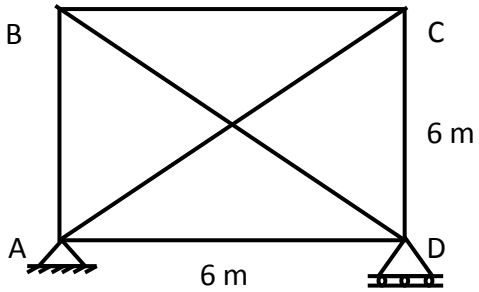
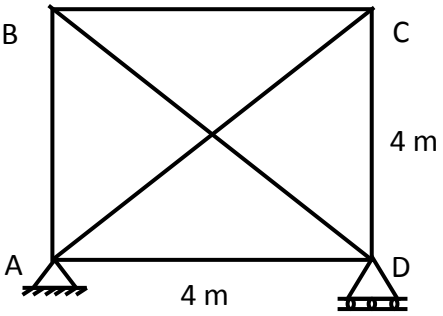
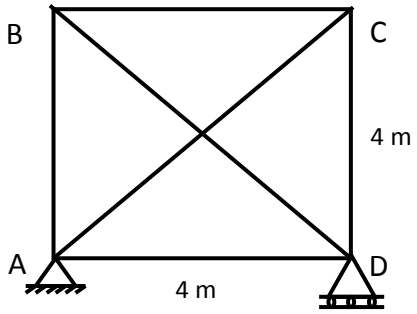
2	Analyze the continuous beam ABC shown below, if support B sinks 10mm using flexibility matrix method. Take EI = 6000 kN/m^2 	Understand	16
3	Analyze the continuous beam shown below by displacement method. 	Understand	16
4	Analyze the continuous beam shown below if the support B sinks by 10mm. Use displacement method. Take $EI = 6000kN/m^2$ 	Understand	16
5	Analyze the rigid frame shown in figure given below by stiffness matrix method. 	Understand	16

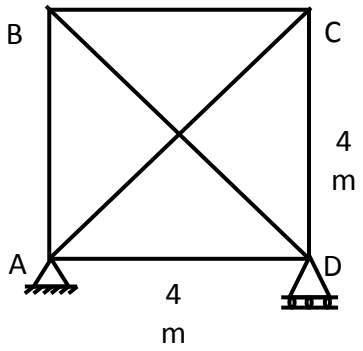
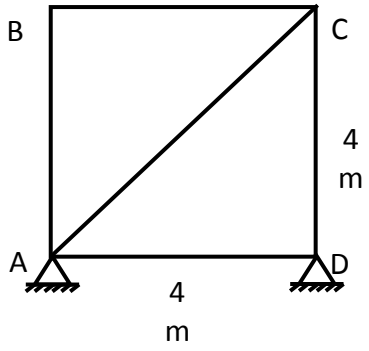
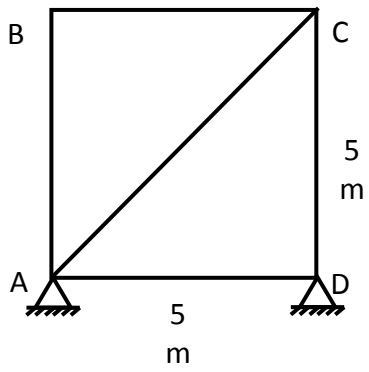
6	Analyze the pin-jointed frame shown in the below figure by stiffness method. Given cross-sectional areas of all members $= 1000\text{mm}^2; \text{E} = 200\ \text{kN/mm}^2$ 	Understand	15
7	Analyze the pin-jointed truss shown in figure below by stiffness matrix method. Take area of cross-section for all members = $1000mm^2$and modulus of elasticity $E = 200kN/mm^2$ 	Understand	16
8	Analyze the continuous beam shown below by displacement method. 	Understand	16
9	Analyze the continuous beam ABC shown below, if support B sinks 10mm using displacement method. Take EI $= 6000\ kN/m^2$ 	Understand	15

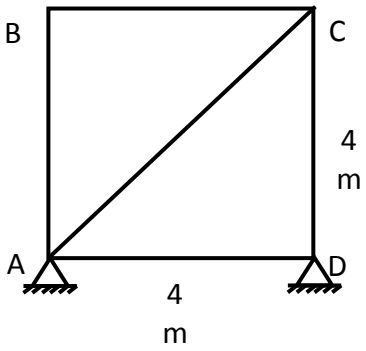
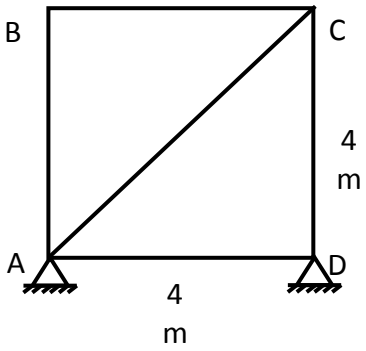
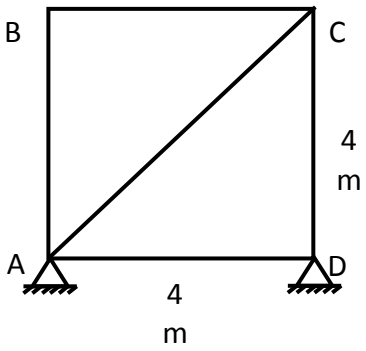
10	Analyze the continuous beam ABCD shown below by displacement method. Take EI same throughout.  	Understand	16
UNIT-V **(A) INFLUENCE LINE DIAGRAMS FOR INDETERMINATE BEAMS (B) INDETERMINATE TRUSSES**			
Part - A (Short Answer Questions)			
1	Define influence lines	Remember	17
2	State the Muller-Breslau's principle.	Remember	17
3	Explain the method for influence lines of indeterminate structures using Muller-Breslau principle.	Remember	17
4	Draw the influence line for the support reaction for the propped cantilever beam, propped at the free-end.	Understand	18
5	On the basis of which theorem is the Muller-Breslau principle derived?	Remember	18
6	Draw the influence line for the support moment for the propped cantilever beam, propped at the free-end.	Understand	17
7	Draw the influence line for the reaction of the prop for the propped cantilever beam, propped at the free-end.	Remember	17
8	Consider a fixed ended beam with a roller support at the mid-span. Draw the influence line diagram to a rough scale for the mid-span support reaction.	Remember	17
9	Consider a fixed ended beam with a roller support at the mid-span. Draw the influence line diagram to a rough scale for the support reaction at the left fixed end.	Remember	17
10	Consider a fixed ended beam with a roller support at the mid-span. Draw the influence line diagram to a rough scale for the support moment at the left fixed end.	Understand	18
11	What is the formula to find the minimum number of members required for a stable configuration of a truss structure?	Understand	19
12	Distinguish between determinate and indeterminate truss structures (pin-jointed frames).	Understand	20
13	Distinguish between static and kinematic indeterminacies for trusses(pin-jointed frames).	Understand	20
14	Distinguish between internal and external indeterminacies for trusses(pin-jointed frames).	Understand	20
15	Differentiate between pin jointed and rigid jointed plane frames.	Understand	17
16	How do we determine the internal degree of indeterminacy for a truss?	Understand	18
17	State the Castigliano's second theorem?	Understand	18
18	What are the various methods used in analysis of an indeterminate truss?	Understand	17

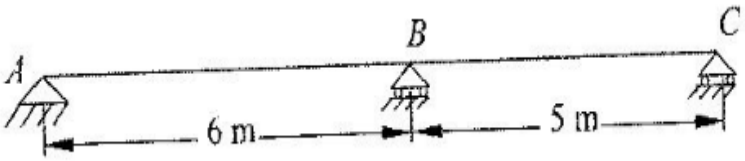
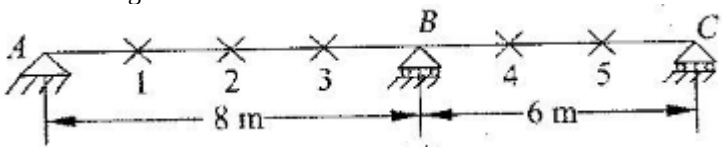
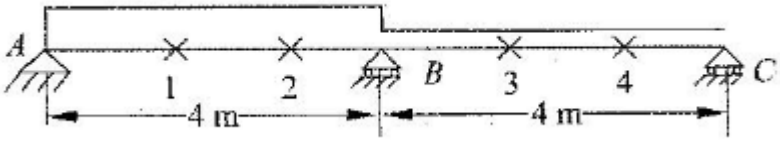
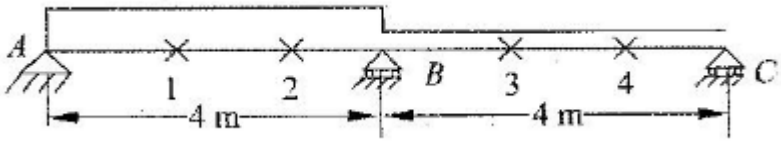
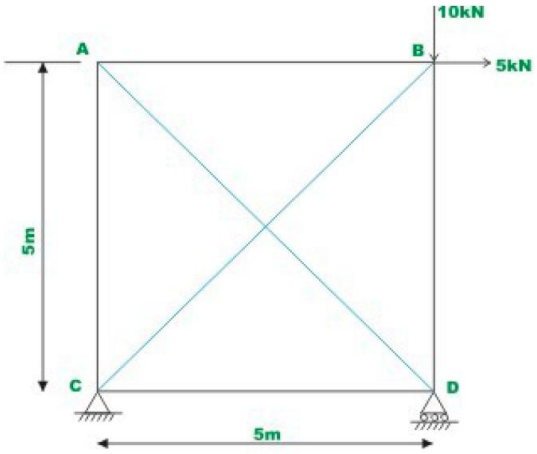
19	Determine the degree of indeterminacy for the following truss 	Understand	17
20	Determine the degree of indeterminacy for the following truss 	Understand	17
	Part - B (Long Answer Questions)		
1	Find the influence line diagram for vertical reaction at A in the following beam. 	Understand	17
2	Find the influence line diagram for bending moment at A in the following beam. 	Understand	17
3	Find the influence line diagram for vertical reaction at B in the following beam. 	Understand	18
4	Find the influence line diagram for bending moment at the mid-span in the following beam. 	Understand	18
5	Find the influence line diagram for shear force in the mid-span in the following beam. 	Understand	18

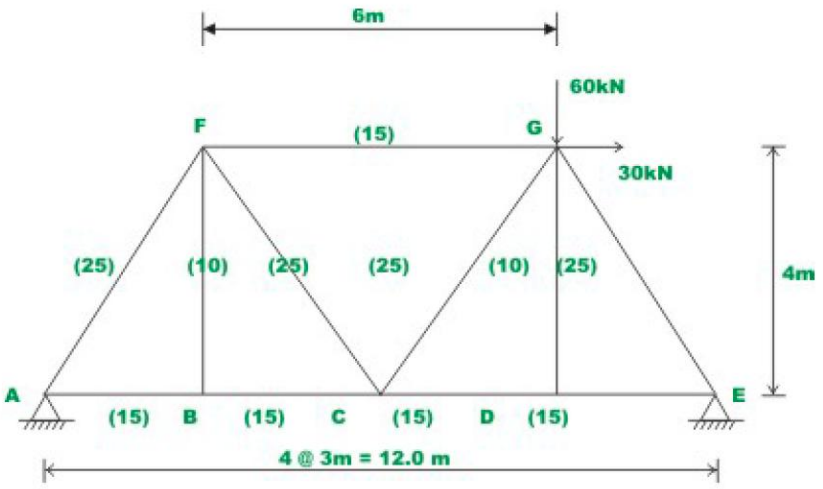
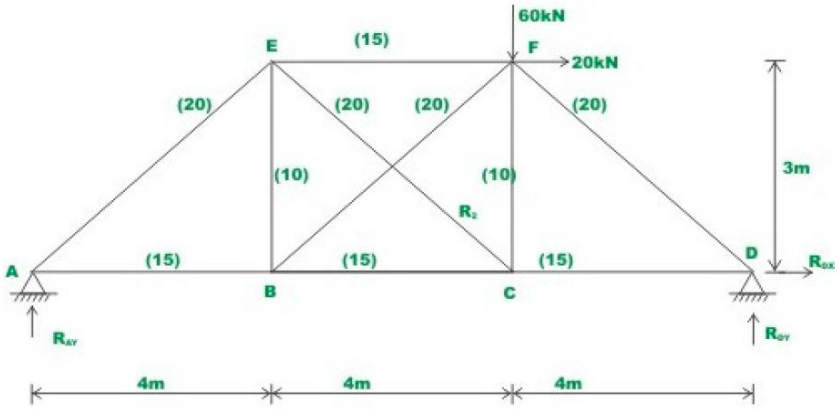
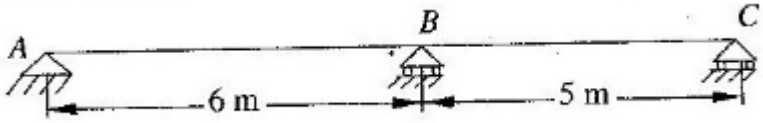
6	Find the influence line diagram for vertical reaction at A in the following beam. 	Understand	19
7	Find the influence line diagram for vertical reaction at B in the following beam. 	Understand	17
8	Find the influence line diagram for bending moment at A in the following beam. 	Understand	18
9	Find the influence line diagram for bending moment at the mid-span in the following beam. 	Understand	19
10	Find the influence line diagram for bending moment at B in the following beam. 	Understand	18
11	Analyze the following truss taking member BD as the redundant. Take EI as constant for all members. Use the method of consistent deformation. Horizontal force at C is 20 kN. And Vertical load at C is 30kN (downwards) . 	Understand	17

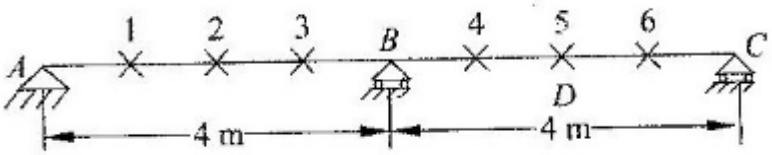
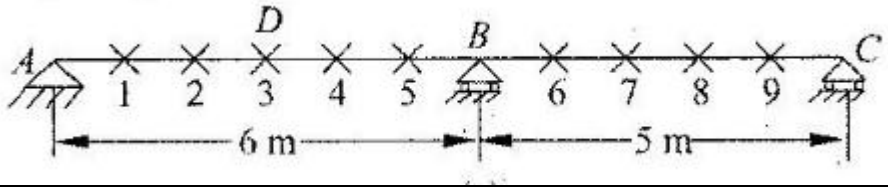
12	Analyze the following truss taking member AC as the redundant. Take EI as constant for all members. Use the method of consistent deformation. Horizontal force at C is 20 kN. And Vertical load at C is 30kN (downwards) 	Understand	18
13	Using the method of consistent deformation, write down the steps in detail for analysis of the following truss. Horizontal force at C is 20 kN. And Vertical load at C is 30kN (downwards) 	Understand	19
14	Using the Castigliano's minimum strain energy principle, write down the steps in detail for analysis of the following truss. Horizontal force at C is 16 kN. And Vertical load at C is 16 kN (downwards) 	Understand	20

15	Analyze the following truss using Castigliano's theorem of minimum strain energy. Horizontal force at C is 24 kN. And Vertical load at C is 24 kN (downwards) 	Understand	20
16	Analyze the following truss by the method of consistent deformation. Take EI as constant throughout. Horizontal force at C is 16 kN. And Vertical load at C is 16 kN (downwards) 	Understand	20
17	Explain in detail the steps involved in analysis the following truss by the method of consistent deformation. Take EI as constant throughout. Horizontal force at C is 20 kN. And Vertical load at C is 20 kN (downwards) 	Understand	20

18	Analyze the following truss using the Castigliano's theorem on minimum strain energy. EI is constant for all members. Horizontal force at C is 16 kN. And Vertical load at C is 24 kN (downwards) 	Understand	20
19	Analyze the following truss by the method of consistent deformation. Take EI as constant throughout. Take horizontal displacement of joint D as redundant. Horizontal force at C is 40 kN. And Vertical load at C is 40 kN (downwards) 	Understand	19
20	Analyze the following truss by the method of consistent deformation. Take EI as constant throughout. Take horizontal displacement of joint A as redundant. Horizontal force at C is 32 kN. And Vertical load at C is 32 kN (downwards) 	Understand	19
Part – C (Problem Solving and Critical Thinking)			

1	Compute the ordinates of influence lines for reaction R_A for the beam shown in below figure at 1m interval and draw the influence line diagram. The moment of inertia is constant throughout. 	Understand	17
2	Draw the influence line diagram for moment B in the continuous beam shown in the below figure after calculating ordinates at 2m intervals. Assume flexural rigidity is constant throughout. 	Understand	18
3	Determine the influence diagram for reaction at A in the continuous beam shown in the below figure. 	Understand	18
4	Using Muller-Breslau principle, calculate the influence line ordinates at 2m interval for vertical reaction at B of the continuous beam ABC shown in the below figure. 	Understand	19
5	Determine the forces in the truss shown by force method. All the members have same axial rigidity. 	Understand	19

6	Calculate reactions and member forces of the truss shown in Figure by force method. The cross sectional areas of the members in square centimeters are shown in parenthesis. Assume $E = 2.0 \times 10^5 \text{ N/mm}^2$.  	Understand	19
7	Determine the reactions and the member axial forces of the truss shown in Fig by Castigliano's strain energy method due to external load. The cross sectional areas of the members in square centimeters are shown in parenthesis. Assume $E = 2.0 \times 10^5 \text{ N/mm}^2$  	Understand	19
8	Find the influence line diagram for reaction at *B* in the continuous beam shown in below figure. Take *El* as constant throughout.  	Understand	20

9	Compute the ordinates of influence line for moment at mid-span of BC for the beam shown in below figure at 1m interval and drawn influence line diagram. Assume moment of inertia to be constant throughout. 	Understand	20
10	Draw the influence line diagram for shear force at *D*in the beam shown in belowfigureafter computing the values of the ordinates at 1minterval. 	Understand	20

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