INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

ASSIGNMENT

Course Name	:	**STRUCTURAL ANALYSIS - II**
Course Code	:	**A60131**
Class	:	III B. Tech II Semester
Branch	:	Civil Engineering
Year	:	2017 – 2018
Course Coordinator	:	S Bhagyalaxmi, Asst Professor, Department of CE
Course Faculty	:	S Bhagyalaxmi, Asst Professor, Department of CE

COURSE OBJECTIVES:

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

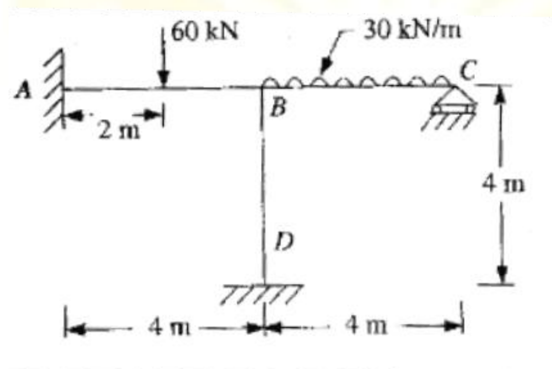
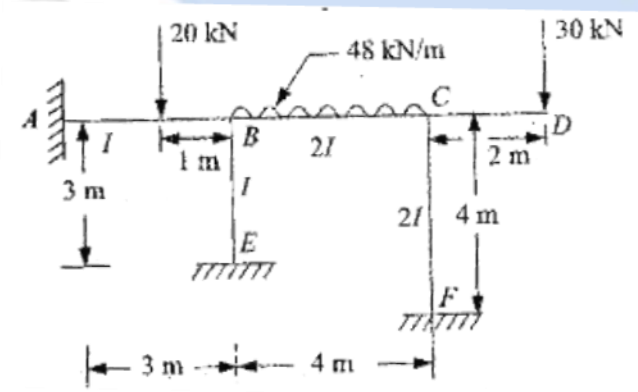
I. Slope deflection, moment distribution and Kani's methods of analysis of indeterminate frames
II. Analysis of two-hinged arches using energy methods
III. Approximate methods of structural analysis for 2D frame structures for horizontal and vertical loads such as cantilever, portal and substitute frame 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

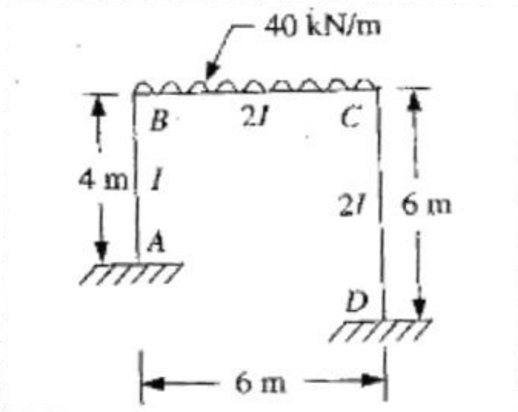
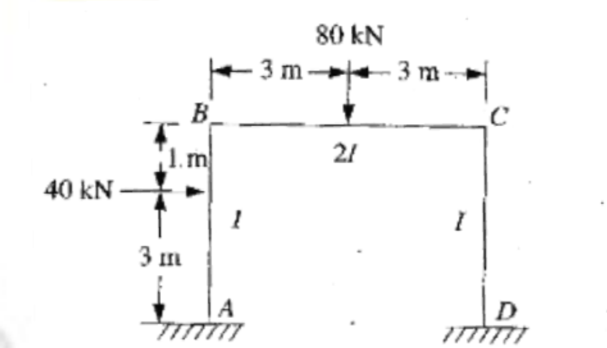
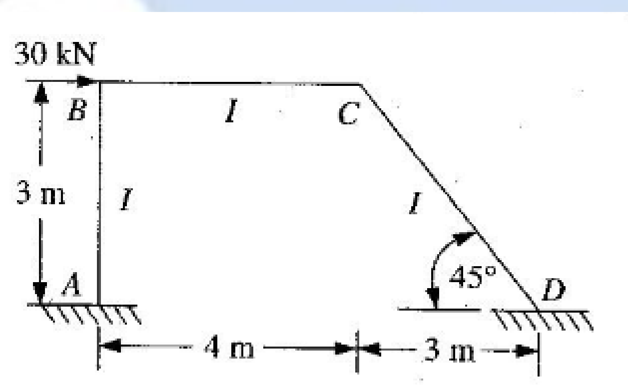
COURSE OUTCOMES:

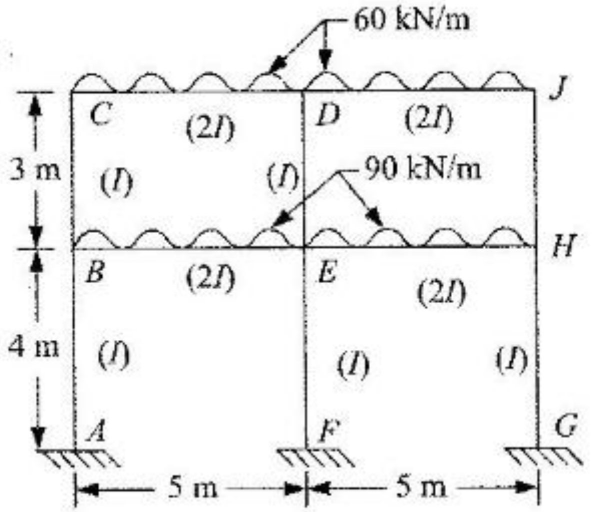
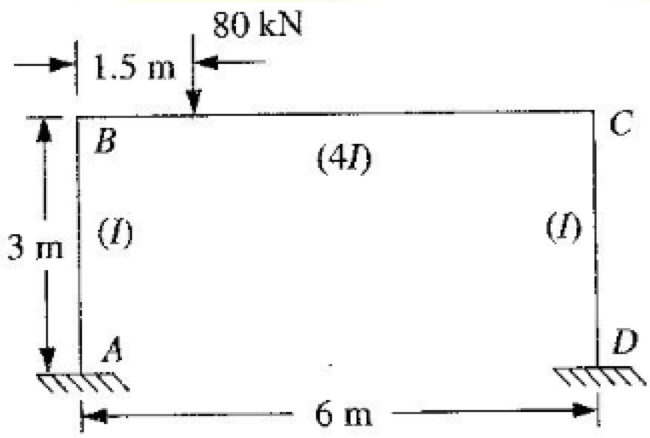
By the end of the course the student is expected to be able to:

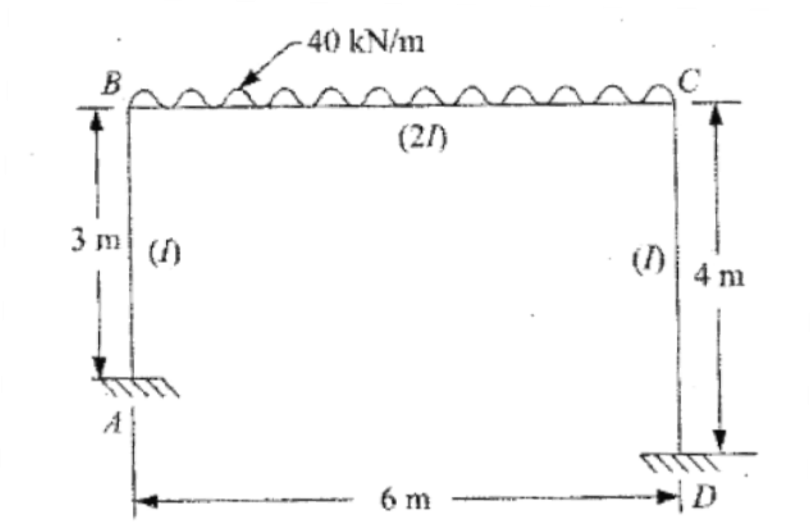
1. Contrast between the concept of force and displacement methods of analysis of indeterminate structures
2. Analyze the methods of moment distribution to carry out structural analysis of 2D portal frames with various loads and boundary conditions.
3. Understand working methodology of Kani's method and 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. Analyze 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.

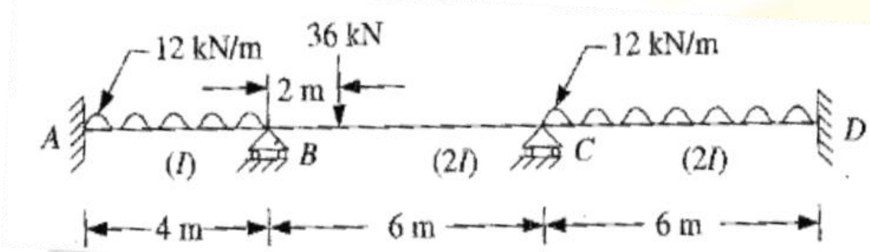
12. Analyze statically indeterminate structures using stiffness method.
13. Evaluate statically indeterminate structures using flexibility method.
14. Execute 2D frame structure for horizontal and vertical loads by portal method.
15. Understand and compare the different methods to analyze plane frames.
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.

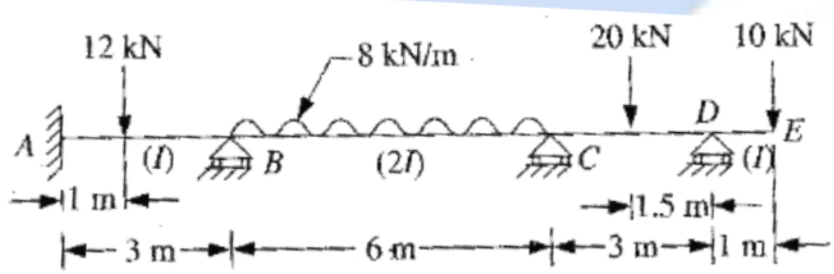
S. No	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-I **UNIT-I** (A) MOMENT DISTRIBUTION METHOD OF RIGID FRAMES (B) KANI'S METHOD OF ANALYSIS FOR BEAMS AND RIGID FRAMES		
1.	Analyze the frame shown in below figure by moment distribution method.  	Remember	2
2	Analyze the frame shown in below figure by moment distribution method.  	Remember	2
3	Analyze the frame shown in below figure by moment distribution method.	Remember	2

S. No	Question	Blooms Taxonomy Level	Course Outcome
			
4	Analyze the frame shown in below figure by moment distribution method. 	Remember	2
5	Analyze by Moment Distribution Method 	Understand	2
6	Analyze the symmetric frame shown in below figure by both Moment Distribution Method and Kani's method. Make use of the symmetry for the analysis given that the moment of inertia of beams is twice that of the columns. Analyze which method is better in this situation.	Understand	1,4

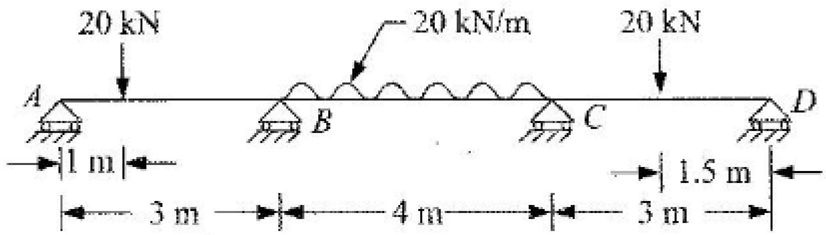
S. No	Question	Blooms Taxonomy Level	Course Outcome
			
7	Using Kani's rotational contribution method, analyze the frame below. Moment of inertia of the members are shown encircled near the members. 	Understand	3
8	Analyze the portal frame shown below by Kani's method	Understand	4

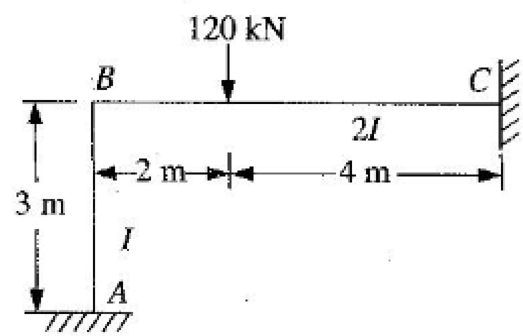
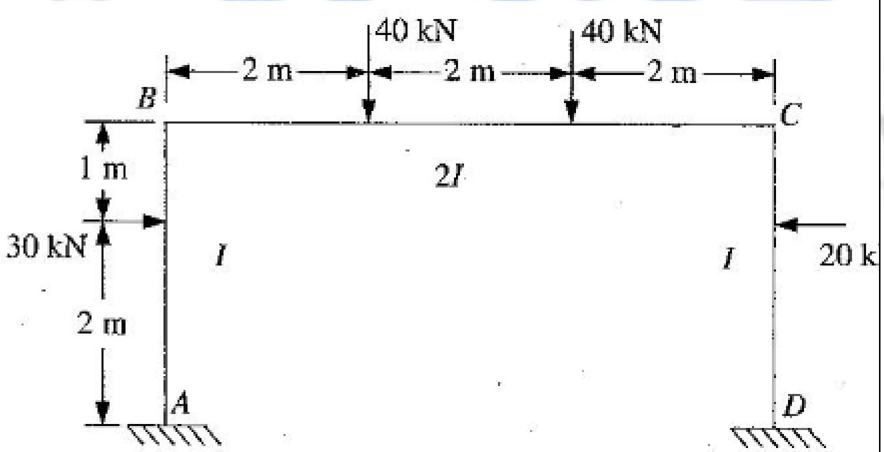
<table>
<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td></td><td>


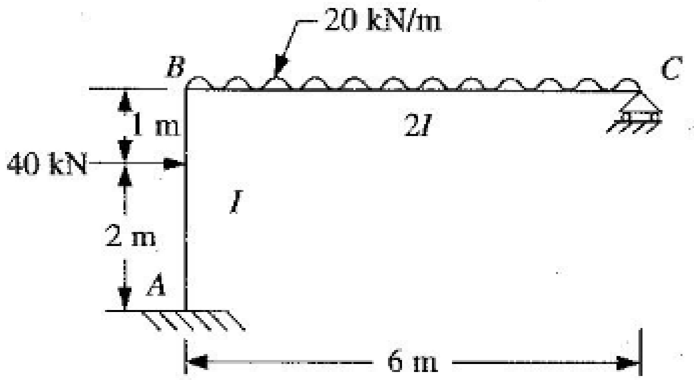
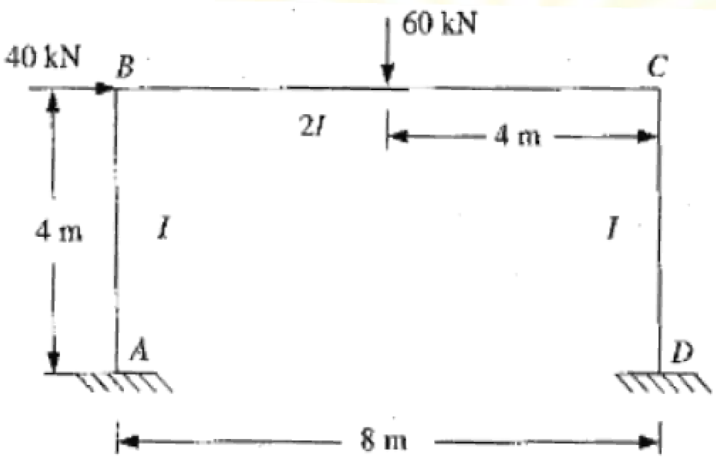
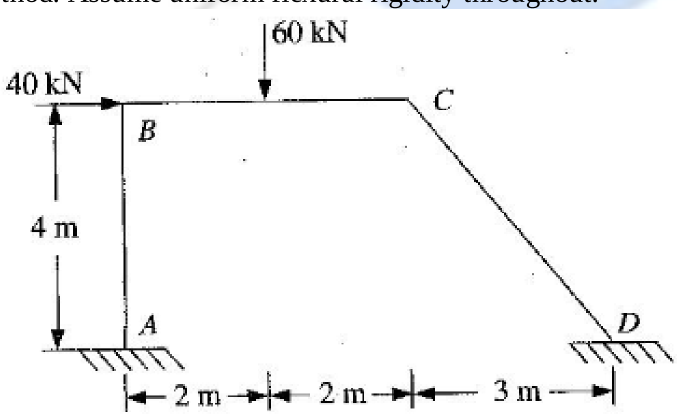
</td><td></td><td></td></tr>
<tr><td>9</td><td>Analyze the continuous beam shown in figure below by Kani’s method.


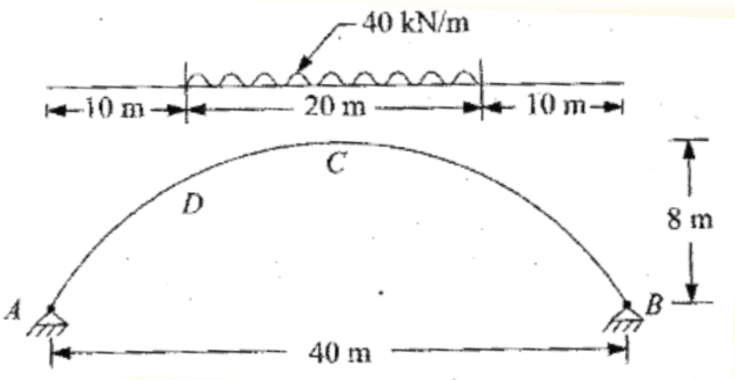
</td><td>Understand</td><td>2</td></tr>
<tr><td>10</td><td>Analyze the continuous beam shown in figure below by Kani’s method.


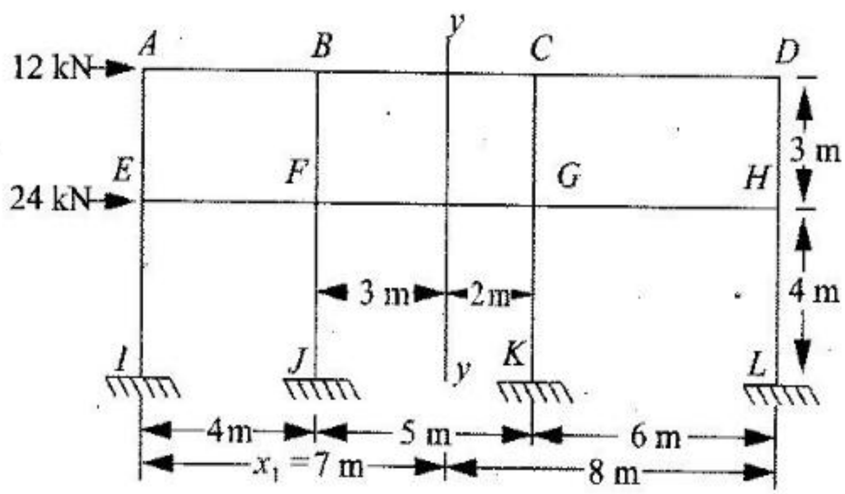
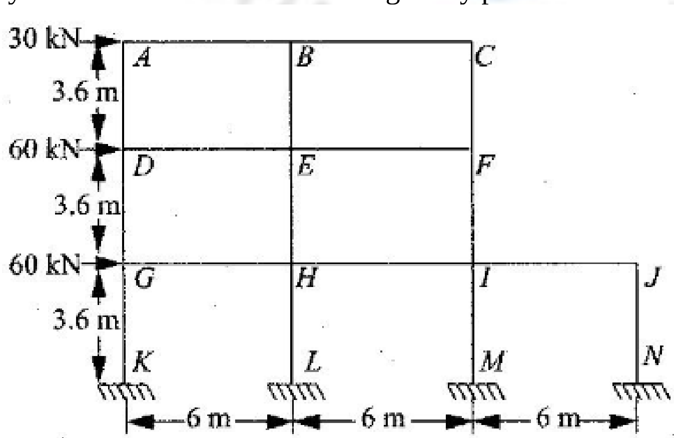
</td><td>Understand</td><td>2</td></tr>
<tr><td>11</td><td>Analyze the continuous beam shown in figure below, if the support C settles down by 5mm. Take Young’s modulus = 200 kN/mm^2 and moment of inertia = 3 x 10^7 mm^2 throughout.</td><td>Understand</td><td>2</td></tr>
</table>

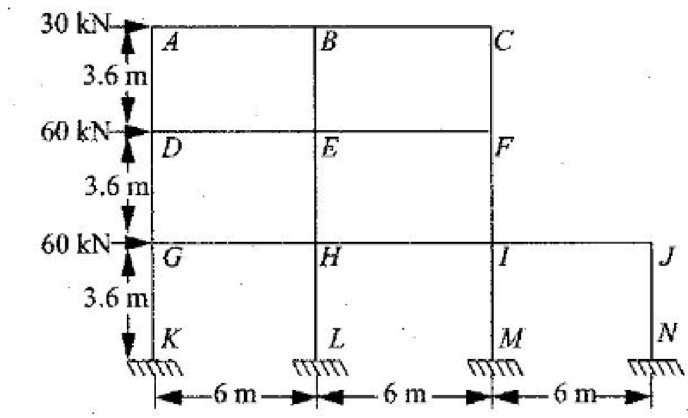
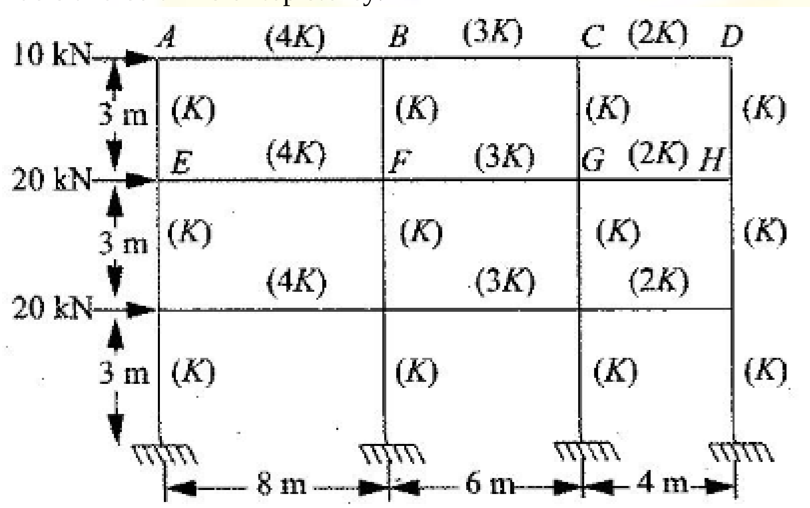
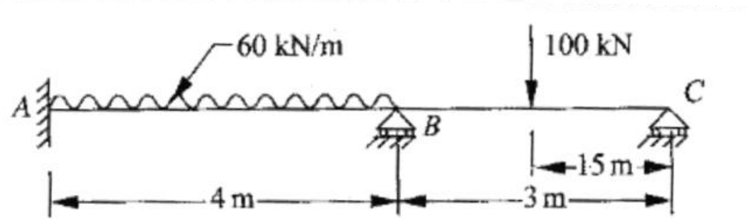
<table>
<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td></td><td>
</td><td></td><td></td></tr>
<tr><td colspan="4">ASSIGNMENT – I
UNIT- II

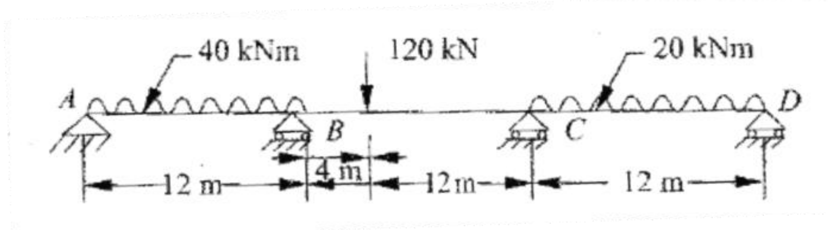
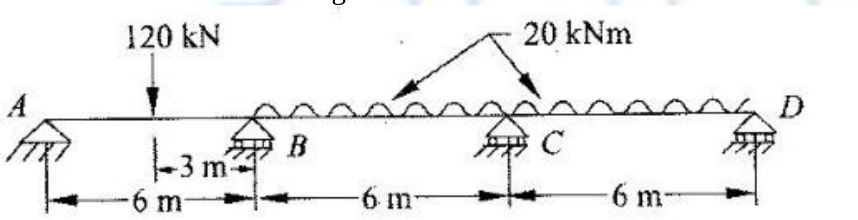
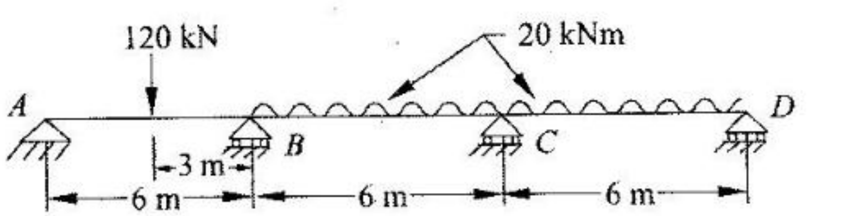
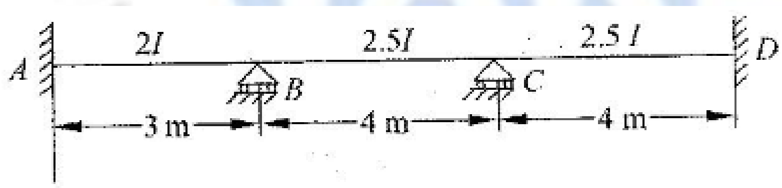
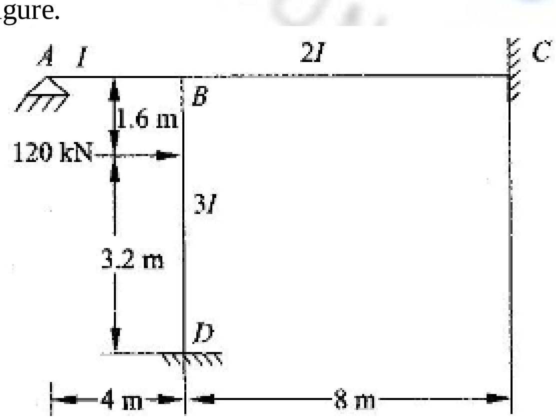
(A) SLOPE DEFLECTION METHOD FOR ANALYSIS OF RIGID FRAMES
(B) ANALYSIS OF TWO HINGED ARCHES</td></tr>
<tr><td>1</td><td>Analyze the frame shown in figure given below by slope deflection method and draw bending moment diagram.

</td><td>Understand</td><td>5</td></tr>
<tr><td>2</td><td>Analyze the symmetric frame shown in figure given below by slope deflection method.

</td><td>Understand</td><td>5</td></tr>
<tr><td>3</td><td>Analyze the portal frame shown in figure given below by slope deflection method and draw bending moment diagram. Note: Unknowns are $\theta_B, \theta_c \, and \, \Delta$</td><td>Understand</td><td>6</td></tr>
</table>

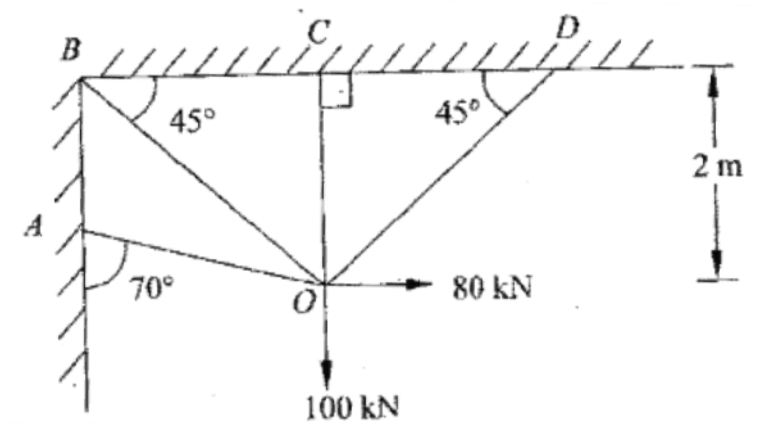
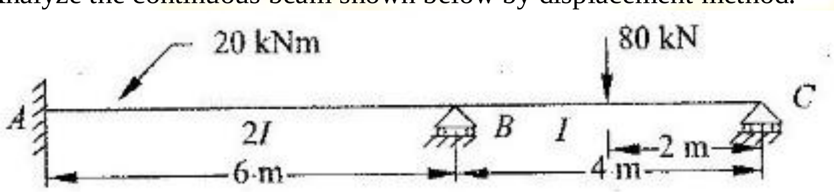
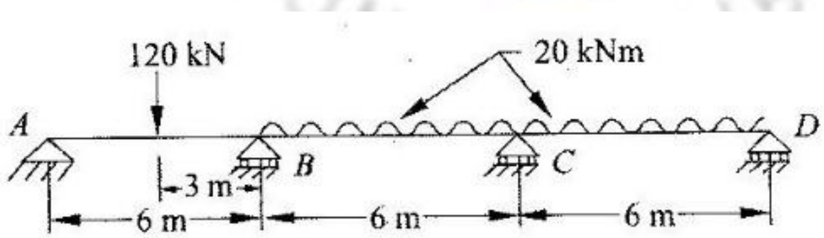
S. No	Question	Blooms Taxonomy Level	Course Outcome
			
4	Analyze the portal frame shown in figure given below by slope deflection method 	Understand	6
5	Analyze the frame shown in figure given below by slope deflection method. Assume uniform flexural rigidity throughout. 	Understand	5
6	A two-hinged semi-circular arch of uniform cross-section has a radius of 8m. It is subjected to a point load of 60 kN acting at a section lying in the left hand span and subtending an angle of 30 degrees with the horizontal.	Understand	6

S. No	Question	Blooms Taxonomy Level	Course Outcome
	Working from first principle, determine the (a) Horizontal thrust, (b) Vertical reactions, (c) Moment under the load and at crown		
7	A two-hinged circular arch has a span of 40m and a rise of 8m. It is loaded with point load of 40 kN at crown. Determine the horizontal thrust developed.	Remember	7
8	A two-hinged circular arch is loaded as shown in the below figure. Determine (a) Horizontal thrust, (b) Moment, Radial Shear and Normal thrust at D.  	Understand	7
9	A two-pinned parabolic arch of span 36m and a central rise 6m carries uniformly distributed load of 30 kN/m on the left half of the span. Determine the bending moment at the crown and also calculate the change in this bending moment if the support yields horizontally by 0.06m per kN of the horizontal thrust. Assume $I_c = 8 * 10^8\ mm^4$ and secant variation of moment of inertia. Take $E = 2 * 10^5\ N/mm^2$	Understand	7
10	A tied arch of span 30m and rise 3m is subjected to a load of 50 kN at the crown. Allowing for the extension of the tie rod and rib shortening, calculating the bending moment at the quarter span. Given, Young's modulus $E = 2 * 10^5 N/mm^2$ $I_c = 1.8 * 10^8 mm^4$. Curved surface area of the $tie = 1000mm^2$	Understand	7
	ASSIGNMENT – I **UNIT - III** **APPROXIMATE METHODS OF ANALYSIS**		
1	Name the methods of approximate structural analysis of frames.	Remember	9
2	Why do we perform approximate analysis?	Understand	9
3	Under which conditions is the Portal method of approximate analysis for building frames best suited	Remember	9
4	Under which conditions is the Cantilever method of approximate analysis	Remember	9

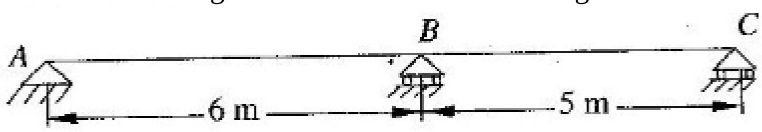
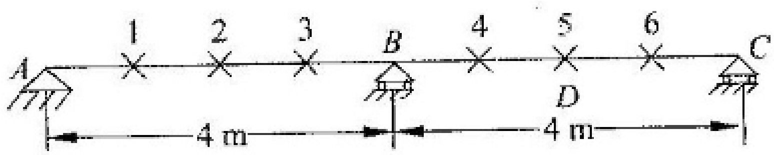
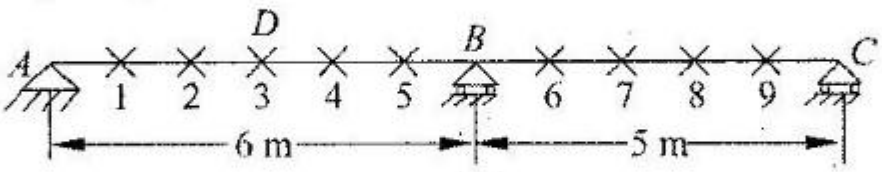
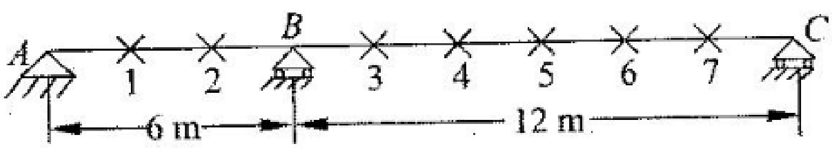
S. No	Question	Blooms Taxonomy Level	Course Outcome
	for building frames best suited		
5	Under which conditions is the Factor method of approximate analysis for building frames best suited	Remember	10
6	Under which conditions is the substitute frame method of approximate analysis for building frames best suited	Remember	10
7	Determine the maximum and minimum moments at mid-span of beam FG and maximum moments in column at joint F of frame shown in below figure for the following loadings: DL on girders = 12 kN/m LL on girders 10 kN/m Self weight of girder - 3 kN/m for 4 m and 5 m girders -4 kN/m (or 6 *m* girders Use substitute frame method for the analysis assuming that stiffness is the same for all members. 	Remember	11
8	Analyze the frame shown in below figure by portal method. 	Understand	11

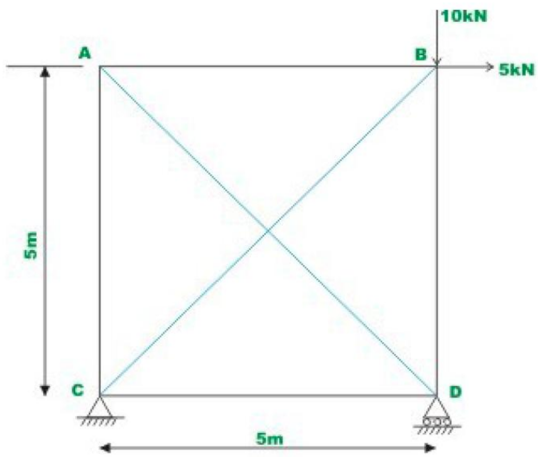
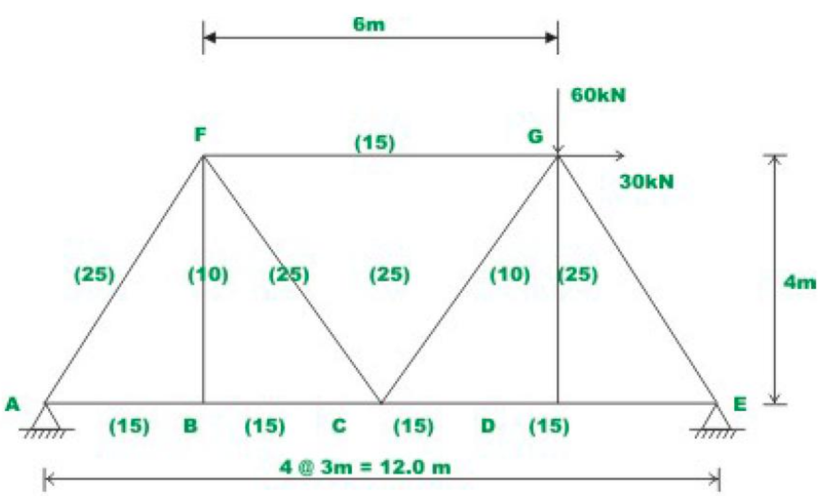
S. No	Question	Blooms Taxonomy Level	Course Outcome
9	Analyze the frame shown in the figure by cantilever method. 	Understand	11
10.	Analyze the frame shown below by factor method to get moments in girders and columns of top storey. 	Understand	11
ASSIGNMENT – II **UNIT-IV** **MATRIX METHODS OF ANALYSIS**			
1	Analyze the continuous beam shown below by flexibility matrix method. 	Understand	13
2	Analyze the continuous beam shown below by flexibility matrix method.	Understand	13

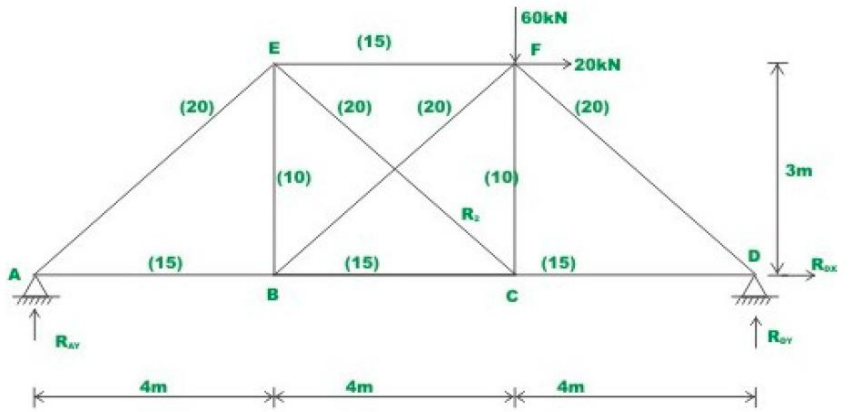
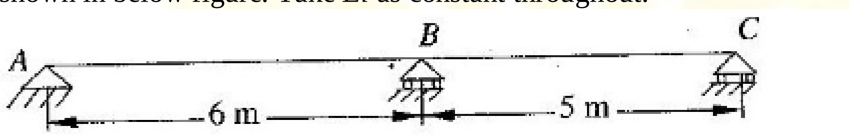
<table>
<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td></td><td>
</td><td></td><td></td></tr>
<tr><td>3</td><td>Analyze the continuous beam ABCD shown figure given below by force method. Take EI same throughout.

</td><td>Understand</td><td>14</td></tr>
<tr><td>4</td><td>Analyze the continuous beam shown below by displacement method.

</td><td>Understand</td><td>14</td></tr>
<tr><td>5</td><td>Analyze the continuous beam shown in the below figure. If the support B sinks by 10mm. Use displacement method. Take EI = $6000\ kN/m^2$

</td><td>Understand</td><td>15</td></tr>
<tr><td>6</td><td>Using the displacement method, analyze the frame shown in the below figure.

</td><td>Understand</td><td>15</td></tr>
</table>

S. No	Question	Blooms Taxonomy Level	Course Outcome
7	Analyze the pin-jointed frame shown in the below figure by stiffness method. Given cross-sectional areas of all members = 1000 mm^2; E = 200 kN/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	16
10	Analyze the continuous beam ABCD shown below by displacement method. Take EI same throughout. 	Understand	1,5

ASSIGNMENT –II
UNIT-V
(A) INFLUENCE LINES FOR INDETERMINATE BEAMS
(B) INDETERMINATE TRUSSES

S. No	Question	Blooms Taxonomy Level	Course Outcome
1	Define influence lines	Remember	17
2	State the Muller-Breslau's principle	Remember	17
3	Find the influence line diagram for reaction at *B* in the continuous beam shown in below figure. Take *El* as constant throughout. 	Remember	17
4	Compute the ordinates of influence line for moment at mid-span of BC for the beam shown in below figure at 1rn interval and drawn influence line diagram. Assume moment of inertia to be constant throughout. 	Remember	17
5	Draw the influence line diagram for shear force at *D* in the beam shown in below figure after computing the values of the ordinates at 1m interval. 	Remember	17
6	Using Muller-Breslau principle, compute the influence line ordinates at 2m intervals for moment at mid-span of BC of the continuous beam ABC shown in figure given below. 	Understand	18
7	Determine the forces in the truss shown by force method. All the members have same axial rigidity.	Understand	18

<table>
<tr><th>S. No</th><th>Question</th><th>Blooms Taxonomy Level</th><th>Course Outcome</th></tr>
<tr><td></td><td>
</td><td></td><td></td></tr>
<tr><td>8</td><td>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 $E = 2.0 \times 10^5 \text{ N/mm}^2$.

</td><td>Understand</td><td>19</td></tr>
<tr><td>9</td><td>Determine the reactions and the member axial forces of the truss shown in Fig by force method due to external load and rise in temperature of member by. The cross sectional areas of the members in square centimeters are shown in parenthesis.
Assume $E = 2.0 \times 10^5 \text{ N/mm}^2$ and $\alpha = 1/75000$ per °C .</td><td>Understand</td><td>19</td></tr>
</table>

S. No	Question	Blooms Taxonomy Level	Course Outcome
			
10	Find the influence line diagram for reaction at *B* in the continuous beam shown in below figure. Take *El* as constant throughout. 	Understand	20

Prepared By: Dr. M Venu Professor, Mrs.S Bhagyalaxmi, Assistant Professor
Department of CE

HOD, CE