Structural Analysis - II
(3150614)

B.E. Semester 5 (Civil Engineering)

Shantilal Shah
Engineering College

Directorate of Technical Education, Gandhinagar, Gujarat

Shantilal Shah Engineering College
Bhavnagar

Certificate

This is to certify that Mr. / Ms. _____

Enrollment No. _____ of B.E. Semester 5th Civil Engineering of this Institute (GTU Code: 043) has satisfactorily completed the Practical/Assignment work for the subject **Structural Analysis – II (3150614)** for the academic year 20___-___.

Place: _____

Date: _____

Name and Sign of Faculty member

Head of the Department

Assignment – Course Outcome Matrix

Course Outcomes (COs):

CO-1: Determine response of statically indeterminate structure by classical & matrix methods.

CO-2: Apply energy principles in determining response of statically determinate & indeterminate structures.

CO-3: Compute approximate internal forces in framed structure subjected to vertical and lateral loads.

CO-4: Determine internal forces and reactions in determinate and indeterminate structures subjected to moving loads.

CO-5: Determine response of framed structure using professional software.

Sr. No.	Assignment	CO1	CO2	CO3	CO4	CO5
1.	Analysis of Statically Indeterminate Structures by Classical Methods	√				√
2.	Analysis of Statically Indeterminate structures by Matrix Methods	√				√
3.	Analysis of Statically Determinate & Indeterminate Structures by Energy Principles		√			√
4.	Analysis of Rigid Jointed Plane Frame by Approximate Methods			√		√
5.	Influence Line Diagrams of Statically Determinate & Indeterminate Structures				√	√

Assignment Grading Rubrics

Exceeds expectation: >90% **Meets expectation: 70-90%**

Below Expectation: 60-70% **Not Acceptable: <60%.**

Sr. No.	Rubrics	Criteria of Grading		
1.	Problem Solving	✓ Independently analyzed statically determinate & indeterminate structures subjected to loading using appropriate methods with no conceptual or computational errors	✓ Independently analyzed statically determinate & indeterminate structures subjected to loading using appropriate method with instructor assistance	✓ Inability to analyze statically determinate & indeterminate structures subjected to loading using appropriate method
		3 Marks	2 Marks	0 Mark
2.	Efficient Drawings and Diagrams	✓ Conceptually correct drawings and diagrams with correct unit of measurement	✓ Conceptually correct drawings and diagrams but with incorrect unit of measurement	✓ Conceptually incorrect drawings and diagrams and without unit of measurement
		2 Marks	1 Marks	0 Mark
3.	Efficient use of Software	✓ Student has full command on the basic tools of the software. ✓ Has applied all the steps in correct sequence to obtain the results.	✓ Student has limited command on the basic tools of the software. ✓ Some steps are followed but not in proper sequence.	✓ Student has no idea how to use the basic tools of the software. ✓ Student has no idea regarding the steps to be followed to obtain the results.
		2 Marks	1 Marks	0 Mark
4.	Neatness	✓ Very neat and well organized headings, statements, calculation and diagram placed properly.	✓ Somewhat neat with some effort and care taken in its preparation.	✓ Messy writing with statements placed haphazardly, which seems to support little effort or care taken in its preparation.
		2 Marks	1 Mark	0 Mark
5.	Punctuality	✓ Student was on time and submitted the assigned work on time.	✓ Student was on time but not submitted assigned work on time.	✓ Student was not on time and not submitted the assigned work.
		1 Mark	0.5 Mark	0 Mark

Index of Assignments
(Progressive Assessment Sheet)

Sr. No.	Assignment	Page No.	Date of Start	Date of Submit-ssion	Assess-ment Marks	Sign. of Teacher with date	Remarks
1	**Analysis of Statically Indeterminate Structures by Classical Methods**			**26/09/23**			
2	**Analysis of Statically Indeterminate Structures by Matrix Methods**			**07/11/23**			
3	**Analysis of Statically Determinate & Indeterminate Structures by Energy Principles**			**03/10/23**			
4	**Analysis of Rigid Jointed Plane Frame by Approximate Methods**			**05/12/23**			
5	**Influence Line Diagrams of Statically Determinate & Indeterminate Structures**			**12/12/23**			
				Total			

Assignment No: 1
Analysis of Statically Indeterminate Structures by Classical Methods

Relevant CO:
CO-1: Determine response of statically indeterminate structure by classical & matrix methods.
CO-5: Determine response of framed structure using professional software.

1. Derive the equation of Slope–Deflection Method.

2. Define following terms with neat sketches:
   (i) Relative Stiffness
   (ii) Distribution Factor
   (iii) Carryover Factor

3. Analyze continuous beam shown in fig.1 by Slope–Deflection Method. Draw shear force and bending moment diagrams showing all salient points.
   $E = 2 \times 10^5$ N/mm^2, b × D = 50 mm × 120 mm.

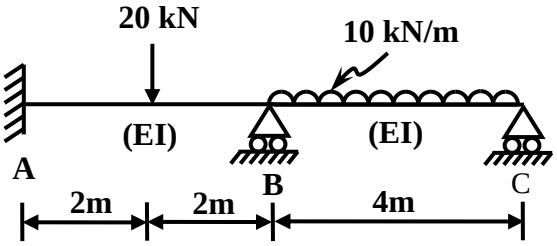

Fig.1

4. Analyze continuous beam shown in fig.1 by Slope–Deflection Method, if Support B settles by 10mm. Draw shear force and bending moment diagrams showing all salient points.
   $E = 2 \times 10^5$ N/mm^2, b × D = 50 mm × 120 mm.

5. Analyze plane frame shown in fig.2 by Slope–Deflection Method. Draw axial force, shear force and bending moment diagrams showing all salient points.
   $E = 25000$ N/mm^2, b × D = 300 mm × 400 mm.

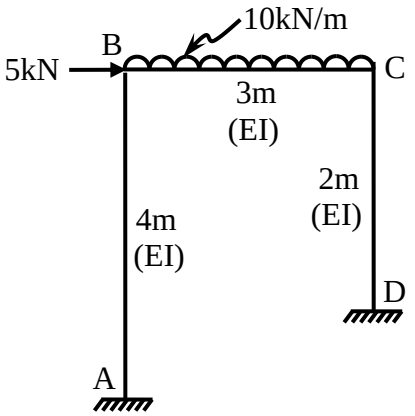

Fig.2

6. Analyze plane frame shown in fig.2 by Moment Distribution Method. Draw axial force, shear force and bending moment diagrams showing all salient points. E = 25000 N/mm^2, b × D = 300 mm × 400 mm.

7. Analyze plane frame shown in fig.3 by Moment Distribution Method. Draw axial force, shear force and bending moment diagrams showing all salient points. E = 25000 N/mm^2, b × D = 300 mm × 400 mm.

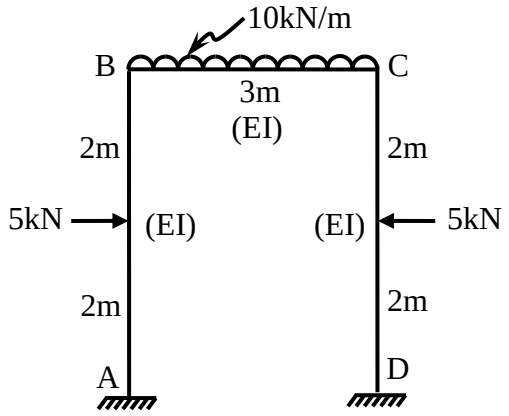

Fig.3

8. Analyze continuous beam shown in fig.1 using any structural analysis professional software and compare the results with the results obtained in Q.3.

9. Analyze plane frame shown in fig.2 using any structural analysis professional software and compare the results with the results obtained in Q.5 & Q.6.

10. Analyze plane frame shown in fig.3 using any structural analysis professional software and compare the results with the results obtained in Q.7.

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Assignment No: 2
Analysis of Statically Indeterminate Structures by Matrix Methods

Relevant CO:

CO-1: Determine response of statically indeterminate structure by classical & matrix methods.

CO-5: Determine response of framed structure using professional software.

1. Analyze continuous beam shown in fig.1 by Stiffness Matrix Method system approach. Draws shear force and bending moment diagrams showing all salient points.

   $E = 25000\ N/mm^2$

   Span AB: b × D = 300 mm × 600 mm

   Span BC: b × D = 300 mm × 400 mm

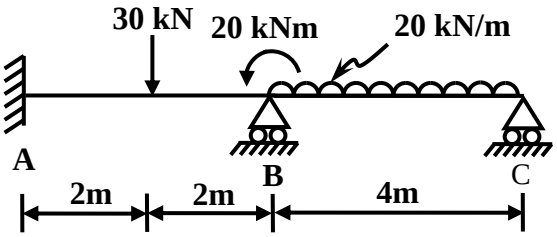

Fig.1

2. Analyze plane frame shown in fig.2 by Stiffness Matrix Method system approach. Draw axial force, shear force and bending moment diagrams showing all salient points.

   $E = 25000\ N/mm^2$

   Column AB: b × D = 300 mm × 600 mm

   Beam BC: b × D = 300 mm × 400 mm

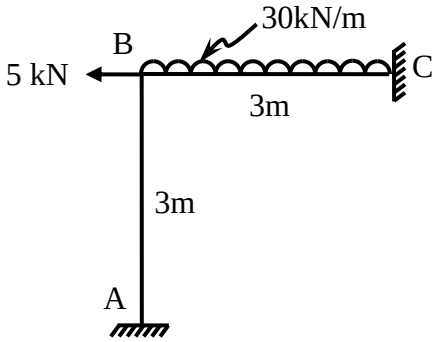

Fig. 2

3. Analyze plane truss shown in fig.3 by Stiffness Matrix Method system approach.
$E = 2 \times 10^5$ N/mm^2
Cross-sectional Area, A = 173 mm^2 (ISA 30 × 30 × 3 mm)

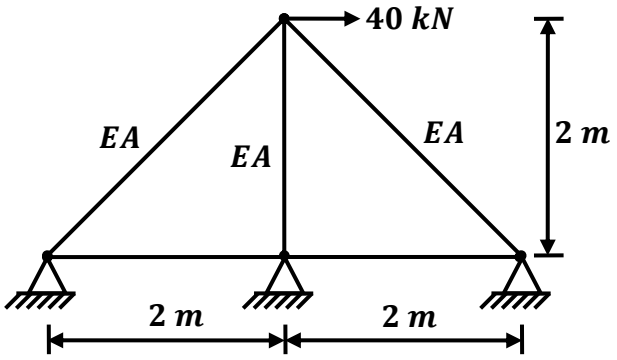

Fig. 3

4. Analyze continuous beam shown in fig.1 by Flexibility Matrix Method system approach. Draw shear force and bending moment diagrams showing all salient points.
$E = 25000$ N/mm^2
Span AB: b × D = 300 mm × 600 mm
Span BC: b × D = 300 mm × 400 mm

5. Analyze plane frame shown in fig.2 by Flexibility Matrix Method system approach. Draw axial force, shear force and bending moment diagrams showing all salient points.
$E = 25000$ N/mm^2
Column AB: b × D = 300 mm × 600 mm
Beam BC: b × D = 300 mm × 400 mm

6. Analyze plane truss shown in fig.4 by Flexibility Matrix Method system approach.
$E = 2 \times 10^5$ N/mm^2
Cross-sectional Area, A = 173 mm^2 (ISA 30 × 30 × 3 mm)

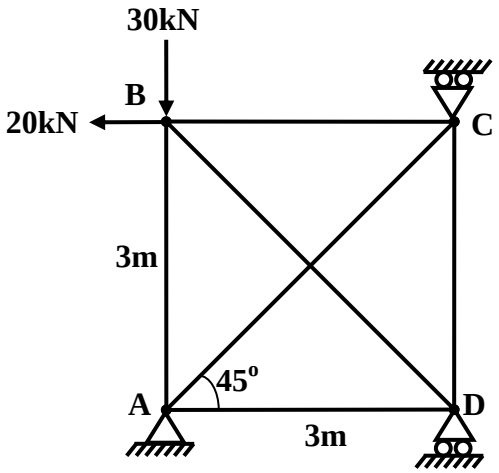

Fig. 4

7. Analyze continuous beam shown in fig.1 using any structural analysis professional software and compare the results with the results obtained in Q.1 & Q.4.

8. Analyze plane frame shown in fig.2 using any structural analysis professional software and compare the results with the results obtained in Q.2 & Q.5.

9. Analyze plane truss shown in fig.3 using any structural analysis professional software and compare the results with the results obtained in Q.3.

Assignment No: 3
Analysis of Statically Determinate & Indeterminate Structures by Energy Principles

Relevant CO:

CO-2: Apply energy principles in determining response of statically determinate & indeterminate structures.

CO-5: Determine response of framed structure using professional software.

1. State: (i) Castigliano's First Theorem and (ii) Castigliano's Second Theorem.

2. Determine slope at A and deflection at C of the simply supported beam shown in fig.1.
   $E = 22500\ N/mm^2$
   $b \times D = 230\ mm \times 300\ mm$
   Compare the results with the results obtained using any structural analysis software.

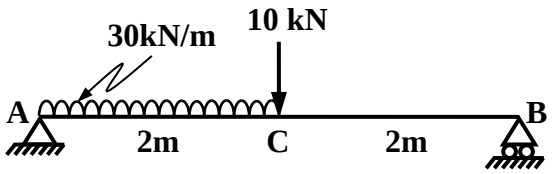

Fig. 1

3. Determine slope and horizontal & vertical displacements at D of the plane frame shown in fig.2.
   $E = 22500\ N/mm^2$
   Beam & Column c/s: $b \times D = 230\ mm \times 300\ mm$
   Compare the results with the results obtained using any structural analysis software.

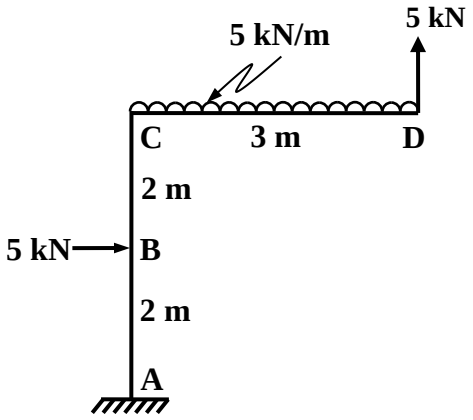

Fig. 2

4. Determine horizontal displacement at the apex point of the plane truss shown in fig.3.
   $E = 2 \times 10^5$ N/mm^2
   Cross-sectional Area, A = 173 mm^2 (ISA 30 × 30 × 3 mm)
   Compare the results with the results obtained using any structural analysis software.

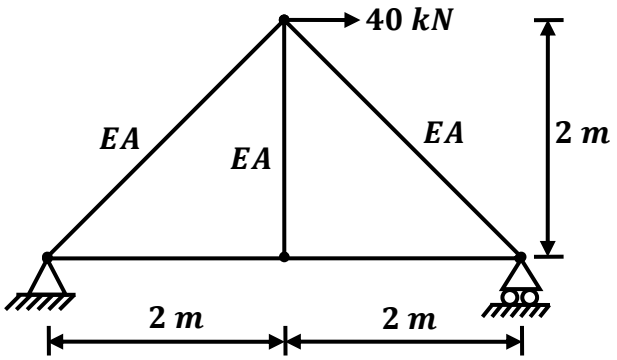

Fig. 3

5. Determine reactions at any one support of the fixed beam shown in fig.4.
   $E = 22500$ N/mm^2
   b × D = 230 mm × 300 mm
   Compare the results with the results obtained using any structural analysis software.

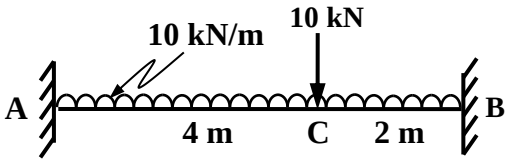

Fig. 4

6. Determine reaction of roller support of the plane frame shown in fig.5.
   $E = 22500$ N/mm^2
   Beam & Columns c/s: b × D = 230 mm × 300 mm
   Compare the results with the results obtained using any structural analysis software.

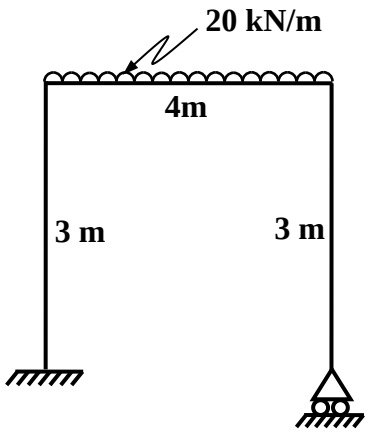

Fig. 5

7. Determine any one support reaction and any one member force for the plane truss shown in fig.6.

$E = 2 \times 10^5$ N/mm^2

Cross-sectional Area, A = 173 mm^2 (ISA 30 × 30 × 3 mm)

Compare the results with the results obtained using any structural analysis software.

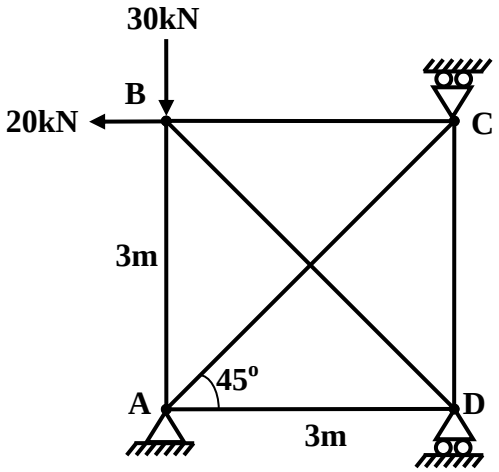

Fig. 6

Assignment No: 4
Analysis of Rigid Jointed Plane Frame by Approximate Methods

Relevant CO:

CO-3: Compute approximate internal forces in framed structure subjected to vertical and lateral loads.

CO-5: Determine response of framed structure using professional software.

1. Analyze the rigid jointed plane frames shown in fig.1 by approximate method. Draw approximate bending moment diagram. All the members have same axial rigidity and flexural rigidity.

   Compare the results with the results obtained using any structural analysis software.

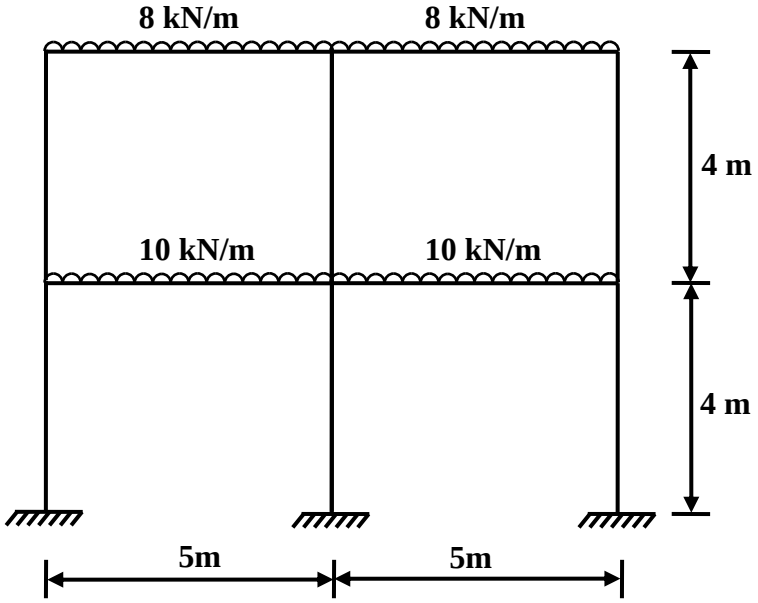

Fig. 1

2. Analyze the rigid jointed plane frames shown in fig.2 by approximate method. All the members have same axial rigidity and flexural rigidity.

   Compare the results with the results obtained using any structural analysis software.

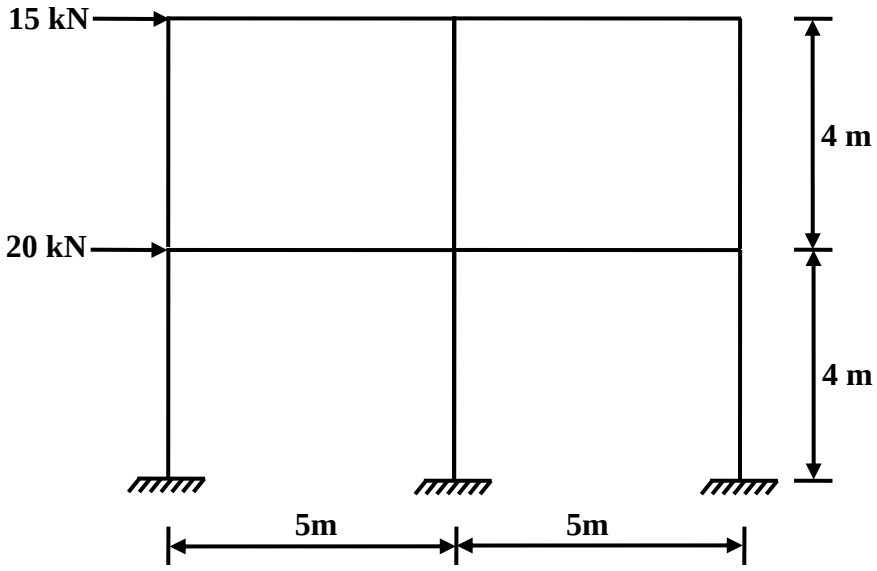

Fig. 2

Assignment No: 5
Influence Line Diagrams of Statically Determinate & Indeterminate Structures

Relevant CO:

CO-4: Determine internal forces and reactions in determinate and indeterminate structures subjected to moving loads.

CO-5: Determine response of framed structure using professional software.

1. What is Influence Line Diagram?

2. Draw influence line diagrams for support reactions, shear force and bending moment at section 3 m from right support of the simply supported beam 8 m span.

3. Three point loads 70 kN, 60 kN and 50 kN equally spaced 3 m respectively, crosses a girder of 12 m span from left to right, with the 50 kN load as leading load. Calculate maximum shear force and bending moment at a section 5m from left end.

4. A uniformly distributed load of intensity 40kN/m and 10m length crosses a girder of 25m span. Find out maximum S.F. and B.M. at a section 12m from left support. Also determine the maximum shear and absolute maximum bending moment in the beam.

5. Develop influence lines for forces in members L_2L_3, U_2L_2 and U_2L_3 of the pratt truss shown in fig.1. Consider the unit load to be moving along the lower chord of the truss L_0L_6.

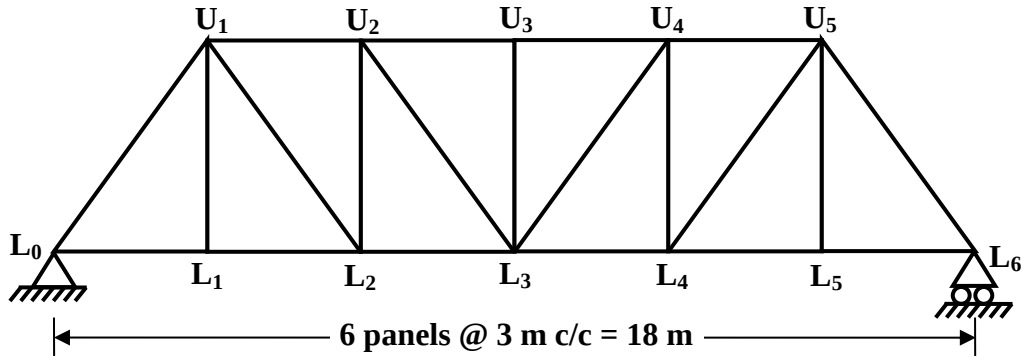

Fig. 1

6. Write Müller-Breslau principle. Write steps for obtaining influence line for reaction and internal forces in propped cantilever beam.

7. Write Müller-Breslau principle. Write steps for obtaining influence line for reaction and internal forces in continuous beam.

8. For the continuous beam ABCD shown in fig.2, construct qualitative Influence Line Diagrams of R_A, R_B, R_C, R_D and bending moment & shear force at the central section of span AB.

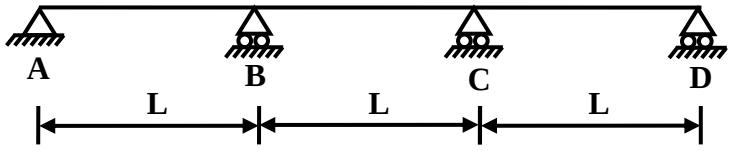

Fig. 2

9. Compare the results of Q. 2, 3 & 4 with the results obtained using any structural analysis software.