Course File

Subject Title/Subject Code: Structure Analysis I
5CE4-02

Semester: V Year: III

Name of the Faculty: Mr Jitendra Choubisa
E-mail id: jitendra.choubisa@technonjr.org

Class Schedule

Total Number of Lectures: 28

i) Course Objective

It aims to equip students with the knowledge and analytical skills needed to evaluate indeterminate structures, using methods like Area Moment, Slope-Deflection, and Moment-Distribution. Additionally, students will gain an understanding of structural vibrations and their mathematical modeling.

INDEX - COURSE FILE

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VISSION & MISSION OF INSTITUTE

Vision

Empowering student with recent and emerging technologies to create innovative technical leaders capable of contributing to industrial and societal needs for betterment of mankind across the globe.

Mission

M1: To provide dynamic learning environment to students by providing constant exposure to latest technologies by linking closely with the industries.

M2: To establish effective interface with industry to obtain live problems to enhance critical thinking and problem solving skills among students and consultancy projects for faculty.

M3: To provide avenues and opportunities to faculty for domain specific trainings and qualification upgradation.

M4: To develop ethical leaders with strong communication skills.

VISION & MISSION OF DEPARTMENT

Department Vision

To increase students learning of fundamentals for designing and planning of buildings and latest technologies through industry-aligned project-based learning which will help in transforming students to be good civil engineering professionals leading to innovation and incubation of new ideas.

Department Mission

M1: To create experimental learning through solving problems of Government, Society, Smart Cities, Industry and other entities.

M2: To teach the latest technologies to the students as beyond the syllabus activity so that they are updated and industry ready.

M3: To enable engineering students understand industry-aligned technologies and learn to find solutions from their early engineering days and this is the only way to produce globally relevant engineers solving real-life problems applying current technologies.

M4: To enable students to generate projects through problem faced by and requirement of Smart cities, industry, Government and other entities whereby those outlined problem statements are to be studied deeply by a group of faculty members to convert them into real-time project format.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs 1: To provide an in-depth understanding of the fundamentals of Civil Engineering and create a foundation for lifelong learning to facilitate a progressive career in the construction Industry, as an entrepreneur and in pursuit of higher studies.

PEOs 2: To equip the students with technical and analytical skills to develop innovative solutions to complex real-life problems using existing and novel technologies. To equip the students with good communication and interpersonal skills, inter-disciplinary teamwork and leadership skills to enable them to fulfill professional responsibilities.

PEOs 3: To expose them to various contemporary issues which will enable them to become ethical and responsible towards themselves, co-workers, Society and the Nation.

PEOs 4: To make the student's industry ready by imparting education related to the latest technologies so that they can grab future industry jobs.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: To be aware of and initiate some-work on future technologies and new developments which may impact the future Industry 4.0.

PSO2: Hands on training on upcoming technologies and project-based learning.

PSO3: Get exposure to BIM (Building Information Modeling).

PROGRAMME OUTCOMES (POs)

A student will develop:

PO01. ENGINEERING KNOWLEDGE: An ability to apply knowledge of Mathematics, Science and Engineering Fundamentals in Electronics and Communication Engineering.

PO02. PROBLEM ANALYSIS: Ability to analyze and interpret data by designing and conducting experiments. Develop the knowledge of developing algorithms, designing, implementation and testing applications in electronics and communication related areas.

PO03. DESIGN/ DEVELOPMENT OF SOLUTION: An ability to Design a system Component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

PO04. CONDUCTION OF INVESTIGATION OF COMPLEX PROBLEMS: Ability to Identify, formulate and solve engineering problems.

PO05. MODERN TOOL USAGE: An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

PO06. THE ENGINEERING AND SOCIETY: Broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.

PO07. ENVIRONMENT & SUSTAINABILITY: Understand the impact of professional engineering solution in societal and environmental contexts, and demonstrate the knowledge of, and need of sustainable development.

PO08. ETHICS: An ability to understand the professional, social and ethical responsibility.

PO09. INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. COMMUNICATION: An ability to Communicate effectively in order to succeed in their profession such as, being able to write effective reports and design documentation, make effective presentations.

PO11. PROJECT MANAGEMENT & FINANCE: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in team, to manage projects and in multidisciplinary environment.

PO12. LIFE-LONG LEARNING: Recognize the need and an ability to engage in life-long learning.

COURSE OUTCOMES (COs) OF THE SUBJECT

CO No.	Mapping	Statement
CO35301.1	**Analyzing**	Students will be able to classify and analyze statically indeterminate structures using various analytical methods.
CO35301.2	**Analyzing**	Students will master the Area Moment, Conjugate Beam, and Three Moments Theorem for structural analysis.
CO35301.3	**Analyzing**	Students will effectively use the Slope-Deflection and Moment-Distribution methods in the analysis of continuous beams and frames.
CO35301.4	**Understanding**	Students will gain a foundational understanding of structural vibrations and the behavior of SDOF systems.
CO35301.5	**Analyzing**	Students will enhance their ability to solve complex structural problems considering both static and dynamic loads.

COS MAPPING WITH POs AND PSOs

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	0	0	1	0	0	0	0	1	2	2	2
CO2	2	2	2	2	0	0	0	0	0	0	0	0	2	2	2
CO3	2	2	2	1	0	0	2	0	1	0	0	1	2	2	2
CO4	3	2	3	1	0	0	1	0	1	0	0	1	3	2	3
CO5	3	2	3	2	0	0	1	0	1	0	0	1	3	2	3

UNIVERSITY ACADEMIC CALENDAR

Academic Calendar for odd Semester for Session

RAJASTHAN TECHNICAL UNIVERSITY KOTA

Course: Bachelor of Technology (B.TECH.) for Odd Semester				
Semester	I	III	V	VII
Induction Program	17.08.2023			
Commencement of Classes	11.09.2023	24.08.2023	04.09.2023	04.09.2023
Commencement of First Mid Term	02.11.2023	03.10.2023	05.10.2023	05.10.2023
Commencement of Second Mid Term	07.12.2023	16.11.2023	20.11.2023	20.11.2023
Last Working Day	23.12.2023	02.12.2023	02.12.2023	30.11.2023
Commencement of Practical Exams	02.01.2024	04.12.2023	23.12.2023	14.12.2023
Commencement of Theory Exams	18.01.2024	14.12.2023	08.12.2023	07.12.2023
Winter Break				

ACADEMIC CALENDAR OF INSTITUTE

Academic Calendar

Academic Calendar for Odd Semester for Session 2023-24 (Odd Semester)

Course: Bachelor of Technology (B.TECH.)				
Semester	**I**	**III**	**V**	**VII**
Induction Program	10-08-2023			
Commencement of Classes	20-08-2023	11-09-2023	30-08-2023	22-08-2023
Commencement of First Mid Term	04-11.2023	02-11.2023	02-11.2023	27-09-2023
Commencement of Second Mid Term	15-01-2024	27-12-2023	27-12-2023	05-12-2023
Last Working Day	20-01-2024	12-01-2024	12-01-2024	20-12-2023
Commencement of Practical Exams	29-01-2024	15-01-2024	15-01-2024	31-12-2023
Commencement of Theory Exams	15-02-2024	30-01-2024	29-01-2024	27-12-2023

Evaluation Scheme

FACULTY DETAILS:

Name of the Faculty	:	Mr. Jitendra Choubisa
Designation	:	Assistant Professor
Department	:	Civil Engineering

1. TARGET

a) Percentage Pass: 100%
b) Percentage I class: 60 %

2. METHOD OF EVALUATION

- ☐ Continuous Assessment Examinations (Mid-Term 1, Mid-Term 2)
- ☐ Assignments / Seminars
- ☐ Mini Projects
- ☐ Quiz
- ☐ Semester Examination

Others_____

3. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.
4. Take the help of creative tools to stimulate creativity. Include slide presentations, demonstration or forms of visual exercises that will excite the young minds and capture their interest.

Signature of Faculty: **Signature of HOD**

UNIVERSITY SYLLABUS

5CE4-02: STRUCTURE ANALYSIS-I

Credit: 2 **Max. Marks: 100(IA:20, ETE:80)**
2L+0T+0P **End Term Exam: 2 Hours**

SN	Contents	Hours
1	Introduction: Objective, scope and outcome of the course.	1
2	Introduction to Indeterminate structures, Degrees of freedom per node, Static and Kinematic indeterminacy (i.e. for beams, frames & portal with & without sway etc.), Releases in structures, Maxwell's reciprocal theorem and Betti's theorem. Analysis of prop cantilever structures, Analysis of Indeterminate Structure (fixed and continues beams) using Area moment method, Conjugate beam method, Three moments Theorem.	11
3	Analysis of Statically Indeterminate Structures using Slope-deflection method and Moment-distribution method applied to continuous beams and portal frames with and without inclined members	11
4	**Vibrations:** Elementary concepts of structural vibration, Mathematical models, basic elements of vibratory system. Degree of freedom. Equivalent Spring stiffness of springs in parallel and in series. **Simple Harmonic Motion**: vector representation, characteristic, addition of harmonic motions, Angular oscillation. **Undamped free vibration of SDOF system**: Newton's law of motion, D Almbert's principle, deriving equation of motions, solution of differential equation of motion, frequency & period of vibration, amplitude of motion; Introduction to damped and forced vibration.	5
	TOTAL	28

PRESCRIBED BOOKS

1. Strength of Materials & Mechanics of Structures: Vol. I by Dr. B.C. Punmia Laxmi Publications (p) Ltd.
2. Theory of Structures by Jangid & Negi, Tata Mc Graw Hill.
3. Structural Analysis by Hibbler R.C., Pearsons.

WEEKLY TIME TABLE OF THE TEACHER

First Time Table: with effect from (Date):

Day	1	2	3	4	5	6	7
Monday							
Tuesday							
Wednesday							
Thursday							
Friday							
Saturday							

COURSE-PLAN

UNIT	Lect. No.	TOPICS	Teaching Methods/ Teaching Aids
1	1	INTRODUCTION: Objective, scope and outcome of the course.	White Board
2	2	Introduction to Indeterminate structures	White Board
2	3	Degrees of freedom per node	White Board
2	4	Static indeterminacy with examples	White Board
2	5	External and internal Static indeterminacy	White Board
2	6	Static indeterminacy for beams, frames and trusses with examples	White Board
2	7	Kinematic indeterminacy	White Board
2	8	Releases in structures	White Board
2	9	Maxwell's reciprocal theorem and Betti's theorem	White Board
2	10	Analysis of prop cantilever structures	White Board
2	11	Analysis of Indeterminate Structure (fixed and continues beams) using Area moment method	White Board
2	12	Analysis of Indeterminate Structure (fixed and continues beams) using Conjugate beam method	White Board
2	13	Analysis of Indeterminate Structure (fixed and continues beams) using Three moments Theorem	White Board
3	14	Analysis of Statically Indeterminate Structures using Slope-deflection method	White Board
3	15	Analysis of Statically Indeterminate Structures using Moment-distribution method	White Board
3	16	Examples of complete unit	White Board
4	17	Elementary concepts of structural vibration	White Board
4	18	Basic elements of vibratory system	White Board
4	19	Degree of freedom.	White Board
4	20	Equivalent Spring	White Board
4	21	Stiffness of springs in parallel and in series	White Board
4	22	Simple Harmonic Motion	White Board

4	23	vector representation, characteristic, addition of harmonic motions	White Board
4	24	Angular oscillation	White Board
4	25	Undamped free vibration of SDOF system	White Board
4	26	Newton's law of motion, D Almbert's principle, deriving equation of motions,	White Board
4	27	solution of differential equation of motion, frequency & period of vibration	White Board
4	28	amplitude of motion; Introduction to damped and forced vibration	White Board

Signature of Faculty: **Signature of HOD**

Assignment – 1

1. Explain the difference between statically determinate and indeterminate structures. Discuss why indeterminate structures are more complex to analyze.
2. Describe Maxwell's Reciprocal Theorem and Betti's Theorem. Provide examples of how these theorems are applied in structural analysis.
3. Explain the concept of degrees of freedom in structural analysis. How do static and kinematic indeterminacies relate to the degrees of freedom?
4. Discuss the Area Moment Method and Conjugate Beam Method for analyzing indeterminate structures. Provide a detailed step-by-step procedure for solving a fixed-end beam using these methods.
5. Describe the Three Moments Theorem and its application in the analysis of continuous beams. Illustrate with an example.

Assignment – 2

1. Explain the Slope-Deflection Method in detail. How is this method applied to continuous beams and portal frames with inclined members?
2. Discuss the Moment Distribution Method for analyzing statically indeterminate structures. What are the advantages and limitations of this method?
3. Explain the basic concepts of structural vibrations. Describe how mathematical models are used to represent vibratory systems.
4. Derive the equation of motion for an undamped free vibration system with a single degree of freedom (SDOF). Explain the significance of the natural frequency and amplitude in this context.
5. Discuss the differences between damped and undamped vibrations. How do damping factors influence the behavior of a vibrating system? Provide examples to illustrate your explanation.

SAMPLE QUIZ QUESTIONS

1) The unit load method is primarily used to calculate:

a) Shear forces
b) Bending moments
c) Deflections in structures
d) Axial forces

Answer: (c) Deflections in structures

2) What is the primary objective of studying indeterminate structures?

a) To design more stable buildings
b) To analyze structures that cannot be determined by static equilibrium alone
c) To understand the properties of materials
d) To calculate the cost of construction

Answer: (b) To analyze structures that cannot be determined by static equilibrium alone

3) Which theorem states that the work done by external forces on a system is equal to the work done by internal forces?

a) Maxwell's Reciprocal Theorem
b) Betti's Theorem
c) The Superposition Theorem
d) The Parallel Axis Theorem

Answer: (b) Betti's Theorem

4) What is the static indeterminacy of a propped cantilever beam?

a) 0
b) 1
c) 2
d) 3

Answer: (b) 1

5) Which method is not typically used to analyze indeterminate structures?

a) Area Moment Method
b) Conjugate Beam Method
c) Finite Element Method
d) Three Moments Theorem

Answer: (c) Finite Element Method

6) Maxwell's Reciprocal Theorem is applied to which of the following?

a) Only determinate structures
b) Only indeterminate structures
c) Both determinate and indeterminate structures
d) Only to trusses

Answer: (c) Both determinate and indeterminate structures

7) The Moment Distribution Method is most suitable for analyzing which type of structure?

a) Simply supported beams
b) Continuous beams and frames
c) Trusses
d) Cantilever beams

Answer: (b) Continuous beams and frames

8) In the Slope-Deflection Method, what is assumed to remain constant?

a) Moments at the ends of members
b) Shear forces
c) Slope and deflection at the ends of members
d) Axial forces

Answer: (c) Slope and deflection at the ends of members

9) The equivalent spring stiffness of two springs in parallel is:

a) The sum of their individual stiffnesses
b) The product of their individual stiffnesses
c) The average of their individual stiffnesses
d) The difference of their individual stiffnesses

Answer: (a) The sum of their individual stiffnesses

10) Which of the following is true for simple harmonic motion?

a) D'Alembert's Principle
b) Newton's Law
c) Maxwell's Reciprocal Theorem
d) Betti's Theorem

Answer: (a) D'Alembert's Principle

Mid Term Paper-I

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 3rd – YEAR (V SEM.) – MT-I

Structure Analysis-I (5CE4-02)

Time: 2 Hr **Max. Marks:**70

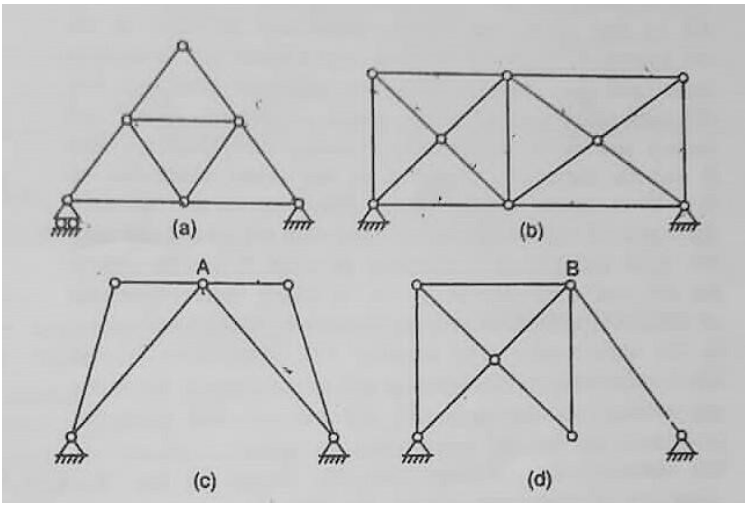
Note:

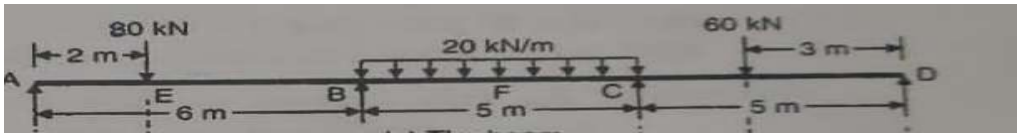
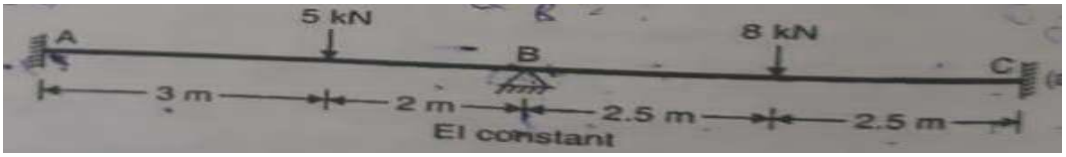
1) The paper is divided into 2 parts: Part-A and, Part-B.
2) Part-A contains 10 questions and carries 2 mark each.
3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

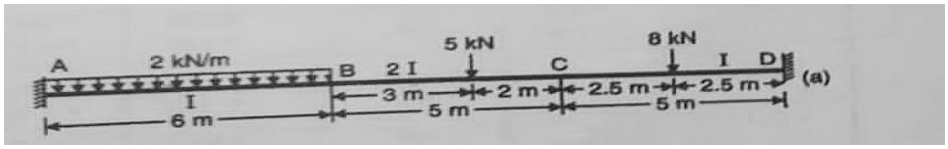
Part- A (20 Marks)

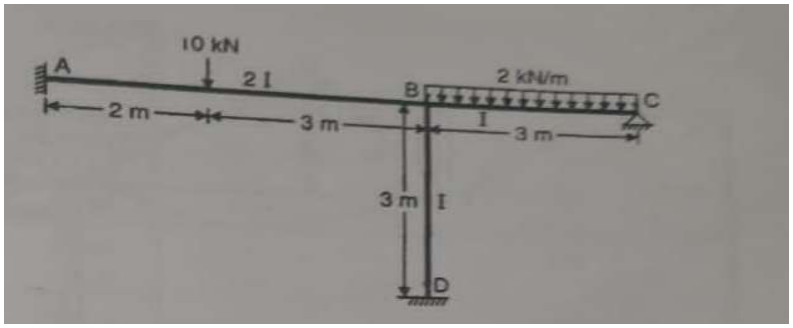
A.	Define Structure.	CO1
B.	Listed the various methods of structure analysis.	CO1
C.	What do you mean by degree of freedom.	CO1
D.	Write down the formula of shear equation.	CO1
E.	Write down slope deflection equation.	CO2
F.	Define stiffness.	CO2
G.	Write down the three-moment theorem.	CO2
H.	Write down the relation between elastic constants	CO2
I.	Write down the formula for distribution factor.	CO3
J.	Write down the equilibrium equation.	CO3

Part- B (50 Marks)

1. Calculate the degree of static indeterminacy for following diagram. 	CO1
OR	

1. Analysis the following beam by 3 moment method. 	CO1
2. Analysis the beam by moment distribution method. 	CO1
OR	
2. Explain Maxwell reciprocal theorem and Betti's theorem.	CO1

3. Analysis the beam by slope deflection method. 	CO2
OR	
3.Analysis the fixed beam by 3 moment method subjected to UDL over whole span.	CO2

4. Analysis the portal frame by moment distribution method. 	CO2
OR	
4. Distinguish between static and kinematic indeterminacy.	CO2

5. Write down the steps to analysis the portal frame with side sway by slope deflection method.	CO3
OR	
5. Explain about indeterminacy of structure and define flexibility and stiffness co-efficient.	CO3

Marks and Gap Analysis of Mid-Term I

S.No.	University Roll No.	Name of Student	Mid-Term 1 MM-70	Remark (Remedial Class need or not – Y/N)
1.	21ETCCE001	Dev vaishnav	50	N
2.	21ETCCE002	Hitesh Sutradhar	50	N
3.	21ETCCE004	Naved khan	43	N
4.	21ETCCE006	Pushpendra gehlot	56	N
5.	21ETCCE007	Shalin Dak	47	N
6.	21ETCCE009	Tamanna kumawat	63	N
7.	21ETCCE300	Muniraj Sharma	63	N
8.	22ETCCE200	Moiz Udaipurwala	54	N
9.	22ETCCE201	Vikas Suthar	61	N

*(Y, if obtained marks are <50%)

Signature of Faculty: **Signature of HOD**

Remedial Action Taken to Remove the Gaps (After Mid- Term 1)

S.no.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome Achieved
1.	NIL				
2.					

Signature of Faculty: **Signature of HOD**

Mid Term Paper-II

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 3rd YEAR (V SEM.) – MT-II

Structural Analysis-I (**5CE4-02**)

Time: 2 Hr Max. Marks: 70

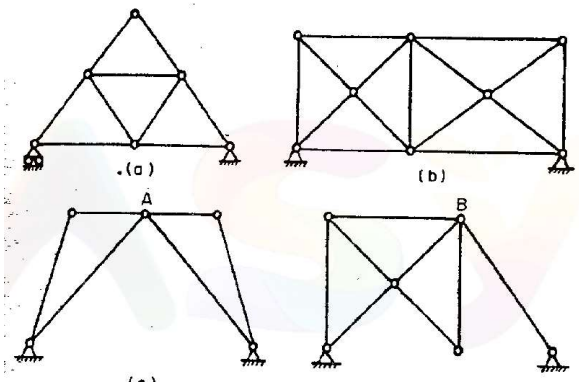
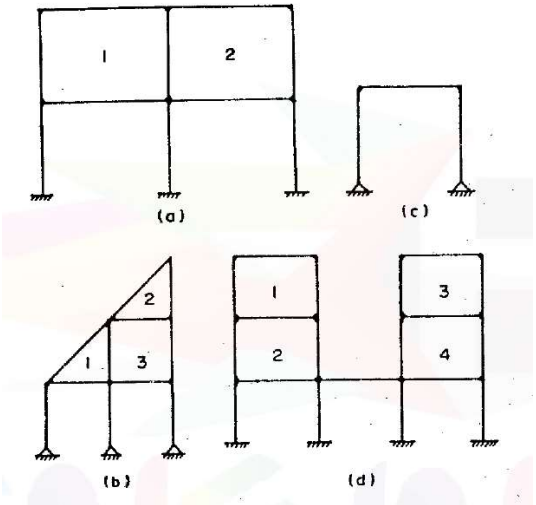
Note:

4) The paper is divided into 2 parts: Part-A, Part-B.
5) Part-A contains 10questions and carries 2 mark each.
6) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (10 Marks)

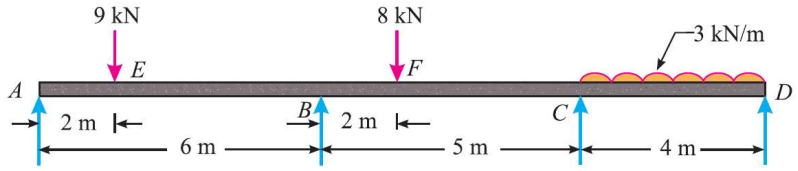
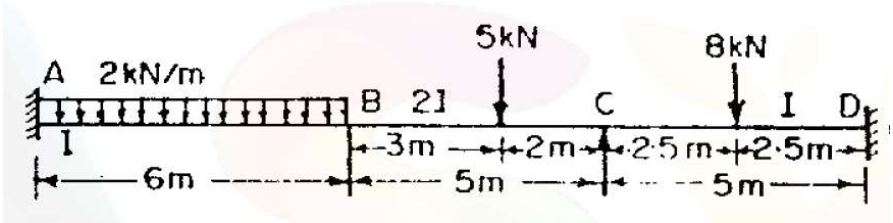
A. Define Indeterminacy.	CO1
B. What do you understand by determinate structure?	CO1
C. Define Maxwell's reciprocal theorem.	CO2
D. Give an example of statically indeterminate structures	CO2
E. State what is 3 moment equation?	CO3
F. Define Static equilibrium Conditions.	CO3
G. Explain what moment distribution method is.	CO4
H. Define Betti's theorem.	CO4
I. Define Amplitude, frequency of SHM.	CO5
J. Explain the term damping.	CO5

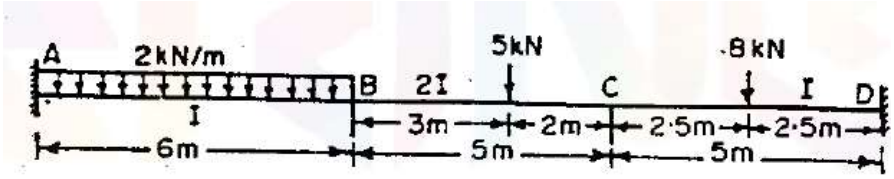
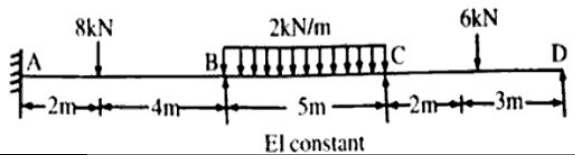
Part- B (50 Marks)

1. Determine Total Structural indeterminacy of the structures shown in figure. 	CO1
OR	
1. Determine Structural indeterminacy of the structures shown in figure. 	CO1

2. A simply supported beam is subjected to a point load at the exact center of the beam. Using the moment-area method, determine the slope at the free end of the beam and the deflection at the free end of the beam. EI = constant.	CO2
OR	
2. A simply supported beam is subjected to a UDL throughout the span. Using the moment-area method, determine the slope at the free end of the beam and the deflection at the free end of the beam. EI = constant.	CO2

3. State Castigliano's first & Second theorem in detail with diagram.	CO3
OR	
3. State Betti's & Maxwell Reciprocal theorem in detail with diagram.	CO3

4. Analyze the beam as shown below by Three moment theorem:  	CO4
OR	
4. Analyze the beam as shown below by Slope deflection equations:  	CO4

5. Solve following by moment distribution method:  	CO5
OR	
5. Using slope deflection method, solve this:  	CO5

Marks and Gap Analysis of Mid-Term II

Sr. No.	University Roll No.	Name of Student	Mid-Term 2 MM-70	Remark (Remedial Class need or not – Y/N)
1.	21ETCCE001	Dev vaishnav	49	N
2.	21ETCCE002	Hitesh Sutradhar	49	N
3.	21ETCCE004	Naved khan	42	N
4.	21ETCCE006	Pushpendra gehlot	55	N
5.	21ETCCE007	Shalin Dak	46	N
6.	21ETCCE009	Tamanna kumawat	62	N
7.	21ETCCE300	Muniraj Sharma	62	N
8.	22ETCCE200	Moiz Udaipurwala	53	N
9.	22ETCCE201	Vikas Suthar	60	N

*(Y, if obtained marks are <50%)

Signature of Faculty: **Signature of HOD**

Remedial Action Taken to Remove the Gaps (After Mid- Term 1I)

S.no.	University Roll no.	Name of Student	Topics to be discussed in Remedial Class	Schedule Date of Remedial Class	Outcome Achieved
1.	NIL				
2.					

Signature of Faculty: **Signature of HOD**

Model Question Paper

5E1741

Roll No. _____ Total No. of Pages: 4

5E1741

B. Tech. V - Sem. (Main) Exam., February - 2023

Civil Engineering

5CE4-02 Structural Analysis - I

Time: 3 Hours **Maximum Marks: 70**

Instructions to Candidates:

Attempt all ten questions from Part A, five questions out of seven questions from Part B and three questions out of five from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL 2. NIL

PART – A

(Answer should be given up to 25 words only) **[10×2=20]**

All questions are compulsory

Q.1 In a simply supported beam of span 7.5 m the deflection at a point A is 4 mm when 10 kN load is applied at point B. What will be the deflection at B if load of 25 kN is applied at A? Point A is 1.5 m from left support and point B is 4.5 m from left support.

Q.2 Define static indeterminacy. Calculate internal and external static indeterminacy for the structure shown in Fig 1.

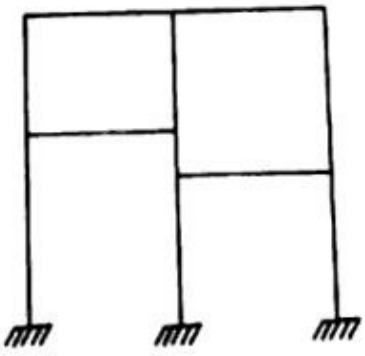


Fig.1

Q.3 Define stiffness of a spring. Based on the stiffness of spring, define linear spring, soft spring and hard spring.

Q.4 Draw neat diagrams to show a Cantilever beam, Propped cantilever beam, Fixed Beam and Continuous beam.

Q.5 What do you understand by a Conjugate beam?

Q.6 What is D'Alembert's Principle?

Q.7 Define the terms –

(a) Carry over factor

(b) Distribution factor used in moment distribution method

Q.8 Can the Clapeyron's Theorem (Theorem of three moments) be applied to solve a fixed beam? If yes, what is the procedure?

Q.9 Find out the ratio of column head moments to be taken in sway analysis of a portal frame by moment distribution method if one of the column is fixed at the base and other is hinged.

Q.10 Define the terms –

(a) Amplitude (b) Damping

(c) Time period (d) Harmonic motion

PART – B

(Analytical/Problem solving questions) **[5×4=20]**

Attempt any five questions

Q.1 What are the special devices available for release of forces in structure? Explain any three devices with the help of diagram. Also, write expressions to compute the static and kinematic indeterminacy if such special devices are used in Rigid Jointed Plane Structure. Assume members to be inextensible.

Q.2 Identify the unknowns in terms of slope and deflection in the given problem shown in Fig.2. Write down the slope deflection equations for the portal frame ABCD shown in Fig.2. Also, write the conditions available, equilibrium equations and shear equation (if required) to find the unknowns. (Solution of equations is not required to find unknowns).

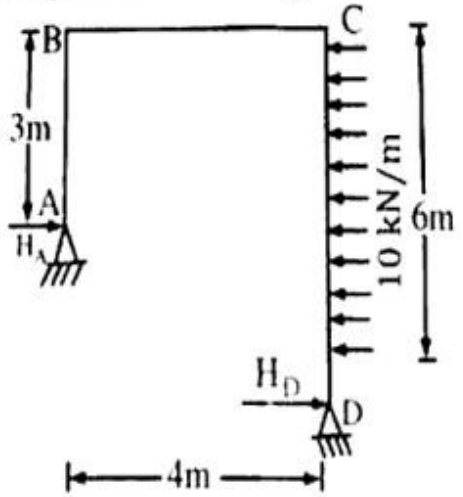


Fig. 2

Q.3 Two springs of stiffness s_1 and s_2 are connected in series and parallel in two different systems. Derive the relation for resultant stiffness of the system when the springs are in -

(a) Series

(b) Parallel

Q.4 In a continuous beam XYZ, XY = L and YZ = L. Supports X and Z are hinge supports and central support Y is roller support. The beam carries uniformly distributed load of intensity 'w' per unit length throughout. Draw shear force and bending moment diagrams for the continuous beam.

Q.5 A fixed beam of span 6 m carries a point load of 20 kN at 2 m from the left hand support. Draw bending moment diagram for the beam using area moment method.

Q.6 A cantilever of length L carries a concentrated load 'W' at 2L/3 from the fixed end. If the free end is supported by a rigid prop, find out the reaction at the prop. Also draw the shear force and bending moment diagrams.

Q.7 Using moment distribution method, calculate the moments at supports of the beam ABCD as shown in Fig. 3

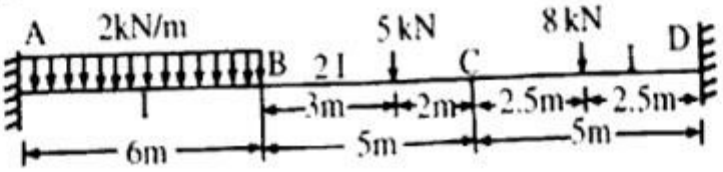


Fig. 3

PART – C

(Descriptive/Analytical/Problem Solving/Design Questions) **[3×10=30]**

Attempt any three questions

Q.1 Solve the structure shown Fig. 4 using moment distribution method. Draw B.M.D. and deflected shape.

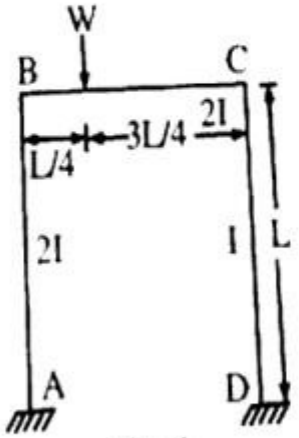


Fig. 4

Q.2 Using theorem of three moments, solve the continuous beam shown in Fig. 5. Plot the bending moment diagram.

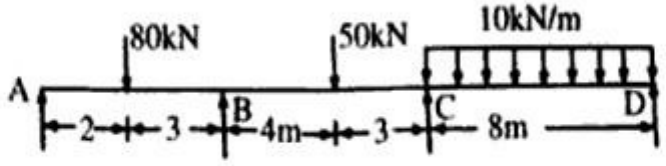
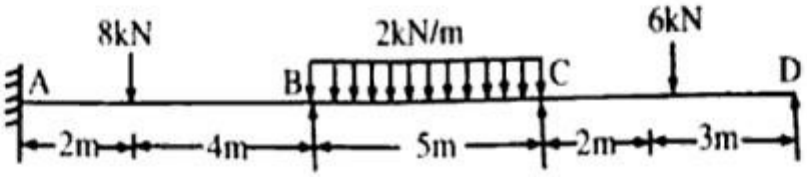


Fig. 5

Q.3 Using slope deflection method solve the structure shown in Fig. 6. Plot the bending moment diagram.



EI constant

Fig. 6

Q.4 Derive the equation of motion for a damped single degree of freedom system having free vibration. Also define the terms –

(a) Critically damped system
(b) Over damped system
(c) Under damped system
(d) Logarithmic decrement

Q.5 In a cantilever beam AB, of span 'L' fixed at A and carrying a load 'P' at free end B, the value deflection 'y' at a section X, distant 'x' from support A is given by ,

$$y = \frac{Px^2 (3L-x)}{6EI}$$

If the cantilever is now loaded with a concentrated load 'W' at X and propped at 'B' to the same level as A, show by using Reciprocal theorem that the reaction at support 'B' is

$$R_B = \frac{Wx^2 (3L-x)}{2L^3}$$

Take E = Modulus of Elasticity and I = Moment of Inertia.

STUDENT PERFORMANCE REPORT

Roll No.	Name of Student	I Mid-Term	II Mid-Term	Average
21ETCCE001	Dev vaishnav	50	49	49.5
21ETCCE002	Hitesh Sutradhar	50	49	49.5
21ETCCE004	Naved khan	43	42	42.5
21ETCCE006	Pushpendra gehlot	56	55	55.5
21ETCCE007	Shalin Dak	47	46	46.5
21ETCCE009	Tamanna kumawat	63	62	62.5
21ETCCE300	Muniraj Sharma	63	62	62.5
22ETCCE200	Moiz Udaipurwala	54	53	53.5
22ETCCE201	Vikas Suthar	61	60	60.5

Signature of Faculty: **Signature of HOD**

RESULT ANALYSIS

S.NO.	RTU ROLL NUMBER	NAME OF STUDENT	END TERM MARKS	SESSIONAL MARKS	TOTAL
		MAX MARKS	**70**	**30**	**100**
1.	21ETCCE001	Dev vaishnav	25	22	49
2.	21ETCCE002	Hitesh Sutradhar	30	22	61
3.	21ETCCE004	Naved khan	22	19	63
4.	21ETCCE006	Pushpendra gehlot	AB	25	
5.	21ETCCE007	Shalin Dak	23	21	49
6.	21ETCCE009	Tamanna kumawat	36	28	69
7.	21ETCCE300	Muniraj Sharma	35	28	73
8.	22ETCCE200	Moiz Udaipurwala	31	24	67
9.	22ETCCE201	Vikas Suthar	33	27	68

TOTAL	PASS	FAIL	ABSENT	PASS %
9	8	0	1	100%

Indirect Assessment:

Overall Teacher Self-Assessment (at the completion of course) in terms of course objective and outcomes

Course Objectives:

It aims to deepen students' understanding of advanced structural analysis techniques essential for civil engineering. It covers the unit load method for deflection analysis, energy methods for evaluating strain energy under various loading conditions, and the application of Castigliano's theorems to both determinate and indeterminate structures. Students will learn to construct and interpret influence line diagrams, analyze the effects of rolling loads, and study the behavior of arches under different support conditions. Additionally, the course introduces unsymmetrical bending, focusing on the computation of stresses and the location of the shear center. Approximate methods for analyzing multistory frames subjected to lateral loads, as well as the tension coefficient method for space trusses, are also explored. Through this course, students will develop the analytical skills necessary to solve complex structural problems, preparing them for professional practice in civil engineering.

Course Outcomes:

At the end of this course students will be able to:

CO1: Students will be able to classify and analyze statically indeterminate structures using various analytical methods.

CO2: Students will master the Area Moment, Conjugate Beam, and Three Moments Theorem for structural analysis.

CO3: Students will effectively use the Slope-Deflection and Moment-Distribution methods in the analysis of continuous beams and frames.

CO4: Students will gain a foundational understanding of structural vibrations and the behavior of SDOF systems.

CO5: Students will enhance their ability to solve complex structural problems considering both static and dynamic loads.

Methodology to identify bright student

It is done by considering a range of criteria, including academic performance, creativity, critical thinking, problem-solving skills, and enthusiasm for learning. Bright students often excel in multiple areas. Observed how students perform in the classroom. In terms of active participation, engagement in discussions, leadership, and the ability to grasp complex concepts.

Efforts to keep students engaged

1. Active Learning:

- Incorporate active learning strategies, such as group discussions, problem-solving activities, and hands-on projects. Active participation keeps students engaged and encourages critical thinking.

2. Varied Teaching Methods:

- Use a variety of teaching methods, including lectures, group work, multimedia presentations, and interactive activities to cater to different learning preferences.

3. Technology Integration:

- Leverage technology, such as online platforms, educational apps, and interactive software, to make lessons more engaging and interactive.

Methodology to identify weak student

It is done by considering a range of criteria, including classroom observation, formative assessment, summative assessment, assignment review etc. Weak students are struggling students with sensitivity and a desire to support their learning. Some measures, such as additional tutoring, personalized assignments, or alternative assessment methods, to help students succeed.

Targeted inventions for weak student

1. Additional Resources
Offer supplementary learning materials, such as textbooks, online resources, or multimedia content, to provide alternative explanations and reinforce key concepts.

2. Remedial classes
Establish a tutoring program where students can receive extra help from teachers.

3. Flipped classroom
Students are assigned pre-class learning materials, often in the form of videos, readings, or online modules, to cover the foundational concepts before coming to class.