SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
(AUTONOMOUS)

QUESTION BANK

Year / Semester: II B.Tech IV Semester **Regulation: R23**

Subject and Code: STRUCTURAL ANLAYSIS&23CIV243T

23CIV243T	STRUCTURAL ANLAYSIS	L	T	P	C
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SYLLABUS

Course Objectives

1.Learn energy theorems
2.Learn the analysis of indeterminate structures Analysis of fixed and continuous beams Learn
3.About slope-deflection method
4.Learn about Moment–distribution method

UNIT–I

ENERGY THEOREMS: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castigliano's first theorem Deflections of simple beams and pin jointed trusses.

UNIT-II

ANALYSIS OF INDETERMINATE STRUCTURES: Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses with upto two degrees of internal and external indeterminacies – Castigliano's–II theorem.

UNIT-III

FIXEDBEAMS& CONTINUOUS BEAMS: Introduction to statically indeterminate beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams – Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

UNIT-IV

SLOPE-DEFLECTION METHOD: Introduction-derivation of slope deflection equations-application to continuous beams with and without settlement of supports - Analysis of single bay portal frames without sway.

UNIT-V

MOMENT DISTRIBUTION METHOD: Introduction to moment distribution method- Application to continuous beams with and without settlement of supports-Analysis of single bay storey portal frames without sway.

COURSE OUTCOMES:

On successful completion of this course the students shoulder able to:		POs related to COs
CO1	Apply energy theorems to analyze trusses	PO1,PO2,PO3, PO5
CO2	Analyze indeterminate structures by using Castigliano's–II theorem	PO1,PO2,PO3, PO5
CO3	Analysis of fixed and continuous beams	PO1,PO2,PO3, PO5

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CO4	Analyzecontinuousbeamsandportalframesbyusingslope-deflectionmethod	**PO1,PO2,PO3,PO5**
CO5	Analyze continuous beams and portal frames by using Moment–distribution method	**PO1, PO2, PO3, PO4,P5**

Textbooks:

1. Analysis of Structures – Vol-I&II by V.N. Vazirani&M.M.Ratwani, Khanna Publications, New Delhi.
2. Basic Structural Analysis by C.S.Reddy., Tata McGraw-Hill Publishers.3rdedition 2017.

Reference Books:

1. Structural analysis by Aslam Kassimali Cengage publications6thedition2020.
2. Structural analysis Vol.I and II by Dr.R. Vaidyanathan and Dr. Perumal–Laxmi publications. 3rd 2016
3. Introduction to structural analysis by B.D. Nautiyal, New Age international publishers, New Delhi.
4. Structural Analysis–D.S. Prakasarao-Univeristy press.
5. Strength of Materials and Mechanics of Structures by B.C. Punmia, Khanna Publications, New Delhi.

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	-
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	3	-	-	-	-	-	-	-
CO4	3	3	3	3	3	-	-	-	-	-	-	-
CO5	3	3	3	3	3	-	-	-	-	-	-	-
CO*	3	3	3	3	3	-	-	-	-	-	-	-

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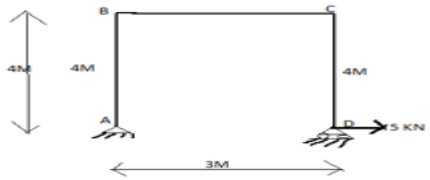
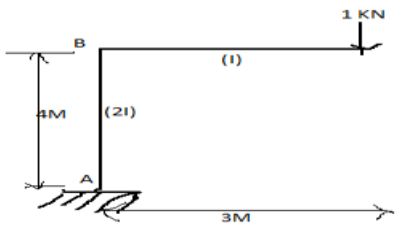
Max Marks: 10

S.No.	CO	Questions	BT
		Unit I: (ENERGY THEOREMS)	
1	1	Derive the expression for strain energy due to axial load?	L4
2	1	Derive the expression for strain energy due to bending moment?	L3
3	1	Explain briefly unit load method?	L4
4	1	Derive the expression for strain energy due to bending moment?	L3
5	1	Determine the horizontal displacement of the roller end D of the portal frame shown in fig.1 EI is 8000kNm^2 throughout 	L5
6	1	Determine the vertical deflection of point C in the frame shown in fig. given E=200kN/mm^2 and I=40x10^{6}mm^4. 	L4
7	1	Castligliao's theorem?	L3
8	1	Determine the vertical deflection of point C in the frame shown in fig. given E=200kN/mm^2 and I=30x10^{6}mm^4.	L5

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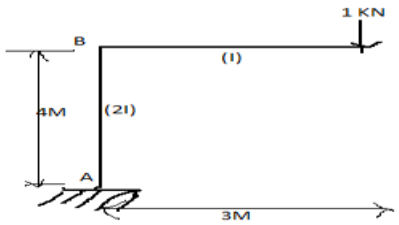
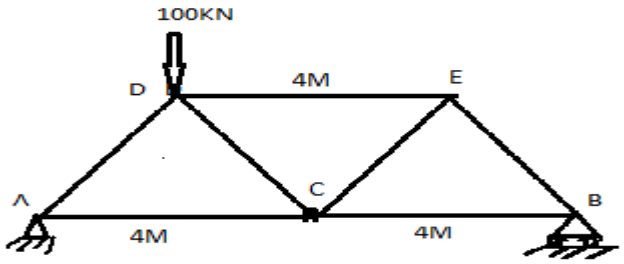
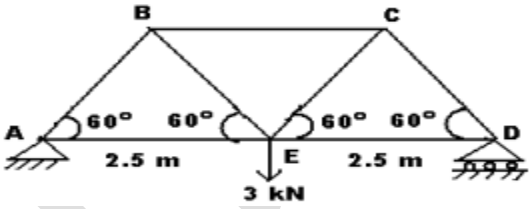
			
9	1	The below fig shows a pin jointed truss loaded with a single load W=100KN.If the area of all members shown in fig is 1000mm^2,what is the vertical deflection of point C? Take E=200KN /mm^2 for all members? Using Unit load method? 	L4
10	1	Determine the vertical deflection of joint E for the Warren truss shown in figure. Take A = 645 mm2 and E = 200 kN/mm2 for all the members. 	L3

S.No.	CO	Questions	BT
Unit II: (ANALYSIS OF INDETERMINATE STRUCTURES)			
1	2	Define a statically indeterminate structure and explain the concept of redundancy.	L4
2	2	Explain the difference between **external and internal indeterminacy** with suitable examples.	L3
3	2	Define **static indeterminacy** and **kinematic indeterminacy**. Derive expressions for static indeterminacy of (a) plane trusses and (b) plane rigid frames.	L4

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
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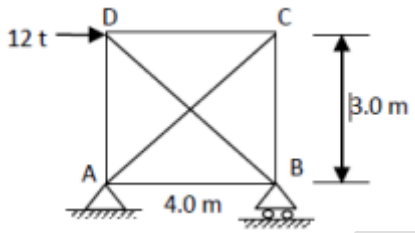
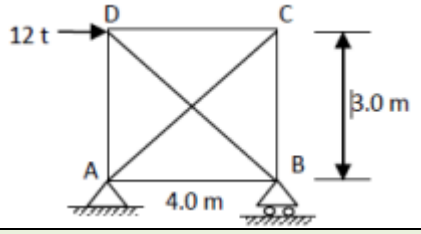
4	**2**	State and prove **Castigliano's theorem (Castigliano's Second Theorem)**. Mention its assumptions and limitations.	**L3**
5	**2**	Calculate the central deflection and slope at ends of a simply supported beam carrying a U.D.L. w per unit length over the whole span.	**L5**
6	**2**	A pin jointed framed structure is loaded as shown in figure below. Calculate the forces in all members. Take area for horizontal members as 20 cm2, vertical members as 30 cm2, inclined members as 50 cm2 and E = 2000 t/cm2. 	**L4**
7	**2**	Define **static indeterminacy** and **kinematic indeterminacy**. Derive expressions for static indeterminacy of (a) plane trusses and (b) plane rigid frames.	**L3**
8	**2**	State and prove **Castigliano's theorem (Castigliano's Second Theorem)**. Mention its assumptions and limitations.	**L5**
9	**2**	Explain the difference between **external and internal indeterminacy** with suitable examples	**L4**
10	**2**	Define a statically indeterminate structure and explain the concept of redundancy.	**L3**
11	**2**	A pin jointed framed structure is loaded as shown in figure below. Calculate the forces in all members. Take area for horizontal members as 20 cm2, vertical members as 40 cm2, inclined members as +0 cm2 and E = 2000 t/cm2. 	**L4**
S.No.	**CO**	**Questions**	**BT**
Unit III: (FIXEDBEAMS& CONTINUOUSBEAMS)			

SREENIVASA INSTITUTE OF TECHNOLOGY AND MANAGEMENT STUDIES
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Subject and Code: STRUCTURAL ANLAYSIS&23CIV243T

1	**3**	A fixed beam of length 6 m carries two point loads of 30 kN each at a distance of 2 m from both ends. Determine the fixed end moments and draw BMD.	**L4**
2	**3**	A fixed beam of span 'l' is subjected to a uniformly distributed load over its entire span .Find the support reactions and moments. Draw the shear force and bending moment diagrams	**L3**
3	**3**	A Fixed beam of span 6 m is subjected a UDL of 5 kN/m on the left half of the span and a point load of 15 kN at the middle of the right half of the span. Draw the SFD and BMD	**L4**
4	**3**	Find the fixed end moments and reactions in support of a fixed beam of length 6m carrying a point load of 30KN on 2m from left end and another point load of 40KN on 2m from right end. Draw the shear force and bending moment diagrams.	**L3**
5	**3**	A fixed beam of span 'l' is subjected to a uniformly distributed load over its entire span .Find the support reactions and moments. Draw the shear force and bending moment diagrams	**L5**
6	**3**	A fixed beam of span 8 m is subjected to a linearly varying load of zero from one support to 6kN/m to the other support. Find the support reactions and moments. Draw the shear force and bending moment diagrams.	**L4**
7	**3**	A continuous beam ABC covers two consecutive spans AB and BC of lengths 4m and 6m carrying uniformly distributed load of 60kN/m & 100KN/m respectively. if the ends A&C are simply supported find the support moments at A,B,C. Draw S.F.D and B.M.D. Using Clapeyron's theorem of three moments.	**L3**
8	**3**	A continuous beam ABC covers two consecutive spans AB and BC of lengths 4m and 6m carrying uniformly distributed load of 20kN/m & point load of 30 KN respectively. if the ends A&C are simply supported, find the support moments at A,B,C. Draw S.F.D and B.M.D.Using Clapeyron's theorem of three moments. AB = I & BC = 2I.	**L5**
9	**3**	A continuous beam ABC covers two consecutive spans AB and BC of lengths 4m and 6m carrying uniformly distributed load of 40kN/m & 80KN/m respectively. if the ends A&C are simply supported find the support moments at A,B,c. Draw S.F.D and B.M.D. Using Clapeyron's theorem of three moments.	**L4**
10	**3**	A continuous beam ABC covers two consecutive spans AB and BC of lengths 4m and 6m carrying uniformly distributed load of 20kN/m & point load of 30 KN respectively. if the ends A&C are simply supported, find the support moments at A,B,C. Draw S.F.D and B.M.D.Using Clapeyron's theorem of three moments. AB = I & BC = 2I.	**L3**

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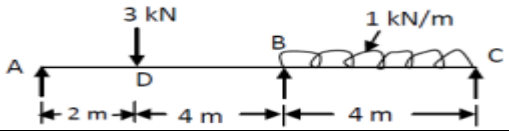
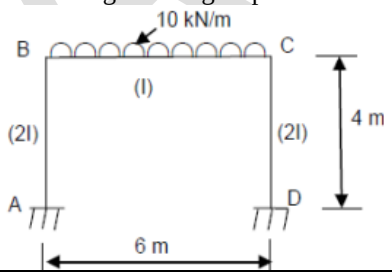
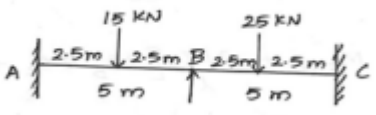
11	**3**	A continuous beam ABC covers two consecutive spans AB and BC of lengths 4m and 6m carrying uniformly distributed load of 40kN/m & 80KN/m respectively. if the ends A&C are simply supported find the support moments at A,B,c. Draw S.F.D and B.M.D. Using Clapeyron's theorem of three moments.	**L3**

S.No.	CO	Questions	BT
		Unit IV: (SLOPE-DEFLECTION METHOD)	
1	**4**	A simply supported beam of span 3m is subjected to a central load of 10 KN. Find maximum slope and deflection. Take I = 12×10^6 mm^4 and E = 200 GPa.	**L4**
2	**4**	A simply supported beam of span 4m is carrying a UDL of 2 KN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI = 80×10^9 N-mm^2.	**L3**
3	**4**	Analyze the continuous beam shown in figure below using slope deflection method. Draw the SF and BM diagrams. 	**L4**
4	**4**	Analyze the portal frame shown in figure using slope deflection method? 	**L3**
5	**4**	A continuous beam ABC consists of spans AB and BC of 5 m length in each. Both ends of the beam are fixed. The span AB carries a point load of 15 kN at its middle point. The span BC carries a point load of 25 kN at its middle point. Find the moments and reactions at the supports. Assume the beam is of uniform section. Use slope deflection method. 	**L5**

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(AUTONOMOUS)

QUESTION BANK

Year / Semester: II B.Tech IV Semester **Regulation: R23**

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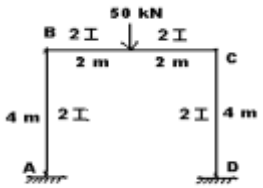
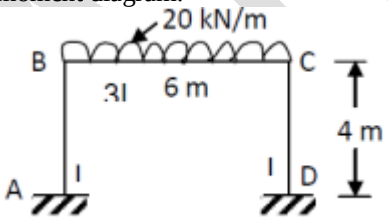
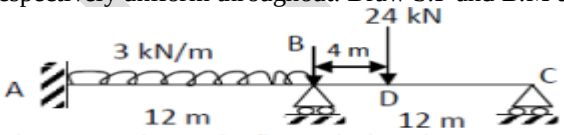
6	**4**	Analyze the frame shown in figure by slope deflection method. Take EI = constant.  Fig.	**L4**
7	**4**	A simply supported beam of span 3m is subjected to a central load of 40 KN. Find maximum slope and deflection. Take I = 10×10^6 mm⁴ and E = 200 GPa.	**L3**
8	**4**	A simply supported beam of span 4m is carrying a UDL of 10 KN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI = 80×10^9 N-mm².	**L5**
9	**4**	A simply supported beam of span 10m is carrying a UDL of 20KN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI = 80×10^9 N-mm².	**L4**
10	**4**	Analyze the portal frame shown in the figure below using slope deflection method. Draw also the bending moment diagram.  	**L3**
11	**4**	Analyze the continuous beam shown in figure below by using slope deflection method. The support B sinks 30 mm, values of E and I are 200 GPa and 0.2 x 109 m4 respectively uniform throughout. Draw S.F and B.M diagrams.  	**L3**

S.No.	CO	Questions	BT
Unit V: (MOMENT DISTRIBUTION METHOD)			
1	**5**	Analyze the continuous beam shown in figure below using moment distribution method. Draw the SF and BM diagrams.	**L4**

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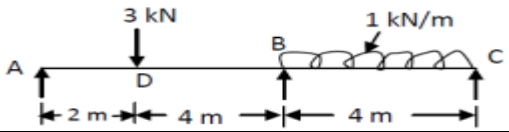
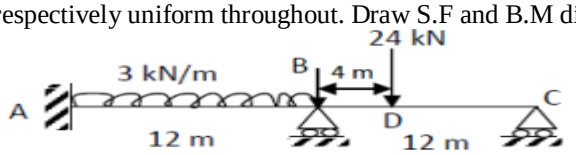
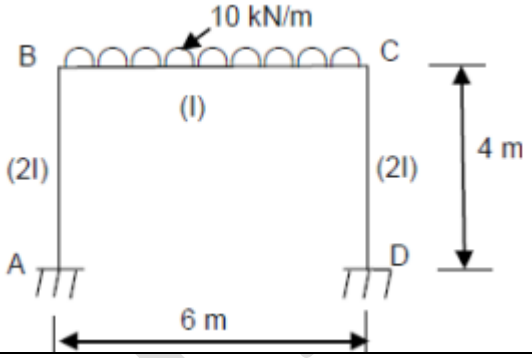
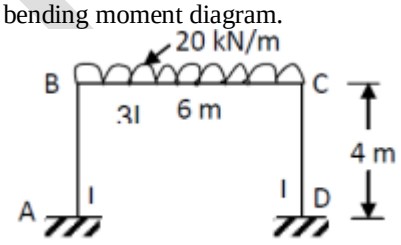
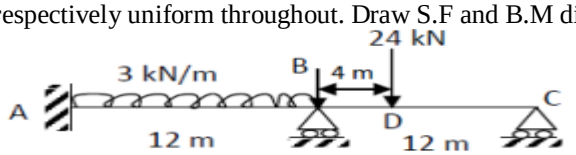
			
2	5	Analyze the continuous beam shown in figure below by using moment distribution method. The support B sinks 30 mm, values of E and I are 200 GPa and 0.2 x 109 m4 respectively uniform throughout. Draw S.F and B.M diagrams. 	L3
3	5	A simply supported beam of span 4m is carrying a UDL of 10 KN/m over the entire span. Find the moment distribution method of the beam. Take EI = 80x10⁹ N-mm².	L4
4	5	A simply supported beam of span 10m is carrying a UDL of 20KN/m over the entire span. Find the maximum moment distribution method of the beam. Take EI = 80x10⁹ N-mm².	L3
5	5	Analyze the portal frame shown in figure using moment distribution method 	L5
6	5	Analyze the portal frame shown in the figure below using moment distribution method. Draw also the bending moment diagram. 	L4
7	5	Analyze the continuous beam shown in figure below by using moment distribution method. The support B sinks 30 mm, values of E and I are 200 GPa and 0.2 x 109 m4 respectively uniform throughout. Draw S.F and B.M diagrams. 	L3

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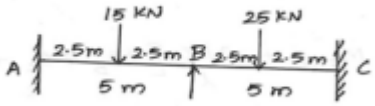
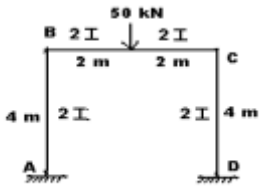
8	5	A simply supported beam of span 10m is carrying a UDL of 30 KN/m over the entire span. Find the moment distribution method of the beam. Take EI = 80x10⁹ N-mm².	L5
9	5	A simply supported beam of span 10m is carrying a UDL of 40KN/m over the entire span. Find the maximum moment distribution method of the beam. Take EI = 80x10⁹ N-mm².	L4
10	5	A continuous beam ABC consists of spans AB and BC of 5 m length in each. Both ends of the beam are fixed. The span AB carries a point load of 15 kN at its middle point. The span BC carries a point load of 25 kN at its middle point. Find the moments and reactions at the supports. Assume the beam is of uniform section. Use moment distribution method 	L3
11	5	Analyze the frame shown in figure by moment distribution method. Take EI = constant.  Fig.	L3

Note: L1-Remembering, L2-Understanding, L3-Applying, L4-Analyzing, L5-Evaluating, and L6-Creating

Instruction to Faculty Members:

The Six Levels of Bloom's Taxonomy:

1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory (e.g., list, define, name, locate).
2. **Understanding:** Constructing meaning, explaining ideas, or concepts (e.g., summarize, interpret, classify, compare).
3. **Applying:** Using information in new situations or implementing procedures to solve problems (e.g., solve, use, demonstrate, implement).

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4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure (e.g., contrast, categorize, distinguish, diagram).
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing (e.g., judge, critique, justify, defend, argue).
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure (e.g., design, construct, develop, formulate).