STRUCTURAL ANALYSIS

Course Code: 20CE1112

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Prerequisites: Mathematics, Applied Mechanics, Strength of Materials.

Course Outcomes: At the end of the course the student will be able to:

CO1: Analyze Propped Cantilever, Fixed Beams and Continuous Beams under different loading and support conditions (L4)

CO2: Analyze beams subjected to moving loads using Influence line diagrams (L4)

CO3: Analyze two hinged and three hinged arches (L4)

CO4: Apply slope deflection method and Moment Distribution Method to analyze continuous beams and portal frames (L4)

CO5: Analyze continuous beams using flexibility and stiffness matrix methods (L4)

UNIT-I **(10 Lectures)**

PROPPED CANTILEVER AND FIXED BEAMS:

Analysis of propped cantilever and fixed beams for different combination of loads; Draw SFD, BMD and deflection diagrams – Effect of sinking and rotation of supports.

CONTINUOUS BEAMS:

Introduction- Clapeyron's theorem of three moments- Analysis of continuous beams with constant moment of inertia, continuous beams with different Moment of Inertia for different spans – Effects of support sinking – Shear force diagram, Bending Moment diagram and Elastic curves.

Learning outcomes:

At the end of the unit, the student will be able to

1. categorize fixed and continuous beams and their performance (L2)
2. classify different loads on beams with different boundary conditions (L2)
3. analyze the beams subjected to loads (L4)
4. study the effect of sinking of supports on performance (L4)

UNIT-II **(10 Lectures)**

INFLUENCE LINES:

Definition of Influence line for reactions, SF and BM at a given position of loading, series of concentrated loads, UDL.

MOVING LOADS:

Introduction, maximum Shear Force and Bending Moment at a given section and absolute maximum Shear Force and Bending Moment due to train of concentrated loads and UDL -Load position for maximum B.M and S.F. at a given section.

Learning outcomes:

At the end of the unit, the student will be able to

1. construct ILD for reactions, SF and BM (L3)

2. calculate position and magnitude of maximum BM and SF due to train of concentrated load and UDL at a given section (L3)
3. analyse the absolute SF and BM of a beam (L4)

UNIT-III **(10 Lectures)**

ARCHES:

Introduction to three hinged arches – Eddy's theorem, determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature.

Introduction to two hinged arches, determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature, support yielding and rib shortening.

Learning outcomes:

At the end of the unit, the student will be able to

1. calculate horizontal thrust, bending moment, normal thrust and radial shear for arches (L3)
2. analyse three hinged arches (L4)
3. analyse two hinged arches (L4)

UNIT-IV **(10 Lectures)**

SLOPE - DEFLECTION METHOD:

Introduction - Derivation of slope - deflection equation – application to continuous beams including settlement of supports, Analysis of single bay single storey portal frames with and without sway - draw Shear force diagram, Bending Moment diagram and Elastic curves.

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MOMENT DISTRIBUTION METHOD:

Introduction - stiffness and carry over factors – Distribution factors– Analysis of continuous beams with and without sinking of supports. Analysis of single bay single storey portal frames with and without sway - draw Shear force diagram, Bending Moment diagram and Elastic curves.

Learning outcomes:

At the end of the unit, the student will be able to

1. develop slope deflection and moment distribution expressions (L3)
2. analyze beams with and without support sinking (L4)
3. analyze portal frames using slope-deflection and moment-distribution method (L4)

UNIT-V **(10 Lectures)**

FLEXIBILITY METHOD:

Introduction to the structural analysis by flexibility concept using System approach and calculations of Static Indeterminacy-application to continuous beams including support settlements. (Maximum indeterminacy of 3) - draw Shear force diagram, Bending Moment diagram and Elastic curves.

STIFFNESS METHOD:

Introduction to the structural analysis by stiffness concept using System approach, calculations of Kinematic Indeterminacy- application to continuous beams including support settlements. (Maximum degrees of freedom of 3) - draw Shear force diagram, Bending Moment diagram and Elastic curves.

Learning outcomes:

At the end of the unit, the student will be able to

1. develop flexibility matrix for beams (L3)
2. develop stiffness matrix for beams (L3)
3. analyze structures with and without support sinking (L4)

Text Books:

1. Devdas Menon, "Structural Analysis" Alpha Science International Ltd. 2007.
2. V.N. Vazirani & M.M. Ratwani, "Analysis of Structures", (Vol I & II), Khanna Publications, New Delhi.
3. K.U. Muthu, Azmi Ibrahim, Maganti Janardhana Yadav & M. Vijayanand "BasicStructural Analysis", 3rd Edition, I. K. International Publishing House Pvt. Ltd.

References:

1. S.S Bhavikatti S.S, "Analysis of Structures", (Vol. I & II), 6th Edition, VikasPublications, 2009.
2. S.B.Junnarkar, "Mechanics of Structures", 10th Edition, Charotar Publishing House,Anand, Gujrat,2000.
3. S.Ramamurtham, R. Narayan, "Theory of Structures", 9th Edition, Dhanapat RaiPublishing Company,2010.
4. C.S.Reddy, "Structural Analysis", Tata McGraw Hill, New Delhi, 2008.
5. R.C. Hibbeler "Structural analysis" 6th Edition, Pearson Publications, 2012.
6. T.S. Thandavamoorthy, "Analysis of Structures", Oxford University Press, New Delhi
7. Pandit and Gupta, "Structural Analysis (Matrix Approach)" Tata McGraw Hill, NewDelhi, 2008.

Web References:

1. https://nptel.ac.in/courses/105/105/105105166/
2. https://nptel.ac.in/courses/105/101/105101085/
3. https://nptel.ac.in/courses/105/101/105101086/
4. https://nptel.ac.in/courses/105/105/105105109/