CE3310: Advanced Structural Analysis

Credit Distribution: C:9 L:3 T:0 P:0 E:0 O:6 TH:0

Course Type: Theory

Description: To learn flexibility and stiffness methods of structural analysis using conventional and matrix formulations, with emphasis on conceptual understanding and application of matrix methods (using MATLAB) to perform linear static analysis of one, two and three dimensional skeletal structures.

Course Content:

1. Statically indeterminate structure: Method of consistent deformation and theorem of least work (including two-hinged/fixed arches, plane frames and simple grids); Approximate lateral load analysis of building frames (portal and cantilever methods); Displacements using principle of virtual forces.

2. Kinematically indeterminate structures: Introduction to displacement methods, Slope deflection method, Moment distribution method.

3. Basic matrix concepts: Review of matrix algebra; Introduction to matrix structural analysis (force and displacement transformations; stiffness and flexibility matrices; basic formulations; equivalent joint loads).

4. Matrix analysis of structures with axial elements: Conventional stiffness method using truss elements in one, two and three-dimensional pin-jointed structures; Reduced stiffness method using truss elements with single degree of freedom; Flexibility method analysis of Statically determinate and indeterminate trusses.

5. Introduction to advanced topics: Matrix analysis of grids and space frames using conventional stiffness method and reduced stiffness method; Elastic instability and second- order analysis; Introduction to finite element analysis.

Text Books

- Structural Analysis, Devdas Menon, Nanosa Publishing House, 2008.

- Advanced Structural Analysis, Devdas Menon, Narosa Publishing House, 2009.

Reference Books

- Structural Analysis: A unified classical and Matrix Approach, Amin Ghali, Adam M Neville and Tom G Brown, 6th ed., Chapman & Hall, 2007.

- Intermediate Structural Analysis, C K Wang, McGraw Hill International, 1983.

- Matrix Structural analysis, W. McGuire, R.H. Gallagher and R.D. Ziemian, 2nd ed., John Wiley & Sons, 2000.

Prerequisite: NIL