Course Number: CE 506

Course Name: Analysis of Indeterminate Structures

Credits: 3-0-0-3

Prerequisites: CE 301 **-** Strength of Materials and Structures
Intended for: UG

Distribution: Discipline Elective

Semester: Odd/Even

Preamble: The subject of "Structural Analysis" constitutes a major facet of civil engineering curriculum. It encompasses the study of conventional theories and the methods developed on their basis to facilitate the determination of force distribution, reactions and deflections in structural systems. The present course has been designed to provide an introduction to the fundamental concepts of structural analysis for indeterminate structures. It concludes by describing the matrix methods of structural analysis.

Course Outline: The course focuses on the basic techniques of structural analysis for indeterminate beams, trusses and frames. It also includes the methods of approximate analysis of structures and concludes with an introduction to matrix methods of structural analysis.

Modules:

1. Introduction: Statically determinate vs. statically indeterminate structures, Determining degrees of static and kinematic indeterminacy, Methods of analysis. **(3 contact hours)**

2. Moment distribution method: Analysis of indeterminate beams subjected to loads and uneven settlement of supports, analysis of rigid frames with and without side sway.**(6 contact hours)**
3. Three-moment theorem: Derivation and application for analysis of continuous beams subjected to loads and uneven settlement of supports. **(6 contact hours)**
4. Kani's method and column analogy method for frames with and without sway. **(6 contact hours)**
5. Analysis using Force method: Analysis of indeterminate beams and frames, law of reciprocal deflections, theorem of least work, Analysis of indeterminate trusses considering reactions and/or member forces as redundant, reactions due to yielding of supports. **(6 contact hours)**
6. Approximate analysis of statically indeterminate structures: Analysis of trusses, vertically loaded building frames, Portal and Cantilever methods for laterally loaded building frames. **(6 contact hours)**

7. Introduction to matrix methods for structural analysis: Flexibility and stiffness matrices, analysis of continuous beams, rigid and pin jointed frames. **(9 contact hours)**

Text Books:

a) C.S.Reddy, 'Basic Structural Analysis', Tata McGraw Hill, New Delhi, 2001.
b) C.K. Wang, 'Intermediate Structural Analysis', Tata McGraw Hill, New Delhi, 2010.
c) R.C. Hibbeler, 'Structural Analysis 6th edition ', Pearson Education, 2009.
d) Ghali, A., Neville, A.M. and Brown, T.G., 'Structural analysis: a unified classical and matrix approach', Spon press, USA and Canada, 2003.
e) C.H. Norris, J.B. Wilbur, S.Utku, 'Elementary Structural Analysis', Tata McGraw Hill, 2003.
f) L. S. Negi and R. S. Jangjid, 'Structural Analysis', Tata Mc. Graw, New Delhi, 1997.
g) Pandit G S and Gupta S P, 'Structural Analysis: a matrix approach', Tata McGraw Hill, New Delhi, 2001.
h) Natrajan, C. and Revathi, P, 'Matrix methods of Structural Analysis: Theory and Problems', PHI, New Delhi, 2014.

Reference books:

a) Mau, S.T., 'Introduction to structural analysis: Displacement and force methods', CRC press, FL, 2012.
b) Weaver, W. Jr. and Gere, J.M., 'Matrix analysis of framed structures', Springer, 2012.
c) Ranzi, G. and Raymond, I.B., 'Structural analysis: principles, methods and modelling', CRC press, FL, 2014.