College of Engineering

Department of Civil Engineering

CE 563 Advanced Structural Analysis

Credit and Contact hours	3 / 3 (Lectures), 0 (Tutorials), 0 (Laboratory)
Required, or Elective	Required
Course Description	Energy principles; Stiffness and flexibility matrix analysis of structures; Finite difference method and a brief outline of the finite element method; Linear and nonlinear analysis of frames; Finite element analysis using open-source software.
Prerequisites or Co-requisites	None
Course Learning Outcomes	Students completing this course successfully will be able to:

Course Learning Outcomes (CLOs)	*Related Student Outcomes (SO)*
CLO1. Recognize energy principles; Stiffness and flexibility matrix analysis of structures; Finite difference method and brief outline of finite element method. K1	**SO1**
CLO2. Apply finite difference method for solving initial value and boundary value problems. S1	**SO2**
CLO3. Employ matrix method for the analysis of 2D and 3D trusses and frames. S1	**SO2**
CLO4. Employ geometric and material nonlinearities in the finite element analysis of frames using open-source software. S1	**SO2**

Student Outcomes related to this Course

SO 1 Recognize advanced engineering knowledge, concepts, and techniques to identify, interpret, and analyze complex and real-life engineering problems.

SO 2 Provide solutions for complex and real-life engineering problems through critical thinking and the use of modern engineering tools, and identify their impact on social, global, cultural, environmental, safety, and economic factors.

Topics Covered

List of Topics	Related CLOs
1. Historical developments	**CLO 1**
2. Energy principles	**CLO 1**
3. Stiffness and flexibility matrix analysis of structures	**CLO 1, 3**
4. Finite difference method	**CLO 1, 2**
5. Introduction to finite element method	**CLO 1**
6. Nonlinear analysis procedure	**CLO 4**
7. Introduction to an open-source software	**CLO 1, 4**
8. Linear and nonlinear finite element analysis of frames using open-source	**CLO 4**

Textbook(s) and Other Required Material	• Igor A. Karnovsky and Olga Lebed (2010). Advanced Methods of Structural Analysis. Springer. • William McGuire, Richard Gallagher, and Ronald Ziemian. Matrix Structural Analysis. 2nd Edition, John Wiley & Sons, Inc. • K.J. Bathe and E.L. Wilson. Numerical Methods in Finite Element Analysis. Prantice-Hall • J.L. Meek. Computer Methods in Structural Analysis. E & FN Spon.
Grading System	Assignments 20% Lecture attendance — Midterm exam 30% Seminar 10% Final exam 40%
Instructors	Prof. Husain Abbas; Office: 1A65; Email: habbas@ksu.edu.sa
Date of Review	March, 2025