

## Finite Element Methods

<b>Code</b> CE- 808	<b>Credit Hours</b> 3+0
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### Course Description

To introduce the application of Finite Element Methods for the analysis of continuum structure. Plane stress and plane strain problems in structures should be addressed. The student should be able to use appropriate software for the design of structures.

### Textbook:

1. R. D. Cook, D. S. Malkus, and M. E. Plesha, (2002): Concepts and Applications of Finite Element Analysis, 4th Edition, John Wiley and Sons, New York.

### Reference Book:

2. D. V. Hutton, (2004): Fundamentals of Finite Element Analysis, McGraw-Hill Inc., New York.
3. O. C. Zienkiewicz and R. L. Taylor, (2000): The Finite Element Method: Volume 1 The Basis, 5th Edition, ButterworthHeinemann, Oxford.
4. K. J. Bathe, (1995): Finite Element Procedures, 2nd Edition, Prentice-Hall Inc., Englewood Cliffs, New Jersey

### Prerequisites

Nil

### Assessment System for Theory

Quizzes	10-15%
Assignments	5-10%
Mid Terms	25-30%
Project	0-10%
ESE	45-50%

### Teaching Plan

Week No	Topics	Learning Outcomes
1-2	Introduction to Approximate Solution Methods for Problems in Elasticity	Course Outline, objectives, teaching plan, assessment method, concepts review
3-4	The Ritz Method	Ritz Method features and applications
5-6	Interpolation	1D interpolation, interpolation by discontinuous functions, hierarchical polynomial bases.
7-8	Weighted Residual Methods	Collocation Method, Subdomain method, Galerkin method, least squares method.
9	<b>MID TERM EXAM</b>	
10-11	Applications of the Finite Element Method	Mathematical foundations of the finite element method and application to field problems
12-13	Isoperimetric Finite Elements	The shape function, isoparametric elements, 1D demonstration bar elements, 2D demonstration triangular elements.

14-15	Displacement-Based Bending Elements in Solid and Structural Mechanics	Computation of the displacement field within a solid subjected to external forces
16-17	Programming the Finite Element Method	Students will be introduced to several MATLAB based programs for developing and solving finite element application problems.
18	<b>End Semester Exam</b>	