

**CRN: 14571 MAK 539E**  
**FINITE ELEMENT METHOD IN MECHANICAL ENGINEERING**

**Fall 2012-2013 Syllabus** (Ders Uygulama Belgesi, 25.09.2012)

**Lectures:** Tuesday 8:30 – 11:30 (D452)

**Faculty:**

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office hours: Mon. 13:30-16:30, Tue 11:30-12:30, Wed.10:30-13:30, Thu.12:30-13:30

**Course Description:**

Introduction. General procedure of FEM.

Element interpolation function, shape functions.

Isoparametric element concept. Discretization.

Techniques for nonlinear analysis.

Integral formulation and variational methods.

Computer programs for applications. Miscellaneous applications.

**Text Book:**

1. Finite Element Beginnings, David A. Pintur,1993, MathSoft Inc., ISBN:0-942075-36-6
2. The Finite Element Method in Machine Design, Eliahu Zahavi, Prentice-Hall, 1992.
3. The Finite Element Analysis. Theory and Application with ANSYS, Saeed Moaveni, Prentice-Hall,1999.

**References:**

1. Introduction To The Finite Element Method, C.S.Desai, J.S.Abel, Von Nostrand Reinhold Company, New York 1972.
2. The Finite Element Method, O.C. Zienkiewicz, McGraw Hill, 1977.
3. Finite element Programming, E.Hinton, D.R.J.Owen, Academic Press,London, 1977.
4. CAD/CAM: Computer Aided Design and Manufact., M.P.Groover, E.W.Zimmers, Prentice-Hall, 1987
5. The Finite Element Method, T. J.R. Hughes, Prentice-Hall, 2000.
6. The Finite Element Method in Engineering, S.S. Rao, Pergamon Press, 1989.
7. Applied Finite Element Analysis, L.J. SEGERLIND, John Wiley and Sons, 1984.
8. The Finite Element Method in Mechanical Design, C.E.Knight, PWS-KENT, 1993.
9. Finite Element Methods in Mechanics, Noboru Kikuchi, Cambridge Univ.Press, 1986.

**Course Objectives:**

The students of mechanical engineering should know and apply FEM which is a powerful numerical solution technique applied extensively for analysis of engineering field problems.

**Course Outcomes:**

Students will demonstrate:

1. To understand FEM and its application fields.
2. To improve computer skills by using FEM-system programs
3. To apply FEM for analysis in design problems.
4. To use FEM for analysis of miscellaneous engineering problems

**Weekly Course Plan:**

Week	Topics
1	Introduction: basic concepts, field problems, history
2	General procedure of FEM: steps
3	Assembling the elements, how to treat boundary conditions
4	Application of procedure to spring systems,
5	Application of computer programs for FE analysis
6	Element interpolation function, shape functions
7	Isoparametric element concept - <b>Midterm Exam</b>
8	Discretization of a region
9	Application of FEM to two dimensional problems
10	Techniques for nonlinear analysis
11	Integral formulation
12	Variational methods
13	Applications to various problems
14	Applications to various problems

**Grading:**

1 Midterm (20%) One midterm will be given during lecture hours.

4 Homework Assignments (40%) Four homework assignments will be given to promote and test understanding of FEM fundamentals and part analysis. In the term project, the students will develop the solid model of a 3-D part and analyze using a commercial FEM package. Some of the midterm questions may be similar to the homework questions. Homework assignments will be prepared individually by every student.

1 Final (40%) Final exam will cover all the topics of the course

**Others:**

Additional announcements on the course will be provided in the web sites: [www.ninova.itu.edu.tr](http://www.ninova.itu.edu.tr) and <http://www.akademi.itu.edu.tr/kocabash>