

**MIAMI UNIVERSITY  
SCHOOL OF ENGINEERING AND APPLIED SCIENCE  
DEPARTMENT OF ENGINEERING TECHNOLOGY**

**ENT 355**

**INTRODUCTION TO FINITE ELEMENT ANALYSIS**

**3**

Course Number

Title

Credit hours

**DESCRIPTION:** An application of the basic concepts of finite element modeling and analysis to various types of engineering technology problems including structural and machine component analysis, conduction and convection heat-transfer analysis, and fluid mechanics analysis. Selected analytical aspects of finite element analysis are introduced throughout the course in order to understand the fundamental concepts in finite element method. Matlab<sup>®</sup> software will be used exclusively for matrix manipulations. ANSYS<sup>®</sup> computer software is an integral part of the course and is used within the laboratory portion.

**PREREQUISITES:**

ENT 333

**TEXT MATERIAL:**

*Fundamentals of Finite Element Analysis*, by David V. Hutton, ISBN 0-07-292236-2

**COURSE OBJECTIVE:**

Upon Completion of this course, students will be able to:

1. Apply the basic concepts of finite element modeling to the creation of approximate discretized physical models.
2. Apply the basic concepts of finite element analysis to constrained discretized physical models in order to obtain the solutions of various types of engineering technology problems.
3. Apply hand-computational procedures to the solution of simple problems.
4. Apply computer analysis software to the solution of more complex problems.
5. Understand ways that results of various analyses may be checked for validity.

**COURSE OUTCOMES:**

**Outcome 6** Knowledge of modern computer-aided engineering analysis and design that is essential to the design of machines and mechanical systems

**Outcome 10** Mathematical and physical science skills necessary for the successful application of engineering concepts to design projects

**TOPICAL OUTLINE:**

Week	Chapter	Description	Lab Assignments
1	1	General Introduction and Basic concepts of the FEM	Introduction to ANSYS
2, 3,4	2	Stiffness matrices, spring and bar elements	Tutorials, simulation assignments, and homework problems on 1D problems
5, 6, 7	3	Truss structures: The direct stiffness method	Tutorials, simulation assignments, and homework problems on 2D and 2D trusses
8, 9, 10	5	Method of weighted residuals	Tutorials, simulation assignments, and homework problems on 2D and 3D solid mechanics problems
11, 12, 13	6	Interpolation functions for general element formulation	Tutorials, simulation assignments, and homework problems on Heat Transfer
14, 15, 16	9	Applications in solid mechanics	Tutorials, simulation assignments, and homework problems on nonlinear problems
17	Final Exam		

## **METHOD OF EVALUATION:**

The following is the distribution of credit for the required tasks:

Homework Problems	10%
Midterm	10%
Computer Simulations	30%
Simulation Test 1	10%
Simulation Test 2	10%
Simulation Test 3	10%
Final Examination	20%

## **Ethics and Academic Conduct**

It is expected that all members of the Department of Engineering Technology (faculty, staff and students) will adhere to the highest ethical standards in all matters. The Department endorses the Code of Ethics for Engineers proposed by the National Society of Professional Engineers (<http://www.nspe.org/ethics/eh1-code.asp>) and strongly defends the rights and responsibilities that accompany academic freedom which are at the heart of the intellectual integrity of Miami University.

It is expected that students will actively conduct themselves in an ethical fashion, for example, by only possessing and using materials authorized by the instructor during examinations, submitting assignments which are the student's original work (carefully referencing sources of information), protecting the integrity of assignments by adhering to prescribed procedures, and carefully utilizing the University's educational resources of materials and equipment.

Any activity that tends to compromise the academic integrity of the institution or subvert the educational process is defined as academic misconduct. Cheating and other forms of academic misconduct undermine the value of a Miami education for everyone, especially for the person who cheats.

The ENT department regards the adhering to academic ethical standards as a very serious issue and will follow the procedures and penalties for academic misconduct (dishonesty) as prescribed in Part V of The Student Handbook, pp. 10-12.

## **Miami University Learning Community**

Miami University is committed to fostering a supportive learning environment for all students irrespective of individual differences in gender, race, national origin, religion, handicapping condition, sexual preference, or age. Students should expect, and help create, a learning environment free from all forms of prejudice. Disparaging comments, sexist or racist humor, or questioning the academic commitment of students based upon these individual differences are behaviors that undermine our learning community. If such behaviors occur in class, please seek the assistance of your instructor or department chair.

## **University Statement Asserting Respect for Human Diversity**

Miami University is a multicultural community of diverse racial, ethnic, and class backgrounds, national origins, religious and political beliefs, physical abilities, ages, genders, and sexual orientations. Our educational activities and everyday interactions are enriched by our acceptance of one another; and, as members of the University community, we strive to learn from each other in an atmosphere of positive engagement and mutual respect.

Because of the necessity to maintain this atmosphere, bigotry will not go unchallenged within this community. We will strive to educate each other on the existence and effects of racism, sexism, ageism, homophobia, religious intolerance, and other forms of invidious prejudice. When such prejudice results in physical or psychological abuse, harassment, intimidation, or violence against persons or property, we will not tolerate such behavior nor will we accept jest, ignorance, or substance abuse as an excuse, reason, or rationale for it.

All who work, live, study, and teach in the Miami community should be committed to these principles which are an integral part of Miami's focus, goals, and mission.