

**Department of Materials Science and Engineering  
University of Maryland, College Park**

**ENMA 484/684: Finite Element Modeling – Fall 2018**

**Course Description:** A brief review of mechanical behavior of materials, introduction to Finite Element Modeling (FEM), and procedures for predicting mechanical behavior of materials by FEM using computer software (at present ANSYS). The FEM procedures include, setting up the model, mesh generation, data input and interpretation of the results.

**Prerequisites:** Permission of the department

**Text Book:**

1. S. Moaveni, "Finite Element Analysis, Theory and Application with ANSYS, 4<sup>th</sup> ed.", Pearson, 2015, ISBN 978-0-13-384080-3.

**Additional References:**

1. ANSYS Manual available in computer lab and via the virtual lab (virtlab.eng.umd.edu).
2. A number of publications will be used as to supplement the text and will be posted on Canvas as appropriate.

**Course Objective:** The main objective of this course is to introduce to the student how to solve materials related problems by FEM with the help of computer software (ANSYS at this time). The specific objectives include:

1. Understand how the finite element method works
2. Learn how to setup the FEM model to solve a problem
3. Learn how to validate the FEM model
4. Learn how to interpret the FEM results
5. Solve various problems by using FEM computer software to predict mechanical behavior of various materials and structures.

**Topics Covered**

- I. INTRODUCTION TO MECHANICAL BEHAVIOR OF MATERIALS
- II. TENSOR AND MOHR'S CIRCLES
- III. INTRODUCTION TO FINITE ELEMENT METHOD
- IV. FINITE ELEMENT NODES AND VARIOUS TYPES OF FINITE ELEMENTS
- V. TYPES OF CONSTRAINTS/BOUNDARY CONDITIONS
- VI. EXAMPLES OF FEM APPLICATIONS
- VII. VALIDATION METHODS
- VIII. INTERPRETATION OF FEM RESULTS
- IX. APPLICATIONS OF FEM TO SOLVE VARIOUS PROBLEMS SELECTED BY STUDENTS. THIS INCLUDES PRESENTATIONS AND SUBMISSION OF FINAL TERM PAPER BY STUDENTS

## **Class Schedule**

Monday and Friday 2:00 p.m. – 2:50 p.m., Room KEB 2107

Wednesday 2:00 p.m. – 2:50 p.m., Room EGR 3106

## **Grading**

Pop Quizzes	15%
Homework	25%
Submission of Term Paper Abstract and Preliminary Presentations, Sept 19 <sup>th</sup>	5%
Midterm Exam – Nov 2 <sup>nd</sup>	25%
Final Exam consists of the following items:	
– Term Paper Presentation (Nov 28 <sup>th</sup> – Dec 10 <sup>th</sup> )	15%
– Final Term Paper Written Report (due Dec 10 <sup>th</sup> )	15%

## **Quizzes and Homework**

Quizzes can be given on any lecture day at any time during the class.

Homework: The due date to submit the homework will be stated in the homework assignment.

Homework submitted after the due date will be given NO CREDIT.

## **Attendance**

Attendance is mandatory for the lecture. Students are required to make every reasonable effort to inform the instructor by email before the start of class if they will be absent, as well as the reason for absence. In addition, if a quiz is given on that day, the student should submit a self-signed letter explaining the reason for their absence. The letter from the student is subject to the rules of the Student Honor Code of the University of Maryland.

**If a student is absent for the Midterm Exam, Term Paper Presentation, or Term Paper submission (Major Grading Events), he or she must provide documentation of illness from a health care professional, and make every reasonable effort to notify the instructor in advance.**

If a student does not follow the above instructions, the student will receive ZERO CREDIT for any grading events missed while absent. Make-up of any grading event is subject to the discretion and convenience of the instructor.

## **Instructor: Dr. S. Ankem**

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## **Office Hours:**

M,W 10:00 a.m. – 12:00 p.m.