Course Title: Finite Element Analysis and Design
Course Prefix: **MCEG** **Course No.:** **4093** **Section No.:** **P01**

Department of | **Mechanical Engineering** **College of** **Engineering**

Instructor Name: | ***Shield Lin***
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Office Hours: | **2:00 p.m. – 2:50 p.m., Tuesday, Wednesday and Thursday. Students are also welcome to walk in or make an appointment to meet with the instructor at other time.**
Virtual Office Hours: | **Anytime by emails**

Course Location: | ***Room 116, S.R. Collins Bldg.***
Class Meeting Days & Times: | **Tuesday and Thursday, 9:30 a.m. – 10:50 a.m.**
Catalog Description: | An Introduction to finite element analysis as a modern computational tool to solve boundary value problems. Applications will be in structural mechanics, fluid flow, and heat transfer. Design and computer projects included.

Prerequisites: | CVEG2063 – Mechanics of Materials.
Prerequisite or Taking Concurrently: MCEG3013 – Heat Transfer.

Required Text: | Finite Element Modeling and Simulation with ANSYS Workbench, 1st Edition, by Xiaolin Chen and Yijun Liu, CRC Press, Taylor & Francis Group, New York, 2015.

Recommended Text/Readings: | Finite Element Simulations with ANSYS Workbench 14, Theory, Applications, Case Studies, by H. Lee, Schroff Development Corporation Publications, 2012.
Finite Element Analysis - Theory and Application with ANSYS, Third Edition, by Saeed Moaveni, Pearson Education, Inc., Upper Saddle River, NJ, 2008.

Access to Learning Resources: | PVAMU Library:
phone: (936) 261-1500;
web: http://www.tamu.edu/pvamu/library/
University Bookstore:
phone: (936) 261-1990;
web: https://www.bkstr.com/Home/10001-10734-1?demoKey=d

Course Goals or Overview:

Teach the students to learn the fundamental concepts of finite element modeling and to use a general-purpose finite element computer tool to solve engineering problems. The students will learn to simulate and solve a variety of problems in structure analysis, heat transfer, fluid flow, mechanical vibration, and design optimization.

Course Outcomes/Objectives

At the end of this course, the student will have knowledge of theoretical aspects of finite element analysis and practical aspects of using ANSYS Workbench Computer Tool to solve problems in structure analysis, heat transfer, fluid flow, mechanical vibration, and design optimization.

Course Outcomes

1. To teach students the fundamental concepts of finite element analysis and the formulation of one, and two-dimensional elements. (applicable to MCEG Obj. 1, 4, 5)

Anticipated Outcomes:

1.1 Students will be able to derive and solve equations with the basic steps and formulation in the finite element method. (relevant to ABET Criterion 3- a, e.)

1.2 Students will formulate and solve one-dimensional elements used in engineering problems. (relevant to ABET criterion 3- a, e.)

1.3 Students will formulate and solve two-dimensional elements used in engineering problems. (relevant to ABET criterion 3- a, e.)

2. To teach students the applications of finite element tool to solve engineering problems using ANSYS Workbench in solid mechanics, heat transfer, fluid mechanics, mechanical vibration, and design optimization. (applicable to MCEG Obj. 1, 4, 5)

Anticipated Outcomes:

2.1 Students will learn and apply ANSYS Workbench to solve structural stress and deflection problems: bar, trusses, beams and frames, wrench, fountain, vase, and stand. (relevant to ABET criterion 3- k)

2.2 Students will learn and apply ANSYS Workbench to solve structural vibration problem: acoustic guitar. (relevant to ABET criterion 3- k)

2.3 Students will learn and apply ANSYS Workbench to solve heat transfer problem: heat sink. (relevant to ABET criterion 3- k)

2.4 Students will learn and apply ANSYS Workbench to solve fluid flow problem: aerodynamic performance of vehicle. (relevant to ABET criterion 3- k)

2.5 Students will learn and apply ANSYS Workbench to solve design optimization problem: weight reduction of structure. (relevant to ABET criterion 3- k)

3. To have students experience engineering design processes utilizing a modern finite element computer tool. (applicable to MCEG Obj. 1, 2, 3, 4)

Anticipated Outcomes:

3.1 Students will be able to understand a problem statement, conduct information research, produce engineering drawings, identify critical issues, collect and calculate required parameters, create a finite element model on computer, perform analysis, interpolate finite element analysis results, make conclusions, discuss results and suggest options. (relevant to ABET criterion 3- a, c, e, f, i, k)

Course Requirements & Evaluation Methods

This course will utilize the following instruments to determine student grades and proficiency of the learning outcomes for the course.

Exams – written and computer tests designed to measure knowledge of presented course material
Exercises – written and computer assignments designed to supplement and reinforce course material
Projects – to measure design and analysis ability to apply presented course material
Class Participation – daily attendance and participation in class discussions are required.

Grading Matrix

Problem Solving Assignments	10%
Computer Assignments	15%
Written Test #1	15%
Written Test #2	15%
Design Project	15%
Computer Test #1	15%
Computer Test #2	15%
Attendance bonus	

Grading Scale: A: 90-100, B: 80-89, C: 70-79, D: 60-69, F: 0-59.

Course Procedures

Submission of Assignments:
Written homework assignments are submitted in the beginning of the class on the due dates; computer assignments are submitted electronically on the due dates and time.
Formatting Documents:
Microsoft Word is the standard word processing tool used at PVAMU.
Exam Policy
Exams should be taken as scheduled. No makeup examinations will be allowed except under documented emergencies (See Student Handbook).

MCEG 4093 Finite Element Analysis & Design
FALL 2016 SEMESTER SCHEDULE

Date	Topics	Assignments (Except for Design Project, all other assignments due in a week from the assigned date)
08/23	Introduction, Matrix Algebra, and Matlab	Handout assignments
08/25	Finite Element Concepts, Spring Element	
08/30	Finite Element Formulation – Spring, Bar	Chapter 1: problems 4, 6, 7
09/01	Finite Element Formulation - Trusses	
09/06	Summary of Spring, Bar and Truss problems	
09/08	Finite Element Formulation - Trusses	Chapter 2: problems 1, 2, & 3
09/13	Written Test #1	
09/15	Finite Element Formulation – Beams and Frames	
09/20	Finite Element Formulation – Beams and Frames	Chapter 3: problems 2 & 3
09/22	Introduction to ANSYS Workbench	
09/27	ANSYS Workbench – Trusses	2.6 Case Study
09/29	ANSYS Workbench – Framing System	3.6 Case Study
10/04	ANSYS Workbench – Wrench	4.5 Case Study
10/06	Modeling and Solution Techniques	
10/11	ANSYS Workbench – Rotating Fountain	5.8 Case Study
10/13	Written Test #2	
10/18	ANSYS Workbench – Heat Transfer Analysis	9.4 Case Study
10/20	ANSYS Workbench – Aerodynamics of Car	10.4 Case Study
10/25	ANSYS Workbench – Vase	6.5 Case Study
10/27	Design Project Using Finite Element Tool	Design Project
11/01	Computer Test #1	
11/03	ANSYS Workbench – Stand Assembly	7.5 Case Study
11/08	ANSYS Workbench – Guitar Vibration Modes	8.7 Case Study
11/10	ANSYS Workbench – Failure Analsys	12.5 Case Study
11/15	Project Presentation	
11/17	Project Presentation	
11/22	Computer Test #2	
11/29	Finite Element Applications in Industry	

University Rules and Procedures

Disability statement (See Student Handbook):
Students with disabilities, including learning disabilities, who wish to request accommodations in class should register with the Services for Students with Disabilities (SSD) early in the semester so that appropriate arrangements may be made. In accordance with federal laws, a student requesting special accommodations must provide documentation of their disability to the SSD coordinator.

Academic misconduct (See Student Handbook):
You are expected to practice academic honesty in every aspect of this course and all other courses. Make sure you are familiar with your Student Handbook, especially the section on academic misconduct. Students who engage in academic misconduct are subject to university disciplinary procedures.

Forms of academic dishonesty:

1. Cheating: deception in which a student misrepresents that he/she has mastered information on an academic exercise that he/she has not mastered; giving or receiving aid unauthorized by the instructor on assignments or examinations.

2. Academic misconduct: tampering with grades or taking part in obtaining or distributing any part of a scheduled test.

3. Fabrication: use of invented information or falsified research.

4. Plagiarism: unacknowledged quotation and/or paraphrase of someone else's words, ideas, or data as one's own in work submitted for credit. Failure to identify information or essays from the Internet and submitting them as one's own work also constitutes plagiarism.

Nonacademic misconduct (See Student Handbook)
The university respects the rights of instructors to teach and students to learn. Maintenance of these rights requires campus conditions that do not impede their exercise. Campus behavior that interferes with either (1) the instructor's ability to conduct the class, (2) the inability of other students to profit from the instructional program, or (3) campus behavior that interferes with the rights of others will not be tolerated. An individual engaging in such disruptive behavior may be subject to disciplinary action. Such incidents will be adjudicated by the Dean of Students under nonacademic procedures.

Sexual misconduct (See Student Handbook):
Sexual harassment of students and employers at Prairie View A&M University is unacceptable and will not be tolerated. Any member of the university community violating this policy will be subject to disciplinary action.

Attendance Policy:
Prairie View A&M University requires regular class attendance. Excessive absences will result in lowered grades. Excessive absenteeism, whether excused or unexcused, may result in a student's course grade being reduced or in assignment of a grade of "F". Absences are accumulated beginning with the first day of class.

Student Academic Appeals Process
Authority and responsibility for assigning grades to students rests with the faculty. However, in those instances where students believe that miscommunication, errors, or unfairness of any kind may have adversely affected the instructor's assessment of their academic performance, the student has a right to appeal by the procedure listed in the Undergraduate Catalog and by doing so within thirty days of receiving the grade or experiencing any other problematic academic event that prompted the complaint.