Syllabus for ME135-01: Finite Element Analysis

Spring 2020
Instructor: Yanbao Ma

Designation: Finite Element Analysis
Catalog Description: Introduce the basic fundamentals of the finite element methods. Beginning with simple one-dimensional problem, continuing to two- and three-dimensional elements, and ending with some applications in heat transfer, solid mechanics and fluid mechanics. Covers modeling, mathematical formulation, and computer implementation.


Course Objectives/Student Learning Outcomes:
- Understand the general steps of finite element methods.
- Understand the basic finite element formulation techniques.
- Be able to derive equations in finite element methods for 1D, 2D and 3D problems.
- Be able to formulate and solve basic problems in heat transfer, solid mechanics and fluid mechanics.
- Be able to write computer program based on finite element methods.
- Be able to use Comsol, a commercial software, to solve basic engineering problems in heat transfer, solid mechanics and fluid mechanics.

Program Learning Outcomes:

Prerequisites by Topic: Math 023 & Math 024 (or equivalent)

Course Policies:
Academic Dishonesty Statement:
- Each student in this course is expected to abide by the University of California, Merced's Academic Honesty Policy. Any work submitted by a student in this course for academic credit will be the student's own work.
- You are encouraged to study together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an e mail, an e mail attachment file, a diskette, or a hard copy. Should copying occur, both the student who copied work from another student and the student who gave material to be copied will both automatically receive a zero for the assignment. Penalty for violation of this Policy can also be extended to include failure of the course and University disciplinary action.
- During examinations, you must do your own work. Talking or discussion is not permitted during the examinations, nor may you compare papers, copy from others, or collaborate in any way. Any collaborative behavior during the examinations will result in failure of the exam, and may lead to failure of the course and University disciplinary action.

Disability Statement: Accommodations for Students with Disabilities: The University of California Merced is committed to ensuring equal academic opportunities and inclusion for students with disabilities based on the principles of independent living, accessible universal design and diversity. I am available to discuss appropriate academic accommodations that may be required for student with disabilities. Requests for academic accommodations are to be made during the first three weeks of the semester, except for unusual circumstances. Students are encouraged to register
with Disability Services Center to verify their eligibility for appropriate accommodations.

**Topics:**
1. Introduction to finite element methods.
2. The method of weighted residuals and Galerkin approximations.
3. FEM in one dimension.
4. The 2-D triangular element.
5. The 2-D quadrilateral element.
6. Isoparametric 2-D elements.
7. The 3-D element.
8. Finite elements in solid mechanics.
9. Application to inviscid flows.
10. Application to viscous fluid mechanics

**Class/laboratory Schedule:**
LECT T&TH 4:30-5:45pm in SSB 130

**Midterm/Final Exam Schedule:**
Midterm exam: 2:55-4:25PM, March 10, 2020
Final: 8:00-11:00am, May 12, 2020

**Course Calendar:**

**Professional Component:**

**Assessment/Grading Policy:**
Lab/Projects/Homework 25%
In-class Quiz 15%
Mid-term exam 30%
Final exam 30%

**Coordinator:**

**Contact Information:**
Office Hours: Wednesday: 10:00-noon in SRE 357