SYLLABUS

ME 4230 FINITE ELEMENT ANALYSIS

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ME 4230 Schedule
Class Nbr. 93641
S. F. Felszeghy — Fall 2017

Finite Element Analysis

Text: *A First Course in the Finite Element Method*, Daryl L. Logan, Sixth Ed., Cengage, 2017.

Week	Date	Topics	Problems
1	Aug. 22	Chpt. 1, Tapered Bar Problem	1.7, 1.8, 1.11, 1.13
	Aug. 24	Chpt. 2	2.1, 2.2
2	Aug. 29	Chpt. 2	2.4, 2.15
	Aug. 31	Chpt. 2, App. A	2.18 (b), (c), 2.20, 2.22
3	Sept. 5	App. A	
	Sept. 7	Chpt. 3, App. B	3.1, 3.9, 3.12
4	Sept. 12	Chpt. 3, Mathcad	3.15 (b), (d), 3.22
	Sept. 14	Chpt. 3	3.28, 3.32, 3.43
5	Sept. 19	Chpt. 3	3.50, 3.56
	Sept. 21	Patran/Nastran Problem 3.22	
6	Sept. 26	Patran/Nastran Tapered Bar	
	Sept. 28	Midterm	
7	Oct. 3	Chpt. 4	4.3, 4.7
	Oct. 5	Chpt. 4	4.10, 4.23
8	Oct. 10	Chpts. 4, 5	4.26, 4.43
	Oct. 12	Chpt. 5	5.2, 5.3, 5.5
9	Oct. 17	Chpt. 5	5.31, 5.35
	Oct. 19	Chpt. 5	5.51, 5.52

10	Oct. 24	Chpts. 5, 6	
	Oct. 26	Chpt. 6	6.1, 6.3 (a), (b)
11	Oct. 31	Chpt. 6	6.11, 6.13
	Nov. 2	Chpt. 6, 7	6.14 (a), (c)
12	Nov. 7	Chpt. 7	7.1, 7.2
	Nov. 9	Midterm	
13	Nov. 14	Chpt. 7	7.15, 7.26
	Nov. 16	Chpt. 13	13.1, 13.4
14	Nov. 21	Chpt. 13	13.20, 13.21
15	Nov. 28	Chpt. 13	
	Nov. 30	Patran/Nastran	

FINAL EXAM: Tuesday, Dec. 5, 3:40 p.m. - 5:40 p.m.

CONTACT INFORMATION

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Office Hours: Library (South) - Palmer Wing 2097, TuTh 3:15 - 4:00 p.m.

COURSE DESCRIPTION AND PREREQUISITES

Prerequisites: CE/ME 2120 (Matrix Algebra for Engineers), ME 2800 (Numerical Methods for Engineers), MATH 2150 (Differential Equations), Corequisites: ME 3060 (Heat Transfer I), ME 3230 (Machine Design I). Derivation of element stiffness matrices for spring, bar, beam, and constant-strain triangle elements, from energy principles. Application to trusses and frames. Steady-state heat transfer. Use of finite element method software.

IMPORTANT message from ME Dept. Chair: Beginning in Fall 2018, **all** ME courses will require a C or better grade for all prerequisites. This is a new requirement for some ME courses (others already require a C or better as indicated in the 2017-18 Catalog). For courses where this is a new requirement, this requirement will be enforced for prerequisites that are taken during Fall 2017 and after.

STUDENT LEARNING OUTCOMES

- Ability to carry out the conceptual and computational steps followed in the displacement, or stiffness, approach, within the finite element method (FEM), to model bodies and simulate deformation processes.

- Ability to carry out analogous steps for steady-state heat transfer.

- Ability to derive element stiffness matrices for linearly elastic spring, bar, beam, and constant-strain triangle elements, from the principle of stationary potential energy.

- Ability to assemble element stiffness matrices to represent three-dimensional trusses, two-dimensional frames, and plates.

- Ability to formulate loads and boundary conditions for truss and frame structures, and plane-strain and plane-stress problems, and incorporate them into the governing force-displacement matrix equations.

- Ability to solve the governing force-displacement matrix equations, by hand calculations, or with mathematical software, or commercial FEM software.

- Ability to extract element stress information.

- Awareness of the complexities and limitations of the finite element method.

- Ability to solve steady-state heat transfer problems with commercial FEM software.

TOPICAL OUTLINE OF THE COURSE

- History, applications, advantages, and limitations of FEM. The analytical steps of FEM. Computer Programs for FEM.
- Introduction to the Stiffness (Displacement) Method
- Development of Truss Equations
- Development of Beam Equations
- Development of Frame Equations
- Two-Dimensional Elements
- Modeling Guidelines Using the Constant-Strain Triangle Element as an Example
- Steady-State Heat Transfer

REQUIREMENTS

The course will be taught as a classroom-based lecture course with the exception of a few class meetings that will be held in a computer lab. There will be two midterm exams and a final exam.

The lectures will serve as the primary source of information for learning the underlying theory of the finite element method. You are expected also to read and study the textbook chapter sections assigned and listed in this syllabus. Because the new edition of the textbook is very expensive, it is acceptable if you buy an older used edition of the textbook. For this reason, pdf copies of the assigned homework problems from the new sixth edition of the textbook will be posted on Moodle. Note that problems in the sixth edition differ sometimes from the problems in the older editions.

You are expected to turn in to the instructor the solutions to the homework problems at the second class meeting following the date, shown on the syllabus, when the problems were assigned. This rule may be waived when the homework problems become difficult or lengthy.

GRADING POLICY STATEMENT

This grading policy statement explains how your letter grade will be determined at the conclusion of this course.

At the conclusion of this course a numerical grade will be computed for you first. This grade will be calculated from the following formula:

$$\begin{aligned}\text{Course grade} = \; & 20\% \times (\text{First Midterm Grade in \%}) \\ & + 20\% \times (\text{Second Midterm Grade in \%}) \\ & + 20\% \times (\text{Homework Grade in \%}) \\ & + 40\% \times (\text{Final Exam Grade in \%}).\end{aligned}$$

The course grades for the entire class will then be plotted on a scale from 0 to 100%. Almost always, the student who earns the highest numerical grade will get an A. The range of the course grades will determine the lowest letter grade. For example, if the range of the course grades is large, then the student who earns the lowest numerical grade may receive a letter grade lower than a C in a senior-level course such as ME 4230. Once the highest and lowest letter grades have been established, the letter grade intervals for the rest of the class will be determined, including the plus and minus subintervals. The length of these letter grade intervals is usually about 15%, and the length of the subintervals is about 5%.

It should be understood that a letter grade is based primarily on the demonstrated level of mastery of the course material, and, secondarily, on the degree of participation in class. Each student's performance will be evaluated relative to the performance of the entire class and similar classes taught by the instructor before, and relative to the level of competency expected by engineering employers and their customers.

CSULA ACADEMIC HONESTY POLICY

http://www.calstatela.edu/sites/default/files/groups/Judicial%20Affairs/Docs/academic_honesty.pdf

AMERICANS WITH DISABILITIES ACT (ADA) STATEMENT

Reasonable accommodation will be provided to any student who is registered with the Office of Students with Disabilities and requests needed accommodation.