

EML4507: Finite Element Analysis and Design

Syllabus – Spring 2018 -- Section 3258

MWF 8th period (3:00 –3:50 PM) MAE-B 211

(Modifications to this syllabus may be required during the semester. Changes will be posted on Canvas.)

Catalog information:

EML 4507 Finite Element Analysis and Design

Credits: 3; Prereq: EGM 3344, EGM 3520 and MAP 2302 with minimum grades of C.
Stress-strain analysis and design of machine elements and finite element analysis

Instructor [Professor B.V. Sankar](#), Department of Mechanical and Aerospace Engineering,

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Class time and location: MWF 8th period (3 -3:50 PM) MAE-B 211

Instructor Office hours: TR 1-3 PM or by appointment

Teaching Assistant: Stephanie Kalen kalensr@ufl.edu **MW 1-2 pm, F 10-11 am** (NEB 109)

Teaching Assistant for ABAQUS: Ms. Ting Dong dting0603@ufl.edu Office hours (TBA),
Recitations: Tuesdays 5th period (as needed) (Place: TBA)

Text book: [Introduction to Finite Element Analysis and Design by Nam-Ho Kim and Bhavani V. Sankar, John Wiley & Sons, Inc., 2009.](#)

Finite Element Software: Some homework will be carried out using commercial finite element software Abaqus. Students are expected to download and install the software on their personal computer. The software can be downloaded from <https://academy.3ds.com/en/software/abaqus-student-edition>

Course Objectives: The objective of this course is to teach how to design, analyze and optimize structural components of machine systems using finite element method. The course exposes students to analytical and numerical methods for computing stresses and strains in structures, use of finite element software for static structural analysis and the application of design and failure criteria to ensure that mechanical components can carry the design load without failure. Another important area of the course is to make the students recognize the importance of self-education and life learning. The main topics covered in the course are outlined below.

1. Mathematical Preliminaries
2. Stress-Strain Analysis- Design Criteria
3. Uniaxial bar and Truss Finite Element
4. Finite Element Analysis of Beams and Plane Frames
5. Finite Elements for Heat Transfer Problems
6. Finite elements for plane and 3D solids
7. Finite Element Analysis Procedures and Modeling
8. Introduction to Design Optimization

COURSE SCHEDULE

Lecture	Date	Day	Chapter	Topics	HW/Quiz/Exam
1	8-Jan	MON		Introduction	
2	10-Jan	WED	0	Mathematical preliminaries	
3	12-Jan	FRI	0	Mathematical preliminaries	
	15-Jan	MON	0	Marti Luther King Day	Holiday
4	17-Jan	WED	1	Stress-Strain Analysis	HW01
5	19-Jan	FRI	1	Stress-Strain Analysis	
6	22-Jan	MON	1	Stress-Strain Analysis	QUIZ 1
7	24-Jan	WED		<i>Tutorial1: FEA using Abaqus CAE</i>	HW02
8	26-Jan	FRI		<i>Tutorial2: FEA using Abaqus input file</i>	
9	29-Jan	MON	1	Stress-Strain Analysis	
10	31-Jan	WED	1	Stress-Strain Analysis	HW03
11	2-Feb	FRI	2	Uniaxial Bar and Truss Elements	
12	5-Feb	MON	2	Uniaxial Bar and Truss Elements	QUIZ 2
13	7-Feb	WED	2	Uniaxial Bar and Truss Elements	HW04
14	9-Feb	FRI	2	Uniaxial Bar and Truss Elements	
15	12-Feb	MON	4	Exam 1	Exam 1
16	14-Feb	WED	4	Beam Finite Element	HW05
17	16-Feb	FRI	4	Beam Finite Element	
18	19-Feb	MON		<i>Tutorial 3: FEA using beam elements</i>	
19	21-Feb	WED	4	Beam Finite Element	QUIZ 3, HW06
20	23-Feb	FRI	4	Beam Finite Element	
21	26-Feb	MON		Beam Finite Element	
22	28-Feb	WED	6	Plane Solid elements	HW07
23	2-Mar	FRI	6	Plane Solid elements	
	5-Mar	MON		Spring Break	
	7-Mar	WED		Spring Break	
	9-Mar	FRI		Spring Break	
24	12-Mar	MON	6	Plane Solid elements	
25	14-Mar	WED	6	Plane Solid elements	HW08
26	16-Mar	FRI	6	Exam 2	Exam 2

27	19-Mar	MON		<i>Tutorial 4: FEA using solid elements</i>	
28	21-Mar	WED	6	Isoparametric Elements	HW09
29	23-Mar	FRI	6	Isoparametric Elements	Quiz 4
30	26-Mar	MON		<i>Tutorial 5: FEA with CAD model</i>	
31	28-Mar	WED	6	Isoparametric Elements	HW10
32	30-Mar	FRI	6	Isoparametric Elements	
33	2-Apr	MON	5	1-D Heat Conduction	
34	4-Apr	WED	5	1-D Heat Conduction	HW11
35	6-Apr	FRI	5	1-D Heat Conduction	QUIZ 5
36	9-Apr	MON	7	Issues in FE Modeling	
37	11-Apr	WED	7	Issues in FE Modeling	HW12
38	13-Apr	FRI		<i>Tutorial 6: Convergence and Accuracy</i>	
39	16-Apr	MON	8	Structural Design and Optimization	
40	18-Apr	WED	8	Structural Design and Optimization	QUIZ 6, HW13
41	20-Apr	FRI	8	Structural Design and Optimization	
42	23-Apr	MON		Exam 3	
43	25-Apr	WED		Review	HW14
	2-May	WED		Final Exam (Comprehensive)	3-5 PM

Course Assignment

Homework: Homework problems are due at 11:59 PM on most **Wednesdays**. Late homework will not be accepted, but two worst home-works will be dropped.

Quizzes: There will be six quizzes. Two worst quizzes will be dropped. No Makeup quiz will be given.

Examinations: There will be three one-hour in-class exams. One worst exam will be dropped. Final exam will be comprehensive.

Students are allowed to bring one hand-written 8½ × 11 inch formula sheet written on both sides for quizzes and exams.

Projects: There will be several projects. These are analysis and design problem involving the use of finite element software.

Assignment	Percentage of Final Grade
HWS (~12)	10%
ABAQUS Projects (~4)	20%
Quizzes (4)	20%
In-term Exams (2)	30%
Final Exam	20%

TOTAL	100%
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Grading Policy

Percentage	Grade	Grade Points
93.4 - 100	A	4.00
90.0 - 93.3	A-	3.67
86.7 - 89.9	B+	3.33
83.4 - 86.6	B	3.00
80.0 - 83.3	B-	2.67
76.7 - 79.9	C+	2.33
73.4 - 76.6	C	2.00
70.0 - 73.3	C-	1.67
66.7 - 69.9	D+	1.33
63.4 - 66.6	D	1.00
60.0 - 63.3	D-	0.67
0 - 59.9	E	0.00

Re-grading: Regrading requests must be submitted along with the graded exam (original) in writing within 48 hours after quiz/exam is returned.

Academic honesty: All students admitted to the University of Florida have signed a statement of academic honesty committing themselves to be honest in all academic work and understanding that failure to comply with this commitment will result in disciplinary action. This statement is reminder to uphold your obligation as a student at the University of Florida and to be honest in all work submitted and exams taken in this class and all others.

All honor code violations will be reported to appropriate university authorities.

Any misconduct in exams will lead to an E grade for the course. Misconduct in quizzes and HWs will result in reduction of grade by a point.

Attendance Policy: Students are expected to attend all classes. They will be responsible for any announcement made in the class regarding assignments, quizzes and exams.

Make-Up Exam Policy

Note: No make-up quiz will be given

Attendance at the exams is required, unless otherwise stated explicitly in advance.

Unexcused absences will be reported as a failure.

Acceptable reasons for absence: Personal or family illness, death of an immediate family member, or other situations of comparable gravity

Documentation must be presented prior to final determination. Examples include but are not limited to

(i) A physician's note, which documents an illness and indicates the severity of the illness that would have prohibited taking the examination

(ii) An obituary, which documents the death of a close family member and their relationship to the student

Note: No make-up quiz will be given

Accommodations for students with disabilities

"Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation."