

EML4507: Finite Element Analysis and Design

Syllabus – Spring 2020 – Class Number 13886

MWF 4th period (10:40 – 11:30 AM) TUR L005

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 4th period (10:40-11:30 AM) TUR L005

Instructor Office hours: MWF 1 PM -3 PM, NEB 137

Teaching Assistants:

Mr. Yang Li yangli1991@ufl.edu – NEB 109

Mr. Fei Shuang shuangfei@ufl.edu – NEB 109

Mr. David Damiani daviddamiani@ufl.edu – NEB 109

Text book: *Introduction to Finite Element Analysis and Design* by Nam H. Kim, Bhavani V. Sankar and Ashok V. Kumar, Second Edition, John Wiley & Sons, Ltd., 2018.

Please note that this course will be participating in the UF All Access program. Login at the following website and Opt-In to gain access to your required course materials –

<https://www.bsd.ufl.edu/G1CO/IPay1f/start.aspx?TASK=INCLUDED> – This option will provide you with digital content that is the best value in the marketplace. Materials will be available approximately 1 week prior to the first day of class.

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

COURSE SCHEDULE

Lecture	Date	Day	Chapter	Topics	HW/Quiz/Exam
1	6-Jan	MON		Introduction	
2	8-Jan	Wed	Appendix	Mathematical preliminaries	
3	10-Jan	Fri	Appendix	Mathematical preliminaries	
4	13-Jan	MON	1	Uniaxial Bar and Truss Elements	
5	15-Jan	Wed	1	Uniaxial Bar and Truss Elements	HW01
6	17-Jan	Fri		Uniaxial Bar and Truss Elements	
-	20-Jan	MON		Matin Luther King, Jr. Day	
7	22-Jan	Wed		<i>Tutorial1: FEA using Abaqus CAE</i>	HW02
8	24-Jan	Fri	1	<i>Tutorial2: FEA using Abaqus input file</i>	QUIZ 1
9	27-Jan	MON	1	Uniaxial Bar and Truss Elements	
10	29-Jan	Wed	3	Beam Finite Element	HW03
11	31-Jan	Fri	3	Beam Finite Element	
12	3-Feb	MON	3	Beam Finite Element	
13	5-Feb	Wed	3	Beam Finite Element	QUIZ 2, HW04
14	7-Feb	Fri	3	Beam Finite Element	
15	10-Feb	MON	3	Beam Finite Element	
-	12-Feb	Wed		Exam 1	Exam 1
16	14-Feb	Fri	3	<i>Tutorial 3: FEA using beam elements</i>	
17	17-Feb	MON	5	Review of Solid Mechanics	
18	19-Feb	Wed		Review of Solid Mechanics	HW05
19	21-Feb	Fri	5	Review of Solid Mechanics	
20	24-Feb	MON	5	Review of Solid Mechanics	
21	26-Feb	Wed	6	Plane Solid elements	Quiz 3, HW06
22	28-Feb	Fri	6	Plane Solid elements	
-	2-Mar	MON		SPRING BREAK	
-	4-Mar	Wed		SPRING BREAK	
-	6-Mar	Fri		SPRING BREAK	
23	9-Mar	MON	6	Plane Solid elements	

24	11-Mar	Wed	6	Plane Solid elements	HW07
25	13-Mar	Fri	6	Plane Solid elements	
26	16-Mar	MON	6	<i>Tutorial 4: FEA using solid elements</i>	
27	18-Mar	Wed	7	Isoparametric Elements	Quiz 4, HW08
28	20-Mar	Fri	7	Isoparametric Elements	
29	23-Mar	MON	7	Isoparametric Elements	
	25-Mar	Wed		Exam 2	Exam 2
30	27-Mar	Fri	9	<i>Tutorial 5: FEA with CAD model</i>	
31	30-Mar	MON	4	1-D Heat Conduction	
32	1-Apr	Wed	4	1-D Heat Conduction	HW09
33	3-Apr	Fri	4	1-D Heat Conduction	
34	6-Apr	MON	9	Issues in FE Modeling	
35	8-Apr	Wed	9	Issues in FE Modeling	QUIZ 5, HW10
36	10-Apr	Fri	9	Issues in FE Modeling	
37	13-Apr	MON	9	<i>Tutorial 6: Convergence and Accuracy</i>	
38	15-Apr	Wed	10	Structural Design and Optimization	HW11
39	17-Apr	Fri	10	Structural Design and Optimization	
40	20-Apr	MON	10	Structural Design and Optimization	
41	22-Apr	Wed		Review	HW12

Course Assignment

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

Quizzes: There will be five quizzes. One quiz with the lowest score will be dropped. No makeup quiz will be given.

Examinations: There will be two one-hour in-class exams. 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 four projects. These are analysis and design problem involving the use of finite element software ABAQUS.

Assignment	Percentage of Final Grade
HWS (~10)	10%
ABAQUS Projects (4)	20%
Quizzes (4)	20%

In-term Exams (2)	30%
Final Exam	20%
TOTAL	100%

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 using a standard form (will be provided) 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."