"Find the gift God gave you. Sharpen, hone, and train it. And, then go use it. Go!"
-Donald P. Shiley '51

Course Instructor: Kenneth E. Lulay, Ph.D., P.E.
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Course Purpose: This course is the middle of three required courses in mechanical engineering with a strong focus on stress analysis (the other courses being Strength of Materials and Machine Design). Stress analysis is a critical aspect in mechanical engineering in that it provides the engineer a way of estimating the expected life and performance of a loaded part. This course is intended to help students develop a strong sense of what stress and strain are and prepares students to use that knowledge in engineering applications.

Course Description: Course builds on the concepts learned in strength of materials and introduces finite element analysis (FEA). Topics include elasticity, 3-dimensional Hooke’s law, and failure theories. FEA is introduced mathematically beginning with springs, trusses, and beams. A commercial FEA software package is used to model plane stress and three-dimensional geometry. Individual projects are used to introduce three dimensional analysis.

Office Hours: Whenever I am free in my office and generally the following:
Monday: 11:30-noon, 1:00-2:00
Tuesday: 10:00-11:00
Wednesday: 2:00-3:00
Thursday: 10:00-11:30
Friday: none scheduled

Class Schedule: TR 12:55-2:20, 3 credits
Prerequisites: ME 222, EGR 322 with a grade of C- or better.

Learning Objectives
Students shall be able to:
- Demonstrate an understanding of the mathematical foundations of finite element analysis
- Demonstrate an understanding that stress and strain are fully three-dimensional phenomena with interactions between different coordinate directions and the application of 3D Mohr’s Circle and Hooke’s Law.
- Demonstrate ability to analyze the stresses and strains using commercial FEA software
- Apply FEA to solve engineering problems
- Demonstrate an understanding of the principles of true stress and strain, plane stress and strain, and properly apply failure theories.
Subject | Week
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Ch 1 and Appendix I - Intro and matrix algebra | 1
Theory of Elasticity (not in the textbook) | 2
Ch 2 – Intro to stiffness/displacement method | 2-3
Ch 3 – Trusses | 3-6
Stress analysis theories (not in the textbook) | 6-8
Ch 6 – Plane stress, plane strain | 8-9
Ch 7 – Modeling issues | 9-10
Ch 11 – Three-dimensional FEA | 10-13
Other applications of computer modeling | 14

Method of Determining Final Grade:
- Required office visits 5%
- Aspirational ethics and professional responsibility 5%
- Small individual final project 5%
- Team projects and near-weekly assignments 25%
- Examinations 60%

At the completion of the course, the total scores from the above distributions will be combined into a letter grade according to the following scale:

- Above 90% A range (A- to A)
- 80% to 90% B range (B- to B+)
- 70% to 80% C range (C- to C+)
- 60% to 70% D range (D- to D+)
- Less than 60% F

The performance criteria for each of these elements are described here:

**Performance Criteria for required office visits**
To develop good communication skills, each student is expected to visit with the instructor at least once every three weeks. If you cannot make scheduled office hours, please work with the instructor to find a viable alternative time. A linear scale will be used for assessment (full credit if you come at least once every three weeks, no credit if you fail to visit at all).

**Performance Criteria for aspirational ethics and professional responsibility**
Assignments will be given about three times during the semester regarding “aspirational ethics and professional responsibility of students”. Assessment will be based on completion of the assignments.

**Performance Criteria for final project**
Students will be required to use finite element method to analyze stress in a complex part and to interpret the results in essay form.

Above 90% - demonstrate near convincingly strong command of the subject
80% to 90% - demonstrate some good command of the subject
70% to 80% - demonstrate rudimentary command of the subject
60% to 70% - demonstrate some understanding of the subject
Less than 60% - failed to demonstrate understanding of the subject

ME304H – as part of their grade for the final project, honors students give a short presentation to the class expecting to have to “defend” their conclusions as if this were a presentation to a client or supervisor.

**Performance Criteria for Exam Problems**
Above 90% - demonstrate near flawless, convincingly strong command of the subject
80% to 90% - demonstrate some mistakes, good command of the subject
70% to 80% - demonstrate rudimentary command of the subject
60% to 70% - demonstrate some understanding of the subject
Less than 60% - failed to demonstrate understanding of the subject

**NOTE:** unclear methodology on exams, regardless of the answer may result in a significantly reduced grade, depending upon instructor’s judgment. So your work should always be clear.

**Performance Criteria for Weekly Assignments and team projects**
Grading will be based strictly on completeness and effective communication (such as following the standard homework format). “Correctness” will not be part of the grading; however, students are strongly encouraged to check the posted solutions to make sure they are solving problems correctly.

**Website:** Assignments will be posted on the course website, and solutions will be posted after the assignment is due. [http://faculty.up.edu/lulay/ME304](http://faculty.up.edu/lulay/ME304)

**Communication:** The number one consistent message we hear from employers is that they seek individuals with good communication skills. Listening and staying informed is a critical element of effective communication. Therefore, students are responsible for regularly checking and acting upon messages sent to their University e-mail. Each student is also expected to make office hour visits at least once every three weeks and to follow the standard homework format at all times. Attending and paying attention in class is part of communication.

**Solutions:** Homework is assigned to help you learn – therefore, don’t just “do the work”, understand it. Attending class and asking questions may or may not be sufficient to do well on exams (usually not). Real/deep learning will mainly occur by “getting your hands dirty” (doing the work). After each assignment has been submitted the solutions will be posted on the course web page. Students are HIGHLY encouraged to review all problems and to understand the correct methodology.

**Professional Responsibility:** Students are expected to practice professional behavior: always do your best – work through and understand 100% of the assigned work, do your own work and work on teams appropriately, no disruptive behaviors (such as “texting/surfing/etc.” and newspapers in class), and arrive on time (before class begins) and be ready to participate as soon as class begins. And of course…ask questions when needed!

**Policy on Exams:** I fully expect students to study together PRIOR to the exams, but once the exam starts, no “assistance” in any manner will be tolerated (you can always ask the instructor for clarifications). No makeup exams will be given. If you cannot attend an exam
for a legitimate reason, please contact the instructor to arrange to take the exam in advance. I am always willing to listen to student needs – but you need to communicate to me.

**Policy on late assignments** All assignments are due at the end of the day on the pre-specified due day. Assignments will not be accepted after that. This policy may be waived for extenuating circumstances. A two-day extension will be granted twice in the semester for each student – you must notify the instructor *via email* before class if you wish to receive an extension.

**University of Portland’s Code of Academic Integrity** Academic integrity is openness and honesty in all scholarly endeavors. The University of Portland is a scholarly community dedicated to the discovery, investigation, and dissemination of truth, and to the development of the whole person. Membership in this community is a privilege, requiring each person to practice academic integrity at its highest level, while expecting and promoting the same in others. Breaches of academic integrity will not be tolerated and will be addressed by the community with all due gravity. See University Bulletin for policy.

**Assessment Disclosure Statement** Student work products for this course may be used by the University for educational quality assurance purposes.

**Accessible Education Services (AES)** Students who experience a disability and require an accommodation to fully participate in this class, contact the Accessible Education Services office located in Buckley Center, Rm. 163 or call 503---943---8985. If you have an AES accommodation plan that includes academic accommodations that apply to this course, make an appointment to meet with the professor to discuss how your accommodation will be implemented. You are responsible for giving sufficient notice to your professor for timely implementation of your accommodation; therefore it is recommended you speak with your professor in the first week of the semester or as soon as your accommodation plan is activated. Also, meet with the professor if you have an AES Safety Plan and/or wish to discuss emergency medical information or special arrangements in case the building must be evacuated. Requests for an alternate location for exams and/or extended exam time should, when possible, be made two weeks in advance of an exam, and must be made at least one week in advance of an exam.

**Shepard Academic Resource Center (SARC)** The Learning Resource Center, located on the first floor of Buckley Center within SARC (BC 163), provides peer assistance tutoring for writing, math, speech and presentations, languages, business and economics, sciences and nursing. For any of these services please visit the website at: [https://www1.up.edu/learningcommons/index.html](https://www1.up.edu/learningcommons/index.html). For *Writing*, you will need to register as a user the first time you go to the website. If you cannot make any of the posted office hours, you can arrange an appointment by emailing *writing@up.edu*. For *Math*, math assistants are available on a walk-in basis. Please go to check the website listed above for a current schedule of hours’ math assistants are available. For *Speech and Presentations*, Speech assistants from the Communication Department are available by appointment only. Just send a request to: *speech@up.edu*. For *International Languages*, language assistance is available by appointment; go to the website listed above and send an email to the target language. For *Biology and Chemistry*, the Chemistry Department offers peer mentoring on a walk-in and appointment basis. The Biology Department offers peer mentoring on a walk-in and appointment basis. For *Business and Economics*. In collaboration with the Pamplin School of
Business, the Learning Commons now offers peer learning support in Economics and Business Law by appointment only. Go to the website listed above for appointment information.

**Learning Assistance Counselor.** Learning assistance counseling is also available in BC 163. The counselor teaches learning strategies and skills that enable students to become more successful in their studies and future professions. The counselor provides strategies to assist students with reading and comprehension, note-taking and study, time management, test-taking, and learning and remembering. Appointments can be made in the on-line scheduler available to all students in Moodle or during posted drop-in hours

**Mental Health Statement** As a college student, you may sometimes experience problems with your mental health that interfere with academic experiences and negatively impact daily life. If you or someone you know experiences mental health challenges at UP, please contact the University of Portland Health and Counseling Center in Orrico Hall (down the hill from Franz Hall and Mehling Hall) at [http://www.up.edu/healthcenter/](http://www.up.edu/healthcenter/) or at 503---943---7134. Their services are free and confidential, and if necessary they can provide same day appointments. Also know that the University of Portland Public Safety Department (503---943---4444) has personnel trained to respond sensitively to mental health emergencies at all hours. Remember that getting help is a smart and courageous thing to do – for yourself, for those you care about, and for those who care about you.

**Non-Violent Community Statement** University of Portland Faculty, Staff, and Students are committed to creating a community free of interpersonal violence, in which all members feel safe and respected. Each of us has a personal responsibility to reject violence or intimidation of any kind. Resources for those experiencing or wishing to report violence can be found on our [http://www.up.edu/cav](http://www.up.edu/cav).

**For courses with labs and/or projects, the suggested statement is as follows:**

No one is allowed to work in the shops without appropriate training from the shop technician and without instructor permission. If students require card access to a lab, they must receive training from a technician.

No food or beverages (including water bottles) are allowed in the computer classrooms, shop, or labs.

**For courses that require students to drive to off-campus meetings, plant tours, field work, or any university sponsored activity, the suggested statement is as follows:**

If you plan to drive to off-campus events as part of this course, you must read the University Vehicle and Transportation Policy for Students: [http://www.up.edu/showimage/show.aspx?file=21092](http://www.up.edu/showimage/show.aspx?file=21092). The policy requires drivers of private or University vehicles to attend a one-time safe driving course, offered by Public Safety, and to submit a trip itinerary to Public Safety prior to each off-campus trip. The itinerary form must be signed by the instructor.

**Academic Regulation Statement** Policies governing your coursework at the University of Portland can be found in the University Bulletin at [http://www.up.edu/provost/default.aspx?cid=9663&pid=1950](http://www.up.edu/provost/default.aspx?cid=9663&pid=1950)