GE 311 – Engineering Design Analysis

(Call No. 33211, Section D)

(MWF, 2:00 -- 2:50 p.m., Room 106B1 Engineering Hall

Instructor: Professor Henrique Reis
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Office Hours:

Mondays, Wednesdays, and Fridays from 8:00 to 9:00 a.m. (tentative), and by appointment.

Course Objectives:

1. Students will be introduced to the fundamentals of theory of elasticity, and how to obtain solutions for stress, strain, and displacement fields. Students will learn stress/strain in 2- and 3-dimensional solids, principal stresses, and stress concentrations.
2. Students will be introduced to the analysis of various engineering configurations, structural and mechanical components (i.e., pressure vessels) using analytical and numerical methods such as the Finite Element Method.
3. Students will be introduced to theories of failure, fracture, buckling, and the application of design criteria.

After completing the course, students will be able to:

1. Calculate stress/strain conditions in two- and three-dimensional solids, including principal stresses/strains, and stress concentrations.
2. Apply modern analytical and numerical solution techniques, including finite element method, for the analysis of structural and mechanical components; analyze engineering designs starting with their structural and mechanical components.
3. Design a balsa wool structure (and, by inference, a metal structure) to meet constraints of size and weight.

Prerequisite and concurrent registration:

If you have not completed and passed the prerequisite course, **GE 310**, you should see the Associate Head of the Department of Industrial and Enterprise Systems Engineering (Room 209, Transportation Building) to drop this course. If you are not enrolled in **GE 312**, you should sign up for the course immediately. If you are enrolled in **GE410**, you should also see the Associate Head of General Engineering to drop GE 410; GE 311 is a prerequisite to GE 410.

Required Texts:

1. "*Advanced Strength and Applied Stress Analysis,"* Richard G. Budinas, 2nd Edition, McGraw-Hill, New York, NY, 1999.

Other Reference Texts:

2. Advanced Strength and Applied Elasticity, 3rd ed., by Ugural, A.C., and Fenster, S.K., Prentice Hall PTR, NJ, 1994.
3. Theory of Elasticity, 3rd ed., by Timoshenko, S. and Goodier, J.N., McGraw-Hill, NY, 1970.

Grading:

Balsa Wood Project	15%
Finite Element Problem	15%
Homework, Attendance, and in-class pop quizzes	10%
Quiz (2), Closed Book, Closed Note, (Dates to be announced in advance)	35%
Final Exam, Closed Book & Closed Note, and Cumulative	25%
Class participation	up to 5 points

Grades will be assigned as follows:

[90 --- 100]..... A
[80 — 89]..... B
[70 --- 79]……C
[60 --- 69]……D
[--- 60]……F

On-time attendance:

On-time attendance at all class meetings is expected. Please be considerate of your class colleagues and avoid coming in late. Notes from missed lectures should be obtained from a colleague.

Daily work:

1. Ten-minute pop quizzes based on previous or prerequisite class work may be given on any day. Absences result in grades of zero for both homework and pop quizzes. Students are expected to bring calculators, pencils, paper, and erasers to each class meeting.
2. The reports for the balsa wood and finite element projects should be done on time. The reports should be typed and should contain all the detailed calculations used in the process.

Homework:

3. Homework deadlines will be given in class. Typically, homework will be due at the beginning of class one week after it is assigned.
4. Homework should be completed neatly and legibly on the front side (only) of green engineer's paper (8 ½" x 11" leafs of paper) and **stapled together in the upper left corner**, placing no more that one problem on a page. Your name, the date, and the assignment number should appear in the upper right corner of the page.
5. For each problem solved, present the problem statement with any associated drawings, a summary of assumptions, a solution presented in a logical and organized sequence, and the answers clearly identified.
6. Neatness and clarity of presentation are taken into account when grading homework problems. Sketches or free body diagrams must be presented when appropriate.
7. Copying solutions from other students, solution manuals, or homework files is unauthorized and may constitute grounds for disciplinary procedures.

Computer project:

One major computer project using the finite element code, ANSYS, is planned. A detailed assignment will be made later. Smaller assignments involving computers may be given as part of the weekly homework.

Balsa wood project:

A balsa wood project is planned. A detailed assignment will be made later.

Examinations:

Examinations are usually closed book and **may** be two hours long. The final exam will be comprehensive. Because of classroom capacity and large enrollment, the exams may be held in the evening in a larger room. Exams missed without an accepted written excuse are scored as a **zero**. Every effort should be made to notify the instructor of an absence from an exam prior to its occurrence.

Grading:

Grading follows the traditional scale. Borderline cases are evaluated individually, and course grades are raised solely at the instructor's discretion, using class participation, enthusiasm, and other subjective factors in that judgment.

Missed Work:

Work should be done on time. Late work may be penalized or not accepted. Various reasons for exceptions to the above policy are documented medical, bereavement, or religious reasons.

Other Matters:

- All work, including homework and projects, are to be the original and independent work of the student. All students are expected to be familiar with the ***CODE OF POLICIES AND REGULATIONS APPLYING TO ALL STUDENTS,*** especially as it relates to Academic Integrity. University Policies and Regulations related to examinations, academic dishonesty, and other matters that affect you will be observed.
- Active participation in class is expected in discussions and in cooperative learning groups that may take place in class.
- **No Cell Phones or Cameras allowed in the classroom.** Students are not allowed to used cell phones or cameras within the classroom.

IMPORTANT DATES

Exam I (Exam date may need to be rescheduled):	Friday, February 24, 2016
Exam II (Exam date may need to be rescheduled):	Friday, March 17, 2016
Finite Element Report Due:	Friday, April 7, 2016
Balsa Structure Due:	Monday, May 1, 2016
Balsa Wood Test:	Wednesday, May 3, 2016
FINAL EXAM SCHEDULE	**Monday, May 8, 2017 (7:00 – 10:00 p.m.)**

TENTATIVE CLASS SCHEDULE

Week	Topic	Reading (Chapter/Section)
January 16	Introduction, Basic concepts	1.0 to 1.6; Chapter 3
January 23	Stress and Strain Transformations and …	2.0 to 2.2
February 6	Principal stresses and strains, Strain Rosettes	2.0 to 2.2; 3.9; 8.3 to 8.4
February 13	Equilibrium, Constitutive, and Compatibility Eqs.	2.3 to 2.5
February 20	Plane Elasticity in Cartesian Coordinates, Airy Stress Function	4.1 to 4.2
February 27	Two-Dimensional Elasticity in Polar Coordinates Energy Techniques	9.4 (Read also 9.0 to 9.3) Chapter 6
March 06	Energy Techniques	Chapter 6
March 13	Finite Elements	Chapters 9 and 10
March 20	*SPRING BREAK (No Classes)*	
March 27	Strength Theories	7.0 to 7.3
April 3	Failure Theories, Fracture Mechanics	7.4
April 10	Fatigue	7.5
April 17	Plastic Behavior	7.7.1 to 7.7.4
April 24	Structural stability	7.6; 3.10
May 1	Balsa Project Discussion, Course Review	

Note: Parts of the syllabus may be subjected to change.