

SE 311

Engineering Design Analysis

Spring 2025

(Call No. 66927, Section D)

(MWF, 2:00 -- 2:50 p.m., Room 2100 Sidney Lu Mech. Eng Bldg.)

Instructor: Professor Henrique Reis
217 Transportation Bldg.
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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 wood 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 Chief Academic Advisor of the Department of Industrial and Enterprise Systems Engineering (1270C Digital Computer Laboratory) to drop this course. If you are not enrolled in **SE 311**, you should sign up for the course immediately. If you are enrolled in **GE410**, you should also see the Chief Academic Advisor to drop SE 410; SE 311 is a prerequisite to SE 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" leaf of paper) and **stapled together in the upper left corner**, placing no more than 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.

Advice To Help You Get a Better Grade – Take Notes by Hand:

Study after study has repeatedly confirmed that students that take notes by hand outperform students who take notes using a laptop or other electronic device. **Consequently, I highly recommend that you take notes by hand.**

Other Tips for Success

To do well in the course, please remember the following:

- Do your work frequently. If you let the work pile up, you may become overwhelmed.
- Consider using a word processor to save all your work so that you have an automatic back up of all your assignments. This will be useful in an unlikely event that your computer/served goes down and you are unable to submit your work.

- It is very important that you communicate throughout the course. Should you have difficulties with some work or are going to be away because of illness or a family emergency (or similar difficulties), please inform the instructor as soon as possible. This will keep the instructor from worrying about your whereabouts.
- When possible provide tips and suggestions to your peers in the class. As a learning community, we can help each other learn and grow. One way of doing this is by helping to address the questions that your peers pose. By engaging with each other, we will all learn better.

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.
- **Electronic Device Usage Policy - No Audio, Photographic, or Video Recording Allowed**
No electronic audio, photographic, or video recording of any class materials or conferences is allowed without my prior written permission. Any recording is a violation of the University Student Code and may subject you to discipline. There are at least two reasons for this: first, we want to provide an encouraging environment for student questions and discussion; and second, we want students and the instructor to have control over the use of their respective images and expressions.

IMPORTANT TENTATIVE DATES
(Some dates may be subjected to change)

Exam I (Exam date may need to be rescheduled):	Friday, February 28, 2025
Exam II (Exam date may need to be rescheduled):	Friday, March 21, 2025
Finite Element Report Due :	Monday, April 14, 2025
Balsa Structure Due:	Monday, May 05, 2025
Balsa Wood Test:	Wednesday, May 7, 2025

FINAL EXAM SCHEDULE **Monday, May 12, 2025 (7:00 – 10:00 p.m.)**

TENTATIVE CLASS SCHEDULE

Week	Topic	Reading (Chapter/Section)
January 20	Introduction, Basic concepts	1.0 to 1.6; Chapter 3
January 27	Stress and Strain Transformations and ...	2.0 to 2.2
February 03	Principal stresses and strains, Strain Rosettes	2.0 to 2.2; 3.9; 8.3 to 8.4
February 10	Equilibrium, Constitutive, and Compatibility Eqs.	2.3 to 2.5
February 17	Plane Elasticity in Cartesian Coordinates, Airy Stress Function	4.1 to 4.2
February 24	Two-Dimensional Elasticity in Polar Coordinates	9.4 (Read also 9.0 to 9.3)
March 03	Energy Techniques	Chapter 6
March 10	Finite Elements	Chapter 6
March 15	<i>SPRING BREAK (No Classes)</i>	
March 24	Strength Theories	7.0 to 7.3
March 31	Failure Theories, Fracture Mechanics	7.4
April 07	Fatigue	7.5
April 14	Plastic Behavior	7.7.1 to 7.7.4

April 21	Structural stability	7.6; 3.10
April 28	Balsa Project Discussion, Course Review	

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.

General Course Policies:**Request for special Accommodations**

If you require special accommodations, please contact the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak Street, Champaign, call 217.333.4603, or email disability@illinois.edu. Please note accommodations are not retroactive to the beginning of the semester, but begin the day you contact your professor with a current letter of accommodation from DRES.

Emergency Dean

"Help is only a phone call away." A university-wide Emergency Dean is always available to provide you with personal assistance in times of emergency, such as serious illnesses, hospitalizations, accidents, deaths or other major crises. Emergency Dean Service: 217-333-0050.

Statement Regarding Anti-Racism/Diversity & Inclusion

The Grainger College of Engineering is committed to the creation of an anti-racist, inclusive community that welcomes diversity along a number of dimensions, including, but not limited to, race, ethnicity and national origins, gender and gender identity, sexuality, class and religion. All students should be treated with respect, so that they can live and learn without marginalization and racism being instigated by other members of our community. Both overt racism and the micro-aggressions threaten inclusivity and hence, have no place at the University of Illinois.

The effectiveness of this course is dependent upon each of us to create a safe and encouraging learning environment that allows all students equitable opportunities and respect. All of us are expected to help establish and maintain an environment where you and your peers can contribute without fear of ridicule or intolerant or offensive language. If you witness or experience racism, discrimination, micro-aggressions, or other offensive behavior, I encourage you to bring this to my attention if you feel comfortable. You can also report these behaviors to the Office for Student Conflict Resolution (<http://www.conflictresolution.illinois.edu/>), or to the Bias Assessment and Response Team (BART) (<https://bart.illinois.edu/>). Based on your report, the staff will reach out to students to make sure they have the support they need to be healthy and safe.

Statement for Professional/Respectful Zoom Activities/Chats

It is imperative to creating a productive learning environment that we practice constructive discourse when in class. This entails respecting your fellow classmates, exhibiting a willingness to listen, and tolerating opposing points of view. Our discussions will center on the integrity of how our topics are being argued, not whether or not you necessarily agree with your classmate's topic or stance. If you argue aggressively, are rude, or are unproductively critical, you will be asked to leave and will be marked absent for that day.

Teaching Responses

Assignments are hand graded, thus, please allow 1-2 weeks for complete grading of these assessments. We will respond to e-mail messages and phone calls within 24 hours of receiving them Monday through Friday 9:00 to 5:00 p.m. central time. Saturdays and Sundays, we will continue to check email, but response time may take up to 48 hours. If you leave a message, please check your e-mail for a response. Email should always be the first communication approach.

Academic Integrity Statement

The University of Illinois at Urbana-Champaign Student Code should be considered as a part of this syllabus. Students should pay particular attention to article 1, part 4: Academic Integrity. Read the Code at the following URL: <http://studentcode.illinois.edu/>. Academic dishonesty may result in a failure grade. Every student is expected to review and abide by the Academic Integrity Policy <http://studentcode.illinois.edu/>. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt what constitutes plagiarism, cheating, or any other breach of any academic integrity.

Emergency Response

Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/bulding-emergency-action-plans/>.

Statement on Family Education Rights and Privacy Act (FERPA)

Any student who suppressed their directory information pursuant to Family Education Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of privacy of their attendance in this course. See <http://registrar\illinois.edu/academic-records/ferpa/> for more information on FERPA.

Statement on Accommodations — Enhanced Statement with Resources

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES, you may visit 1207 S. Oak St., Champaign, call 333-4603, email disability@illinois.edu or go to DRES website. If you are concerned you have a disability-related condition that is impacting your academic progress, there are academic screening appointments available on campus that can help diagnosis a previous undiagnosed disability by visiting DRES website and selecting “sign-Up for an Academic Screening” at the bottom of the page.

Statement on Sexual Misconduct and Reporting

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to University’s Title IX and Disability Office. In turn, any individual with Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options.

A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and maintain confidentiality can be found here: <http://wecare.illinois.edu/resources/students/#confidential>. Other information about resources is available here: <http://wecare.illinois.edu>.

Statement when Using the NET (Netiquette Statement):

In any social interactions, certain rules of etiquette are expected and contribute to more enjoyable and productive communications. The following are tips for interacting online via email or discussing board messages, adapted from guidelines originally compiled by Chuq Von Rospach and Gene Spafford (1995):

- Remember that the person receiving your message is someone like you, deserving courtesy and respect.
- Avoid typing all sentences or phrases in Caps Lock
- Be brief; succinct, thoughtful messages have the greatest effect.
- Your messages reflect your personality; take time to make sure that you are proud of their form and content.
- Use descriptive subject headings in your e-mails.
- Think about your audience and the relevance of your messages.
- Be careful when you use humor and sarcasm; absent the voice inflections and body language that aid face-to-face communication, Internet messages are easy to misinterpret.
- When making follow-up comments, summarize the parts of the message to which you are responding.
- Avoid repeating what has already been said.; needless repetition is ineffective communication.
- Cite appropriate references whenever using someone else’s ideas, thoughts, or words.

Statement Regarding Copyright

Material associate to this course, (i.e., SE311) has been developed solely for the students enrolled in this course. Use of this material by anyone not associated with SE311 course violates Copyright, and the person or persons may be subjected to the Ethics code of Conduct from the University of Illinois at Urbana-Champaign.

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