Strength of Materials
GEN310, Spring 2017, 4 Credits

Class meetings: Wednesdays 2:00 PM to 3:50 PM in Bergstrom 104
Final Exam Period: Tuesday May 9th 2:00 PM
Prerequisite Courses: GEN210
Required Background: Newton’s Laws, Vector Analysis, Engineering Mechanics-Statics, Calculus

Instructor: Scott Greene, PE, PhD, Lecturer in Engineering
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(Text preferred, but please state your name in your message!)

Office: Room 204 in 206 Charles
Office Hours: Wednesday 1:30PM to 4:30PM or appointment

Description: Introduction to Solid Mechanics: stress and strain in materials. Applications addressed include: Design and investigation of joints, beams, torsion members and columns; evaluation of shear, moment, slope and deflection of beams and combined stresses, and failure of materials.

Available at Carroll University Bookstore. Connect Access (ISBN 9780077625207) is required for this course and includes an eBook. Students have the option of obtaining the hard copy of the text (ISBN 9780073398235).

Copyright Year: 2015 Update 2016
Publisher: McGraw Hill Education

In addition to the selected text, readings and viewings from the Carroll library and online resources are required and will be posted in the LMS portal for this class.

The instructor maintains a private library of Engineering books which are available for student use during the semester. Students should contact the instructor to borrow a text or they will have one forced upon them.

The students are encouraged to use, find, and share resources legally available from the internet and Carroll University library, such as MITOpenCourseWare, that can help them learn the topics covered in the course. Please let the instructor what sources you found helpful so that they can be shared with the class and future classes.

Philosophy:
The overall goal of the course is for the students to gain abilities to (1) solve problems and (2) acquire technical knowledge. The course subject, Solid Mechanics and Strength of Materials, is the setting for the course and students will gain an understanding of the subject material as a consequence of developing problem solving and knowledge acquisition skills. Questioning, discussion, experimentation, and exploration are encouraged. Please read the course guidelines on the LMS which further outline the instructor’s philosophy.
Tentative Sequence of Topics:
- Review material from Engineering Statics:
  - Distributed loading
  - Moment of an area and centroid of an area
  - Second moment of an area or Moment of Inertia
- Stress and Strain in Axial Loading
- Torsion
- Bending
- Analysis of Beams and Shear and Bending Moment Diagrams
- Shearing in Beams and Thin-walled Members
- Transformations of Stress and Strain
- Principal Stress
- Deflection of Beams
- Columns
- Energy Methods

Course Objectives

Students will develop a working knowledge of the Mechanics of Materials, also known as Strength of Materials, or introductory Solid Mechanics. Upon successful completion of the course, students will have a basic understanding of the behavior of solid materials under static loading and methods to calculate strength, deformation, and deflection of structural members. Upon completing this course students should be prepared to undertake upper-level undergraduate courses in structural and mechanical design.

Student outcomes within the context of a major in Applied Physics and Engineering:
Students develop abilities to:

1. identify, formulate, and solve engineering problems (ABET 3.e)
2. independently acquire technical knowledge (ABET 3.i^1)
3. apply knowledge of mathematics, science, and engineering (ABET 3.a)
4. design and conduct experiments, as well as to analyze and interpret data (ABET 3.b)
5. communicate effectively (ABET 3.g)
6. use the techniques, skills, and modern engineering tools necessary for engineering practice (ABET 3.k)

Note that the reference to the ABET Student Outcomes Criterion 3 is for the benefit of students in the 3+2 program earning a second degree in Engineering from a ABET accredited institution such as the University of Wisconsin at Madison, Milwaukee, or Platteville

^1 “… an ability to engage in life-long learning”
Student Learning Outcomes:

After completing this course students will be able to:

1) Evaluate normal and shear stress, strain and deformations for well-defined problems.

2) Predict the expected magnitude and location of maximum stresses in structural members subjected to well-defined loadings (axial, torsion, bending).

3) Calculate the state of stress at a point in a loaded beam and calculate beam deflections.

4) Apply and explain fundamental mechanics of materials concepts including stress, strain, shear, bending, torsion, principal planes and principal stresses as well as terms such as Young’s Modulus, Poisson’s Ratio, Mohr’s Circles, and Yield Strength.

5) Prepare well documented problem solutions and utilize modern computational tools such as MATLAB, R, Python, and Inventor

Measures:
Every week both in-class “lab” assignments and homework assignments will be required. All assignments must be completed with a passing grade for students to pass the course. Homework will be due every Monday, Wednesday, and Friday starting the second week of class. Late homework will not count towards the course grade. In addition to homework and in-class assignments, there will be on-line quizzes and tests. The in-class final is composed of questions representative of the Solid Mechanics questions from typical Fundamentals of Engineering Exam standardized tests.

Grades:
At conclusion of the course, for a passing grade (D, C, or B) a student must demonstrate the ability to:

- Explain the principles, concepts, and common vocabulary of mechanics of materials;
- Independently and in teams complete and explain the solution of the assigned lab problems;
- Independently solve problems of the elementary level of difficulty in every assigned section of the text;
- Independently solve problems of a moderate level of difficulty in one or more assigned sections of the text. The quantity, consistency, and variety of solutions demonstrated distinguishes grades of B, C, and D.

At conclusion of the course, for a grade commensurate with mastery (AB or A) of strength of materials, a student must demonstrate the ability to:

- Independently solve and explain the approach to problems of a moderate level of difficulty in every assigned section of the text;
- Independently solve and explain the approach to problems of a challenging level of difficulty in more than one chapter of the text (excluding the introductory chapters). The quantity, consistency, and variety of solutions demonstrated distinguishes grades of A from AB.
Students demonstrate their abilities by (i) participating in class and by completing (ii) on-line homework prior to the due dates, (iii) in-class hand written assignments, (iv) take-home on-line chapter quizzes and tests, and (v) the comprehensive in-class final exam. Students will have the ability to check their readiness with chapter pre-tests before scheduling on-line final chapter tests. There is no a priori numerical grade scale for this course and the weighting of assignments and tests is at the discretion of the instructor. Students are welcome to contest their grades and will be given the chance demonstrate mastery of the course material by re-taking quizzes and tests or succeeding on the final.

Students must attend and participate in all course meetings (or complete remedies for all excused absences and have no unexcused absences) to receive a grade of B or better. Grades of A and AB are reserved for students that meet mastery criteria.

**Accommodation:** Any student who needs an accommodation based on the impact of a disability should contact the Office of Services for Students with Disabilities at 262-524-7335 in the Walter Young Center to coordinate reasonable accommodations. Please feel welcome to contact me privately to discuss specific needs.

**Student Obligations:**

- This course requires in-class participation. Attendance at every class meeting is expected. Students are accountable for all material covered at each class meeting including completion of the in-class assignments and coordination with their classmates. Students should inform the instructor prior to missing any class meetings and to propose a plan to remedy the impacts of their absence. If due to an emergency the student is not able to contact the instructor prior to class, the student should contact the instructor as soon as is reasonable. Typical remedies for missing class include completing the in-class assignments and preparing a summary or explanation of a portion of the class material missed. In general, remedies will require about two to three hours of out-of-class work.

- Familiarize yourself with the Carroll University Academic Integrity Policy located in the student handbook. [https://my.carrollu.edu/ICS/Departments/Student_Affairs](https://my.carrollu.edu/ICS/Departments/Student_Affairs)

- Carroll University emphasizes that students have an obligation to conduct their academic work with honesty and integrity. All acts of academic misconduct are serious.
  - If you have any questions about appropriate citations and attributions, please ask the instructor.

- The instructor can impose a sanction of failure for any individual assignment or for the course if a student violates the Carroll University Academic Integrity Policy.

*The instructor and the University reserve the right to modify, amend or change the syllabus (course requirements, grading policy, etc.) as the curriculum and/or program require(s).*