
Professor:	J. Daniel Dolan	
Office:	121 Sloan Hall and Wood Materials and Engineering Lab	Office Hours: 9:00 – 11:00 MWF or by Appointment
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Course Objectives:

The purpose of CE 514, Advanced Mechanics of Materials is to provide a thorough understanding of advanced topics concerning the response of materials and structural elements to applied forces of deformation. The course will begin with a thorough explanation to solving mechanical problems. The course will begin by presenting the theory of stress and strain. These basics will be used to derive generalized elastic constitutive relations in materials with anisotropic and time-dependent properties. Prediction of failure of materials will be covered in sections dealing with yielding, failure criteria, and fatigue. These components will provide a basis for elasticity solutions assuming either plane stress or strain. Finally, these solution techniques will be applied to the stress analysis of curved beams, beams on elastic foundations, asymmetric beams, torsion of prismatic elements, and thick-walled cylinders. The course is expected to give a firm foundation to advanced design topics while providing the foundations to finite element solutions to more complex problems.

Method of Instruction:

The instruction for CE 514 will consist of three one-hour lectures each week. These lectures will introduce the analytical techniques and advanced mechanics concepts that were described above. The theories will be reinforced through regular homework assignments and exams. An opportunity to develop practical applications will be given through class projects.

Course Text:

Ugural, A. C. and S. K. Fenster. 2003. *Advanced Strength and Applied Elasticity*, 4th Edition. Prentice-Hall PTR. Upper Saddle River, NJ. 544 pp.

Evaluation:

Progress and retention will be evaluated with homework assignments, exams, and projects. Homework/Projects will be assigned regularly to reinforce concepts covered in lecture. A Mid-Term Exam will be given to assess the understanding of the general elasticity components. A Final Exam will be assigned to assess the ability to utilize the different analysis methods presented in the course.

Grading:

The course grade will compromise a weighted average of all assignments. The specific distribution will be:

Item	Weight (%)
Homework/Projects	30
Mid-Term Exam	30
Final Exam	40
Total	100

Notes and Assignments:

Course notes and assignments, along with additional information, will be placed on a course web page in PDF format for the student to download.

All electronic material will be in Adobe Acrobat format. A free copy of Adobe Acrobat Reader may be obtained from the following website:

<http://www.adobe.com/products/acrobat/alternate.html>

Attendance and Deadlines:

Attendance role will not be taken at the lectures. However, students are responsible for daily assignments. Homework will be due at the beginning of the lecture on the due date, which will be shown on all homework assignments. **NO LATE ASSIGNMENTS WILL BE ACCEPTED !!!** Missing assignments will be given a grade of zero.

Course Outline

CE 514: Advanced Mechanics of Materials

Stress

- Definition of Stress
- Stress Transformation
- Equilibrium
- Principle Stresses

Strain

- Motion and Deformation
- Strain Transformation
- Strain Energy

Stress-Strain Relationships

- Generalized Hooke's Law
- Planes of Symmetry
- 3-D and 2-D Solutions
- Arbitrary Material Orientation
- Time Dependence

**Elasticity
Solutions**

Failure Criteria

- Yielding
- Fracture
- Fatigue
- Duration of Load

Elasticity Solutions

- Plane Stress
- Plane Strain

Stress Analysis

- Curved Beams
- Beams on Elastic Foundations
- Asymmetric Bending
- Torsion of Prismatic Elements
- Thick Walled Cylinders

**Classical
Solutions in
Stress Analysis**