

# Mechanics of Deformable Bodies (EGR–332)

Block 4 – 2018

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## General Information:

**Instructor:** Brian Johns

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**Office Hours:** 11:30am-12:00 pm MWThF, or by appointment

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## Prerequisite:

EGR-231: Engineering Mechanics

MAT-122: Calculus of Several Variables

## Course Meeting Times:

MW 10:00am-11:30am (RSC 427)

TThF 9:00am-11:00am (RSC 427)

MTWTh 1:00pm-3:00pm (RSC 427/TBA)

## Required Textbook:

Hibbeler, R. C. (2015). *Mechanics of Materials (10<sup>th</sup> Edition)*. Pearson education. ISBN-13: 978-0134319650.

## Other Required Course Materials:

Engineering Computation Pad

Mechanical Pencils

Graphing Calculator

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## Course Description & Objectives:

### Course Description:

An introduction to the effects of forces on solid bodies. Structures will be analyzed under axial, shear, torsional, and bending loads. Students learn to assess structures in terms of stress, strain, and deflection under the various types of loading. The course emphasizes individual and group problem-solving. Students apply course concepts to build and evaluate their own structures during hands-on design projects.

**Course Objectives:**

The course is designed to support the *Educational Priorities and Outcomes* of Cornell College.

- Understand the fundamental and analytical skills related to the mechanical concepts of stress, strain, and failure.
- Reinforce systematic problem solving skills through repetition and practice of basic engineering problems.
- Use modern engineering tools, such as finite element analysis, 3D printing, and CNC manufacturing, to design and solve open-ended real-world mechanics problems.
- Reinforce iterative design progression through prototyping and experimental testing.
- Understand the impact of factors of safety in mechanical designs and reinforce ethically-responsible engineering decisions.
- Create group settings where leadership characteristics can be strengthened.
- Collaborate in engineering teams and communicate effectively (orally and written).

**Course Performance Indicators:**

- 1a. Demonstrates the ability to identify and formulate mathematical equations to describe complex engineering problem.
- 1b. Demonstrates the ability to solve engineering problems by combining scientific concepts and mathematical models.
- 1c. Demonstrates the ability to use software as a tool to solve engineering problems.
  
- 2a. Convert open-ended problems to design specifications.
- 2b. Construct a prototype which meets design specifications
- 2c. Design a product (system, component, or process) that solves a real-world problem.
- 2d. Demonstrates ability to build and assemble complex devices.
- 2e. Construct a bill of materials for a prototype which meets specifications.
  
- 4a. Analyze the ethical implications of an engineering problem
- 4b. Proposes a solution or critiques a proposed solution to an engineering problem which impacts the world.
  
- 5a. Adopt leadership roles to accomplish team objectives.
- 5b. Perform delegated tasks and actively participate in group meetings.
- 5c. Encourage the participation of others.
- 5d. Respond objectively to conflict within a team.
- 5e. Foster constructive climate within and between teams.
  
- 6b. Analyze experimental data using simple statistics.
- 6c. Evaluate experimental data in light of relevant theory.
  
- 7b. Accurately self-evaluates work for future improvement.
- 7c. Takes personal initiative to learn independently

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## Course Outline:

The key to learning concepts is through deliberate practice and repetition. Students will work in both individual and group settings to solve problems. Additionally, group projects will be assigned concurrently to individual assignments.

### Class Topics (subject to change):

- Stress
- Strain
- Mechanical Properties of Materials
- Axial Load
- Torsion & Bending
- Transverse Shear
- Combined Loadings
- Stress Transformation
- Strain Transformation
- Deflections of Beams and Shafts

## Grading

### Grading Criteria:

Component	Percentage
Homework	10%
Projects	30%
Exam 1	20%
Exam 2	20%
Exam 3	20%

### Grading Scale:

A	95-100
A-	90-94
B+	87-89
B	84-86
B-	80-83
C+	77-79

C	74-76
C-	70-73
D+	67-69
D	64-66
D-	60-63
F	<60

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## Course Requirements & Policies:

### Attendance:

As a student you are expected to attend all sessions of class. Please inform me of any planned absences at the beginning of the block so we can make arrangements.

### Exams:

There will be three (3) exams during the course. Although there is not a comprehensive final, the exams will progressively build on the topics of earlier exams.

**Projects:**

There will be several small projects throughout the duration of the course. Projects will require teamwork, communication, and design. Furthermore, the team will demonstrate their projects using both written and oral communication.

**Homework:**

Expect to have homework every day. Several problems will be randomly selected for grading in each homework set. Homework is due at the beginning of class. No late homework will be accepted.

**Academic Honesty Policy:**

Cornell College expects all members of the Cornell community to act with academic integrity. An important aspect of academic integrity is respecting the work of others. A student is expected to explicitly acknowledge ideas, claims, observations, or data of others, unless generally known. When a piece of work is submitted for credit, a student is asserting that the submission is her or his work unless there is a citation of a specific source. If there is no appropriate acknowledgement of sources, whether intended or not, this may constitute a violation of the College's requirement for honesty in academic work and may be treated as a case of academic dishonesty. The procedures regarding how the College deals with cases of academic dishonesty appear in The Catalogue, under the heading "Academic Honesty."

**Students with Disabilities:**

Students who need accommodations for learning disabilities must provide documentation from a professional qualified to diagnose learning disabilities. For more information see <http://cornellcollege.edu/disabilities/documentation/index.shtml>

Students requesting services may schedule a meeting with the disabilities services coordinator as early as possible to discuss their needs and develop an individualized accommodation plan. Ideally, this meeting would take place well before the start of classes.

At the beginning of each course, the student must notify the instructor within the first three days of the term of any accommodations needed for the duration of the course.