UCONN
UNIVERSITY OF CONNECTICUT

CE 3110
Mechanics of Materials
School of Engineering

Syllabus – Fall 2019

Course and Instructor Information

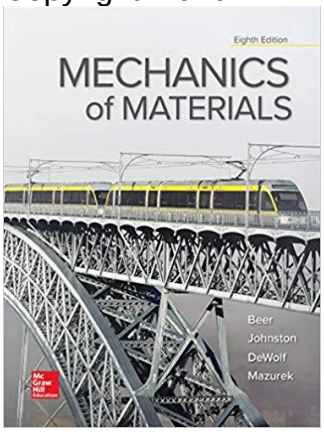
Course Title: Mechanics of Materials
Credits: #3
Format: (Flipped)
Prerequisites: CE 2110, Enrollment in the school of engineering
Professor: Sarira Motaref, Ph.D., P.E.
Associate Professor in Residence
Email: Sarira.motaref@uconn.edu
Telephone: 860-486-2731
Office location: Engineering II, room 310
Office Hours/Availability: Monday and Friday, 11:30AM-1:00 PM or weekdays by previous appointment

Teacher Assistants:

1. Tao Zhang, tao.zhang@uconn.edu office hour: Thursdays and Fridays 2:30PM-4PM, CAST 123
2. Sachin Tripathi, sachin.tripathi@uconn.edu, office hour: Monday2:30-4-30, CAST 123
3. Michael Vaccaro, michael.t.vaccaro@uconn.edu, office hour: Tuesdays 2PM-5PM, CAST 123
4. Sketchup and Virtual Reality TA: Arpita Kurdekar, arpita.kurdekar@uconn.edu, office hour: with previous appointment via Webex

Course Materials

Required Materials:
E-Book: Mechanics of Materials
By Ferdinand Beer and E. Russell Johnston, Jr. and John DeWolf and David Mazurek
ISBN10: 1260113272
ISBN13: 9781260113273
Copyright: 2020



Section 1
https://connect.mheducation.com/class/s-motaref-fall-2019

Section 2
https://connect.mheducation.com/class/s-motaref-fall-2019-02

Texts are available through a local or online bookstore. The UConn book store carries many materials that can be shipped via its online Textbooks To Go service. For more information, see Textbooks and Materials on our Enrolled Students page.

Course Organization:

The class is a flipped. It means that the lectures will be delivered online and students will come to the class for recitation (if needed), problem solving and to address their questions on assignments.

Class includes total of 14 weeks, 33 Lectures, [08/26/2019 to 12/06/2019]

Class Outlines

1. Watch a video (approximately 10 min.) lecturing concepts and background information.
2. Watch a video (approximately 10-20 min.) solving sample problems.
3. Study your E-book for assigned chapters (Optional).
4. Complete Assignments (available in HuskyCT) before deadline using your smart book account.
5. Attend the class to practice problem solving skill and submit in-class group HWs.
6. Take 3 midterm exams and a Final Exam [in class].
7. Take online quizzes via HuskyCT.

In Class Activities

Active learning method is utilized in this class. The class sessions involves with problem solving (by students) individually and in teamwork. Instructors and TAs will guide you during problem solving. The solution to the problems will be presented either in class or detailed solutions will be available after deadline in Connect.

To effectively use the class sessions, please follow the instruction below.

1. Having calculator/pencil/eraser in class session is mandatory.
2. You are supposed to watch the lecture video and sample solving video **before** attending the class. You can find lecture number from Calendar.
3. In-Class HW should be completed by teams and submitted during class.
4. Install Sketchfab application on your smartphone. We show and discuss some 3D models during class using this application.
5. Send your questions on the watched videos to instructor at least 2 hours before your class session. Instructor will have a recitation on that topic if it is necessary.

Course Description

Simple and combined stress, torsion, flexure and deflection of beams, continuous and restrained beams, combined axial and bending loads, columns.

Mechanics of materials, also called strength of materials, is a subject which deals with the behavior of solid objects subject to stresses and strains. The study of Mechanics of materials often refers to various methods of calculating the stresses and strains in structural members, such as beams, columns, and shafts. The methods employed to predict the response of a structure under loading and its susceptibility to various failure modes takes into account the properties of the materials such as its yield strength, ultimate strength, Young's Modulus, and Poisson's ratio; in addition the mechanical element's macroscopic properties (geometric properties), such as it length, width, thickness, boundary constraints and abrupt changes in geometry such as holes are considered.

Course Objectives

By the end of the semester, students should be able to:

1. Explain basic concepts of stress, strain and their relations based on linear elasticity
2. Calculate stresses and deformation of a bar due to an axial loading under uniform and non-uniform conditions
3. Calculate stresses and deformation of a torsional bar

4. Sketch shear-moment diagrams of a beam and find the maximum moment/shear and their locations
5. Calculate normal and shear stresses on any cross-section of a beam
6. Apply Mohr's circle to calculate principal stresses and angles in plane stress cases.
7. Calculate stresses on a structure under combined loadings
8. Calculate deflections of a beam under combined loads by using methods of moment-area and superposition
9. Recognize stability and buckling phenomena for a slender member under an axial compressive force.

Course Outline (and Calendar if Applicable)

Course Modules
See each Module's Objectives and Activities page for complete information and the calendar for all due dates.
Lecture 1: Introduction to Normal and Shear Stress (CH-1)
Lecture 2: Normal and Shear Stress Components(CH-1)
Lecture 3: Stress-Strain Diagram (CH-2)
Lecture 4: Hook's law and deformation of member under axial loading (CH-2)
Lecture 5: Stress Calculation in Statically Indeterminate Elements (CH-2)
Lecture 6: Elements under temperature, Poisson's Ratio, and Shearing strain (CH-2)
Lecture 7: Stress Concentration; Plastic Deformation (CH-2)
Lecture 8: Torsion (CH3)
Lecture 9: Angle of Twist, Indeterminate Shafts (CH-3)
Lecture 10: Design of Transmission shaft (CH-3)
Midterm Exam 1-Refer to you course Calendar for date (Chapters 1 to 3)
Lecture 11: Stresses and Deformations under pure bending (CH-4)
Lecture 12: Neutral axis location and second moment of inertia (CH-4)
Lecture 13: Composite Materials under bending, curvature (ρ) (CH-4)
Lecture 14: Eccentric Axial Loading (CH-4)
Lecture 15: Shear and Bending-Moment Diagrams (CH-5)
Lecture 16: Beam analysis method of cut, method of integration (CH-5)
Lecture 17: Relations Among *w*, *V*, and *M* (CH-5)
Lecture 18: Design of Prismatic Beams in Bending (CH-5)
Lecture 19: Shearing Stresses in a Beam (CH-6)
Lecture 20: Sharing Flow, Thin-Walled Members(CH-6)
Lecture 21: Shear Center (CH-6)
Midterm Exam 2-Refer to you course Calendar for date (Chapters 4, 5, 6)
Lecture 22: Transformation of Plane Stress, Principal plane, (CH-7)
Lecture 23: Mohr's Circle for Plane Stress (CH-7)
Lecture 24: Three-Dimensional Stress Analysis; Fracture Criteria (CH-7)
Lecture 25: Stresses in Thin-Walled Pressure Vessels (CH-7)
Lecture 26: Deflection of Beams, Equation of the elastic curve (CH-9)
Lecture 27: Application of Equation of Elastic Curve in Beams (CH-9)
Lecture 28: Application of equation of elastic curve in indeterminate beams (CH-9)
Lecture 29: Method of Superposition (CH-9)
Lecture 30: Columns: Euler's Formula (CH-10)
Lecture 31: Stability of structures (CH-10)
Lecture 32: Columns with other end conditions, Design of Columns (CH-10)
Lecture 33: Design of Columns Under an Eccentric Load (CH-10)
Midterm Exam 3-Refer to you course Calendar for date (Chapters 7,9, 10)

Course Requirements and Grading

Summary of Course Grading:

Course Components	Weight
Home works (13 sets)	25%
Quizzes (9 sets)	15%
In-Class HW (9 sets)	15%
Midterm exams (3 sets)	45%
**Final exam (Optional)	See the description below
**Comprehension of Concepts Assignments (Smart Book)(Optional)	Bonus
**Virtual Reality Project (Optional)	Bonus

**Please see descriptions below about Reading assignments, Final Exam and VR projects.

Home works

- There are 13 sets of Home works during the semester. Each set includes 4 to 7 homework problems.
- Homeworks are available under **Connect** access. You can receive hints, check your work before each submission. Detailed feedback will be available to you after due date.
- The due date is on every Sundays (**until 11:59PM**) or Wednesdays in the week of Midterm exams. The due dates are available on calendar. The calendar file is located in HuskyCT under Syllabus & Calendar.
- Deadlines are firm. NO REQUEST FOR DEADLINE EXTENTION will be accepted. Please start your HW early. Reach out to the instructors or TAs for additional help before the deadline.

Quizzes

- There are 9 sets of quizzes available in HuskyCT. You need to complete each quiz at the end of each chapter Deadlines are usually on Tuesdays at 11:59PM. Please refer to class calendar.
- You will have 2 attempts to complete each quiz. You see your wrong answers after the first attempt. The highest grade between 2 attempts will be recorded as your grade.
- Deadlines are firm. NO REQUEST FOR DEADLINE EXTENTION will be accepted.

In-Class Home works

- You will be assigned to a team of 3 (your team location and team number will be posted in the beginning of the class). A problem from the past exams related to the topic of that day (refer to the calendar) should be completed by the team in 15 minutes. Instructor and TAs provide guidance during this activity.

- Team members will be defined based on your last name or first name or student ID or major,… Be ready to work with different classmates during the semester!

- Each team submit 1 paper and the grade is assigned to all team members.

- You may miss up to 2 in-class HWs. You can come to the next available office hours (of the instructor) and re- ake this HW in her office.

Midterm exam

- **In-Class** Midterm exams (3 Midterm exams):

Midterm exam 1: Monday, September 30th , 2019(50 minutes) [Chapters 1, 2, 3]
Midterm exam 2: Monday, October 28th , 2019(50 minutes) [Chapters 4, 5, 6]
Midterm exam 3: Wednesday, December 2nd , 2019(50 minutes) [Chapters 7,9, 10]

- Midterm exams contain 4 questions. You have 50 minutes to answer questions.

- Exams are NOT open book/open notes. Equation Sheets will be provided. You can only have your calculator, pencil and eraser. Please DO NOT use Pen to answer questions. There is no restriction on the calculator model for the exam

- Solution to midterm exams will be available in HuskyCT under Course Resources/Exam Solutions.

- **Make up exams** will be offered to students only in following cases:

    a) Students with disability can contact CSD to schedule exam in a private room with extended time. b) Athletic team members also can reschedule exam with a letter from their coach (in case of conflict between exams and their tournaments).

- ***Other case (Medical emergency, family emergency,...): with an official letter from hospital or doctors. Date: **Friday, November 22th** during class time, Materials: Comprehensive from all chapters.

***Assessment on comprehension of Engineering concepts (Smart Book)[Optional]**

There are assignments from the engineering concepts available in SmartBook via HuskyC. You will read and comprehend the engineering concepts and then complete the practice questions. You can earn 3 points towards your final grade if you complete all chapters by December 15th.

Final Exam [Optional]

Final exam is comprehensive from all chapters. Final exam grade can be replaced with one of your lowest grades from Midterm exams. There is no risk taking the final as the highest grade between the final and midterm exams will be selected to calculate your final grade.
You may decide not to attend the final exam if you are happy with your midterm exams' grades.

VR (Virtual Reality) Project [Optional]

You can earn extra point by participating in VR project activity:
More information are available under VR project in HuskyCT

1. Learn Sketchup drafting tool and build some models from the textbook, indicate stresses on the model and show the expected deformation. (You can complete up to 3 models and earn 5 points per model

towards each midterm exam).
Note: suggested models along their problem statements are available in HuskyCT. Deadlines: Model 1: End of September, Model 2:End of October, Model 3: End of November

2. Use available 3D models in Sketchup **3d warehouse**, identify possible applied loads, indicate type of stresses and show them on your model. You need to apply your knowledge that you will be learning in this course to identify at least 10 different locations under stresses. You can complete up to 1 model and earn 3 points toward your final grade. Deadline is on December 1st.

Note: the model you choose can be selected from suggested models or you can select other models but it should be approved by the instructor.

Grading Scale: (It is subjected to change)
Undergrad

Grade	Letter Grade	GPA
93-100	A	4.0
90-92	A-	3.7
87-89	B+	3.3
83-86	B	3.0
80-82	B-	2.7
77-79	C+	2.3
73-76	C	2.0
70-72	C-	1.7
67-69	D+	1.3
63-66	D	1.0
60-62	D-	0.7
<60	F	0.0

Due Dates and Late Policy

All course due dates are identified in the calendar available in HuskyCT under Syllabus& Calendars. Deadlines are based on Eastern Standard Time; if you are in a different time zone, please adjust your submittal times accordingly. *The instructor reserves the right to change dates accordingly as the semester progresses. All changes will be communicated in an appropriate manner.*

No late assignments will be accepted. No makeup quiz will be offered.

Feedback and Grades

You will receive online feedbacks on your assignments and quizzes. Midterm exams and final exams results will be available to you in a week after the exam date. In addition solutions to all home works, quizzes, midterm exams, and final exams will be available in huskyCT under Course Resources.

Student Responsibilities and Resources

As a member of the University of Connecticut student community, you are held to certain standards and academic

policies. In addition, there are numerous resources available to help you succeed in your academic work. This section provides a brief overview to important standards, policies and resources.

Student Code

You are responsible for acting in accordance with the University of Connecticut's Student Code Review and become familiar with these expectations. In particular, make sure you have read the section that applies to you on Academic Integrity:

- Academic Integrity in Undergraduate Education and Research
- Academic Integrity in Graduate Education and Research

Cheating and plagiarism are taken very seriously at the University of Connecticut. As a student, it is your responsibility to avoid plagiarism. If you need more information about the subject of plagiarism, use the following resources:

- Plagiarism: How to Recognize it and How to Avoid It
- Instructional Module about Plagiarism
- University of Connecticut Libraries' Student Instruction (includes research, citing and writing resources)

Copyright

Copyrighted materials within the course are only for the use of students enrolled in the course for purposes associated with this course and may not be retained or further disseminated.

Netiquette and Communication

At all times, course communication with fellow students and the instructor are to be professional and courteous. It is expected that you proofread all your written communication, including discussion posts, assignment submissions, and mail messages. If you are new to online learning or need a netiquette refresher, please look at this guide titled, The Core Rules of Netiquette.

Adding or Dropping a Course

If you should decide to add or drop a course, there are official procedures to follow:

- Matriculated students should add or drop a course through the Student Administration System.
- Non-degree students should refer to Non-Degree Add/Drop Information located on the registrar's website.

You must officially drop a course to avoid receiving an "F" on your permanent transcript. Simply discontinuing class or informing the instructor you want to drop does not constitute an official drop of the course. For more information, refer to the:

- Undergraduate Catalog
- Graduate Catalog

Academic Calendar

The University's Academic Calendar contains important semester dates.

Academic Support Resources
Technology and Academic Help provides a guide to technical and academic assistance.

Students with Disabilities
Students needing special accommodations should work with the University's Center for Students with Disabilities (CSD). You may contact CSD by calling (860) 486-2020 or by emailing csd@uconn.edu. If your request for accommodation is approved, CSD will send an accommodation letter directly to your instructor(s) so that special arrangements can be made. (Note: Student requests for accommodation must be filed each semester.)

Blackboard measures and evaluates accessibility using two sets of standards: the WCAG 2.0 standards issued by the World Wide Web Consortium (W3C) and Section 508 of the Rehabilitation Act issued in the United States federal government." (Retrieved March 24, 2013 from http://www.blackboard.com/platforms/learn/resources/accessibility.aspx)

Software Requirements and Technical Help

- Word processing software
- Adobe Acrobat Reader
- Internet access

(add additional items as needed and link to http://ecampus.uconn.edu/plug-ins.html)

This course is completely facilitated online using the learning management platform, HuskyCT. If you have difficulty accessing HuskyCT, online students have access to the in person/live person support options available during regular business hours in the Digital Learning Center (www.dlc.uconn.edu). Students also have 24x7 access to live chat, phone and support documents through www.ecampus24x7.uconn.edu.

Minimum Technical Skills

To be successful in this course, you will need the following technical skills:

- Use electronic mail with attachments.
- Save files in commonly used word processing program formats.
- Copy and paste text, graphics or hyperlinks.
- Work within two or more browser windows simultaneously.
- Open and access PDF files.

(add additional items as needed and link to http://ecampus.uconn.edu/plug-ins.html)

University students are expected to demonstrate competency in Computer Technology. Explore the Computer Technology Competencies page for more information.

Evaluation of the Course

Students will be provided an opportunity to evaluate instruction in this course using the University's standard procedures, which are administered by the Office of Institutional Research and Effectiveness (OIRE).

Additional informal formative surveys may also be administered within the course as an optional evaluation tool.