

Syllabus – Fall 2020

Course and Instructor Information

Course Title: Mechanics of Materials

Credits: #3

Format: (Flipped)

Prerequisites: CE 2110, Enrollment in the school of engineering

Classroom: MCHU 102

https://www.kaltura.com/index.php/extwidget/preview/partner_id/2090521/uiconf_id/37067881/entry_id/1_1bdtadom/embed/dynamic?

Join the class in-person (MCHU 102) or online via Live Kaltura on **Wednesdays** and **Fridays**.

Join the class via Blackboard Collaborate Ultra on **Mondays**.

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 via Webex: <https://uconn-cmr.webex.com/meet/sam11036>

Teacher Assistants:

- Tao Zhang, tao.zhang@uconn.edu office hour: Wednesday and Thursday 2:30PM-4:00PM, <https://uconn-cmr.webex.com/meet/taz18003>
- Michael Vaccaro, michael.t.vaccaro@uconn.edu, office hour: Tuesday 12:20-1:50P
Wednesday 11:30AM-1PM, <https://uconn-cmr.webex.com/meet/mtv16101>
- Shalini Shial, shalini.shial@uconn.edu, office hour: Tuesdays: 10:30AM -12PM, Thursdays: 11AM -12:30PM, <https://uconn-cmr.webex.com/meet/shs16137>

Course Materials

Required Materials:

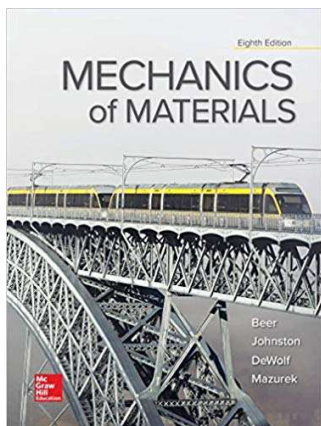
E-Book: Mechanics of Materials

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-2020---001>

Section 2

<https://connect.mheducation.com/class/s-motaref-fall-2020---002>

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 in-person or attend via Live Kaltura, problem solving and to address their questions on assignments.

Class includes total of 14 weeks, 33 Lectures, [08/31/2020 to 12/04/2020]

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. Try to solve "Test yourself" questions (available in HuskyCT) after each video. These problems are Not graded but designed to check your knowledge and show you implementation of your learnings in real life problems. Solutions to these questions are available at the bottom of the page for each week.
4. Study your E-book for assigned chapters to (Optional: See page 6).
5. Complete Assignments using your smart book Connect account (available in HuskyCT) before deadline.
6. Attend the class (in-person or virtually) to practice problem solving skill and submit teamwork assignments.
7. Take 3 midterm exams and an optional Final Exam [in class/online].
8. Take online quizzes via HuskyCT.
9. Contribute to class materials based on your strength (Optional: see page 6)

In Class sessions

Active learning method is utilized in this class. The class sessions involve 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 pre-lecture video and sample solving video **before attending** the class. You can find lecture number from class calendar.
3. **Teamwork Assignments** should be completed by teams via google slide and submitted during class. Teams will collaborate in HuskyCT via Collaborate Ultra. Refer to calendar for the dates of this activity.
4. 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 its 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 shearing 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 (12 sets)	25%
Quizzes (9 sets)	15%
Teamwork problem solving (12 sets)	15%
Midterm exams (3 sets)	45%
**Final exam (Optional)	Grade can be replaced with the lowest Midterm exam
**Comprehension of Concepts Assignments (Smart Book)(Optional)	2 points toward final grade

Course Components	Weight
Strength based projects (Optional)	5 points toward each midterm exam (up to 15 points)

****Please see descriptions below about Reading assignments, Final Exam and Strength based Projects.**

Home works

- There are 12 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)**. The due dates are available on calendar.
- Deadlines are firm. **NO REQUEST FOR DEADLINE EXTENTION** will be accepted. Do not contact instructors or TAs if you miss submission of HWs. 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.

Teamwork problem solving

- This activity occurs on **Mondays** during the class time. You need to attend the class via collaborate ultra and complete the assignment synchronously.
- You will be assigned to a team of 4 (via Blackboard Collaborate Ultra).
- A problem from the past exams from topics of the previous week (refer to the calendar) should be completed by the team in 20 minutes. Instructor and TAs provide guidance during this activity.
- Team members will be defined randomly, and team number will be assigned.
- Problems will be shared via google slide.
- Each team submit 1 paper and the grade is assigned to all team members.
- You should contact instructor (sarira.motaref@uconn.edu) **immediately** if you miss a teamwork assignments. You can complete makeup questions up to 2 times in the semester.

Midterm exam

- Midterm exams (3 Midterm exams):

Midterm exam 1: Wednesday, September 30th, 2020 (60 minutes) [Chapters 1, 2, 3]-Online and in-

person

Midterm exam 2: Wednesday, October 28th, 2020 (60 minutes) [Chapters 4, 5, 6] -Online and in-person

Midterm exam 3: Friday, December 4th, 2020 (60 minutes) [Chapters 7,9, 10] -Online

- 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. 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 cases (Medical emergency, family emergency, online technical difficulty such as internet, malfunctioning laptop,...): with an official letter from hospital or doctors. Date: **Monday, December 7th** during class time, Materials: Variable (You will take the exam (1 or 2, or 3) that you have missed. Format: Online, Time: during your class time

***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 2 points towards your final grade** if you complete all chapters **by December 7th**.

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. Final exam will be online.

I-Course (INCLUSIVITY):Strength based projects[Optional]

Sign up for this project by determining your strength/talent/hobby via google form:

Section 1

https://docs.google.com/forms/d/e/1FAIpQLSfyAudixuBepy16SOrhkrosFIM3iJNQnt6u5pXVGcMR0dsChQ/viewform?usp=pp_url

Section 2

https://docs.google.com/forms/d/e/1FAIpQLSdEDsGbO07TZkiHv1VOnYuei15oyVBs2o1oINy2SVhHOZRADA/viewform?usp=pp_url

Contribute to the class materials by completing a project relevant to Mechanics of Materials topic and from areas of your strength. Your production should be shared and reviewed by the instructor to meet

the acceptable quality. (You can submit up to 3 projects, you can earn 5 points towards each midterm exam and earn 5 point for each project). Here are some suggestions for your strength based projects:

1. Design a problem from area of your interest applicable to the concepts you learn in this course along its solution.
2. Build objects using wood cardboard, metal, 3D printing,... that can be used in demonstration of mechanics concepts.
3. Prepare videos that shows concept (s) that you are learning in Mechanics of Materials.
4. Prepare series of pictures from real world objects that you can see application of concepts.

You can find further information from this document

https://uconn-my.sharepoint.com/:b:/g/personal/sarira_motaref_uconn_edu/EWSsWOBXDCINiL4wNFB5gl0BNXvMno5wpFPbOw7se_NeJQ?e=bn9bSZ

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/plugin-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/plugin-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.

Resources for Students Experiencing Distress

The University of Connecticut is committed to supporting students in their mental health, their psychological and social well-being, and their connection to their academic experience and overall wellness. The university believes

that academic, personal, and professional development can flourish only when each member of our community is assured equitable access to mental health services. The university aims to make access to mental health attainable while fostering a community reflecting equity and diversity and understands that good mental health may lead to personal and professional growth, greater self-awareness, increased social engagement, enhanced academic success, and campus and community involvement.

Students who feel they may benefit from speaking with a mental health professional can find support and resources through the [Student Health and Wellness-Mental Health \(SHaW-MH\)](#) office. Through SHaW-MH, students can make an appointment with a mental health professional and engage in confidential conversations or seek recommendations or referrals for any mental health or psychological concern.

Mental health services are included as part of the university's student health insurance plan and also partially funded through university fees. If you do not have UConn's student health insurance plan, most major insurance plans are also accepted. Students can visit the Student Health and Wellness-Mental Health located in Storrs on the main campus in the Arjona Building, 4th Floor, or contact the office at (860) 486-4705, or <https://studenthealth.uconn.edu/> for services or questions.

Accommodations for Illness or Extended Absences

Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify your instructor as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with your instructor to determine how you will complete coursework during your absence.

If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at dos@uconn.edu to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.

Inclusion Statement

I am a member of the INCLUDE program team, an NSF-funded neurodiversity initiative that aspires to create an inclusive learning environment in which *all* students can thrive. Emphasis is given to providing a strengths-based approach to education that encourages students to identify, develop, and leverage their unique abilities to address complex engineering problems. This course was designed to address the diverse thinking and learning styles that neurodiverse students possess. Several pedagogical innovations will be implemented in this course including, but not limited to peer-learning, alternative examination modalities, project-based learning, etc.