

Mechanics of Materials

EGM 3520 – Class #11770

Class Periods: MWF Period 3 (9:35 – 10:25am)

Location: Weil 270

Academic Term: Spring 2022

Instructor

Dr. Chelsey Simmons

Email: css@ufl.edu (Please contact through Canvas or using your UFL email; I cannot respond to non-UFL addresses)

Office: HWLEE 467

Office Hours: Mondays and Wednesdays Period 6 (12:50 – 1:40pm)

Links for weekly Zoom office hours and to request personal appointments posted in Canvas

Course Description

Stress and strain at a point, stress-strain-temperature relations and mechanical properties of materials. Systems subject to axial load, torsion and bending. Design concepts, indeterminate structures and applications. *Credits:* 3

Course Pre-Requisites / Co-Requisites

EGM 2511 Statics (not EGM 2500) and MAC 2313 Analytical Geometry/Calc III

Course Objectives

The purpose of the course is to provide students with the means of analyzing and designing various machine and load bearing structures. Upon completion of this course each student should have (a) basic understanding of engineering mechanics and the ability to apply this understanding to analyze and solve a given problem; (b) basic understanding of material properties and mechanical deformation; and (c) the ability to apply advanced science and engineering principles in the design and analysis of structures to support loads within a given limit of safety.

Recommended Textbook: Beer, Johnston, DeWolf, and Mazurek, "Mechanics of Materials", 7th edition, McGraw Hill
N.B. Older editions are perfectly fine references, though recommended problems are from the 7th edition and may have slight differences from older/newer versions. Graded assignments are *not* from the book.

Materials and Supply Fees: None

Relation to Program Outcomes (ABET):

Outcome	Coverage*
1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	High
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	Medium
3. An ability to communicate effectively with a range of audiences	Low
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	Medium
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	Medium

<i>Date</i>	<i>Lecture Topics</i>	<i>Sections Covered*</i>	<i>Practice Problems</i>	<i>Assignments**</i>
1/5	Stress	Statics Review, 1.1, 1.2	1.1, 1.9, 1.12, 1.22	
1/7	Stress components	1.3, 1.4	1.26, 1.31, 1.35	
1/10	Design considerations	1.5	1.42, 1.53	
1/12	Strain, Axial deformation	2.1	2.1, 2.4, 2.7, 2.14, 2.19, 2.21	
1/14	Exam 1 – Statics, Ch. 1	<i>Review: Free body diagrams, 1.64, 1.65, 1.66</i>		
1/17	-----MLK Holiday-----	-----	-----	
1/19	Statically indeterminate	2.2, 2.3	2.33, 2.41, 2.51	
1/21	Poisson's ratio, 3D Hooke's Law	2.4, 2.5	2.61, 2.68	#1
1/24	Shear Strain, Stress concentrations	2.7-2.11	2.78, 2.98	
1/26	Plastic deformation	2.12	2.101, 2.105	
1/28	Torsional stresses	3.1	3.3, 3.11	
1/31	Angle of twist, gear problems	3.2, 3.3	3.34, 3.42	
2/2	Statically indeterminate problems	3.3	3.51, 3.57	
2/4	Design of shafts	3.4, 3.5	3.68, 3.76, 3.86	#2
2/7	V and M diagrams, relationships	5.1	5.1, 5.11, 5.13	
2/9	V and M relationships	5.2	5.36, 5.51, 5.52	
2/11	Exam 2 – Ch. 1-3	<i>Review: 2.126, 2.130, 2.133, 2.134, 3.156, 3.157, 3.158, 3.159</i>		
2/14	Singularity Functions	5.4	5.98, 5.102, 5.108	
2/16	Bending and Calculating I	4.1, Appendix A	4.1, 4.3, 4.9	
2/18	Normal stress due to bending	4.2	4.10, 5.16, 5.24	
2/21	Composites, Stress Concentrations	4.4, 4.5	4.37, 4.40, 4.62	
2/23	Elastoplastic beams	4.6, 4.7	4.73, 4.76	#3A (Individual)
2/25	Design of Beams	5.3	5.85, 5.115, 5.117	
2/28	Shear flow in beams	6.1	6.3, 6.5	
3/2	Shear stresses in beams	6.1, 6.2	6.9, 6.14, 6.18, 6.22	#3B (Group)
3/4	Exam 3 – Ch. 4-5	<i>Review: 4.192, 4.196, 4.200, 5.152, 5.156, 5.158, 5.161</i>		
SPRING BREAK				
3/14	Thin walled members	6.3, 6.4	6.29, 6.30, 6.36, 6.43	
3/16	Shear flow/stress practice	6.1-6.4	6.12, 6.21, 6.23, 6.38	
3/18	Mohr's circle	7.2 – 7.4	7.32, 7.40, 7.66, 7.71	#4
3/21	Pressure vessels, plane strain	7.6, 7.7	7.98, 7.112	
3/23	Measurement of strain	7.8, 7.9	7.140, 7.149	
3/25	Failure criteria	7.5	7.87, 7.88	
3/28	Combined loading	8.3	8.31, 8.37	
3/30	Combined loading	8.3	8.42, 8.47	
4/1	Combined loading	8.3	7.26, 7.165, 8.53	#5
4/4	Beam deflections	9.1	9.3, 9.11	
4/6	Statically ind. beams	9.2	9.20, 9.23, 9.33	
4/8	Exam 4 – Ch. 6,7,8	<i>Review: 6.89, 6.90, 6.93, 7.159*, 7.163*, 7.164*, 7.166*, 8.66, 8.69, 8.74 *inc. Mohr's Circle</i>		
4/11	Singularity functions	9.3	9.36, 9.43, 9.51	
4/13	Superposition	9.4	9.65, 9.75, 9.82	
4/15	Column buckling	10.1	10.13, 10.19	
4/18	Design of columns	10.3	10.59, 10.62	
4/20	Prep for Final	<i>Review: 9.159, 9.165, 9.168, 10.27, 10.117, 10.121, 10.126</i>		
4/26	Cumulative Final (Entire course, esp. Ch. 8-10)	12:30-2:30pm in Weil 270 https://registrar.ufl.edu/courses/final-exam		

*Sections correspond to Beer & Johnston 7th Edition. Complementary video recordings to pre-watch or makeup missed classes are posted in Canvas.

Deadlines subject to change but typically **before class on date indicated. See CANVAS for final deadlines.

Updated 12/28/2021

Attendance Policy, Class Expectations, and Make-Up Policy

Scheduled class time will be a combination of traditional lectures, “flipped” problem solving sessions, and group work. Class attendance is highly recommended but is not mandatory. Recommended resources, e.g. textbook chapters and recorded lectures, will be posted in Canvas to supplement class-time instruction. Excused absences and extensions on assignments and exams must be consistent with university policies in the undergraduate catalog and require appropriate documentation. <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

Assessments

Practice Problems (Ungraded): To motivate you to keep up with the material, practice problems are listed for you to work through as a means to test your understanding of the material. They will not be collected nor graded, but they are critical to developing problem-solving skills necessary for exams and engineering in the real world. You are encouraged to work through these *each week* to ensure understanding and make sure that you have time to ask for help well before the exams.

“On the Job” Assignments (25%): Graded assignments every 2-3 weeks are mini-projects inspired by real-world tasks you could expect to be assigned in a summer internship or at your first job. They will involve light background research, extensive calculations, and moderate technical writing. Since communication skills are important in the real world and not just numerical answers, holistic grading will look at the quality of your explanations and writing in addition to your calculations.

Assignments are to be turned in electronically on the Canvas website *before class (by 9:35am)* on the dates indicated. Late assignments are accepted for a 20% penalty each *weekday*; i.e. assignments due Friday at 9:35am but turned in any time between 9:45am Friday and 11:59pm Monday are worth 80%, Tuesday 60%, etc. Grades and solutions are posted the next Friday. Typically, working on problems together is permitted; however, copying homework or otherwise submitting substantially similar content is NOT permitted. Specific guidelines for each assignment will be articulated clearly when posted to Canvas at least two weeks before due date.

Exams (75%): Exams will be given during class and finals period on indicated days. **No makeup exams are allowed unless absence documented per University policy.** Exam problems will be similar to the practice problems but will include longer, comprehensive questions as well as short conceptual questions. Students are permitted to use a calculator for exams. Relevant formulas will be provided; no additional materials are allowed. The in-class exams account for 12.5% each and the Final Exam is 25%.

Grading Policy

An example numerical grading scheme is shown below. This information should only be used as a **general guide** as the course instructor reserves the right to adjust the final numerical grading demarcations.

A	95-100	B+	89-91.9	C+	79-81.9	D+	69-71.9
A-	92-94.9	B	85-88.9	C	75-78.9	D	65-68.9
		B-	82-84.9	C-	72-74.9	E	<65

N.B. A grade of C- will not be a qualifying grade for critical tracking courses. Furthermore, in order to graduate, students must have an overall GPA and an upper-division GPA of 2.0 or better (C or better). For more information on grades and grading policies, please visit: <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Re-grading Policy: Any and all re-grade requests must be submitted by email to professor **within one week** after return of the graded work. The written request must explain in detail where you believe the grader has made a mistake in grading and what correction you have identified. The request must have your original assignment attached.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is

important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu

- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance](https://title-ix.ufl.edu), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS) Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

COVID-19

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.

- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.