Mechanics of Materials Spring 2024

EGM 3520 Section 1683 Class 20715

Lecture: Monday/Wednesday/Friday, Weil Hall 270, 1:55 pm – 2:45 pm (7th Period)
Office Hours: Mon/Wed/Fri Reitz Union (in front of Constans Theatre) 2:50 pm – 3:50 pm

Professor

Ghatu Subhash, Ph.D.
Email: subhash@ufl.edu
Phone: 352-392-7005
Office: NEB 251

Teaching Assistants

Graduate and undergraduate TAs and their office hours will be communicated through Canvas.

Course Description

Introduction to stress and strain, stress-strain-temperature relations and mechanical properties of materials. Analysis of systems subjected to axial load, torsion load and bending. Design concepts, indeterminate structures and applications.

Course Pre-Requisites

EGM 2511 (not EGM 2500) and MAC 2313
Engineering Mechanics: Statics and Analytical Geometry/Calculus III

Course Objectives

The purpose of this course is to provide students with the means to analyze and design load bearing structures including machines. Upon completion of this course, each student should have:

1. A basic understanding of engineering mechanics and the ability to apply this understanding to analyze and solve a given problem.
2. A basic understanding of material properties and mechanical deformation.
3. 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.

Required Textbooks and Software

Mechanics of Materials, Seventh Edition
Beer, F.P.; Johnston, Jr., E.R.; DeWolf, J.T.; and Mazurek, D.F.
The eighth edition of this textbook is sufficient, but it is the student's responsibility to confirm that problems assigned from the seventh edition are consistent with those in the eighth edition.

Professional Component (ABET)

EGM 3520 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical & Aerospace Engineering (MAE). Specific MAE program outcomes supported by this course include being able to work professionally in the area of mechanical systems, including the design and realization of such systems.

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	Low
3) An ability to communicate effectively with a range of audiences	
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	Low
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	
6) An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	
7) An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not addressed by this course.

Assessment Methods

Your grade for this course will be determined based on your performance on homework, quizzes, and exams as follows:

Homework (weekly assignments) 10%

Your 2 lowest homework assignments will be dropped.

Homework is to be submitted electronically on Canvas by 10:00 pm on the due date. Working in groups is permitted. However, copying homework is NOT permitted. To assist the graders, homework should adhere to the following format: Each problem should be on a single sheet of paper, with a clear problem statement, appropriate free-body diagram, and the solution with reasonable significant digits inside a box. Use of solution manuals or websites to complete homework is considered cheating and a violation of the honor policy.

Homework in this class is VERY IMPORTANT. The problem solving skills that you develop by doing the homework are similar to the skills that you will need in the real world of engineering practice. Students are encouraged to develop a problem-solving procedure, rather than memorize how to complete a certain type of problem. TAs have been instructed to look for problem solving process and explanations, not just answers.

Quizzes (6) 15%

Quizzes will be given in the first 12 minutes of class on assigned days. Your worst 1-Quiz will be dropped. The purpose of the quizzes is to periodically assess your understanding of course topics in a short format in a lower stress environment than exams.

Exams (3) 25% Each

Exams will be two hours in length given on the assigned days. Exams will be scheduled at the same time as the other sections of Mechanics of Materials (except the final exam). Exam location will be announced on Canvas once UF assigns the rooms.

Grading Scale

An example numerical grading scheme is shown below. This information is a general guide; the course instructor reserves the right to adjust the final numerical grading demarcations. Course grades will be "elevated" (curved) if necessary – this decision will not be made until the end of the semester once all exams and homework assignments are graded. Additional information may be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

100–93.4 = A, 93.3–90.0 = A-
89.9–86.7 = B+, 86.6–83.4 = B, 83.3–80.0 = B-
79.9–76.7 = C+, 76.6–73.4 = C, 73.3–70.0 = C-
69.9–66.7 = D+, 66.6–63.4 = D, 63.3–60.0 = D-
60.0-0.0 = E

Attendance Policy, Class Expectations, and Make-Up Policy
Class attendance is strongly encouraged but is not mandatory. Excused absences for homework submission and quizzes must be consistent with university policies in the undergraduate catalog and require appropriate documentation. Homework extensions and make-up quizzes/exams will be provided for excused absences in which notification is provided and approved before the assignment due date. https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx

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.

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 Honor 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. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor.

Commitment to a Safe and Inclusive Learning Environment
The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values, including the elimination of

discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of race, creed, color, religion, age, disability, sex, sexual orientation, gender identity and expression, marital status, national origin, political opinions or affiliations, genetic information, and veteran status.

- Your academic advisor or Graduate Program Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.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

Course Evaluations

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. Summaries of results are available to students at https://gatorevals.aa.ufl.edu/public-results/.

Software Use and Copyrighted Materials

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 are 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 or 392-1575. You can also call the University Police Department at 392-1111 or dial 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, located at Yon Hall, Room 427, 1908 Stadium Road, 352-273-1094, title-ix@ufl.edu.

Sexual Assault Recovery Services (SARS): Contact the Student Health Care Center at 392-1161.

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

Academic Resources

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

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

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

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

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

Student Complaints Campus: https://care.dso.ufl.edu.

On-Line Students Complaints: https://distance.ufl.edu/getting-help/.

Assignment Sheet

Date	***Topics***	***Sections Covered***	***Homework Collected (Tentative)***
1/8	Statics review	Statics Review, 1.1	----------
1/10	Stress	1.1, 1.2	
1/12	Stress components	1.3, 1.4	HW1: 1.7, 1.10, +1*
1/15	----------	Dr. *MLK Day Holiday*	----------
1/17	Design considerations	1.5	HW 2: 1.32, 1.35 +1
1/19	Strain	2.1 ***Quiz 1***	HW 3: 1.43, 1.45, 1.55, +1
1/22	Axial deformation	2.1	HW 4: 2.3, 2.14, 2.19, +1
1/24	Statically indeterminate	2.2	HW 5: 2.25, 2.27, +1
1/26	Temperature effects	2.3	HW 6: 2.33, 2.39, +1
1/29	3D Hooke's Law	2.4-2.8	HW 7: 2.47, 2.51, +1
1/31	3D Hooke's Law	2.4-2.8 ***Quiz 2***	HW 8: 2.65, 2.68, +1
2/2	Stress concentrations	2.10, 2.11	HW 9: 2.70, 2.77, +1
2/5	Torsional stresses	3.1	HW 10: 2.95, 2.97, +1
2/7	Review, Chapters 1-3	***Exam 1***	----------
2/9	Gears & statically ind.	3.2, 3.3	HW 11: 3.10, 3.17, +1
2/12	Design of shafts	3.4-3.6	HW 12: 3.36, 3.41, +1
2/14	Pure bending	4.1, 4.2	HW 13: 3.70, 3.74, +1
2/16	Bending deformation	4.2, 4.3	HW 14: 4.10, 4.11, +1
2/19	Eccentric Loading	4.7	HW 15: 4.9, 4.16, +1
2/21	Beam Bending	5.1 ***Quiz 3***	HW 16: 4.106, 4.115, +1
2/23	V and M diagrams	5.2	HW 17: 5.4, 5.9, +1
2/26	Design of beams	5.3	HW 18: 5.52, 5.59, +1
3/28	Shear stresses in beams	6.1	HW 19: 5.69, 5.76, +1
3/1	Shear flow in beams	6.2	HW 20: 6.4, 6.7, +1
3/4	Thin-walled members	6.3, 6.4	HW 21: 6.15, 6.23, +1
3/6	Stress transformations	7.1 ***Quiz 4***	HW 22: 6.30, 6.40, +1
3/8	Mohr's circle	7.2 – 7.4	HW 23: 7.7, 7.14, +1
3/9 -3/16		----------SPRING BREAK----------	
3/18	Mohr's circle	7.2 – 7.4	HW 24: 7.31, 7.41, +1
3/20	Review Chapters 4-6	***Exam 2***	
3/22	Failure criteria	7.5	----------
3/25	Failure criteria	7.5	----------
3/27	Pressure vessels, plane strain	7.6, 7.7	HW 25: 7.83, 7.88, 7.96
3/29	Strain transformation	7.8	HW 26: 7.100, 7.109, 7.115
4/1	Strain Rosettes	7.9	HW 27: 7.137, 7.145, +1
4/3	Combined loading	8.1 ***Quiz 5***	HW 28: 7.144, 7.145, +1
4/5	Combined loading	8.3	HW 29: 8.16, 8.19, +1
4/8	Combined loading	8.3	HW 30: 8.37, 8.38, +1
4/10	Beam deflections	9.1	HW 31: 8.43, 8.47, +1
4/12	Statically indeter. beams	9.2	HW 32: 9.2, 9.10, +1
4/15	Singularity functions	9.3	HW 33: 9.20, 9.21, +1
4/17	Superposition	9.4 ***Quiz 6***	HW 34: 9.46, 9.53, +1
4/19	Column buckling	10.1	HW 35: 9.66, 9.89, +1
4/22 and 4/24		Review	

Exams 1 and 2: 8:20 – 10:10 pm (location to be announced).

Final Exam: Per Registrar's office (https://registrar.ufl.edu/courses/final-exam) on **05/01/2023 Wednesday 10:00 am –12:00 pm** in Weil 270
*all +1 problems will be posted on Canvas