EGM 3520: Mechanics of Materials
Fall 2022 Syllabus –Section # (Course #) 158N (28010) and 3580 (24024)

Modifications to this syllabus may be required during the semester. Any changes to the syllabus will be posted on the course web site and announced in class.

Instructor:

Dr. Peter Ifju, Professor, Department of Mechanical and Aerospace Engineering, ifju@ufl.edu, NEB 131, 392-6744

Lecture times and location:

Section 158N, 3rd Period (9:35 – 10:25) MWF in FLG 270
Section 3580, 6th Period (12:50 – 1:40) MWF in MCCC 100

Textbook:

F.P. Beer, E.R. Johnston, J.T. Dewolf and D.F. Mazurek, "Mechanics of Materials, 7th edition" McGraw Hill. Homework will be taken from 7th edition. Other editions are acceptable for reference

Catalog Description:

Credits: 3; 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.

Pre-requisites and Co-requisites:

Prerequisites: EGM 2511 and MAC 2313.

Teaching Assistant Office Hours:

Office hours with teaching assistants will be available. Location and schedule will be posted on the course website.

Course Online Resources:

E-Learning/Canvas system (https://lss.at.ufl.edu/)

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:
1. Basic understanding of engineering mechanics and the ability to apply this understanding to analyze and solve a given problem.
2. 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.

Professional Component (ABET):

EGM 3520 supports several program outcomes enumerated in the Mission Statement of the Department of Mechanical and 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 [ME Program Outcome M4].
Mathematics (25%), Engineering Sciences (50%), Engineering Design (25%)

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

Assessment Methods:

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

Homework 15%

Your 2 worst homework assignments will be dropped. Each day homework is "collected" there will be three problems assigned, two problems will be from the book (Mechanics of Materials, 7th edition) and one problem that we will make from scratch. The textbook problems will be graded for "completeness" and will receive 5 points each. The made from scratch problem will be graded more closely and will be given 10 points. No late homework will be accepted. Homework is to be submitted electronically on the Canvas Website at 9:30 am (for both sections). Working in groups is permitted. However, copying homework is NOT permitted. Written homework must 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 appropriate significant digits inside a box. See Homework Example at the end of this document. Use of solution manuals or websites to complete homework is considered cheating and a violation of the honor policy and will be fully enforced. Use of solution manuals to complete homework is considered cheating and a violation of the honor policy.

Quizzes 10%

No makeup quizzes allowed without a good excuse. Quizzes will be given in the first 15 minutes of class on assigned days, be in class ready to go. Your worst quiz will be dropped

***Midterm Exams 25%* (2)**

Common-time night exams will be given from 8:20 – 10:10 pm on the nights shown on the schedule

Final Exam 25%

Exam schedule

Section 158N, 3rd Period, Final Exam: 12/15/2022 @ 7:30 AM - 9:30 AM
Section 3580, 6th Period, Final Exam: 12/15/2022 @ 12:30 PM - 2:30 PM

Grading Scale:

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. Course grades will be "curved" if necessary – this decision will not be made until the end of the semester once all exams and homework assignments are graded.
93-100 = A, 90–92.9 = A-, 87–89.9 = B+, 83–86.9 = B, 80–82.9 = B-, 77–79.9 = C+,
73–76.9 = C, 70–72.9 = C-, 67–69.9 = D+, 63–66.9 = D, 60–62.9, <60 = E

Additional information regarding letter grades and associated grade points may be found at:
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx.

Assignment and Testing Schedule

EGM 3520 MECHANICS OF MATERIALS FALL 2022

Date	***Topics***	***Sections Covered***	***Homework Collected***
8/24	Statics review	Statics Review, 1.1	----------
8/26	Stress	1.1, 1.2	HW 1: statics problems
8/29	Stress components	1.3, 1.4	HW 2: 1.7, 1.10
8/31	Design considerations	1.5 ***Quiz 1***	HW 3: 1.32, 1.38
9/2	Strain	2.1	HW 4: 1.43, 1.55
9/5	----------	*Labor Day Holiday* ----------	
9/7	Axial deformation	2.1	HW 5: 2.3, 2.14
9/9	Statically indeterminate	2.2, 2.3	HW 6: 2.25, 2.27
9/12	3D Hooke's Law	2.4-2.8	HW 7: 2.33, 2.39
9/14	Stress concentrations	2.10, 2.11 ***Quiz 2***	HW 8: 2.68, 2.77
9/16	Plastic deformation	2.12	HW 9: 2.95, 2.97
9/19	Torsional stresses	3.1	HW 10: 2.68, 2.102
9/21	Gears & statically ind.	3.2, 3.3	HW 11: 3.10, 3.17
9/23	Design of shafts	3.4-3.6	HW 12: 3.36, 3.41
9/26	Elastoplastic shafts	3.7, Review	HW 13: 3.70, 3.74
9/28	Chapters 1-3	***Exam 1***	----------
9/30	Pure bending	4.1, 4.2	----------
10/3	Bending deformation	4.2, 4.3	HW 14: 4.10, 4.11
10/5	Composite beams	4.4, 4.5	HW 15: 4.9, 4.16
10/7	----------	*Homecoming Holiday* ----------	
10/10	Elastoplastic beams	4.6, 4.7	HW 16: 4.33, 4.40
10/12	Transverse loading	5.1 ***Quiz 3***	HW 17: 4.68, 4.71
10/14	V and M diagrams	5.2	HW 18: 5.4, 5.9
10/17	Design of beams	5.3	HW 19: 5.52, 5.59
10/19	Shear flow in beams	6.1	HW 20: 5.69, 5.76
10/21	Shear stresses in beams	6.1, 6.2	HW 21: 6.4, 6.7
10/24	Thin walled members	6.3, 6.4	HW 22: 6.15, 6.23
10/26	Stress transformations	7.1 ***Quiz 4***	HW 23: 6.30, 6.40
10/28	Mohr's circle	7.2 – 7.4	HW 24: 7.7, 7.14
10/31	Exam preparation	Review	HW 25: 7.31, 7.41
11/2	Chapters 4-6	***Exam 2***	----------
11/4	Failure criteria	7.5	----------
11/7	Pressure vessels, plane strain	7.6, 7.7	HW 26: 7.72, 7.88
11/9	Measurement of strain	7.8, 7.9	HW 27: 7.100, 7.133
11/11	----------	*Veterans Day Holiday* ----------	
11/14	Combined loading	8.1, 8.3	HW 28: 7.137, 7.145
11/16	Combined loading	8.3 ***Quiz 5***	HW 29: 8.37, 8.38
11/18	Beam deflections	9.1	HW 30: 8.43, 8.47
11/21	Statically ind beams	9.2	HW 31: 9.2, 9.10
11/23	----------	*Thanksgiving Holiday* ----------	
11/25	----------	*Thanksgiving Holiday* ----------	
11/28	Singularity functions	9.3	HW 32: 9.20, 9.21
11/30	Superposition	9.4 ***Quiz 6***	HW 33: 9.46, 9.53
12/2	Column buckling	10.1	HW 34: 9.66, 9.89
12/5	Design of columns	10.3	HW 35: 10.11, 10.26
12/7	Exam preparation	Review	HW 36: 10.27, 10.74

Exams 1 and 2 will be at night, ***Final Exam*** will be during the scheduled time

Attendance Policy, Class Expectations, and Make-Up Policy:

Class attendance is highly recommended but is not mandatory. Excused absences for homework submission, quizzes and exams 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 before the assignment 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.

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**, 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 suppor*t*, 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.

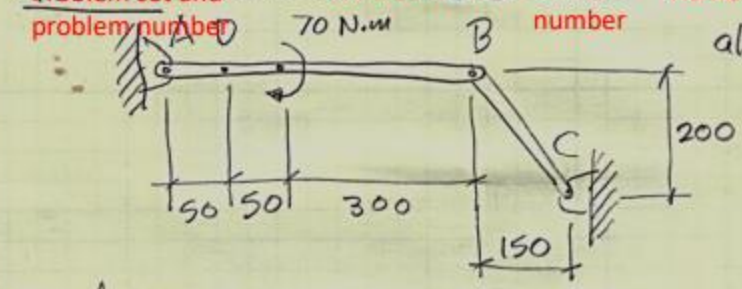
On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.

Example Homework Problem Format

12-1 | EGM3520 | 1585 | Ifju, Peter

Problem set and problem number | Course number | Section number | Name: Last name first

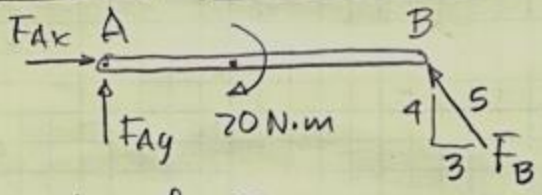
Given: Structure ABC

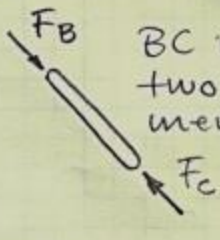


all dimensions in mm

Find: Internal loadings @ D

Solution: FBD of AB to find reactions





BC is a two force member.

Solving for F_{Ay}

$\Sigma M_B = 0: -F_{Ay}(0.4\,m) - 70\,N\cdot m = 0$

$\therefore \quad F_{Ay} = -175\,N$ or $F_{Ay} = 175\,N \downarrow$

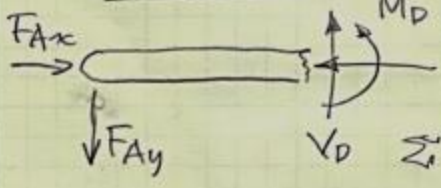
Solving for F_B

$\Sigma F_y = 0: \quad -175\,N + \frac{4}{5}F_B = 0 \quad \therefore \quad F_B = 218.75\,N$

Solving for F_{Ax}

$\Sigma F_x = 0: \quad -\frac{3}{4}F_B + F_{Ax} = 0 \quad \therefore \quad F_{Ax} = 131.25\,N \rightarrow$

FBD of AD

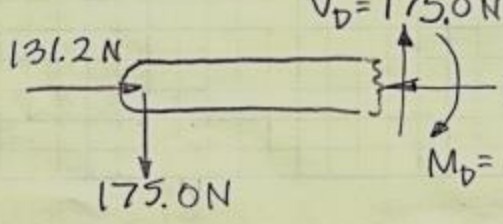


$\Sigma F_x = 0: \quad \boxed{N_D = 131.2\,N \leftarrow}$

$\Sigma F_y = 0: \quad \boxed{V_D = 175.0\,N \uparrow}$

$\Sigma M_D = 0: \quad F_{Ay}(0.05\,m) + M_D = 0$

$\therefore \quad \boxed{M_D = 8.75\,N\cdot m}$



Final answers should be boxed, have correct significant figures (3 unless it starts with a 1, then 4) Have correct units.