

EGM2511 Engineering Mechanics: Statics
Spring 2024
Class # 11515 / 11516

Instructor

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Office Hours: Monday 1:00pm – 2:00pm (in person, NSC 321)

Tuesday 1:00pm – 2:00pm (virtual, a Zoom link will be posted on Canvas)

If these times do not work for you then send me an email and I will gladly schedule a time to meet with you that works with your schedule

Course Website: Canvas. EVERYTHING will be posted to Canvas. You are responsible for all material and announcements posted to Canvas.

Course Interaction: All classes will meet at their regularly scheduled time every MWF in the classroom posted. Attendance is expected for all class periods. The material is best learned through interaction and engagement.

Instructional Team

The instructional team will consist of the instructor and a group of undergraduate peer mentors for the course. The peer mentors will be heavily involved in class time and will hold office hours outside of class to meet with students as well. You are welcome to attend any of the peer mentor office hours even if they are not the students you see in your course section. The best way to communicate with any person on the instructional team is by e-mail. The email addresses will be posted under the *Course Information* menu on Canvas.

Meeting Times and Rooms

There are three sections of the course:

Class Number 11515

Meeting times: MWF 2 (8:30am – 9:20am)

Class Number 11516

Meeting times: MWF 3 (9:35am – 10:25pm)

Final Exam (All Sections): Saturday 4/27 at 10:00am

Course Description

Reduction of force systems, equilibrium of particles and rigid bodies, vector methods and their application to structures and mechanisms.

Prerequisite

PHY 2048 Physics with Calculus 1

Corequisite

MAC 2313 Analytic Geometry and Calculus 3

Course Objectives

- a) Students understand and appreciate the relationship between the underlying principles of mechanics and the behavior of static mechanical systems.
- b) Students can represent physical bodies and restraints as idealized statical systems.
- c) Students understand the relationship between natural forces and how to properly model them.
- d) Students can analyze particles and rigid bodies subjected to external forces using analytical means and numerical methods implemented in computer programs.
- e) Students can apply the principles of statics to systems in the context of design or other similar engineering contexts.
- f) Students advance their abilities to solve engineering problems and to communicate the outcomes of technical investigations.
- g) Students will be prepared for more advanced study of engineering mechanics.

Professional Component (ABET):

This course is designed to identify and formulate solutions to statics problems using the students math and science background. This will be done using modern engineering tools and techniques to provide effective communication of the students work. The techniques are developed to encourage lifelong learning.

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	Medium
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	Low
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies	High

Topics Covered

- Free Body Diagrams including the representation of different support reactions and types of forces like point loads, distributed loads, self-weight, and applied moments
- Static Equilibrium for both particles and rigid bodies
- The use of vector Principles, force and moment equilibrium, and integration for any distributed effects
- Fluid Statics
- Friction
- Analysis of Simple Structures (Trusses, Frames, and Machines)

- Internal Forces and Bending Moments including visual representation through shear force and bending moment diagrams
- Computation of area properties for different shapes including the centroid, moment of inertia, and use of parallel axis theorem

Materials and Supply Fees

None

Texts and Readings:

A set of Course Notes, examples, and other information will be posted on the course Canvas page. These items constitute the textbook for the course.

I am happy to give guidance on additional reference books. The problem is not that there are too few resources, it is that there are too many, and they do not all agree on notation and approach. You will find that the solution process in this course is different than most textbook examples.

Course Schedule

The details and due dates of everything are posted to the document *EGM2511 Schedule* on Canvas.

Week 1:	Intro to Course
Week 2:	Module 1 – Equilibrium
Week 3:	Assessment 1
Week 4:	Module 2 – Distributed effects
Week 5:	Assessment 2
Week 6:	Module 3 – Hydrostatic pressure
Week 7:	Assessment 3
Week 8:	Module 4 – Truss analysis
Week 9:	Assessment 4
Week 10:	Spring Break
Week 11:	Module 5 – Frame analysis
Week 12:	Assessment 5
Week 13:	Module 6 – Internal forces
Week 14:	Assessment 6
Week 15:	Module 7 – Properties of Areas
Week 16:	Assessment 7 & Final Exam

Organization of the Course:

The details and due dates of everything in the course are posted on the course calendar document on Canvas.

The course is organized into seven modules, each of two-week duration. Each module will include new lecture video(s), 2-3 recitation sessions, one rehearsal exam, and one module assessment. During the recitations, students will actively work on problems associated with the topic and will continue to exercise those ideas as homework problems. There will be an examination style assessment at the end of each module. Each student will also be required to complete three computing projects, each culminating in a final report.

Coursework

The course will include several different kinds of work with different expectations associated with each. Each student is expected to complete all assigned work within the period granted. Late work will not be accepted.

The coursework includes:

1) Recitation work: Recitation sessions will center on group problem solving. All students are expected to actively contribute to their group in solving these problems. The instructional team will be available to help and answer questions during these periods. All in-class work will be counted as part of the student's progress in the course. **Engagement and participation counts!** During recitation each group is to work on the problem(s) that they choose. Several days later, every *individual* will submit **completed** solutions in the required format to Canvas. Therefore, it is **not necessary to complete each problem during the recitation session**. The goal of recitation is for each group to form a solid framework for each problem solution in class, while the instructional team is available for support.

2) Rehearsal Exams: "Rehearsals" take place in class prior to the module assessment and are very similar in difficulty to the assessment but are "open everything" which means you can use computers, classmates, talk to the instructional team, etc. The last 5 minutes of class will be reserved for self grading of the rehearsal exam.

Late work: The due date of required work is noted in the *EGM 2511 Schedule*. Late work **will not be accepted**.

**Please note: Learning is best achieved in an environment where discussions take place. Thus, as in recitations, you may find it beneficial to discuss your homework with other class participants in a small study group of approximately 3 to 5 students. I welcome collaborative work; however, in order to be successful on exams, you must be able to solve the problems on your own. If this is not the case, you will have great difficulty performing well on assessments and computing projects in this course.

3) Module Assessments: Progress and mastery of concepts will be assessed each module. The assessment for each module will be done individually, during class time, and without access to any additional resources. Your hand-written problem solutions on module assessments and the final exam must be neat and legible and **must follow the required format** (which is the same as recitation work and all solutions in this course).

The dates for each module assessment are published on the *EGM 2511 Schedule* on Canvas.

The date and time of the final exam is: Saturday April 27, 2024 at 10:00am.

There are no makeup opportunities for module assessments. If you miss an assessment then you have only missed an opportunity to demonstrate your mastery, but your course grade will not and cannot be reduced (because it is not based on averages). This does mean that it will also not improve if you miss an assessment. To "make up" for the missed assessment you simply have to use your remaining assessment opportunities to their fullest.

A reference sheet may be used during all assessments. The sheet must be **hand written (no photocopies or printouts)** and it can be no larger than 1 side of an 8.5" x 11" sheet.

4) Computing Projects: There will be three computing projects that reinforce the statics ideas covered in the modules and the problems worked in recitations. Students will use MATLAB to numerically compute the static behavior of a problem and to explore unique aspects of the problem. There is no requirement for knowledge of programming. You will be given a program that works and asked to explore it.

A final written report is required for each computing project. Each student is responsible for a unique report. The reports must be prepared in accord with the guidelines presented in *Guidelines for CPs* and the evaluation guide *Evaluation of CPs*.

The programs are planned as follows:

CP 1. *Distributed Load*

CP 2. *Truss Analysis*

CP 3. *Shear and Bending Diagrams*

Engagement:

This course is designed for high engagement of the students. There will be multiple ways to demonstrate engagement in this course through class participation, homework quality, self-assessments, etc.:

Class participation: In class we will be working, usually in groups, on solving statics problems. Engagement means coming prepared, working actively during the class, asking questions, showing leadership in the group, etc. You can earn up to 5 engagement points for attending each recitation period.

Problem solving speed: Speed is not required as everyone is new and learning the material, but to encourage efficiency there is an opportunity to earn extra engagement points each recitation. You can earn up to 4 engagement points for completing one of the day's problem during the 50 minute recitation period.

Homework: The completion and quality of assigned homework will count towards engagement. The students also have the opportunity to participate in the development of additional examples for all students. You can earn up to 4 engagement points per homework problem.

Self-Assessment: After each module assessment the students will have an opportunity to provide a self-assessment of their work. The completion and accuracy of the self-assessment will count towards engagement. You can earn up to 12 engagement points per self-assessment depending on the accuracy and thoughtfulness of your responses.

General Approach: The most effective learning is driven by curiosity, and the most effective learners are aware of their own intellectual development. Engagement includes the regular demonstration of these attributes. To do so elevates the learning environment for everyone.

Grading Criteria

Your final grade in the course will be based upon the degree of mastery of the ideas in each module, as demonstrated through the mastery assessments, the completion of the computing projects, and the level of engagement in the course throughout the semester. Your course grade is made up of the following:

$$\text{Score} = [(0.70 * \text{Assessments}) + (0.30 * \text{Computing Projects})] * \text{Engagement Multiplier}$$

The aim is to promote mastery and not just add up points. Engagement will serve as a course multiplier (think of it as a cup to fill up by continually accruing credits for engagement activities—there are more than enough opportunities and there is no upper limit to engagement points). The engagement scores vary every semester and will be normalized based on the current semester's engagement average. If your engagement score is right at the average your engagement multiplier will be 1.0.

I will be tracking progress on the 12 course mastery objectives (these will be discussed extensively throughout the course) and will associate mastery with multiple consistent demonstrations of knowledge. Each mastery objective is complete once you have shown the objective correctly 6 times (i.e. done it correctly on 6 different assessments during the semester). By the end of the semester, the goal is to master all 12 of the course mastery objectives. The opportunity to demonstrate mastery will exist right up to the final exam (but don't wait until

then). The document *Assessing Mastery* has more details on the course objectives and mastery-based grading of the assessments.

The computing project portion of the grade is based on the three projects that will be evaluated following the document *Evaluation of CPs*.

Every student's score starts at 0 (it is not averaged throughout the semester). With the addition of each assessment and computing project your score should increase. This does mean that your score will be low for much of the semester and I will not be able to predict your final grade, but it also means that you can only ever increase your score and it will never decrease. You will only receive a letter grade after the final exam based on the score you have earned at that point; until then you will receive detailed feedback every other week with your current score based on the work you have completed. The details on how to read your feedback will be provided in the document *How to Read Your Dashboard*.

There are minimums that must be met to pass the course which ensure that you have learned the minimum concepts in the course. The minimums include (1) mastery of 5 out of the 12 objectives AND (2) a CP score greater than 36 for all three projects. At the end of the semester if one of those minimums are not met you will automatically earn an E in the course. *However, do not worry about these minimums if you are putting in effort and working towards understanding the course material, as long as you are attending class, engaging, and completing the material you will surpass these minimums with ease.* If you have met those two minimums then your final grade will be assigned based on your final score. The final score to grade conversion is:

S Index	Grade
102+	A
92-101	A-
84-91	B+
76-83	B
68-75	B-
60-67	C+
52-59	C
44-51	C-
<44	E

Class Absences:

Class attendance is expected for all class meetings and is included in the engagement part of your grade. You are responsible for any missed class material and class announcements. An excused absence must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and requires appropriate documentation.

General Class Policies

1. Attend each class session on time and be prepared. Have the preparatory reading done, lectures and example videos watched, and ***be ready to ask questions*** and actively discuss the day's problems.
2. Class schedule and effort expectations: 3 hours of inclass meetings per week equals a *minimum* of 9 hours out-of-class work per week.
3. Professional presentation is expected on all submittals.
4. Retain originals or copies of all graded material for your records and for future reference.

5. Be respectful and considerate of everyone.
6. The syllabus is subject to change based on factors and needs of the course environment.

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.

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/>.

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/policies/student-honor-code-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.

A violation of the honor code will result in academic sanctions (typically a failing grade assigned for the course) and further disciplinary action. If you have any questions or concerns, please consult with the instructor 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 Undergraduate 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

Software Use and Copyrighted Material

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use and the use of copyrighted material. 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: <http://www.counseling.ufl.edu/cwc>, 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/>.

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://www.crc.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://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

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