

Engineering Mechanics - Dynamics
EGM 3401 Class 12953
Class Periods: MWF, period 7, 1:55 PM – 2:45 PM
Location: FLG 0220
Academic Term: Fall 2024

Instructor:

Dr. Christopher “Chrispy” Petersen
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Office Hours: NEB453, Tu 11:00 am - 12:30 pm, We 4:00-5:00 or by appointment

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

Please contact through the Canvas website or Slack. Do not email them personally.

- Sarah Clees, Undergraduate Grader
- Ivanna Millian, Undergraduate Grader
- Trevor Taylor, Undergraduate Grader
- Martin Lu, Undergraduate Grader

Course Description

Continues the dynamics sequence begun in EGM 3400 plus extended coverage of particle and rigid-body dynamics, with applications to land, sea, air, robotic, and space problems.

Course Pre-Requisites / Co-Requisites

Pre-requisites: EGM 2511 or EGM 2500, and MAC 2313.

Course Objectives

To provide a thorough and systematic introduction to the subject of dynamics of particles and rigid bodies using a Newton-Euler approach. To develop a deep understanding of the kinematics of particles and rigid bodies, the kinetics of a particle, the kinetics of a system of particles, and the kinetics of a rigid body. Many examples will provide insight into the underlying physical processes.

Materials and Supply Fees

None

Relation to Program Outcomes (ABET):

| Outcome | Coverage* |
|--|-----------|
| 1. 1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics | High |
| 2. 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. 3) an ability to communicate effectively with a range of audiences | Low |
| 4. 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. 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. 6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions | Low |
| 7. 7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies | High |

*Coverage is given as high, medium, or low. An empty box indicates that this outcome is not covered or assessed in the course.

Required Textbooks and Software

- There are two options: 1) MATLAB/Simulink, at least version 2018a, base version (no external toolboxes required) or 2) Octave. UF Apps can be used to access MATLAB for free via web interface. Octave is also free and can be downloaded from <https://octave.org/>. MATLAB student license can also be purchased relatively cheaply. Both MATLAB & Octave have similar interfaces and run the same type of files.

Recommended Materials

- Dynamics of Particles and Rigid Bodies: A Systematic Approach, A. Rao, Cambridge University Press, 2006.
- Geometry, Kinematics, Statics, and Dynamics, D. Bernstein – PDF version given

Course Schedule

Tentative, may adjusted as the semester progresses.

- Week 1: Fundamentals, Code
- Week 2-3: Point masses, frames, integration, equilibrium, plotting and debugging
- Week 4-5: Rotation, transport theorem, reaction forces, runge-kutta, stability, vector fields
- Week 6-7: Conservative energy, energy transfer, comparison of integration, observability
- Week 8: Study Week
- Week 9: Midterm (1/2 of the exam is in class on the 16, the rest is a take home from 16-18)
- Week 10-11: Non conservative energy, energy contours, controllability
- Week 12-13: System of particles, robustness, assumptions,
- Week 14-15: Rigid bodies, fitting data, model verification
- Week 16: Study Week
- Week 17: Final (Thursday 12Dec, 3-5 same location as class)

Important Dates

- 23Aug First day of class
- 16Oct Midterm, in-class, REQUIRED
- 16-18Oct Midterm, take-home, REQUIRED
- 12Dec Final, 3pm-5pm, in-person, REQUIRED

Course Specifics

The class every week will be taught in three sections. The first section (typically Friday) will be a traditional blackboard lecture where fundamentals are taught and discussed. The second section (typically Monday) will be in-lecture practice problems to solidify these concepts with discussion and in-class participation. The third section (typically Wednesday) will have a computer component to show the application of the material and enable frequent discussions of dynamics in-the-world (e.g. discussion of current events and dynamics). Any time left over in lectures will be opportunities to work on the course assignments. In class, students will be expected to participate via in-class “quizzes”. These will, most of the time, not be marked for correctness, but rather effort (though there maybe correct answers for bonus credit to the grade). Throughout the week there may be pre-recorded lectures for students to watch to expedite the learning process and save time in class. All-in-all, this type of class is created to

facilitate a blend of theory and application. The structure may evolve through the semester due to pacing and remaining on schedule.

Outside of class, most weeks there will be canvas quizzes. These quizzes are intended to reinforce knowledge and understand gaps. The quizzes can be taken as many times as possible during a one week period. However, each attempt at a SINGLE question will lower the worth of that question by 2%-5%. The minimum lower score for the ENTIRE quiz will be 80%, however, this minimum score is only guaranteed if at every retry the student in the comment portion of the quiz explains why they got the question wrong in the first place and why they chose their current answer. If this is not sufficient, then the instructor may deduct further to lower the score below 80%. The quizzes are not intended to be difficult or take too much time, but to ensure concepts are not forgotten between assignments.

Assignments will typically (but not always) consist of a traditional dynamics problem and a topic specific problem selected by the student. All students must do the traditional problem. The topic specific problems represent the application of fundamentals to a variety of domains (land, sea, air, space, robotics, etc.) that will carry on through the semester. The student is only needed to do ONE of these topic specific problems, and can switch tracks (e.g. from space to air or air to space) if they want to. The point is to give students exposure to all types of problems. Students need to show all their work for full credit. Partial credit will be given to students who show their process. If a student is cannot arrive at the answer, highlighting that the answer is incorrect with an explanation of why may also result in partial credit. Recognizing something is wrong is sometimes just as important as getting something right. Please ensure that the assignments are legible, as points are difficult to give if the process cannot be followed, with answers circled or boxed. The primary form of submission will be through Canvas, but if not possible, other acceptable forms of submission will be used as approved by the university.

Assignments may also have coding portions, in which case the student is expected to adequately comment their code for readability. All resources along with extra videos will be given so that students can perform the assignments with the base software required (e.g. there should not require any toolboxes). Students will be graded on how the code functions. To do so, a framework may be given by the instructor to ensure the code can be graded. If the code does not produce answers that the student believes is correct, or if the code will not run, the student should comment on why they believe it is not working and point to the source, in which case partial credit maybe given. Recognizing something is wrong is sometimes just as important as getting something right.

After an assignment is graded, students will be given a score with a brief generated report that shows how the student did and maybe how to improve. The students will then have till the next assignment due date (approx. one-two weeks) to “redo” their assessments to make up to half credit back. To get the full half credit, students must point out where they messed up and why they did it that way. Then students must fix the problem and demonstrate they understand why this is the correct method. **Please note**, because the instructor gives up to half credit back on homework assignments, he will not accept late assignments at a reduced grade. A late homework is graded as a zero. Students should pass in what they have at the due date, and can recover up to half points later.

The class will also implement a “Comment Card” system. At the end of every lecture each student will be either given a piece of paper or a weblink to use that will enable writing/drawing anything: a comment, a question for the class, a critique for the instructor, a joke, a drawing, a topic of discussion, anything. These are completely anonymous and no name should be given. Then at the beginning of the next class, 10-20 will be chosen at random to read in-front of the class (though all cards will be reviewed beforehand to ensure all voices heard). Please be respectful in the Comment Card system, as any inappropriate Comment Cards will be removed from the random reading process.

There will be one midterm and one final, both are open book, open note, open laptop. The midterm will consist of two parts. The first will be an in person exam, where students will be given a problem, like the assignments, to solve half-way. This will be passed in at the end of class to grade. Then the students will be given 48 hours to complete the take-home portion, where they will continue the problem, but be given the solutions to the first half. The in-person portion focuses on set-up and mathematics, while the take home focuses on results and coding. All students must show be in attendance for the exam. The take-home portion must also be performed BY YOURSELF. No working in groups. The final will be in person during finals week. This will not be shifted. The final will be a single

problem for students to solve, similar to the assignments. Note for both midterm and final, you must do your own work. Copying from other students or other sources is a violation of academic integrity.

Attendance Policy, Class Expectations, and Make-Up Policy

Regular lectures will be held in person and thus attendance will be expected. Attendance will not be tracked explicitly. Instead attendance will be tracked implicitly via frequent in-lecture quizzes that happen every lecture. At the end of the semester, the participation credit will be a function of how many in-lecture quizzes students do. All lecture material will be made available to all students throughout on Canvas, but note that not all lectures will be recorded. That said, the lecture material posted should be sufficient if one class is missed. Your instructor is also available to assist to ensure students can catch-up.

If a student is going to be absent for any reason, please send an email to the instructor as soon as possible. If there is sufficient time before the absence (e.g. >2 days for assignments, >3 days for exams), the student and the instructor should come to an agreement beforehand on how the student will make-up their course material. If an absence is sudden (e.g. <2 days for assignments, <3 days for exams), then letting the instructor know after the missed class will be acceptable if a message is sent as soon as possible after the absence. Once returned to campus, the student and instructor will work on a plan to make-up the material. Please note reasons for absence are noted in the university attendance-policies (see link below). Please do not force one-self to come to campus for lecture, if there is a reason please let the instructor know. Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies. Click here to read the university attendance policies:

<https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Evaluation of Grades

| Assignment | Total Points | Percentage of Final Grade |
|------------------------------------|--------------|---------------------------|
| Assignments (6) | 100 each | 55% |
| Participation via In-Class Quizzes | 100 each | 10% |
| Out of Class Quizzes | 100 each | 10% |
| Midterm Exam | 100 | 15% |
| Final Exam | 100 | 15% |
| | | 105% |

Grading Policy

The following is given as an example only.

| Percent | Grade | Grade Points |
|-------------|-------|--------------|
| 93.4 - 100 | A | 4.00 |
| 90.0 - 93.3 | A- | 3.67 |
| 86.7 - 89.9 | B+ | 3.33 |
| 83.4 - 86.6 | B | 3.00 |
| 80.0 - 83.3 | B- | 2.67 |
| 76.7 - 79.9 | C+ | 2.33 |
| 73.4 - 76.6 | C | 2.00 |
| 70.0 - 73.3 | C- | 1.67 |
| 66.7 - 69.9 | D+ | 1.33 |
| 63.4 - 66.6 | D | 1.00 |
| 60.0 - 63.3 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

More information on UF grading policy may be found at:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.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 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 or TAs in this class.

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.

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 Coordinator
- HWCOE Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@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/>.

Academic Resources

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

Career Connections 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: <https://distance.ufl.edu/getting-help/>; <https://distance.ufl.edu/state-authorization-status/#student-complaint>.