

ASEN 2703 INTRODUCTION TO DYNAMICS AND SYSTEMS

Spring 2023 SYLLABUS

Lecture: Tuesday/Thursday AERO 120
Section 001: 11:30 AM - 12:45 PM
Section 002: 1:00 PM – 2:15 PM

Final exam: Wednesday, May 10th, 10:30 AM – 1 PM.

Class Website: <http://canvas.colorado.edu>

Instructors

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Overview

The study of dynamics is a key component of every undergraduate engineering major and is especially relevant to Aerospace Engineering. In the upper division you will begin taking courses dealing with the dynamics of air and space vehicles, building upon the fundamentals presented in this class. Structures, fluids, controls, and orbital mechanics all have roots in this material, so it is critical that you build this technical base carefully.

In this class and co-requisite lab course (ASEN2803) the fundamentals of two-dimensional motion of particles and rigid bodies are presented from both a theoretical and practical point of view. In addition to deriving and using first principles of dynamics, we will do experiments, designs, and hands-on work that are intended to help students develop an intuition or feel for dynamics. Furthermore, we take the study of simple motions one step further by introducing the fundamental concepts of vibrations and control into this course. Vibration analysis is critical to aerospace vehicle design, and as engineers we must both understand the motion of vehicles and learn how to modify the vehicle to suit mission requirements. This course will give you a flavor of these advanced topics, laying the groundwork for more advanced studies in your junior and senior years.

Textbook

Required: *Engineering Mechanics: Dynamics*, by Bedford and Fowler, Fifth Edition, 2008.
ISBN VP ISBN-10: 0132971135

Course Outline

1. Particle Kinematics and Kinetics
2. Particle Energy and Momentum Methods
3. Planar Rigid Body Kinematics and Kinetics
4. Rigid Body Energy and Momentum Methods
5. Vibrations
6. Systems and Control

Prerequisites

Physics 1, ASEN2001, and ASEN2012, APPRM2350 are prerequisites for this course. APPM2360 is a pre or co-requisite. Much of the material covered in this class has been introduced in your freshman physics class. It also depends heavily on a solid understanding of statics. Students are expected to have a working knowledge of vector operations and vector calculus. Assignments regularly require the use of MATLAB; students are expected to be proficient in the use of MATLAB for problem solving.

Course Components

Material and concepts are introduced, and student mastery is evaluated using several mechanisms throughout the course:

Reading Assignments - The primary means for conveying factual information, techniques, and examples is reading assignments in the textbook and course notes. The textbook is excellent, providing clear explanations and numerous examples of varying difficulty - take advantage of this outstanding resource. Reading assignments are to be completed prior to the class lecture period.

Lecture & Discussion – We typically start a new topic in each lecture session. The instructor will provide a complementary overview of the material covered in the reading assignment.

Homework – Homework problems are generally assigned once per week. They provide practice in solving problems of varying difficulty and sometimes will also involve computing. Collaboration on homework is allowed (copying from others or solution manuals is not); however, students are encouraged to use homework as a means to ensure their individual mastery of the subject.

Group Problem Solving – In the lecture periods we will sometimes have group problem solving sessions. A problem will be presented that may include conceptual questions about the material and/or relevant problems (often from previous year's exams). Students work in groups to answer the questions & submit their work for class participation credit. We discuss the questions and problem solutions in class.

Exams – Four *midterm exams* will be conducted in lecture at ~3-4 week intervals. These exams will include both conceptual questions and detailed problems similar to homework or lab analysis. The *final exam* is comprehensive, covering material from the entire course.

Course Policies

Grading errors: If you notice an error in grading of your assignment, you may use the regrade request function in Gradescope to briefly describe the error. Regrade requests for any exam or assignment must be submitted within 2 weeks of the grade posting to Canvas.

Office Hours: Instructor and TA office hours will be arranged and posted to Canvas as soon as possible.

Email: We will use Piazza to address most questions in this course. If you need to discuss something sensitive with the instructors, you may use Email – please include ASEN2703 in the subject line. We reserve the right to reply to email questions only during business hours, i.e. Monday through Friday, 8:00 am – 5:00 pm. Emails received 24 hours or less before the exams are not guaranteed a response prior to the exam.

Attendance: Attendance to lecture in-person is expected, but not required in general. In-class exercises are included as part of the participation grade. Attendance in-person for exams is required.

Exams: There are a total of 5 in-person exams in this class – 4 in-class midterm exams and a comprehensive final, with dates provided on the class schedule. The lowest exam score will be dropped in calculating your final course grade. In general, we will use this flexibility to allow for situations where students cannot take an exam due to an unavoidable schedule conflict or cannot take an exam due to illness or other emergency situation occurring on the exam date. If you have a schedule conflict or cannot take an exam, please notify the instructor as early as possible, so that an appropriate course of action can be taken.

Instructions on what materials may be used for exams will be provided by the instructors.

Any type of collaboration or copying on an exam or final constitutes cheating and will result in an F for the course. An honor code violation report will be filed.

Grading - Grades on individual assignments and for the overall course are set based on the following criteria. **Grades do not correspond to pre-specified ranges of scores.**

- A, A- Demonstrates superior understanding of the material beyond the course requirements, excellent technical work
- B+, B Demonstrates comprehensive understanding of the material, very strong technical work
- B-, C+ Demonstrates good understanding of the material, complete technical work
- C Demonstrates adequate understanding of the material to proceed to the next level; sufficient technical work
- C- Does not demonstrate adequate understanding of the material to proceed to the next level
- D Poor technical work
- F Unsatisfactory performance

Homework Policies

Posting & Submission

- Homework will be posted on Canvas/Gradescope including the due date & time.
- Late homework will not be accepted, but the lowest two homework grades will be dropped.
- Solutions will be posted on Canvas after the due date.
- Homework is to be submitted on Gradescope with a new page for each question, making sure that the pages are correctly assigned to the right problem.

Collaboration vs Copying/Plagiarism

- Collaboration is permitted on homework. You may discuss the means and methods for formulating and solving problems and even compare answers, but you may not copy someone's assignment. Copying material from any resource (including solutions manuals) and submitting it as one's own is considered plagiarism and is an Honor Code violation. The more you think about the problems yourself, the more you learn, and the more successful you will be on exams and in subsequent courses.
- Directly copying from a solution manual or other source is considered plagiarism.
- While we strongly discourage students from relying on a solutions manual for pedagogical reasons, we will NOT consider the USE of a solutions manual as plagiarism. What is critical is that students SOLVE the homework on their own, regardless of the tutoring or resources they used, and not turn in a copy of someone else's work. Thus, copying another student's homework or the answer key and turning it in is plagiarism and a violation of the honor code.

Content

Homework solutions must demonstrate an understanding of the principles involved by including diagrams, using correct notation and terminology, explaining the approach in a clear and technically precise manner, showing the key steps to obtaining the solution, and outlining the answer with proper units. These problem-solving steps are critical for developing problem formulation skills.

Format

- Homework should be neatly handwritten with a new page for each problem. Typed homework is acceptable if you prefer it, but is definitely not required or encouraged. If you write a MATLAB script or function to solve the problems, the code must be included in your submission.
- Always submit work with a professional appearance. Neatness, clarity, and completeness count. Very messy work will not be graded and will be assigned a score of zero.
- Vector notation must be used when appropriate. Numerical values must include units and a meaningful number of significant digits. Final answers must be indicated with an arrow, underline, or box.

Grading

Homework is graded partially based on completion of all assigned problems (~50%) and partially based on the quality/accuracy of a subset of the assigned problems (~50%). To receive credit for completion, problems must be presented using the full appropriate problem solving approach. The problems graded for accuracy will be evaluated in more detail looking for correct methods, accurate complete results, and clear explanations (where appropriate).

In computing the overall homework grade, we will drop the two lowest homework scores. This is meant to provide some flexibility in dealing with a higher workload in another class or unexpected situation that prevents you from completing one or two of the assignments on time.

Grade Policy

Type	Description	Percentage
Exams	Average of scores on 4 unit exams & final – with lowest score dropped	75%
Homework	Average of homework scores – with lowest two scores dropped	20%
Participation	Submission of in-class activity problems or noted office hour discussions 1 point each, up to maximum of 5 points.	5%

Grading Philosophy

Assignments are graded to an absolute standard designed to indicate your level of competency in the course material. Minor adjustments may be made in the assignment of final grades, but curving is not implemented to achieve a specific distribution of grades. The final grade indicates each student's demonstrated readiness to continue to the next level in the curriculum. The AES faculty have set these standards based on our education, experience, interactions with industry, government laboratories, others in academe, and according to the criteria established by the ABET accreditation board.

University Policies Spring 2022

Classroom Behavior

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the [classroom behavior](#) policy, the [Student Code of Conduct](#), and the [Office of Institutional Equity and Compliance](#).

Requirements for COVID-19

As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the “Accommodation for Disabilities” statement on this syllabus.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu).

If you need to miss an exam due to illness or quarantine, please notify the instructor by email so that appropriate arrangements can be made. You are not required to provide any specific information as to the nature of the illness or cause for quarantine.

Accommodation for Disabilities

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the [Disability Services website](#). Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see [Temporary Medical Conditions](#) on the Disability Services website.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

Honor Code

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code academic integrity policy. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to the Honor Code (honor@colorado.edu; 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the [Honor Code website](#).

In this class, the academic sanction for a violation of the honor code on an exam will be a final grade of F in the course.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. The university will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by or against members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or email cureport@colorado.edu. Information about university policies, [reporting options](#), and the support resources can be found on the [OIEC website](#). Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting options. To learn more about reporting and support options for a variety of concerns, visit [Don't Ignore It](#).

Religious Holidays

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. In this class, please provide us with a list of these conflicts in the first two weeks of the semester.

See the [campus policy regarding religious observances](#) for full details.