ASEN 2703 INTRODUCTION TO DYNAMICS AND SYSTEMS
Spring 2023 SYLLABUS

Lecture: Tuesday/Thursday AERO 120
Section 001: 2:30 – 3:45 PM
Section 002: 4:00 – 5:15 PM

Final exam: Saturday, May 4th, 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, APPM2350 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 methods & post solutions.

Exams – Three *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. 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 1 week 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 the Canvas Discussion Board 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 4 in-person exams in this class – 3 in-class midterm exams and a comprehensive final, with dates provided on the class schedule. The final exam score can be used to replace one lower or missing in-class exam. 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. Final grade thresholds will be set by the instructors, with the cutoff for a C- not higher than 70.

- 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 , C- Demonstrates adequate understanding of the material to proceed to the next level; sufficient technical work
- D Does not demonstrate adequate understanding of the material to proceed to the next level
- 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 be 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 3 unit exams & final.*	80%
Homework	Average of homework scores – with lowest two scores dropped	15%
Participation	Submission of in-class activity problems 1 point each, up to maximum of 5 points.	5%

*Exam Grade – To provide some flexibility for issues coming up with the unit exams and to recognize improved mastery of the material throughout the course, the exam scores will be weighted/averaged as follows:

- If the final exam score is lower than all unit exams, it will count the same as a unit exam contributing 20% to the final grade.
    - For example, with these scores: Exam1 (80), Exam2 (90), Exam3 (85), Final Exam (75), the exam average for the final grade = ¼ (80+90+85+75) = 82.5
- If the final exam score is higher than any of the unit exams, it will count as 40% of the final grade (replacing the lowest unit exam score) and the higher two unit exams will each contribute 20% to the final grade.
    - For example, with these scores: Exam1 (75), Exam2 (80), Exam3 (85), Final Exam (90), the exam average for the final grade = ¼ (80+85+2*90) = 86.25

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 2024

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure 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 Infectious Disease

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all applicable campus policies and public health guidelines to reduce the risk of spreading infectious diseases. If public health conditions require, the university may also invoke related requirements for student conduct and disability accommodation that will apply to this class.

If you feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the guidance of the Centers for Disease Control and Prevention (CDC) for isolation and testing. If you have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home but should follow the guidance of the CDC for masking and testing.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

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.

If you have a required medical isolation for which you require adjustment, for example because of an exam, please email the instructor as soon as possible to make necessary arrangements. You are not required to state the nature of the illness or provide any medical documentation.

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. Violations of the Honor Code may include but are not limited to: plagiarism (including use of paper writing services or technology [such as essay bots]), 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 Student Conduct & Conflict Resolution: honor@colorado.edu, 303-492-5550. Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

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. University policy prohibits protected-class discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website.
Please know that faculty and graduate instructors must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don’t Ignore It page.

Religious Accommodations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, **we request that all religious accommodation needs be reported to the instructors by February 1, 2024.**

See the campus policy regarding religious observances for full details.

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact Counseling and Psychiatric Services (CAPS) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through Academic Live Care. The Academic Live Care site also provides information about additional wellness services on campus that are available to students.