ASEN 2703: INTRODUCTION TO DYNAMICS AND SYSTEMS SYLLABUS SPRING 2025

Instructor Information

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Teaching Assistants and Facilitators

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Course Overview

Course webpage: canvas.colorado.edu

Lectures: Tuesdays and Thursdays in AERO 120

- Section 001: 2:30 – 3:45 PM
- Section 002: 4:00 – 5:15 PM

Course description:
The study of dynamics is a key component of every undergraduate engineering major and is especially relevant to the Aerospace Engineering Sciences. In the upper division, you will begin taking courses focused on 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 develop a strong technical foundation in dynamics.

In this class, the fundamentals of two-dimensional motion of particles and rigid bodies are presented from a theoretical point of view. We will derive and use first principles of dynamics, with applications to a variety of problems. 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 any 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.

Prerequisites: Requires prerequisite courses ASEN 2701 and APPM 2360 or MATH 2130 & MATH 3430. Requires prerequisite or corequisite course of APPM 2350 or MATH 2400. Much of the material covered in this class uses concepts from your first-year 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 topics: We will cover the following topics during the listed quarters (i.e., 4 weeks):

1. Particle kinematics and kinetics (Q1)
2. Particle energy and momentum methods (Q1)
3. Planar rigid body kinematics and kinetics (Q2)
4. Rigid body energy and momentum methods (Q3)
5. Vibrations (Q4)
6. Systems and control (Q4)

Course schedule: A document listing the estimated schedule for covering course topics, the lead instructor, reading assignments, and assessment dates is provided on Canvas.

Textbook

Required: *Engineering Mechanics: Dynamics,* by Bedford and Fowler, Sixth Edition, 2023. ISBN VP ISBN-10: 9780138034016

Course Components

Concepts are introduced and student proficiency is evaluated using the following mechanisms:

Reading assignments: The primary means for conveying information, techniques, and examples is reading assignments in the textbook and any provided notes. The textbook is excellent, providing clear explanations and numerous examples of varying difficulty; take advantage of this outstanding resource. Reading assignments are listed in the course schedule and are expected to be completed prior to the lecture for which they are assigned (except on the first day of class).

Lectures: We typically start a new topic in each lecture. The instructor will provide a complementary overview of the material covered in the reading assignment. You are expected to attend lectures, take notes, ask questions, answer questions, and actively participate in any activities. Lectures will be recorded via classroom capture and automatically posted to Canvas so that students who are not able to attend a class can access the material they missed.

In-class problem-solving: In the lecture periods, we will sometimes have group problem-solving activities. A problem will be presented that may require conceptual discussion, problem formulation, diagrams, or technical calculations. Students work in small groups to answer the questions. Then, we discuss the questions and problem solutions in class. These problem-solving activities are not graded, but they are designed to support your learning.

Homework: Homework problems are generally assigned once per week. They provide practice in solving problems of varying levels of difficulty and may also involve computing. Problems may include questions from the textbook as well as more complex problems. Students are encouraged to use homework as a means to ensure their individual proficiency of the subject.

Exams: This course includes a total of four exams. Three midterm exams will be administered in-person during the scheduled lecture time for each section at ~3-4 week intervals; the

scheduled exam dates are listed in the course schedule available in Canvas. One final exam is comprehensive, covering material from the entire course. These exams may include both conceptual questions and detailed problems similar to homework.

Note: no opportunities for extra credit will be provided.

Administrative Policies

Office hours: Instructor and TA/TF office hours will be arranged and posted to Canvas at the start of the semester.

Communication: You may use the optional course Slack page to discuss any technical questions with the instructional team and/or your fellow class members. However, administrative, student-specific, or grade-related questions may be discussed only over email. You must send emails from your CU email address and list "ASEN2703:" at the start of the subject line of your email. We reserve the right to reply to email questions only during business hours, i.e., Monday through Friday, 8:00 am – 5:00 pm. Please note that we cannot respond immediately; we will respond as soon as we are able and according to the time-sensitive nature of the request. Emails received 1 business day or less before any exams are not guaranteed a response prior to the exam.

Attendance: You are expected, but not required, to attend lectures where course material is presented in-person; we will not record or grade attendance. If you miss a lecture period where course material is presented, you are expected to watch the lecture recording in a timely manner to catch up. However, you are required to attend all exams in-person.

Homework Policies

Homework posting and submission

- Homework assignments will be posted on Canvas with the deadline clearly listed.
- Assignments will generally be due in the evening on the specified deadline.
- All assignments must be submitted in Gradescope by the deadline.
- You may resubmit or update your homework in Gradescope multiple times before the homework deadline, for instance, if you wish to correct an error. However, you will not be able to resubmit or update your homework after the deadline has passed or after grading.
- Once you submit your assignment electronically, please double check that the file has uploaded correctly, is readable and is not corrupted; it is your responsibility to ensure it is uploaded correctly. We will not grade a homework if we cannot open the file.
- Late homework will not be accepted.
- The lowest two homework grades across the entire semester will be automatically dropped when calculating grades.
- Solutions will be posted on Canvas after the deadline has passed.

Content

Homework submissions must demonstrate an understanding of the principles involved by including the following components, where applicable: diagrams, using correct notation and terminology, explaining the approach in a clear and technically precise manner, showing the key steps and intermediate quantities used to obtain the solution, discussion of relevant theory and technical concepts, and outlining the answer with proper units. These components are critical for developing problem-solving and technical communication skills. A commented code or script alone is not considered a homework solution unless specifically requested for a problem and will not receive full credit; for credit, a write-up (by hand or typed using word-processing software) with the components described above must accompany the solution to each problem, unless otherwise specified.

Format

- Homework should be neatly handwritten with a new page for each problem. Typed homework is acceptable, if you prefer, but is not required or encouraged. If you write a MATLAB script or function to solve the problems, the code must be included at the end of your submission. Code does not serve as a substitute for working and will not receive full points. You must write out your working.
- Always submit work with a professional appearance, i.e., neat, clear, and complete. Very messy work that cannot be read will not be graded, receiving 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 boxed.

Acceptable Use of AI in this class

Students in this class are not allowed to use artificial intelligence (AI) or machine learning tools (e.g., ChatGPT or Dall-E 2) on any assessment in this course. Use of these tools would not enhance your learning in the subject matter covered in this class. Each student is expected to complete each assessment without assistance from AI. Use of AI will be treated as a form of academic dishonesty akin to plagiarism or cheating.

Grading

Homework is graded partially based on completion of all assigned problems and partially based on the quality/accuracy of a subset of the assigned problems. To receive credit for completion, problems must be presented using the full appropriate problem-solving approach. The problems graded for accuracy and quality will be evaluated in more detail by looking for a correct technical approach; accurate, clear, and complete working; and accurate answers.

In computing the overall homework grade, we will drop the two lowest homework scores. This grading scheme provides, for example, some flexibility in dealing with a higher workload in another class or an unexpected situation that prevents you from completing one or two of the assignments.

If you believe that your homework was graded incorrectly, you have 1 week from when it is returned to request a regrade in Gradescope (except at the end of the semester). This request

must be submitted in Gradescope and should include a brief description of the suspected grading error and the relevant rubric item/s. You must review the homework solution before submitting a regrade request. Regrade requests will be reviewed by a member of the instructional team. When a regrade request has been submitted, we reserve the right to regrade the entire homework. In that case, it is possible that the homework score may change (increasing or decreasing) if any additional errors are located.

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. However, you must implement the technical approach and write up your submission yourself. Remember, the more you think about and solve the problems yourself, the more you learn, and the more successful you will be on exams and in subsequent courses.
- Copying material from any resource (including solutions manuals, material from previous classes, or another student's homework) and submitting it as your own is considered plagiarism, which is an Honor Code violation. Plagiarism will be reported to the Honor Code office and will result in academic sanctions in this course.
- 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 (as long as you do not copy from it).

Exam Policies

There are 4 in-person exams in this class: 3 in-class midterm exams scheduled during the semester and 1 comprehensive final exam. The dates for all exams are provided in the class schedule.

Prior to each exam, the instructors will provide a list of specific exam policies, including the course content to be covered, materials allowed, etc. These exam policies must be followed.

If you cannot take an exam at the scheduled time due to a foreseen and excusable reason, notify the instructors at least two weeks prior to the exam date to request an alternate exam time/date. In this case, it is up to the instructors to determine if an exam will be rescheduled. If you cannot take an exam due to illness or another emergency occurring on the exam date, notify the instructor as soon as possible so that an appropriate course of action can be arranged. For students with accommodations, you will be contacted with relevant timing and logistics of the exam; you must respond promptly to any requests for scheduling information throughout the semester.

Exams must be completed independently. Any type of collaboration, copying, or violation of the exam policies is not permitted and will result in severe academic sanctions (e.g., receiving a grade of F in the course) and a report will be filed with the CU Honor Code office.

Course Grading Scheme

The numerical course grade will be calculated using the following assessments and weightings:

Assessment	Percentage
Homework (lowest two scores dropped)	20%
Exam 1	20%
Exam 2	20%
Exam 3	20%
Final Exam	20%

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.

Final grade thresholds will be set by the instructors, with the cutoff for a C- not higher than 70. Letter grades for the overall course are determined by the instructors based on the following criteria:
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

University Policies

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. Understanding the course's syllabus is a vital part in adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. 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.

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 temporary illness, injury or required medical isolation for which you require adjustment, please email the instructor as soon as possible to make necessary arrangements.

Accommodation for Religious Obligations

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, you must alert the instructors with the need for a religious accommodation during the first two weeks of classes, i.e., by January 24, 2025.

See the campus policy regarding religious observances for full details.

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.

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, marital 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.

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 abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. 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 OIEC support resources including confidential services can be found on the OIEC website.

Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about their options and support resources. To learn more about reporting and support for a variety of concerns, visit the Don't Ignore It page.

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.