ASEN 2003 Spring 2020 Syllabus
INTRODUCTION TO DYNAMICS AND SYSTEMS

Lecture:
- Section 100 Monday/Wednesday 11:00 AM - 12:15 PM AERO 120
- Section 200 Monday/Wednesday 12:30 PM - 1:45 PM AERO 120

Lab:
- Section 301 TTh 12:30-2:20 PM (AERO 141)
- Section 302 TTh 2:30-4:20 PM (AERO 141)
- Section 303 TTh 4:30-6:20 PM (AERO 141)

Final: Saturday May 2 from 10:30 AM to 1:00 PM

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

Instructors

Professor Penina Axelrad
Office: AERO 417 / Phone: (303) 492-6872 / Email: penina.axelrad@colorado.edu

Professor Jay McMahon
Office: AERO 461 / Phone: (303) 492-3944 / Email: jay.mcmahon@colorado.edu

Lab Instructors:
Bobby Hodgkinson
Office: AERO 150D / Phone: (303) 492-4481 / Email: hodgkinr@colorado.edu

Josh Mellin
Office: AERO 141E / Email: joshua.mellin@colorado.edu

Teaching Assistants/Fellows:

Karina Rivera	email: Karina.RiveraLopez@Colorado.EDU
Jacob Vendl	email: Jacob.Vendl@colorado.edu
Emma Markovich	email: Emma.Markovich@Colorado.EDU
Conner Martin	email: Conner.Martin@Colorado.EDU
Dawson Beatty	email: Dawson.Beatty@colorado.edu
Iris Altman	email: Iris.Altman@colorado.edu
Andrew Mahon	email: Andrew.Mahon-1@colorado.edu

Textbook

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

Overview

The study of dynamics is a key component of every undergraduate engineering major, but 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.

ASEN 2003 differs from a classical first course in dynamics in two ways. The first is that 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.

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

Calculus 1-2, Physics 1, ASEN2001, ASEN2012, and GEEN1300 Introduction to Computer Programming, 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 is not); however, students are encouraged to use homework as a means to ensure their individual mastery of the subject. In class group problem solving and labs will allow for considerable collaborative problem solving.

Clickers – We will use Clickers in this course during lecture periods. There are two main reasons we use Clickers: first, extensive research has shown that the use of Clicker questions during lecture can lead to improved learning, comprehension, and retention by the students; second, Clickers are an effective way for us to get feedback from the entire class on how well concepts are being understood. Clicker questions are graded only for participation – there is no penalty for entering the incorrect answer.

Group Problem Solving – In the lecture and lab periods we will sometimes have group problem solving sessions. A handout is provided with conceptual questions about the material and/or relevant problems (often from previous year's exams). Students work in groups of 2-4 to answer conceptual questions about the material and do practice problems in preparation for the unit exam. We discuss the questions and problem solutions in class.

Labs - There are a variety of experimental and design labs in this course that offer a different perspective on the material. They vary in duration and requirements. Each lab handout will state the objectives of the assignment, the report requirements, and the weighting (number of points) in the overall lab grade. In some cases, students will observe dynamic phenomena in the lab before we formally discuss the theory and do practice problems. Why do it in this order? The idea behind this type of "discovery learning" is that it helps you develop a concrete mental picture to connect to abstract mathematical concepts; and, it allows the student to formulate the questions that need to be answered to fully understand the experiment. In particular, we have tried to avoid making the labs "canned" or "turn-key"; that is, you should not expect to be able to walk into the lab, collect some data, and crank out the answer to some lab questions.

The labs are designed to require you to try something, ask questions of the instructors and TA's, make some calculations, and maybe redo the experiment based on what you observed. The final result of the lab is not a "right" answer, but rather a set of answers and a solid explanation, based on correct mathematical theory and good experimental practice, of why such results were obtained. In other laboratory exercises, we will stress data analysis skills. This includes extensive usage of computer programming and statistics. In these examples, we expect students to follow directions from the instructor and provide a lab write-up that demonstrates that students understood the key concepts of the lab. Presentation of results will be stressed and students are expected to properly describe what was measured, what was modeled, and whether discrepancies between observations and models are significant. Although the computer programs written for this class will not be graded, students are required to turn them in. Students will also be required to follow programming instructions made by the instructor. Our purpose in making these programming requirements is to teach students new and efficient methods for conducting engineering analyses. Proper presentation of laboratory results is important throughout the ASEN curriculum.

Exams – Four in-class exams will be conducted at ~ 3-week intervals. Exams will include both conceptual questions and more detailed problems similar to homework. The final exam will contain material from the entire course.

Logistics

1. TA/CA Office Locations and Office Hours will be arranged and announced as soon as possible.
2. We reserve the right to reply to email questions only in 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. To better help us manage and track your emails please include **ASEN2003** at the beginning of the subject line.
3. Attendance to lecture is expected. Attendance at laboratory sessions is mandatory. In-class assignments may be given at any time and students are expected to come to class prepared to participate.
4. Homework assignments are due at the start of class on the due date. Each assignment must be scanned and uploaded to Canvas in a single pdf titled as follows: HW##_*Lastname_Firstname*
   For example, my submission for the first homework would be named: *HW01_Axelrad_Penina*
   More details on homework submission are provided later in this document.
5. Exams & Comprehensive Final - Exams will be given during the class periods. 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 or accusation report will be filed. Make-up exams are only given by the instructors when necessitated by extenuating circumstances such as a serious medical condition or emergency. If such a situation arises, contact the instructor by email or on their office phone number as soon as possible.
6. Lab Reports - Experimental and design lab exercises are conducted and submitted together with your team. Contributions of each team member will be identified for each exercise. Collaborations with other teams, including shared diagrams or extensive discussion of results must be acknowledged. A grading rubric is provided with each lab.
7. Deadlines - Late assignments are not accepted except under extenuating circumstances such as a school closure or sudden illness. If such an event occurs you are expected to contact the instructor immediately by phone or email. A hectic schedule or crashed computer is not an acceptable reason for a late lab submission. If you know in advance that you will not be on campus for a due date, you may submit your assignment to Canvas any time prior to the due date.
8. 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

   To receive a course grade of C or better, a student must earn a C or better on the individual grade in this class. A C is the minimum grade that allows you to proceed to a course for which this is a

prerequisite. If the exam and final scores are below a C, a student will not be assigned a grade higher than a C- regardless of their lab and homework scores.

If you believe there is an error in grading of any of your assignments, you may submit a brief written explanation of what you think is incorrect, along with the original assignment, to the instructor. If the problem is a clerical error in adding up points or entering values in Canvas, you may submit the documentation to one of the TA/CA's rather than the instructor.
Mistakes in grading need to be reported to the instructor within 2 weeks of their being posted on Canvas.

9. Safety is the number one priority for laboratory activities. If you have not already done so, you are required to attend an orientation and safety lecture presented both by ITLL and by course staff during the first week of the semester. Anyone violating rules of safe conduct may receive a zero for the laboratory exercise and may be restricted from ITLL. Use of ITLL facilities is a privilege, not a right. Those endangering themselves, others, or laboratory equipment by their unsafe conduct will not maintain their access privileges.

10. Use of electronics in the classroom aside from taking notes is strongly discouraged. If you desire to view any animated images, please sit in the back of the room so as to not distract those students who are in the line of sight behind you.

11. Assignment and Exam Regrade Policy: If you would like to submit a regrade request for any assignments or exams you must email the regrade request to all instructors (Prof McMahon, Prof Axelrad, and Prof Hodgkinson) within *1 week of the graded assignment return date*.
    - The regrade request must include a pdf of your graded exam, along with a clearly written email stating:
        i. What assignment / quiz / exam is this request referencing?
        ii. What problem is this request referencing?
        iii. Identify and describe the problem element in question.
        iv. Discuss what you think is misgraded.
        v. Identify specific evidence supporting your claim.
    - Points can be added OR removed based on correctness. Therefore, if a mistake was made in grading and too few points were awarded, the regrade request may increase the final score, however if the professor finds a mistake was made in grading and too many points were awarded, then the regrade request may lower the final score.
    - For every exam, a subset of exams will be scanned and saved. *DO NOT ALTER YOUR EXAM IN ANY WAY IF YOU PLAN ON SUBMITTING FOR REGRADE.*

Final Exam

The final exam is scheduled for Saturday, May 2 from 10:30AM-1:00 PM. If you have 3 or more finals scheduled for the same day, university policy allows you to request a rescheduling of the exams in excess of 2. Please check your schedule and notify the instructor within the first 2 weeks of the semester if you will require a rescheduled exam for this class.

Homework Rules & Logistics

Posting & Submission

- Homework will be posted on Canvas including the due date & time.
  Solutions will also be posted on Canvas when the assignment grades are returned.
- Homework assignments are due at the start of class on the due date.
- Scanned homework submissions should be uploaded to Canvas in a single pdf titled as follows:
  - HW##_Lastname_Firstname

  For example, my submission for the first homework would be named: HW01_Axelrad_Penina
  Downloading the *camscanner* app from a colorado.edu email address gives free access to the full pro version
- Alternatively, students may submit homework on paper at the start of lecture.
- If you must miss class for an excused absence, you may submit your homework early via Canvas. Late assignments are not accepted without prior instructor approval. If you know in advance that you must miss a homework due date or lab, send your instructor an e-mail or voice mail to make arrangements.

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 are not free to 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. Remember, the more you think about the problems yourself, the more you actually 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, 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. Your name (last, first), assignment number, and due date must be noted on each page.
- Always submit work with a professional appearance. Neatness, clarity, and completeness count. Very messy work will be not be graded and a score of zero recorded.
- 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. Multiple answers (when only one is required) will be counted incorrect.

Grading

- For grading purposes, homework is considered part of the group grade and only contributes to the total grade when the individual work is C or better.
- 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).

Grading

Type	Description	Percentage
Individual Grade	Unit Exams (4)	60%
	Final Exam	35%
	Participation, including lab and clickers	5%
	Individual Total	100%
Group Grade	Labs	80%
	Homework	20%
	Group Total	100%
Final Grade	If individual grade >= C *	Final = 0.6*Individual + 0.4*Group
	If individual grade < C	Final = Individual

**The cutoff for individual grades will not be higher than 70%.*

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 there is a limited amount of "curving" in the course. The final grade indicates your 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.

The course grade is primarily dependent on individual measures of competency, i.e. exams. The other course assignments are designed to enrich the learning experience and to enhance individual performance, not to substitute for sub-standard individual competency. Accordingly, group assignment grades are only incorporated into the final grade when the individual grade is a C or better. In other words, if your individual average is below a C, the group-based grade fraction will not be averaged in to your final grade, which will then be based solely on your individual score. This policy makes it important to use the group assignments to enhance your own learning. If the work in the assignment is split up among group members, be sure that the learning is not also split up, but is shared among the whole group. Homework is included in the group grade because collaboration is encouraged; it does not mean that copying is permitted on homework.

Aerospace Engineering Sciences & University Policies 2020

(statements can be found online as well)

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 or injury, see Temporary Medical Conditions under the Students tab on the Disability Services website.

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. 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 policies on classroom behavior and the Student Code of Conduct.

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 policy may include: 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 at the Honor Code Office website.

Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering a positive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct, intimate partner abuse (including dating or domestic violence), stalking, or protected-class discrimination or harassment by 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 cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.
Please know that faculty and instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

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, you must let the instructors know of any such conflicts within the first two weeks of the semester so that we can work with you to make reasonable arrangements.
See the campus policy regarding religious observances for full details.