ASEN 3801 Vehicle Dynamics and Control Lab

Fall 2025

Course Syllabus

Section 001: T 8:30am-10:20am, AERO 141 Section 002: T 1:00pm-2:50pm, AERO 141
Section 003: T 3:05pm-4:55pm, AERO 141

1 INSTRUCTOR

Dr Melvin Rafi
Office: AERO N203 Office Hours: by appointment

2 INSTRUCTIONAL TEAM

Teaching Facilitators:
Kirin Kawamoto
Grace Halbleib
Andrew Kabos

Lab Assistants:
Nathan Whittenburg
Alexander Freehling

3 COURSE WEBSITE

Link to Canvas page:

4 TEXTBOOK

While there are no required textbooks for this course, the textbooks associated with ASEN 3700 and ASEN 3728 are highly recommended as a reference for the material covered in the laboratory assignments.

5 COURSE DESCRIPTION

This course emphasizes applications of engineering dynamics and control principles for modeling, simulating, designing, analyzing, and evaluating aerospace vehicle systems. Experimental and computational focus on problems in aircraft flight stabilization and spacecraft attitude control.

6 COURSE OBJECTIVES

This course emphasizes applications of engineering dynamics and control principles for modeling, simulating, designing, analyzing, and evaluating aerospace vehicle systems. Over several labs, there is experimental and computational focus on problems in aircraft flight stabilization and spacecraft attitude control. A student who successfully completes this course will:

- Understand how to collect, analyze, and interpret data, and to form/support conclusions about applications of rigid body dynamics and dynamical systems theory to aerospace vehicles, as well as to make order of magnitude judgments and to use measurement unit systems and conversions.

- Identify the strengths and limitations of theoretical models as predictors of real-world dynamical behavior in aerospace vehicle systems, and learn how to validate relationships between simulated/measured data and underlying physical principles.
- Understand selection, operation, and application of appropriate sensors, instrumentation and/or software tools to make measurements of dynamic physical quantities in aerospace vehicle systems.
- Understand how to select, modify, and operate appropriate engineering tools and resources.

The course will also reinforce understanding of fundamental concepts covered in ASEN 3728 Aircraft Dynamics and ASEN 3700 Orbital Mechanics/Attitude Dynamics and Control.

7 COURSE PREREQUISITES/COREQUISITES

Requires prerequisite courses ASEN 2803 and ASEN 2804 (all minimum grade C-).
Requires prerequisite or corequisite ASEN 3700 and ASEN 3728 (all minimum grade C-)

8 CLASS POLICIES

8.1 General Policies on Syllabus and Schedule Changes

We reserve the right to make changes to the course policies stated in the Syllabus and to the Course Schedule as required throughout the semester. We will give sufficient advance notice of changes via announcements on Canvas and/or during class. The most current Syllabus and Course Schedule will be posted on the course website.

8.2 Class Format

1) This class meets in-person once a week for one hour and fifty minutes of active lab instruction.

2) Activities vary from week to week – some weeks will be focused on formal lecture or lab introductions, while other weeks will be "work days" for your team to perform analytical development, hands-on lab measurements, programming, simulations, writing lab reports, or completing other lab deliverables.

3) All labs will be carried out in small groups assigned by the Instructional Team. These groups will be sized appropriately to match the amount of work expected.

4) The university expects a minimum of 100 minutes of out-of-class work per week for a 1 credit lab course (approximately 25 hours total over the semester). Students will be expected to review posted material prior to lab and work on lab related assignments outside of the normal meeting times. For more information, see https://www.colorado.edu/registrar/faculty-staff/curriculum/courses/contact-hours#lecture_lec_-2101.

8.3 Course Evaluations

Please see the section "Assignments & Grading" below for more information on the evaluations in this course for determining final grades.

8.4 Communication

1) **Canvas** – Canvas is the official webpage for this course. All general announcements, assignments, course materials, and grades will be available via Canvas. Please do not use direct messaging via Canvas messages to contact the Instructional Team. Instead, please use Canvas Discussions or email (see notes below).

2) **Canvas Discussions** – General questions about assignments, syllabus, class policy, and assessments should be posted on the Discussions page on Canvas.

3) **Email** – For this course, email should only be used for questions or concerns regarding individual scheduling conflicts or individual issues. Email should not be used as a primary communication method for general questions about assignments, syllabus, and class policy, etc. Due to large volumes of emails received, emails sent to instructors or TFs on such topics might go unanswered. Instead, students are encouraged to use Canvas Discussions for general questions about assignments, syllabus, class policy, etc.

4) **Response Times** – All correspondence to Instructors and TFs will be handled during regular business hours (M-F, 9am-5pm). Please remember not to expect immediate responses to emails or Canvas Discussions messages. Additionally, please do not expect responses to emails outside these hours or during the weekend.

5) **Additional Guidelines** – Any medical or University-related needs of absence that are known (i.e. non-emergency related) should be communicated to the Instructor as soon as possible. Whenever possible, any expected impact to assignments/exams should be coordinated with the Instructor ***prior to missing a course deadline, not after***.

8.5 Office Hours and Student Resources

1) **Instructor Office Hours** – Instructor office hours for this course are by appointment only. Students may send the instructor an email to schedule an appointment for office hours if necessary. Students are highly encouraged to make use of lab times to ask questions, as this is when there will be most access to the Instructional Team.

2) **Teaching Facilitator Office Hours** – TF office hours for this course will be held during Study Hall. To improve academic support, provide peer mentorship, and build community for undergraduate students, the Aerospace department launched the Undergraduate Study Hall program. During Study Hall, TFs will be available to provide support. For information on the latest Study Hall hours and locations, please see the course website.

8.6 Attendance

1) Attendance is expected at all scheduled lab sessions.

2) Participation in lab activities is required. Students who come to class prepared and participate in discussions typically have a more rewarding experience. Participation will be determined via peer evaluations, in-lab activities, and in-lab observations by the Instructional Team.

3) Lab assignment introductions or lectures will not be recorded or posted for asynchronous viewing. Students who miss important information during lab periods should coordinate with their assigned lab groups and catch-up independently on the material they may have missed.

8.7 Student Expectations and Professional Behavior

1) Professional behavior and considerate communication practices are expected at all times. Any questions, comments, or concerns you may have should be respectfully voiced to your peers or the Instructional Team either in-person or via email.

2) **Safety is the Number 1 Priority in an in-person laboratory.** Anyone violating rules of safe conduct may receive a zero for the lab exercise and may be restricted from the lab facilities.

3) Use of lab facilities is a privilege, not a right. You are expected to conduct yourself according to the lab rules and regulations. Those endangering themselves, others, or lab equipment by their unsafe conduct will not maintain their access privileges. Failure to wear appropriate safety gear where necessary will result in a 10% grade penalty for the lab for each infraction.

4) Eating and drinking inside the lab is strictly prohibited.

8.8 Required Equipment

The lab assignments in this course require that students work with software such as MATLAB for analysis and word processing tools for report writing. Additionally, students need to be able to submit work in various digital formats (such as PDF). Access to a computer is recommended to accomplish the above.

9 ASSIGNMENTS & GRADING

The course evaluations and grade weightings for this course are as follows:

Assignment	Weight
Lab Assignments	90%
Individual Participation Activities	10%

The total percent score for the lab assignments category is calculated as follows:

$$\text{Total \% for Lab Assignments category} = \left(\frac{\sum_{i=1}^{n} \text{Score for Lab } i}{\sum_{i=1}^{n} \text{Maximum possible score for Lab } i} \right) \times 90\% \quad \text{where} \quad n = 5 \text{ labs}$$

9.1 Assignments

9.1.1 Lab Assignments

1) Lab assignment documents will be provided in advance of the first session for that particular lab. The lab document will provide a detailed description of various steps and milestones for each lab. You are required to carefully study the lab documents before the beginning of each lab section. These lab documents will also include guidelines for the work that needs to be submitted for each lab.

2) In this class, we will exclusively use the MATLAB programming language, which is widely-used in the aerospace industry. The minimum requirement is some proficiency with MATLAB. If you are not familiar with MATLAB, it is your responsibility to become so.

3) All lab reports and submitted work are expected to have a professional appearance. Neatness, clarity, and completeness count. It is important to remember that it is not sufficient for only you to understand your work – others should be able to understand your work as well. Additional detailed guidelines for lab reports and presentations can be found in the respective lab assignment documents.

4) Students are expected to work in groups for each lab assignment, and each group should only submit one lab report. Individually submitted lab reports are not accepted.

5) Lab reports should be completed using a digital word processing program (eg. Word, LaTeX, etc) and submitted as a PDF. All group numbers and group member names with relevant assignment information must appear on the cover page.

6) Individual grades for lab assignments may be adjusted by instructors based on peer-evaluations and/or reports of non-participation. Poor peer evaluations or reports of non-participation will result in a lower assigned grade. Individuals whose name does not appear on a group submission will not receive credit for the assignment.

9.1.2 Individual Participation Activities

1) Individual participation activities are worth 10% of the total course grade.

2) Individual participation activities will consist of a self-assessment and peer-evaluation for each lab assignment, administered via Canvas. Individual participation activities may also consist of various in-lab activities.

9.2 Late Assignments

1) All assignments and deliverables must be submitted by the specified due date and time.

2) Late submissions will not be accepted unless prior approval is given or highly extenuating circumstances caused the student to miss the submission deadline. This will be considered on a case-by-case basis.

9.3 Regrade Requests

1) Regrade requests must be made via Gradescope within 1 week of the graded lab reports being returned (with the exception of the last lab assignment, which might have a shorter regrade window), keeping in mind the points below.

2) The purpose of a regrade request is to bring grading errors to the attention of the Instructional Team, and not to request a modification to the grading process or design of the rubric. The rubrics are final and cannot be changed or adjusted.

3) The regrade request should clearly specify the rubric item where-in the suspected grading error was made. It should also clearly explain, with direct references to the group's submitted work, why and where the student believes that a grading error was made, such that the submitted work qualifies for the stated rubric item. In other words, explain why you think that your work qualifies for the rubric item in question.

4) Regrade requests submitted without the required information will not be reviewed.

9.4 Group Work Etiquette and Honor Code Violations

1) All students in a group are expected to participate and contribute meaningfully and substantially to the group's work.

2) If a student does not participate in the group (ie. attending lab periods, group meetings, discussions, etc.) and does not contribute sufficiently to the group's work, the team may be re-organized, and the non-participating student may receive a zero grade for the assignment.

3) Groups can work together to discuss the means and methods for formulating and solving problems, and even compare answers – *however, you are not free to copy work from other groups*. **Copying material from any resource (including code from another student or online) and submitting it as one's own is considered plagiarism and is an Honor Code violation.** Students who are caught copying material will receive a zero grade for the class and will be reported for an Honor Code Violation.

9.5 Final Grade Policies

Assignments are graded to an absolute standard designed to indicate your level of competency in the course material. 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 experience, interactions with industry, government laboratories, others in academe, and according to the criteria established by the ABET accreditation board.

Grades for the course are set based on the following criteria:

A, A-	Demonstrates mastery of the course material in both conceptual and quantitative aspects.
B+, B	Demonstrates comprehensive understanding of the material, with a solid conceptual grasp of key concepts and strong quantitative work.
B-, C+	Demonstrates good understanding of most key concepts, with few major quantitative errors.
C	Demonstrates satisfactory understanding of the material, with sufficient quantitative work.
C-	Demonstrates adequate understanding of the material to proceed to the next level; quantitative work with some persistent errors.
D	Little understanding is evident, consistently poor quantitative work.
F	Unsatisfactory performance.

10 CU BOULDER SYLLABUS STATEMENTS

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 of 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 Student Conduct & Conflict Resolution and will 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 contact your Instructor as soon as possible.

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. If you require a religious accommodation, please contact your Instructor as soon as possible. See the campus policy regarding religious observances for full details.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the Registrar's website for instructions on how to change your personal information in university systems.

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.

Additional classroom behavior information

- Student Classroom and Course-Related Behavior Policy.
- Student Code of Conduct.

- Office of Institutional Equity and Compliance.
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- 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 OIEC@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 the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support 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.