

## ASEN 2704 – Spring 2024

### Introduction to Aerospace Vehicle Design and Performance

**Lecture:** **Mon/Wed** (Room AERO 120; In-person only/no hybrid or remote option)

1:30 – 2:45 pm (Section 001)

3:00 – 4:15 pm (Section 002)

**Instructors:** Prof. John Mah (Aircraft Instructor)

Pronouns: he/him

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Prof. Katya Arquilla (Spacecraft Instructor)

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#### Teaching Assistants & Fellows:

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#### Class Canvas Website:

#### Gradescope:

**Texts:** Anderson, **Introduction to Flight**, 9<sup>th</sup> ed. (hardcopy or electronic version)  
Sellers, **Understanding Space: An Introduction to Astronautics**, 3<sup>rd</sup> (2005) or 4<sup>th</sup> (2014) ed. (only select chapters required: 1, 4, 5, 6, 7, 12, 13, and 14.)

**Prerequisites:** ASEN 2702, ASEN 2012, APPM 2360 or equivalent.

**Corequisites:** APPM 2350 or equivalent.

#### Required Equipment

- A way to turn written work into a PDF. This could be a tablet computer on which you write electronically, or a scanner smartphone app (such as CamScanner or Scannable) to scan in handwritten work on paper.

**Course Objectives:** To introduce the theory and methods for design and performance analysis of aircraft and spacecraft. Aircraft topics include wing design, propulsion, aircraft performance, and stability and control.

Spacecraft topics include mission design, rocket performance, orbital mechanics and spacecraft subsystems. Emphasis is placed on introducing systems engineering aspects of design and analysis for aerospace vehicles.

### Major Course Topics

#### Aircraft

1. Elements of airplane design
2. Performance of airfoils and wings
3. Elements of airplane performance
4. Preliminary airplane stability and control
5. Preliminary airplane propulsion

#### Spacecraft

1. Elements of space mission design
2. Launch requirements and rocket performance
3. Introduction to astrodynamics
4. Overview of spacecraft subsystems
5. Introduction to spacecraft systems engineering

### Grading Guidelines

Individual:

<b>4x Exams</b>	<b>80% Overall</b>
2 x Aircraft Exams	40% (20% each)
2 x Spacecraft Exams	40% (20% each)
<i>*2<sup>nd</sup> spacecraft exam will be administered during the final exam period</i>	
<b>Homework Assignments</b>	<b>20% Overall</b>
Aircraft Homework	10%
Spacecraft Homework	10%
<b>TOTAL</b>	<b>100%</b>

- We reserve the right to make minor changes to this distribution of weights based on variations in assignments and will announce any changes to the class.
- Passing this class requires a final grade of a “C-” with a baseline of 70% average across these weighted elements.

- **Minor adjustments may be made in the determination of final letter grades and with grade cut lines, but there is no “curving” in this course. This course uses the standard grading percentage cutlines:**

Letter Grade	Range
A	100% to 94%
A-	< 94% to 90%
B+	< 90% to 87%
B	< 87% to 83%
B-	< 83% to 80%
C+	< 80% to 77%
C	< 77% to 73%
C-	< 73% to 70%
D+	< 70% to 67%
D	< 67% to 63%
D-	< 63% to 60%
F	< 60% to 0%

- 70% is the maximum for which the C- cutline will be set but may be set lower after instructor review of the course (never higher). Students should not assume this baseline will be lowered for final grades.
- Please verify all your scores and grades on Canvas and Gradescope within 2 weeks after they are posted; requests to change a score need to be made within this period. All regrade requests should be submitted to Gradescope using the “regrade request” functionality.
- Rationale for course assignments and evaluations
  - Reading assignments are to be completed before viewing the lecture. The lectures will help clarify and supplement your reading and to prepare you for homework assignments and exams.
  - Homework reinforces the mental processes that help you to become proficient in a subject. In addition to the assigned homework, we encourage you to work additional problems for practice and make summary notes for yourself. Before beginning any homework assignment, you should read the relevant text sections and work through the examples in the text.
  - Exams provide a comprehensive gauge to determine what you have learned individually.

### **Exam Policies**

The exams will consist of both conceptual questions and work-out application problems. All exams will be conducted in-person during normal lecture periods and locations (or in designated time/location for final exam). You will not be given full credit for a work-out problem if you submit the final answer without showing all your work. This is because a structured, logical process is more vital for students to demonstrate and practice than just getting “the right answer”. This policy is meant to benefit the student, as if you have the wrong final answer, this work will be used to give

you partial credit based on your understanding of concepts and your engineering approach to problem formulation.

- Expect new material to be presented in the lecture periods. Exams can cover all material in the course including lectures, application problems, homework, and reading assignments.
- Collaboration on exams or any other defined individual assignments, using another student's work as your own, allowing another student to use your work as their own, or accessing prohibited external resources during an exam is considered academic dishonesty and will not be tolerated. **If you are caught in any of these activities, you will be reported to the Honor Council, and if found guilty, may receive an academic penalty up to failure of the course depending on the nature of the dishonesty.**
- Regrade requests must be submitted to the professors within 2 weeks of the grade posting to Canvas. Regrade requests should be submitted through Gradescope using the "regrade request" functionality. Regrade requests should not be e-mailed to any member of the instructional team. Regrade requests are only considered if you believe there was an error in the grading of your exam per the written rubric. Regrade requests are not to argue against the grading rubric, as we carefully design this for each exam.
- Exam Dates:
  - Aircraft Exams
    - Aero Exam 1: Wednesday, 7 Feb 24 (in class)
    - Aero Exam 2: Monday, 4 Mar 24 (in class)
  - Spacecraft Exams
    - Space Exam 1: Wednesday, 10 Apr 24 (in class)
    - Space Exam 2: Wednesday, 8 May 24 (7:30-10am During Finals Period – Location TBD)
- Make-up exams will not be granted unless for extreme issues outside of student's control that could not be prevented with prior deconfliction. Determination will be on a case-by-case basis by the instructors.
  - Reasons that DO NOT warrant a make-up exam include (but are not limited to):
    - Social Events / Family vacations
    - Club Activities
    - Travel arrangements for breaks (you must consider your academic calendar before making these arrangements)
  - To better support your overall college experience and growth, we will work with you to enable participation in the following:
    - Aerospace / Engineering conference or event participation where you are actively presenting or are part of a team that is actively participating.
    - Intercollegiate athletic competitions where you are an active team member.
  - A student who requests multiple missed exam make-ups during the course may be denied a make-up exam. All make-up exams must be completed w/in 3 work-days from

original exam date. No remote exam options will be provided unless physical attendance is not possible for a make-up.

### **Final Exam**

There is no comprehensive final exam for this course; however, the common final exam date/time and location will be utilized for the second spacecraft exam. Location of the exam will be updated later in the semester.

### **Homework Policies**

Homework assignments will be assigned prior to each exam. These assignments will be graded for completion and a select few problems will be graded in full (randomly chosen by instructor). The purpose of homework is to provide you application problems to reinforce concepts and allow you to practice a structured methodology for problem formulation and solving. Accomplishing all homework is vital for you to be successful on the exams and final exam.

- All homework questions must be submitted to the course discussion page under the appropriate homework assignment/question. No homework questions should be emailed to the instructional team—all questions should be asked at office hours or posted on the Canvas discussion page. The instructional team may not respond to posts that are posted within 24 hours of an exam.
- Collaboration is permitted on homework. However, we strongly recommend to first work on your own on the homework before comparing your results with your homework team members. If collaborating on the homework, we recommend you discuss the means and methods for formulating and solving problems and compare answers, but that you do not just look at someone's solution or copy someone's work. Remember, the less you think about the problems yourself, the less you actually learn, and the more difficult it will be to succeed on exams.
- Homework solutions will be posted before each exam.

**Office Hours & Study Hall:** Students can ask questions about concepts, example problems given in the lecture videos, and homework assignments during the instructor's office hours or the Aerospace Study Halls that will be held throughout the week and supported by the course TFs. Students are strongly encouraged to participate in both these opportunities, even if they don't have specific questions about the material or the homework. The course Canvas discussion page may also be used for any questions at any time and will be moderated by the instructional team.

### **Additional Admin Notes:**

1. We reserve the right to make changes to the weekly course schedule based on occurring events that require different dispositions. We will give sufficient advance notice through announcements in class and posting on the web. Changes to this syllabus and assignments-table may be announced at any time during class periods. We will post the current syllabus and assignments-table on the web. Both are dated in the footnote.
2. Canvas will be used to send out announcements, to provide comments to you daily on class activities, and to provide general information about course assignments.

### 3. Rationale for course assignments and evaluations

- Reading assignments are to be completed before viewing the lecture. The lectures will help clarify and supplement your reading and to prepare you for homework assignments and exams.
- Homework reinforces the mental processes that help you to become proficient in a subject. In addition to the assigned homework, we encourage you to work additional problems for practice and make summary notes for yourself. Before beginning any homework assignment, you should read the relevant text sections and work through the examples in the text.
- Exams provide a comprehensive gauge to determine what you have learned individually.

#### **University Policies:**

##### 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 Diseases

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all public health orders to reduce the risk of spreading infectious diseases.

The CU Boulder campus is currently mask optional. However, if masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class. Students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct & Conflict Resolution. Students who require accommodation because a disability prevents them from fulfilling safety measures related to infectious disease will be asked to follow the steps in the “Accommodation for Disabilities” statement on this syllabus.

For those who feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the [further guidance of the Public Health Office](#). For those who 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.

##### Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

[Disability Services](#) determines accommodations based on documented disabilities in the academic environment. If you qualify for accommodations because of a disability, submit your accommodation letter from Disability Services to your faculty member in a timely manner so your

needs can be addressed. Contact Disability Services at 303-492-8671 or [dsinfo@colorado.edu](mailto:dsinfo@colorado.edu) for further assistance.

If you have a temporary medical condition or required medical isolation for which you require accommodation, please notify the instructor immediately and we will coordinate efforts to mitigate the impact to the course and your project teammates. Also 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](#). 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](mailto: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.

#### 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 believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email [cureport@colorado.edu](mailto: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 have a responsibility to 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 an outreach from OIEC about their options for addressing a concern and the support resources available. To learn more about reporting and support resources for a variety of issues, 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, it is expected that you review the course schedule and identify any conflicts that may impact your ability to meet project timeline requirements due to religious observance within the first three weeks of**

**class. This will allow for the instructor and your teammates to plan for mitigating the impacts.**

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.