ASEN 2704 – Spring 2023

Introduction to Aerospace Vehicle Design and Performance

Lecture: **Mon/Wed** (In-person only; no hybrid or remote option)
2:45 – 4:00 pm (Section 001)
4:15 – 5:30 pm (Section 002)

Instructors: Prof. John Mah (Aircraft Instructor)
He/him
Email: john.mah@colorado.edu

Prof. Torin Clark (Spacecraft Instructor)
He/him
Email: torin.clark@colorado.edu

Teaching Assistants:

Tyler Hall	tyha4023@colorado.edu
Maison Rhea	marh3078@colorado.edu
Ben Watanapongse	bewa2484@colorado.edu
Kate Kosmicki	kako5425@colorado.edu
Santiago Huertas	sahu3778@colorado.edu
Micah Bergeron	mibe5777@colorado.edu
Tyler Schwinck	Tyler.Schwinck@colorado.edu
Skylar Edwards	sked2869@colorado.edu
Benjamin David Foehr	Benjamin.Foehr@Colorado.EDU
Cody Bahan	Cody.Bahan@colorado.edu
Sam Hatton	Samuel.Hatton@colorado.edu

Class Canvas Website:

Slack:

Gradescope:

Texts: Anderson, **Introduction to Flight**, 9th ed. (hardcopy or electronic version)

Sellers, **Understanding Space: An Introduction to Astronautics**, 3rd (2005) or 4th (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

Evaluated Outcomes

The Department of Aerospace Engineering Sciences has adopted a policy of assigning grades according to evaluated outcomes (Ox) in each course. Each assignment designed and graded to assess some combination of several or a few of the following outcomes:

O1 Professional context and expectations (ethics, economics, etc.)
O2 Historical perspective and vision
O3 Multidisciplinary, system perspective
O4 Written, oral, graphical communication ability
O5 Knowledge of key scientific/engineering concepts
O6 Ability to define and conduct experiments, use instrumentation
O7 Ability to learn independently, find information
O8 Ability to work in teams
O9 Ability to design systems
O10 Ability to formulate and solve problems
O11 Ability to use and program computers

Evaluation of these outcomes allows an assessment of your performance and provides a major portion of the process we use for continuous assessment and improvement of the entire AES undergraduate curriculum. The model for these outcomes derives from several sources including the "*Desired Attributes*

of an Engineer" as defined by The Boeing Company, and "curriculum reviews" from major aerospace corporations including The Boeing Co., Lockheed Martin Corp. and Ball Aerospace Corp. These inputs were combined with the AES faculty vision of the desired attributes of an aerospace engineer and the requirements of the Accreditation Board for Engineering and Technology (ABET) to produce this list of evaluated outcomes. Each assignment designed and graded to assess some combination of these outcomes.

Grading Guidelines

Individual:

4x Quizzes	**80% Overall**
2 x Aircraft Quizzes	*40% (20% each)*
2 x Spacecraft Quizzess	*40% (20% each)*
Homework Assignments	**20% Overall**
Aircraft Homework	*10%*
Spacecraft Homework	*10%*
1x Comprehensive Final (Optional)	
	Overall Grade Can Replace Lowest Aircraft Quiz Grade
	Overall Grade Can Replace Lowest Spacecraft Quiz Grade
TOTAL	**100%**

- 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 73% 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.**
    - 73% 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 quizzes.
    - 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.
    - Quizzes provide a comprehensive gauge to determine what you have learned individually.

Quiz & Final Exam Policies

The quizzes and final 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 quizzes, using another student's work as your own, allowing another student to use your work as their own, or accessing prohibited external resources during a quiz 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 1 week 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 quiz per the written rubric. Regrade requests are not to argue against the grading rubric, as we carefully design this for each quiz.
- Quiz Dates:
    - Aircraft Quizzes
        - Aero Quiz 1: Monday, 6 Feb 23
        - Aero Quiz 2: Monday, 27 Feb 23
    - Spacecraft Quizzes
        - Space Quiz 1: Monday, 3 Apr 23
        - Space Quiz 2: Monday, 24 Apr 23
- Make-up quizzes 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 quiz make-ups during the course may be denied a make-up quiz. All make-up quizzes must be completed w/in 3 work-days from original quiz date. No remote quiz options will be provided unless physical attendance is not possible for a make-up.

Final Exam Policies

The final exam will be comprehensive and cover both aircraft and spacecraft portions of the course. The **total grade** for the final exam can be used to replace the lower of your aircraft quizzes **and** the lower of your spacecraft quizzes. You cannot use the final exam to replace both of either the aircraft or spacecraft quizzes. If your total score on the final exam is lower than any of your lowest aircraft or spacecraft quiz scores, your original quiz grade will remain unchanged. The final exam is optional. Students are not required to take the final exam and the final exam will not be counted towards your grade on its own.

- **The final exam will take place at the following university-scheduled final exam time:**
  - **9 May 23 from 7:30 – 10:00 am (location TBD).**
- For any questions regarding final exam policies, please refer to the CU Final Exam Policy: https://www.colorado.edu/policies/final-examination-policy

Homework Policies

Homework assignment will be assigned prior to each quiz. 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 quizzes and final exam.

- All homework questions must be submitted to the course Slack workspace 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 Slack. The instructional team may not respond to posts that are posted within 24 hours of a quiz.
- 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 quizzes.
- Homework solutions will be posted before each quiz.

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. 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 Slack workspace may also be used for any questions at any time and will be moderated by the instructional team.

Additional Admin Notes:

1. All questions regarding course content (material, homework, quizzes) should be posted to the course Slack workspace or asked during lecture or office hours. Slack posts regarding homework or quiz that are received 24 hours or less before the assignment deadlines or quiz may not be responded to. All other administrative questions, concerns, or issues not regarding course content should be e-mailed to the instructor. E-mails and Slack posts will be responded to during business hours, i.e. Monday through Friday, 8:00 am – 5:00 pm MST/MDT by both instructors and course TA/TFs.

2. 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.
3. 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.
4. 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 quizzes.
    - 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.
    - Quizzes provide a comprehensive gauge to determine what you have learned individually.
    - A comprehensive final reinforces the value of revisiting and recalling concepts and material from the entire course to reinforce long-term retention and learning.

CLASSROOM BEHAVIOR

Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. 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 classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

REQUIREMENTS FOR COVID-19

As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). Immediately notify your instructors of your illness and we will coordinate with you to mitigate course issues that arise due to illness.

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, see Temporary Medical Conditions on the Disability Services website.

In this course, we schedule separate rooms for students with accommodations to take the quizzes. Accommodations will only be provided for a given quiz when the instructor has received the official accommodation letter from Disability Services prior to 48 hours of the quiz. If the student has received an unofficial accommodation letter from Disability Services and emails that to the instructor at least 48 hours before the quiz, then that accommodation will be honored.

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, 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. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

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 sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, protected-class discrimination and harassment, 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. 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 any issues related to these policies regardless of when or where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution options. To learn more about reporting and support options for a variety of concerns, 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, all conflicts with scheduled exams, quizzes, or assignments should be coordinated within the first two weeks of class (NLT 1 Feb) to ensure enough time to plan any adjustments that result.**

See the campus policy regarding religious observances for full details.