ASEN 2004 – Spring 2022

Introduction to Aerospace Vehicle Design and Performance

Lecture: Tu/Th 8:30 – 9:45 am (Section 100)
- Zoom (10-21 Jan):
- In-Person (24 Jan – 28 Apr): Aero 120

Tu/Th 10:00 – 11:15 am (Section 200)
- Zoom (10-21 Jan):
- In-Person (24 Jan – 28 Apr): Aero 120

Lab: M/W 8:30 – 10:20 am (Section 301 / Room Aero 141)
M/W 8:30 – 10:20 am (Section 303 / Room Aero N100)
- Zoom (10-21 Jan):

M/W 10:35 am – 12:25 pm (Section 302 / Room Aero 141)
M/W 10:35 am – 12:25 pm (Section 304 / Room Aero N100)
- Zoom (10-21 Jan):

Instructors: Prof. John Mah (Aircraft Lecture / Lab Section 301/303)
He/him
Email: john.mah@colorado.edu

Prof. Torin Clark (Spacecraft Lecture)
He/him
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Prof. Melvin Rafi (Lab Section 302/304)
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Lab Coordinator: Trudy Schwartz
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Class Canvas Website: https://canvas.colorado.edu/courses/80583

Slack:

Quiz / Lab Submission Site: Gradescope:

Class Email List: Through Canvas.

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 2002, ASEN 2012, APPM 2350 or equivalent.
Corequisites: APPM 2360 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.
- A computer microphone or a phone would be very beneficial to participate in group work.

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

Commented [JM1]: Do we want to use Gradescope for lab submissions? I think using Canvas might be easier because of the ability to grade by group and automatically assign grades to everyone by group.

Commented [AWJ2R1]: We can also do that in Gradescope, they just have to tag their group members when they upload. They've all had practice with that in 2001. So, I think we should do labs in Gradescope too.

Group work:	2 Aircraft Labs	20% (10% each)
	2 Spacecraft Labs	20% (10% each)
Individual:	6 Quizzes (3 aircraft, 3 spacecraft)	60% (10% each)
		100%

- Group work only counts towards final grade if the total individual grade is C or better.
- 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.
- We reserve the right to make minor changes to this distribution of weights based on variations in assignments.

Course Delivery
Guidelines use the following definitions:

- In-Person (Synchronous): activity in person on campus on scheduled days and times.
- Remote (Synchronous): activity via Zoom or other real-time platform on scheduled days and times; students will need to participate in activity or complete assignment at a specified time.

Class	**Class Delivery**	**Notes**
Lecture	Remote (Synchronous) 10 – 21 Jan In-Person (Aero 120) 24 Jan – 28 Apr	All lecture videos for remote courses will be recorded via Zoom and posted on Canvas for review. For in-person lectures, all lectures will be recorded via Classroom Capture and links provided in Canvas.
Quizzes	In-person (Aero 120)	Quizzes occur during scheduled lecture time. Attendance is required.
Final Exam (Optional)	In-person (TBD)	The final exam will occur during the university-scheduled time and is optional (see Final Exam section further below in syllabus)
Office Hours	Remote (Synchronous) 10 – 21 Jan In-Person (TBD) 24 Jan – 28 Apr	Offered over Zoom during remote portion of semester. In-person office hours location and time will be announced in class.
Lab	Remote (Synchronous) 10 – 21 Jan In-Person (See section room assignments above) 24 Jan – 28 Apr	Offered over Zoom and will occur during scheduled lab time during remote portion of the semester. For in-person labs, see room assignments above for each section. You also need to work with your assigned lab team outside of lab hours to complete assignments.

Online Learning Protocol During Remote Portion of Semester
The Zoom meeting environment is a professional one—this includes expectations for your conduct, attire, and environment. Please refer to the "AES Lab and Groupwork Protocol" document for more details. Here are some highlights:

1) Please use your preferred full name when you join the Zoom session. Do not use any usernames or "nicknames" that don't represent your real name.
2) Please mute yourself when you are not talking to avoid distracting the rest of the class.
3) If you feel comfortable turning your camera on during office hours and lab, you are encouraged to do so. However, students will not be required to show video of themselves during any part of the class. If you choose to have your camera turned off, we would appreciate you putting a picture of yourself as your Zoom profile picture to help us connect your face to your name!
4) You will be able to fully participate in the class without having a webcam. You will be able to ask questions during recitation, office hours, and lab through voice (by using the "Raise Hand" feature in Zoom) or through chat.
5) This course is a professional space. If you are not in an office-like setting, we recommend that you use a virtual background if your computer allows. Also please wear attire that you would wear to class if we were meeting in person.
6) Be engaged and responsive during the meeting. Don't be afraid to speak or use chat, especially if the meeting is small. Your feedback and engagement are essential to the communication that takes place in a meeting.

Quiz Times and Policies
Instead of exams, students will take 6 quizzes throughout the semester. Each quiz will consist of a few conceptual questions and at least one work-out problem. All quizzes will be conducted in-person during normal lecture periods and locations. You will not be given credit for a work-out problem if you submit the final answer without work. If you have the wrong final answer, this work will be used to give you partial credit.

- Aircraft Quizzes
  - Quiz 1: Tues, Jan. 25
  - Quiz 2: Thurs, Feb. 10
  - Quiz 3: Tues, March 1
- Spacecraft Quizzes
  - Quiz 4: Thursday, March 18
  - Quiz 5: Thursday, April 8
  - Quiz 6: Tuesday, April 26

As students may use the final exam to replace up to 3 quizzes, make-up quizzes will be not be granted unless for extreme issues outside of student's control that prevented prior deconfliction. Determination will be on a case by case basis by the instructors.

Commented [TC3]: this would make life much easier...however I am surprised students don't have a fuss over not being able to make up quizzes for a legitimate reason (getting sick). But I am fine to go with it if you'd like and it is established up front.

Commented [4R3]: I'm ok with softening the language on this to account for the fact we're still in a pandemic. I'd rather not encourage students to show up for quizzes even though they are sick just to ensure they don't use up one of their 3 makeups.

Final Exam
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 be used to replace up to 3 quiz grades. The final exam will consist of 6 questions, each one covering material from a different quiz. You will choose

up to 3 questions to answer. If your score on a given final exam question is higher than your score for the corresponding quiz, your quiz score will be replaced with your score on that final exam question. If your score on a given final exam question is lower than your score for that quiz, your quiz score will remain unchanged.

The final exam will take place during the university-scheduled final exam time, which is:

- **Optional Final Exam: Monday, 2 May, 7:30 – 10:00 am**

Homework: One homework assignment will be assigned for each quiz. These assignments are to provide you practice application problems to prepare you for the quizzes but homework will not be graded.

Office Hours: Students can ask questions about concepts, example problems given in the lecture videos, and homework assignments during office hours that will be held throughout the week. Students are strongly encouraged to participate in office hours, 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.

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.

Important Notes:
1. All questions regarding course content (material, homework, quizzes, lab assignments) should be posted to the course Slack workspace or asked over Zoom during lab, recitation, or office hours. Slack

posts regarding quizzes or lab assignments that are received 24 hours or less before the deadlines will not be responded to. All other 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.

2. All homework questions must be posted to the course Slack workspace. If we receive an email with a homework question, we will direct you to the course Slack workspace board.
3. 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.
4. 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.
5. Rationale for course assignments and evaluations
    - Reading assignments are to be completed before viewing the lecture video. The lectures will help clarify and supplement your reading and to prepare you for homework assignments, quizzes, laboratory work, 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.
    - Experimental laboratory exercises are more complex than the homework and require special equipment (such as the static test stand). You will work in teams to collect and analyze the data, as well as deliver the experimental laboratory assessment.
    - Quizzes provide a gauge to determine what you have learned individually.
    - Design projects help you to learn how to synthesize the basic concepts, methods, and tools presented in the course curriculum by combining theory and practice. The team-oriented lab approach will give you experience in the benefits and challenges of working and cooperating in groups, as is typical in this industry.
6. Homework:
    - 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 will 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.

Commented [AWJ5]: John's comment: "Added Slack part…if we organize the TA/TF to regularly check and respond, we can generally get their questions answered more efficiently. Maybe we should limit emails to just personal correspondence communicating any issues not pertaining to course content."

Commented [AWJ6R5]: My response: I re-worded this to limit emails to non-course content questions. I think that's a good idea.

Commented [AWJ7]: Are you good with this?

Commented [JM8R7]: Yes

7. Quizzes:
    - Make-up quizzes will be not be granted unless for extreme issues outside of student's control that prevented prior deconfliction. Determination will be on a case by case basis by the instructors. The final exam will be used for replacing up to 3 quiz grades per the policy stated above.
    - Expect new material to be presented in both the lecture/ and laboratory periods. Quizzes and exams can cover all material in the course including lectures, problems, homework, and laboratory work.
    - Collaboration on quizzes or exams, using another student's work as your own, or allowing another student to use your work as their own is considered academic misconduct and will not be tolerated. If you are caught in any of these activities, you will be reported to the Honor Council.
    - 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 a 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.
8. Labs:
    - ALL students are expected to attend all scheduled lab sessions on Mondays and Wednesdays. This will ensure that students have an opportunity to hear the lab introductions, work in small groups on the lab assignments, ask questions about the lab assignments, take short lab quizzes, and participate in debriefs at the conclusion of each assignment. Lab meetings will NOT all be recorded. Some selected lab sessions may be recorded if they have significant material discussion. The course schedule will provide a summary of lab topics, duration of the lab, and lab deliverables.
    - Students will work in groups on lab assignments outside of class time at the discretion of and organization by the lab group. Group formation will be defined prior to the kickoff of team lab assignments.
    - Students can ask questions about lab assignments during the normal scheduled lab dates and times, or during office hours.
    - Many assignments will require access to a computer and basic programming skills. Computer programming skills are a prerequisite for this class, e.g. GEEN 1300 or CSCI 1300. We will not teach computer programming, although we will make an effort to formulate the assignments to emphasize proper computing skills. In this department we primarily use the programming language MATLAB. You can download a free MATLAB license for your personal computer from CU at https://oit.colorado.edu/software-hardware/software-downloads-and-licensing/matlab. You can also use MATLAB Online for this course at https://matlab.mathworks.com/.
    - Lab documents will be provided in advance of the labs, which provide a detailed description of various steps and milestones in each lab. You are required to carefully study the lab

Commented [JM9]: I've allowed use of other programs for my labs, but if you want to limit to Matlab I'll change my lab instructions. I don't think anyone has chosen to use another method.

Commented [AWJ10R9]: That's fine with me; you can keep it open to any program. I've re-worded this sentence.

documents before the beginning of each lab section. These lab documents will also include guidelines for the individual and group work that needs to be submitted for each lab.

- Experimental lab reports should be completed using digital word processing program (Word, LaTex, PDF, etc). All group member names with relevant assignment information must appear on the cover page. Bottom line - submit all work with a professional appearance. *Neatness, clarity, and completeness really do count in the work world!*
- Students are encouraged to submit lab questions to the course Slack workspace under the appropriate channel. As with the homework, you may discuss the means and methods for formulating and solving problems but you cannot compare answers on Slack nor post your exact work or computer code.

9. Grading
    - 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.
    - To receive a course grade of C or better (which is required to fulfill the prerequisite for junior-year courses), students must receive a C or better in the individual coursework portion of the class. Stated differently, the students who receive an individual grade of C- or lower will not receive any group grades.

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 policies on classroom behavior and the Student Conduct & Conflict Resolution policies.

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. Students who fail to adhere to these 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.

CU Boulder currently requires masks in classrooms and laboratories regardless of vaccination status. This requirement is a precaution to supplement CU Boulder's COVID-19 vaccine requirement. Exemptions include individuals who cannot medically tolerate a face covering, as well as those who are hearing-impaired or otherwise disabled or who are communicating with someone who is hearing-impaired or otherwise disabled and where the ability to see the mouth is essential to communication. If you qualify for a mask-related accommodation, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus. In addition, vaccinated instructional faculty who are engaged in an indoor instructional

activity and are separated by at least 6 feet from the nearest person are exempt from wearing masks if they so choose.

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). Please notify your instructor of any absences due to illness or quarantine. Because of FERPA student privacy laws, students do not need to state the nature of their illness when alerting instructor of absences.

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.

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 academic integrity policy. 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 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 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. The university will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by or against 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 email cureport@colorado.edu.

Information about university policies, reporting options, and the 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 of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about their rights, support resources, and reporting 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.**