ASEN 2004 – Summer 2022

Introduction to Aerospace Vehicle Design and Performance

Lecture: **MTTF** 8:30 – 9:45 am (Aero 111)

Lab: **MTTF** 10:00 – 11:50 am (Aero 141 - PILOT)

Instructors: Prof. John Mah (Aircraft Lecture / Lab)
He/him
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Prof. Jordan Dixon (Spacecraft Lecture / Lab)
He/him
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Lab Assistants:

Class Canvas Website: https://canvas.colorado.edu/courses/83568

Exam / Lab Submission Site: Gradescope: https://www.gradescope.com/courses/396905

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: 1-7, and 12,-14.)

Prerequisites: ASEN 2002, ASEN 2012, APPM 2350 or equivalent.
Corequisites: APPM 2360 or equivalent.

Required Equipment

- Computer access with MATLAB

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

Group work:	2 Aircraft Labs	20% (10% each)
	2 Spacecraft Labs	20% (10% each)
Individual:	4 Exams (2 aircraft, 2 spacecraft)	60% (15% 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 1 week 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

- All lecture and labs will be conducted in-person (synchronous) on campus on scheduled days and times.
- Students are expected to attend all in-person lectures and labs.
- Classroom capture videos of lectures will be provided; however, are meant to support studying and review of material and not as a substitute for attendance.
- Failure to attend labs and participate fully in lab team/group assignments may result in a failure or additional reduction in grade for any assignment based on instructor assessment of student work.

Exam Times and Policies
Students will take a total of 4 exams throughout the course which comprise the total of your individual grade. Each exam will consist of a few conceptual questions and at least one work-out problem. All exams 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. Below is the current schedule of exams; however, ensure you monitor the detailed course schedule posted on Canvas as update may change these dates.

Aircraft Exams
- Exam 1: Thursday, 9 Jun 22
- Exam 2: Friday, 24 Jun 22

Spacecraft Exams
- Exam 3: Thursday, 7 July 22
- Exam 4: Friday, 22 July 22

Make-up exams 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.

Final Exam
There is not a true "final exam" in this course. The last spacecraft exam #4 may be taken during the final exam period, but will not be comprehensive.

Homework: One homework application assignment will be assigned for each exam. These assignments are to provide you practice to prepare you for the exams. They will not be graded for points; however, successfully completing all the application problems is critical to doing well on exams in this course.

Office Hours: Students can ask questions regarding lecture, labs, 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.

Evaluated Outcomes
The Department of Aerospace Engineering Sciences has adopted a policy of assigning grades according to evaluated outcomes (Ox) in each course. Each exam is 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 exam is designed and graded to assess some combination of these outcomes.

Important Notes:

1. As this is a compressed summer course with small enrollments, there will be significant opportunities throughout the week to engage with instructors on questions. We ask that all questions regarding course content (material, homework, exams, lab assignments) should be addressed as much as possible during lab, lecture, or office hours. Questions outside of normal contact times throughout the week can be submitted to the instructors via the Canvas discussions page and will be answered there. DO NOT EMAIL COURSE QUESTIONS DIRECTLY TO INSTRUCTORS. Questions that are received 24 hours or less before the deadlines/exams may not be responded to. All other questions, concerns, or issues not regarding course content can be e-mailed to the instructors (i.e. for personal issues / scheduling issues, etc). E-mails and discussion 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 Canvas discussions board so all can benefit from the question and response. If we receive an email with a homework question, we will direct you to the course Canvas discussion 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. Please monitor those announcements regularly.
5. Rationale for course assignments and evaluations
    - Reading assignments are to be completed before the lecture. The lectures will help clarify and supplement your reading and to prepare you for homework assignments, exams, and laboratory work.
    - Homework reinforces the mental processes that help you to become proficient in a subject. In addition to the suggested homework, we encourage you to work additional problems for practice and make summary notes for yourself. Before beginning any homework practice problems, 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.
    - Exams 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 posted to the course Canvas discussions board so all can benefit from the question and response. If we receive an email with a homework question, we will direct you to the course Canvas discussion board.
   - 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

7. Exams:

   - Make-up exams 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.
   - Expect new material to be presented in both the lecture/ and laboratory periods. Exams can cover all material in the course including lectures, problems, homework, and laboratory work.
   - Collaboration on 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 and will be subject to an academic penalty determined by the instructors that may include failure of the course.
   - Regrade requests must be submitted to the instructors within 1 week of the grade posting. 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 assessment.

8. Labs:

   - ALL students are expected to attend all scheduled lab sessions. 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 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 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!* You will be expected to list individual contributions of team members for group work as well.
- Students are encouraged to submit lab questions to the course Canvas discussion page. As with the homework, you may discuss the means and methods for formulating and solving problems but you cannot compare answers 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. 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). If you will be missing lecture or lab events due to illness, please notify your instructors via email as soon as possible to coordinate any arrangements for the course.

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. **If a religious observance conflict with a scheduled exam or required lab component, you must notify your instructors at least 1 week in advance to allow for coordination.**

See the campus policy regarding religious observances for full details.