Syllabus for ASEN 3300:
Aerospace Electronics and Communications

Fall 2023
Revised: 08/25/2023

Weekly schedule
Lecture: AERO 120, Monday and Wednesday, **10:40 - 11:30 am** (section 010)
Lab: AERO 141, Tuesday and Thursday, **8:30 – 10:20 am** (section 011) or **10:35 am – 12:25 pm** (section 012)

Instructors
Professor Xinzhao Chu
Office: CIRES 241
Phone: 303-492-3280
e-mail: xinzhao.chu@colorado.edu
Office hours:
Mondays 11:30am-12:30pm at AERO 259
Wednesday 5-6pm at AERO 259

Professor Scott Palo
Office: AERO 413
Phone: 303-492-4289
e-mail: scott.palo@colorado.edu
Office hours:
TBD starting Oct 16

Teaching and Lab Assistants
TFs/LAs and their office hours are posted on Canvas.

Lab Coordinator
Trudy Schwartz
Office: AERO 150B
Phone: 303-735-2986
e-mail: trudy.schwartz@colorado.edu

Class Web Portal
- Canvas site at: https://canvas.colorado.edu

Required Texts and Equipment
- ASEN 3300 Lab Kit: Provided to each group and stored in PILOT; to be returned at the end of the semester. Students are responsible for replacement of items broken or not returned.
- **Textbook**: Scherz and Monk, *Practical Electronics for Inventors*, 4th edition; ISBN-10: 1259587541. Available online here: https://www.accessengineeringlibrary.com/content/book/9781259587542?implicit-login=true

Suggested Reference Texts
- Horowitz and Hill, *The Art of Electronics*, 3rd edition; ISBN-10: 0521809266
- Wolfson, *Essential University Physics, Volume 2*, 3rd edition; ISBN-10: 0321976428
- Makarov, Ludwig and Bitar, *Practical Electrical Engineering*, Springer, 2016; ISBN 978-3-319-

Course Overview

Modern aerospace vehicles rely on electronics, computers, and communications as essential system

components. While these systems are most often designed by Electrical Engineers, to be effective as system designers, integrators, and analysts, Aerospace Engineers must have a solid understanding of these critical subsystem areas. The aim of this course is to provide an overview of analog electronics, digital electronics, and communication system concepts as they are used in the aerospace industry. **The emphasis is on practical, hands-on experience and important concepts in a select number of key areas**. Throughout the course, students work in teams to design, build, test, and analyze electronic circuits, work with electronic instruments, interface these instruments to a computer, and design a communications link. It is our goal that students walk away from this class with a basic understanding of instrumentation electronics, computer interfacing, and radio communications. This understanding is derived from experience building and working with real electronics in the lab.

Course Outline

The course is divided into three main sections: i) analog electronics, ii) digital electronics, and iii) communications. A number of the lab experiments in all three sections are designed to utilize the Analog Devices ADXL321 or 326 accelerometer.

1. In the Analog Electronics section of the course we look at the accelerometer output to study vibrations of a beam. In the process, we build passive circuits to lower the output range of the accelerometer and active circuits to amplify it, conditioning circuits to filter noise in the output, and learn to use multimeters, oscilloscopes, and spectrum analyzers.
2. In the second section of the course on Digital Electronics, you will learn about relevant topics such as communications protocols, analog-to-digital and digital-to-analog conversions, sampling, aliasing, combinatorial and sequential logic circuits.
3. In the final section of the course on Communications, we learn how to modulate carrier signals, compute a satellite communications link budget, and design and conduct a GPS receiver experiment.

Prerequisites

Physics II, Aerospace Mathematics, and Introduction to Dynamics and Systems are prerequisites for this course. In fact, much of the material covered in this class you have been exposed to already in these earlier courses. We expect you to build upon this experience base and make connections between the new material and the old. In ASEN 2001-2004 you have seen and used instrumentation electronics, but in general, someone else took care of designing them. In Physics II you covered some circuit theory, but did not build any practical systems. For this course it is assumed that you have a working knowledge of the prerequisite material. We will build on this foundation by revisiting these topics in more detail and conducting hands-on laboratory experiments.

Class Format

The semester is organized into 12 weekly laboratory modules, with other weeks reserved for exams. With the exception of the first lab, each lab module lasts one week beginning with the Monday lecture session. The Monday lecture introduces the concepts and materials to be studied in the lab, and provides an overview of the reading materials and the lab activities, including a pre-lab homework assignment. The following Tuesday lab session begins group lab work on the week's assignment. Instructors and teaching assistants are available in the lab to answer questions, demonstrate how to use equipment, and discuss the material with individual lab groups. The second lecture period is used to finish the topic of the ongoing lab and teaching assistants will be in lab to answer questions about the experiments; the weekly quiz will be available to students starting at 5 pm on Wednesday. Students will take the quiz before 5 pm on Thursday. Thursday's lab section continues the group work in the lab with emphasis on documentation of methods and analysis of results for inclusion in the lab report. **Group lab reports are due the next day, Friday, at 6 pm,** and will be submitted **online via Gradescope** (as a PDF) for grading. Please review the Lab Guidelines handout for more information. We will try to grade

the group lab reports within one week.

Assessment / Written and Practical Exams

Assessment of individual student knowledge and ability is conducted **using written and practical examinations**. For the schedule of the exams please see the class schedule. Written and practical exams will take place **in-person** and synchronously. The practical exam involves demonstrating knowledge and skills such as proper use of equipment, how to set up a circuit, and how to perform measurements.

Course Grading

The final grade is a combination of individual and group work.

Type	Description	Percentage
Individual Work (IW) (75% total)	Quizzes (best 11 out of 12)	5%
	Exam #1 (midterm)	15%
	Exam #2 (midterm)	15%
	Practical Exam	10%
	Final Exam	25%
	Faculty, TA, and Peer Evaluation	5%
Group Work (GW)	Lab Reports (12)	20%
	Pre-lab assignments	5%
Final Grade (FG)	If IW > 70% FG = 0.75*IW + 0.25*GW else FG = IW	

Take note of the last line above: If your individual work grade is less than 70%, then the group work will not be included in your final grade, and your final grade will be given by your **individual work only**. Otherwise, individual work accounts for 75% of your final grade, and group work accounts for the other 25% of your final grade.

Faculty, TF, and Peer Evaluation: 5% of your final grade will be based on feedback from the faculty, TA and your lab partners. This grade will be anchored to your individual work grade and will be adjusted up or down based on feedback. Items that can increase your grade include active participation in your lab group, participation in online discussions (Slack), participation in class and office hours. The best way to increase this grade component is to demonstrate engagement in the course and be a good lab partner. This element can have an impact if you are on a grade boundary and is determined at the discretion of the course faculty.

Regrade requests: Requests for grade changes are the responsibility of the student. If you feel that a prelab, quiz, lab report, or exam has been graded incorrectly, bring your concerns to the instructor or one of the TFs. Regrade requests will be accepted up to one week after grades have been posted for an

assignment.

Rationale for course assignments:

- Prelabs reinforce the mental processes that help you to become proficient in a subject. The prelab quizzes largely serve as your homework assignments in this class. We also encourage you to work additional problems for practice. Before beginning any assignment, you should read the text and work the examples in the text.
- Experimental laboratory exercises are either more complex than hands-on homework or require special equipment. You will work in pairs to collect and analyze the data, as well as write up the experimental laboratory report.
- Exams and quizzes provide a gauge to determine what you have learned individually.
- Lab experiments help you to learn how to synthesize the basic concepts, methods, and tools presented in the course curriculum. The team-oriented lab approach will give you experience in working and cooperating in groups as is typical in industry.

Assignment Submission and Late Policy

1. Prelabs:
   a. Submitted as a Canvas "quiz". Multiple tries are allowed, and you can work with your lab partners. Prelab Canvas submission opens at 6 pm on Friday along with the lab assignment and closes at 5 pm on Tuesday regardless of lab section.
   b. Prelabs will not be accepted after 5 pm Tuesday.
2. Quizzes
   a. Quizzes are conducted on Canvas and available from Wednesday at 5 pm until Thursday at 11:59pm. You will have 15 minutes to complete the quiz once you start it. Only a single try is allowed.
   b. Quizzes are a closed book, closed notes individual assignment.
   c. Once you have taken the quiz you may not discuss it with anyone until after Thursday midnight.
   d. No makeup quizzes will be provided as quiz solutions are provided shortly after Thursday midnight.
   e. Your quiz grade will take the best 11 out of 12 quizzes; this policy is designed to accommodate missed quizzes.
3. Lab reports:
   a. Due at 6 pm each Friday.
   b. 10 point deduction for each day late.
   c. An assignment submitted at 6:01pm is considered one-day late, so don't wait to submit.
   d. Late penalties will not be assessed until Monday at 6:01pm
   e. Labs will not be accepted after 6 pm the following Friday (one week after the due date).

Exams

This course has four (4) scheduled exams. This includes two evening exams scheduled for Wednesday October 4th and Wednesday November 1st from 5:30 to 7:00pm in AERO 120. A lab practical exam is scheduled for Thursday November 16th during lab and the final exam is scheduled for Sunday December 17th 7:30-10:00pm in AERO 120. All exams are in person and mandatory. If you will miss one of these exams please contact the faculty immediately to discuss alternative options. Should you miss an exam for any reason you must contact the faculty within 24 hours otherwise you will receive a zero (0) for your exam grade.

Exam and Assignment Regrading

Regrading requests for any assignment must be submitted within 1 week after the assignment has been

returned. All regrading requests must be coherent and show a clear understanding of the problem. Generic requests for more points will not be considered.

Communications

- All questions regarding course content (lecture material, prelabs, quizzes, exams, lab assignments) should be posted to the course **Slack workspace** or asked during lab, lecture, or office hours.
- Please post questions about lab, prelab, and quizzes in the relevant channel for that lab. Use the #general channel for course logistics questions.
- We encourage you to use the #random channel for fun (but appropriate) posts that are peripherally related to the course.
- If we receive an email with a prelab or lab question, we will direct you to post on the course Slack workspace and relevant channel.
- The teaching team will make every effort to respond to course related Slack posts in a timely manner (typically within 1 business day).
- Questions posted 24 hours or less before an assignment deadline may not receive a response before the deadline.
- Any question, concern, or issue not regarding course content or of a personal nature should be e-mailed to a course instructor.
- **Any emails sent to a member of the teaching team should include ASEN3300: in the subject line.**
- We cannot guarantee that emails and Slack posts will receive a response outside of regular business hours, i.e. Monday through Friday, 8:00 am – 5:00 pm MST/MDT.
- **We strongly encourage you, the students, to answer each other's questions in Slack.** This is a great way to work together to solve problems, and not have to wait for an instructor or TA response.
- We reserve the right to make changes to the weekly course schedule based on unexpected events that may come up during the semester. We will give sufficient advance notice through announcements in class and posting on Slack. Changes to this syllabus may be announced at any time during class periods, and an updated syllabus document will be posted on Canvas.

Cheating

Cheating will not be tolerated, and the CU Honor Code will be upheld.

As group work is part of this class (lab experiments and report), it is useful to clarify what is considered cheating. You are expected to perform the lab assignments as a group and divide the workload equally. Communication within the group is encouraged. It is OK to discuss the assignments and reports with fellow students in the class as long as this is done with the intention of learning, i.e., understanding the material. Sharing results or data analyses is permitted only under specific circumstances, when there is no way for you to retake the data or redo the analysis. For example, if you realize after finishing your lab work that your data are erroneous, you may use and analyze the data from a different group. However, in this case, you need prior faculty approval and provide a full disclosure and explanation why data sharing was necessary, and give proper credit to the source. Using answers from prior semesters is not allowed and considered an honor code violations.

When in doubt about what is considered unethical, you should always exercise caution and ask the instructor(s) if they have any questions or concerns that what they are doing may be a violation of the honor code.

Weekly Schedule (labs 2-12)

Topic	Day	Time	Type	Submission
Prelab due	Submission opens on Friday along with lab assignment and closes on Tuesday	5 pm	Individual submission	Gradescope
Weekly Quiz due (15 minutes)	Submission opens on Wednesday and closes on Thursday	5 pm	Individual	Canvas
Lab Due	Friday	6 pm	Group	Gradescope

Some Logistics

1. Students are assigned to a team of 3 persons for the duration of the semester.
2. Teams work together to study the lab; design, implement, test, and analyze their circuits; and write the lab reports. Students are encouraged to collaborate in preparing for quizzes, discussing lab questions and results.
3. Weekly quizzes and all exams are to be completed individually. Any type of collaboration or copying constitutes cheating and will result in a zero grade for all parties involved and will be reported. A repeated instance of cheating will be reported on the student's permanent record and will result in an F for the course. Please see also Honor Code web pages at http://www.colorado.edu/academics/honorcode/.
4. Weekly quizzes will be conducted via Canvas starting on Wednesday 5 pm and closing on Thursday, 5 pm. Students will have 15 minutes to complete the quiz once started.
5. The purpose of the prelab assignment (submitted individually) is to prepare you for the weekly lab. It is important to complete the prelab before the first lab session; otherwise you will have difficulty completing the lab in the allotted lab time. Answers to prelab questions will be entered into Canvas. Canvas Prelab submission opens on Friday at 6 pm and closes on Tuesday 5 pm.
6. Lab exercises are conducted together with your team and a single lab report is submitted at the end of the week via Canvas. Collaborations with other groups including shared diagrams or extensive discussion of results must be acknowledged in your report. Copying text or answers from another group with or without their permission constitutes cheating and will result in a zero grade for the weekly lab module. A repeated instance of cheating will be reported on the student's permanent record and will result in an F for the course. Please see the Honor Code web pages at http://www.colorado.edu/academics/honorcode/.
7. University closure: If an assignment is due and the University is closed due to weather or other circumstance, then the assignment will be due on the next day that the University is open. In the event that a lab or lecture is cancelled due to a University closure, please check the website and Canvas announcements for updated information. All critical communications will be conveyed through Canvas announcements.
8. Please check your schedules as soon as possible to determine if you expect to miss class on any of these days for religious or other reasons. If there is a conflict, it is the student's responsibility to notify the instructors as soon as possible to make alternate arrangements. Copying, collaborating, or discussing material in a written or oral exam during the exam period constitutes cheating and will result in an F for the course, and will be reported on the student's permanent record.

University Policies - Fall 2023

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 for further assistance.

If you have a temporary medical condition or required medical isolation for which you require accommodation, please contact the faculty at your earliest convenience to develop a plan for managing the situation. 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

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

bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar

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

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

(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.

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

In this class, please contact the faculty at least two (2) weeks in advance to discuss options for managing the conflict.
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

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