ASEN 5090 INTRODUCTION TO GNSS - SYLLABUS

Lecture MWF 9:35-10:25 AM, AERO N240

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Office hours: See Canvas

Logistics for Fall 2025

ASEN5090 is available in-person and via on-line learning. Students registered in the ASEN5090-001 section are expected to attend the scheduled lectures regularly in person; however, there is no problem making up a few lectures by watching asynchronously online if you are ill, or have other personal reasons for missing class. Students registered in the ASEN5090-001B section are expected to watch recorded lectures asynchronously; however, if seats become available in the classroom, students may come in person, but keep in mind that priority goes to the students registered for the 001 section.

Overview

ASEN 5090 *Introduction to GNSS* is a core Aerospace Engineering Sciences (AES) course for the Astrodynamics and Satellite Navigation Focus Area. It provides an overview of the principles of operation of global satellite navigation systems (GNSS) with primary emphasis on the U.S. Global Positioning System (GPS). This course covers the fundamentals of both hardware and algorithms/software aspects of GNSS and is meant for graduate students interested in pursuing further study in GNSS as well as those pursuing specializations in astrodynamics, autonomy, remote sensing, communications, and other fields that rely upon GNSS instruments. ASEN 5090 is a prerequisite for advanced satellite navigation courses including ASEN 6091 GNSS Receivers, ASEN 6090 GNSS Software and Applications, and ASEN 6092 GNSS Remote Sensing.

Prerequisites & Eligibility

ASEN 5090 is open to graduate students in Engineering, Physics, Applied Math, Geological Sciences, Geography, and related fields. Advanced undergraduates who are interested in taking the course must get instructor permission. Students are expected to have good problem-solving skills, physics, calculus, vector and matrix math, linear algebra, computer programming, and the ability to write clearly.

Required Textbook:

Global Positioning System, Signals Measurements, and Performance, Revised 2nd Edition, by P. Misra and P. Enge, Ganga-Jamuna Press. You can find it on Amazon or at the bookstore.
There are two different versions of the 2nd edition available that you might find online. Both are fine. You should NOT purchase the 1st edition. It is missing a number of sections that we will use.

Recommended Reference Book

Position, Navigation, and Timing Technologies in the 21st Century, Ed by Y.T.J. Morton, et al.
Available for download through the CU Libraries:
Vol 1: https://ieeexplore-ieee-org.colorado.idm.oclc.org/book/9304973
Vol 2: https://ieeexplore-ieee-org.colorado.idm.oclc.org/book/9304974

Subject Outline

1. GNSS Basics
2. Measurements and Errors
3. Position Solutions
4. GPS Signals and Receivers
5. Applications

Assignments

There are 8 homework assignments that range from working assigned problems in the book to a series of assignments that build up to programming a GPS position solution. Collaboration is permitted on these assignments. This means you may discuss the means and methods for solving problems and even compare answers, but you are not free to copy solutions from classmates or from internet resources. The work that you turn in must be your own--copying is not allowed for any assignments. Students who are found to be copying any portion of an assignment will be reported for violation of honor code and may incur both academic and non-academic sanctions.

Each homework assignment will identify what must be turned in and the deadline for submission, which is the same for both on-campus and distance learning students. All assignments are to be submitted via Gradescope, accessible through the course CANVAS page. Up to two late assignments per student will be accepted as described on the course schedule.

Exams

There will be a midterm exam in week 8 and a final exam due on the campus-assigned date/time. Both exams will be administered as ~24-hour take-home exams via Canvas/Gradescope. Each student, whether on-campus or distant, is personally responsible to abide by the CU Honor Code and the exam rules specified on the assignment. Any violation of this requirement including use of AI, collaboration, or copying on an exam constitutes cheating and will result in an F for the course. An honor code violation report will also be filed with the honor code office.

Grading Policy

Grades on individual assignments and for the overall course are set based on the following criteria.

A, A-	Demonstrates superior understanding of the material, excellent technical work
B+, B	Demonstrates comprehensive understanding of the material, strong technical work
B-	Demonstrates adequate understanding of the material, complete technical work
C	Demonstrates barely adequate understanding of the material and minimally sufficient technical work, not satisfactory to fulfill graduate degree requirements
D	Poor technical work
F	Unsatisfactory performance

Final grades will be based on the following weighting

Participation	5	*Includes in-class and/or online activities and discussions*
Midterm Exam	10	
Final Exam	15	
Assignments	70	
Total	100	

University Policies

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. Understanding the course's syllabus is a vital part of adhering to the Honor Code.

All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution: StudentConduct@colorado.edu. Students found responsible for violating the Honor Code will be assigned resolution outcomes from Student Conduct & Conflict Resolution and will be subject to academic sanctions from the faculty member. Visit Honor Code for more information on the academic integrity policy.

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

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.

If you have a temporary illness, injury or required medical isolation for which you require adjustment, please work with the recorded and online lecture materials, and let the instructor know promptly if you require any accommodation in terms of assignment deadlines. You are not required to inform the instructor of the nature of your illness.

Accommodation for Religious Obligations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Please communicate the need for a religious accommodation in a timely manner. For this class, you are expected to review the course schedule and let the instructor know within the first two weeks of the semester of any such conflicts so that we can work out an accommodation plan. See the campus policy regarding religious observances for full details.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not always align with how they identify. If you wish to have your preferred name (rather than your legal name) and/or your preferred pronouns appear on your instructors' class rosters and in Canvas, visit the Registrar's website for instructions on how to change your personal information in university systems.

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, marital status, political affiliation, or political philosophy.

Additional classroom behavior information

- Student Classroom and Course-Related Behavior Policy.
- Student Code of Conduct.
- Office of Institutional Equity and Compliance.
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- Office of Institutional Equity and Compliance.

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 abuse (dating or domestic violence), stalking, and related retaliation by or against members of our community on- and off-campus. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who have been subjected to misconduct can contact OIEC at 303-492-2127 or email OIEC@colorado.edu. Information about university policies, reporting options, and OIEC support resources including confidential services can be found on the OIEC website.

Please know that faculty and graduate instructors are required to inform OIEC when they are made aware of incidents related to these concerns regardless of when or where something occurred. This is to ensure the person impacted receives outreach from OIEC about resolution options and support resources. To learn more about reporting and support a variety of concerns, visit the Don't Ignore It page.

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.

Conditional Use of AI in This Class

You are permitted (but not required) to conditionally use generative AI tools in this course for the following purposes only:
* partial code generation (i.e. ≤ 30% as measured by total lines of code submitted) for programming on homework assignments;
* to review or study course material and topics on your own.
If you use gen AI tools for partial code generation on homework, you must document your usage by stating this explicitly at the top of your assignment and cite the portions (lines of code) that were generated by the specific tool you used. Failure to properly document gen AI usage for coding assignments on homework will be treated as a potential CU Honor Code violation.

You **may not** use gen AI tools to produce solutions for other nonprogramming questions on homework.
You **may not** use gen AI tools for any kind of question (whether programming or non-programming) on the midterm or final exams. Exam work submitted for grading must conform to these guidelines, in order to receive full credit reflective of your own individual competency, learning, and understanding of the material.