

# ASEN 6044: Advanced State Estimation

## Spring 2024 Course Syllabus

### General Information

**Instructor:** Prof. Nisar Ahmed ([nisar.ahmed@colorado.edu](mailto:nisar.ahmed@colorado.edu)), Smead AES Dept.

**Time and Location:** Tues & Thurs 4:00 pm - 5:15 pm, AERO N240.

**Course Website:** [canvas.colorado.edu](https://canvas.colorado.edu) (posted course materials, announcements, assignments, recorded lectures, etc.)

**Office Hours:** TBD (other times by appointment only)

### Course Textbook:

B. Ristic, S. Arulampalam, N. Gordon, *Beyond the Kalman Filter: Particle Filters for Tracking Applications*, Artech House Radar Library, 2004, ISBN-13: 978-1580536318.

**Description** This advanced graduate course will cover principles and techniques for designing, implementing, and analyzing probabilistic state estimators for dynamical systems that require "going beyond" traditional least-squares and Kalman filtering approaches.

**Prerequisites:** (1) ASEN 5044: Statistical Estimation for Dynamical Systems (or equivalent graduate level coursework in probability and linear estimation/Kalman filtering with permission of instructor); and (2) demonstrable competency completing projects and assignments on ones own in a technical programming language (e.g. Matlab/Octave, Python, C/C++, C#, Java, Julia, etc.). **THESE ARE FIRM NON-NEGOTIABLE REQUIREMENTS { DO NOT ENROLL IN THIS COURSE UNLESS YOU MEET BOTH OF THESE PRE-REQS!**

## Course Details

**Grading and Project Assignments** Course work will involve a mix of assignments and projects. There will be no exams. Assignments will ensure that students demonstrate basic understanding of the course material. Projects will integrate and explore concepts and techniques covered throughout the course. Assignments will consist of short theoretical and programming problems motivated by different applications, as well as questions to guide development of and reporting on final project applications. The final project will be developed over the course of the semester, and will serve in place of a final exam.

Students are highly encouraged to collaborate with one another on assignments, although individual assignments must be submitted. Students have the option of working together in groups of two (max) on the final project if they so choose, though significant individual contributions will be expected on group projects.

**Grading breakdown:** assignment/project exercises: 40%; final project: 40%; class participation: 20% (students are highly encouraged to ask and answer questions during class, office hours, via e-mail, etc.). Note that group final project report submissions will result in the same grade for both group members.

Tentative Course Schedule (may vary somewhat)

Week(s)	Topic
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If you have a required medical isolation for which you require adjustment, please contact the instructor as soon as possible to arrange for any necessary accommodations or assignment extensions.

**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 policy 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.

All incidents of academic misconduct will be reported to the Honor Code Council (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. 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 misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, 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

any assignment (see Course Details above).

See the campus policy regarding religious observances for full details.