

# AE483: UAV Navigation and Control

## Syllabus, Fall 2016

### Personnel

#### Instructor

- Tim Bretl (office: CSL 148, phone: 217-244-3126, email: [tbretl@illinois.edu](mailto:tbretl@illinois.edu))

#### Teaching Assistants

- Yijie Cheng (email: [yicheng49@illinois.edu](mailto:yicheng49@illinois.edu))
- Jose Sepulveda (email: [jsepulv2@illinois.edu](mailto:jsepulv2@illinois.edu))
- Akshay Shetty (email: [ashetty2@illinois.edu](mailto:ashetty2@illinois.edu))

#### Engineering Teaching Lab Specialist

- Dan Block (email: [d-block@illinois.edu](mailto:d-block@illinois.edu))

### Time and Place

#### Lecture

- Mondays and Wednesdays from 1:00pm-1:50pm, in Talbot 103

#### Laboratory

- Date and time by section (Mondays, Wednesdays, or Fridays at 9:00-10:50am or 3:00-4:50pm; or Thursdays at 10:00-11:50am), in Transportation 302 — **labs begin on Monday, August 29**

#### Final Presentations

- Wednesday, December 14, from 7:00-10:00pm, in Talbot 103

#### Office Hours

- To be announced.

### Course Description

This course provides an introduction to autonomous aerospace systems, specifically unpiloted and remotely-piloted aerial vehicles. As a case study, you will learn how to automate a state-of-the-art, high-performance, commercially-available quadrotor helicopter. The lecture will focus on algorithm design (e.g., vehicle kinematics and dynamics, optimal control, and collision avoidance). The laboratory will focus on algorithm implementation and flight testing.

### Prerequisite

Be an undergraduate student in Aerospace Engineering, with credit or concurrent registration in AE202, AE352, AE353, and AE370 (or equivalent).

### Required Texts

None.

### Homework

There will be four homework assignments, done individually. Each assignment is due at the start of class. Late homework will not be accepted.

## Laboratory

There will be four laboratory assignments, done in groups. Each assignment requires a demo (to be shown during lab to a teaching assistant) and a report (to be submitted no later than one week after the demo). Attendance during lab is required, unless a written explanation is obtained from the emergency dean. You will not receive credit for a lab or demonstration that you do not attend.

## Exams

There will be four exams. All exams will be closed book. Electronic devices—calculators, phones, etc.—will not be permitted. However, you will have access to MATLAB. You will take all four exams in the Computer-Based Testing Facility or “CBTF” (<https://edu.cs.illinois.edu/cbtf/>), which is in the basement of Grainger Library (Room 57). Our use of CBTF will give you flexibility in scheduling your exams, will show your results immediately, and will allow you to retake any exam as often as you like. Details will be discussed in class. There will be no final exam.

## Project

There will be a final project in the laboratory, done in groups. This project requires a demo (presented to the entire class in Talbot 103 from 7-10pm on December 14) and a report (submitted prior to the demo). Attendance at the final presentation is required, unless a written explanation is obtained from the emergency dean.

## Grading

### Distribution

- 25% homework assignments
- 25% laboratory assignments
- 25% CBTF exams
- 25% final project

### Scale

- 97-100 (A+), 93-97 (A), 90-93 (A-), 87-90 (B+), etc.
- No curve will be applied to the grades.

## Schedule

- quad-rotor kinematics (5 hours)
- quad-rotor dynamics (5 hours)
- optimal control of quad-rotors (5 hours)
- collision avoidance with quad-rotors (5 hours)
- to be announced (5 hours)

## Website

We will be using piazza as the course website. You will receive an invitation to enroll within 24 hours. Please do so. All correspondence from us will be through piazza.