**MEEG 467-019 Applied Controls**

**3 credits / 3 contact hours [elective]**

**Department of Mechanical Engineering**

**University of Delaware – Spring 2017**

**Instructors** Dr. Dustyn Roberts Dr. Guoquan (Paul) Huang

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**TAs** Victoria (Tori) Wahlquist (vwahl@udel.edu) – grad TA/grader

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**Office hours** Check Canvas: <http://www.udel.edu/canvas/>

**Textbook** None

**Other Supplemental Materials**

* You are required to purchase a [Sparkfun Inventor Kit](https://www.sparkfun.com/products/14094) (or equivalent) to serve as your textbook and use throughout the semester for hands-on assignments.
* If you have a laptop, bring it to class. You can still succeed in the class without one, but please see one of the instructors to make arrangements.

**Catalog Description**: In this course, students will develop a practical appreciation for all the components of a robotic system as they learn to apply control theory to analyze and control real world robotic systems. In doing so, they will expand their knowledge of different operating systems and programming environments used in robotics and controls work. This a hands on course with some lecture and a lot of studio time for independent and group project work.

**Prerequisites**: MEEG 311 and MEEG 312 or equivalent, or permission of instructor[[1]](#footnote-1)

**Communication** A course website and email list has been set up using Canvas (<http://www.udel.edu/canvas/>). All official announcements will be published there.

**Phases** The class is divided into three phases:

1. Physical computing with Arduino (Dr. Roberts)
2. Open and closed loop control and response (Drs. Roberts/Huang)
3. Robot control with Crazyflie flying quadcopter (Dr. Huang)

For the last two phases you will work on in a group of 3-4 and deliverables will include exercises, demos, and documentation in different forms.

**Format** This course is more lab than lecture. Will we use an active learning strategy know as project-based learning that is focused on you discovering what you need to know rather than us telling you. Research shows that this leads to better learning[[2]](#footnote-2) (and it happens to be, in our opinion, way more fun).

**Learning Objectives**

1. **Hardware**: Identify a variety of inputs (sensors) and outputs (actuators, displays) that can be used with microcontrollers (Arduino, Crazyflie). Create actual circuits from simple electrical schematics.
2. **Software**: Write code in various languages (C-based Arduino, Python) and development environments (Arduino IDE, MATLAB) to interpret data from inputs and affect outputs to a given microcontroller system. Analyze, interpret, and visualize data as needed to characterize a given system.
3. **Control**: Implement open loop and closed loop control strategies using appropriate hardware and software.
4. **Communicate**: Give an effective oral presentation summarizing progress on a given project.
5. **Teamwork**: Function effectively in teams as determined by instructor observation, peer ratings, and self-assessment. Conduct meaningful performance assessments of the team, individual team members, and self and identifying strengths and weaknesses of each.

# Student Outcomes\* Addressed:

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| **Student Outcome** | **Addressed by:** |
| (a) an ability to apply knowledge of mathematics, science, and engineering | Objectives 1, 2, 3 |
| (b) an ability to design and conduct experiments, as well as to analyze and interpret data | Objectives 2, 3 |
| (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability |  |
| (d) an ability to function on multidisciplinary teams | Objective 5 |
| (e) an ability to identify, formulate, and solve engineering problems |  |
| (f) an understanding of professional and ethical responsibility |  |
| (g) an ability to communicate effectively | Objective 4 |
| (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context |  |
| (i) a recognition of the need for, and an ability to engage in life-long learning | Objective 5 |
| (j) a knowledge of contemporary issues |  |
| (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice | Objectives 1, 2 |

\*No ABET outcomes are directly assessed in electives

**Calendar (including a brief list of topics to be covered)**

Schedule as of 2/6/2017 (see Canvas for updates)

**Grading** **10% Attendance**: There is a lot of hands-on and group work required in this course. Time will be allotted in class for working on exercises and projects, and you are expected to participate with full effort and enthusiasm. Class attendance is mandatory unless otherwise noted. Review the policies on excused absences in the [Faculty Handbook](http://facultyhandbook.udel.edu/handbook/3113-student-class-attendance-and-excused-absences). For relatively minor, short-term illnesses (e.g., colds and flu, where attendance in class is undesirable), you are not required to inform the instructor.

 **15% Individual Exercises:** Exercises are due by the beginning of class on the stated due date unless noted otherwise. Details of submission (online, in person) will be included in each assignment.

 **75% Group Projects**: There will be several deliverables for each of two major group projects (e.g. in class demo, analysis work, video recording). Details will be provided through Canvas.

* Late assignments (individual or group) *will not be accepted.* Exceptions will only be made at the discretion of the instructor for serious illness or emergencies .

Final letter grades will be determined through the standard breakdown:

A 90-100, B 80-90, C 70-80, D 60-70, F <60

+/- grades are assigned at the discretion of the instructor and typically represent the bottom 2% and top 2% within a particular letter grade range. For example: a B- is typically 80-82%.

**Peer Evaluation** You will use the Comprehensive Assessment of Team Effectiveness (CATME: <www.catme.org>) to evaluate the teaming behaviors of yourself and your teammates. These evaluations will be incorporated into your final grades for each project.

**HELP!** --TA office hours

--Instructor office hours

--The [Center for Counseling and Student Development](http://www.udel.edu/counseling) (CCSD) can help with personal problems, stress, or life circumstances that interfere with your academic functioning. The CCSD works with you on a confidential and individual basis and is funded by student health fees so does not charge for services.

**Integrity** Familiarize yourself with UD’s [Code of Conduct](http://www.udel.edu/stuguide/15-16/code.html), which establishes standards of behavior for students at the University. While we encourage discussions between classmates on coursework, all work (unless otherwise indicated) must be performed and will be graded individually. Plagiarism, cheating, and other academic misconduct will not be tolerated*.* Any violation of this standard will be reported immediately to the [Office of Student Conduct](http://www.udel.edu/studentconduct/ai.html).

**Inclusion** This classroom is a place where you will be treated with respect. We welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class.

**Accommodation** Any student who has a documented need for accommodation from the [Office of Disability Support Services](http://www.udel.edu/DSS/) (DSS) based on the impact of a disability should contact the instructor privately to discuss the specific situation as soon as possible.

1. Note that since this is still an “experimental” class without an official course number, no prerequisite is listed in the course description. However, if you have not had MEEG 311 and 312 or an equivalent course, you will need the permission of the instructor to remain enrolled. [↑](#footnote-ref-1)
2. Ask Prof. Roberts for references if interested. [↑](#footnote-ref-2)