

Fall 2018

ID 312-001: Mechanics & Electronics

Mathew Schwartz

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Mechanics and Electronics:

ID-312 | Fall 2018

Tuesday 2:30 -5:20 A.M. | Weston 661
Professor Mathew Schwartz | cadop@njit.edu
OFFICE HOURS: | Tuesday 12:15-1:15 PM by appointment (Weston 675)

Overview:

As computation becomes more accessible, both in cost and in size, the everyday products we encounter have the potential to become more independent and provide alternative services than their main function. Often these are referred to as 'smart' products, which can be a chair that analyzes posture or seating times, or a vacuum that navigates and maps the floor that needs to be cleaned. In this class, the basics and fundamentals of how these products work will be covered in a bottom up approach. This means rather than focus on designing a 'smart chair', the class will go over the basics of how electrical circuits work, how various sensors work, and how the mechanics aspects of a moving chair could work. Students coming out of this class should then be able to apply this knowledge to any project in their studio or in professional life.

This class is designed as both mechanics and electronics, rather than a more integrated mechatronics class. The difference is largely in that the fusion of the two components requires a broader knowledge base, including programming and control theory. While some of this will be touched upon at the end of the semester, the class will focus more on foundational skill sets that students can use in a future elective course. Specifically, students will learn how to solder, read and write circuit diagrams, use power supplies and oscilloscopes, etc.

While this class has been on the books, it is largely a new development. Past classes were taught 3rd year second semester. This gave little time to apply the knowledge in studio, and limited the quality of student projects. As it is now first semester of the second year, students should have ample time to apply the knowledge, or take additional classes to improve their knowledge before graduation. Additionally, the class will focus more on ensuring students reach a basic competency in various aspects of mechanics and electronics.

Students with disabilities or academic accommodations should see me at the start of the semester to discuss any needs as the letters from the Dean of Students does not always arrive in a timely fashion.

Schedule

Week Date	Topic (likely to change)	Information
1 September 4	Introduction	What to expect (new class format) New Electronics Lab (Volunteers?) Using Research Tools
2 September 11	Soldering and Connecting	Research Assignment 1 Due September 17 11:59 PM
3 September 18	Research Presentations	
4 September 25	Fundamentals of Electronics \ Research Presentations	Research Assignment 2 Due October 1 11:59 PM
5 October 2	Wearable Technology	
6 October 9	User Inputs	Electronics Project Due October 15 11:59 PM
7 October 16	Sensors	
8 October 23	Mechanical systems	
9 October 30	Smart Vehicles	
10 November 6	Kinematics / Robotics	
11 November 13 Last Class Before Withdraw date	PCB Manufacturing	Mechanics Project Due November 19 11:59 PM
12 November 20 NO CLASS Thursday Class Meets		
13 November 27	Logic	
14 December 4	Arduino	
15 December 11	Arduino	

Skill Assignments

Multiple skills will be evaluated through submitting the implemented skill. Some of these will overlap with quizzes. This list is subject to change (adding more or removing some skills)

- 1) Soldering
- 2) Desoldering
- 3) Heat shrink
- 4) Crimping
- 5) Multimeter
- 6) Digital Caliper
- 7) Reading Resistor Value
- 8) Reading Sensors using Oscilloscope
- 9) Dividing Voltage
- 10) Decoding Circuit Diagram
- 11) Creating Gears
- 12) Gear Ratios
- 13) Defining Lead Screws
- 14) Calculating Motor Torque
- 15) Logic Tables
- 16) Joint Links
- 17) Batteries
- 18) Fritzing

Details for each skill will be provided in a separate document.

Electronics Project

Given a circuit or electronics based project, recreate it and integrate it into a design.

Mechanical Project

Given a mechanical based project or system, recreate it and integrate it into a design.

Research Assignments

Reading a peer reviewed research paper and preparing a pdf presentation. The elements of the assignment include:

- 1) Statement of Hypothesis (is this theoretical, experimental etc.)
- 2) Explanation of Methodology (do they use human subjects? do they use quantitative data?)
- 3) Application or Use of Research (do the authors give insight to how it can be used, does it impact other designs?)

Submission

- All Research Assignments are submitted on **MOODLE**
- All Skill Assignments are submitted in **CLASS**
- The Projects are submitted on **MOODLE**,
- The Quizzes are administered during **CLASS** time

- Moodle is used for grading. For COAD Students, all work submitted on moodle must be submitted on Kepler by the end of the semester to receive a grade.

Quizzes: At various points in the class, a quiz will be given. Dates are unannounced, with no make-up time without a notice from the dead of students. In general, the quiz will cover information about circuit diagrams, mechanical systems, and other topics discussed in class. The following are a few topics to be covered, however, others will be included in the quizzes, so students should take notes in class.

- 1) Logic Tables
- 2) Resistors
- 3) Torque
- 4) Circuit Diagrams
- 5) Gear Ratios

Grading:

10% Participation

20% Projects

20% Quizzes

5% Research Assignments

45% Skill Assignments

Grading Criteria for Projects(Equal Weight)

Novelty

How unique is your project? Does it do something other projects do not (both in class and in the world)? Does it achieve something other people have not, or does it explain something unique?

Relevance

Is the project based on the guidance given in the class? Does it achieve the goals of the project? Is it related to Design or Architecture?

Submission

Are the submission guidelines followed? Are files named correctly?

Grading Criteria for Skills

For each skill a specific criteria and number will be given. For example, soldering 20 pairs of wires together, each soldered joint will be pulled to make sure it is a solid connection. For each connection that is solid and uses the appropriate amount of solder (by measurement), will be counted, divided by the total number (20).

Late Work:

Late work is accepted with a half ($\frac{1}{2}$) point reduction per hour after the deadline. Each hour is rounded up. For example, a grade of 95 will become a 92 if submitted 5.2 hours late. In the case of a presentation or quiz, this policy does not apply and make-up presentations are not accepted. Skill assignments have a 2 week grace period after the original submission date to fix or improve the skills.

Readings

Suggested readings will be provided, but no books are required for purchase. Most of the reading for this class will be decided by the student (under specific parameters) to individualize the reading to their project and interest.

Plagiarism

Plagiarism refers to text, visual, and intellectual property. Not citing work, misleading during a presentation or submission on where the idea came from, or using words from a paper without quotations will be reported to the dean of students.

Lates

Arrival to class on time, and remaining for the duration of class, is mandatory. Attendance is taken at the beginning of class. If a student is late they must notify the professor at the class break (1.5 hours after the start) and have their name recorded as late. Not doing this will count as an absence and will affect the grade. Arrival later than 1.5 hours into class is recorded as absent. Each late is 2 points off of the participation grade. Each Absent is 5 points off of the participation grade.

University/College Rules

Academic integrity and honesty are of paramount importance in this class. The NJIT "University Code on Academic Integrity" will be upheld and any violation can, and will be, brought to the immediate attention of the Dean of Students by either a faculty member or student.

Regular attendance is expected. When possible, please give advance notice of your absence. NJIT requires attendance for ALL students. After 3 recorded absences, your grade will be lowered by ONE (1) letter grade for each additional absence, if you are not carrying a medical, school or religious related excuse. This means that any student who would have received an "A" will now receive a "B", a "B+" reverts to a "C+", etc. No excuses will be accepted without a written note from the Dean or a doctor. Students with particular needs and foreseen absences should present them to their instructor within the first week of class. Attendance for student athletes: No student athlete may miss any regularly scheduled classes for any practice activities. This means students can neither miss nor leave class early (or arrive late) to attend a practice. While student athletes may miss class when participating in intercollegiate competition, it is the responsibility of the student athlete to proactively inform the instructor well in advance to make appropriate arrangements to complete or make up any assignments or exams in a timely fashion.

Students with disabilities should see me at the start of the semester to discuss any needs.

The syllabus is an outline for the class, and subject to change. Students are required to regularly check changes of the syllabus.

"Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

<http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.

*Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. **Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university.** If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at dos@njit.edu"*