 Objective:
The course objective is to introduce students to the design of systems containing mechanical, electrical and electronic components.

Course Content: Mechatronics design refers to the practice involving the synergic use of mechanical engineering, electronic and electrical engineering, programming, control theory, sensor and actuator technology, to design modern systems. It is the way the world works in the 21st century. We now have electric motors that are smaller than the period at the end of this sentence (Really!!). Microprocessors run everything from your MP3 player to the airbags in your car to your Mr. Coffee. To prepare you for designing the newest and coolest stuff, we have created this course. In this class you will design gear trains and power transmission systems, and will couple them to optical encoders and to a controller for position and speed control. You will learn about a variety of sensors useful in robotics, manufacturing, the automotive, aerospace industries, and medicine among others. You will learn how to connect sensors and actuators to a control system and how to write control programs for making good things happen. This will be one of the coolest courses you ever take.

Learning Outcomes: This is your first real Mechanical Engineering design course, although you may have done some team design projects in E1.

In General, By the end of this course you will develop:

• An ability to apply knowledge of mathematics, science, and engineering;
• An ability to design and conduct experiments, as well as to analyze and interpret data;
• An ability to design a system, component, or process to meet desired needs;
• An ability to function on multi-disciplinary teams;
• An ability to identify, formulate and solve engineering problems;
• An understanding of professional and ethical responsibility;
• An ability to communicate effectively;
• A recognition of the need for, and an ability to engage in life-long learning;
• An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice;
• An ability to use modern microprocessors, microcontrollers, sensors, and actuators in mechatronics systems designed to monitor and control products and processes.

In particular, By the end of this course you will:

• Know how to create mechanical drawings of some basic items using Pro Engineer.
• Know how to specify and use basic mechanical design elements, such as gears, belts, bearings, lead screws, universal joints, differentials and others. We will study these mechanisms at the level of functionality and application.
• Know how to specify and use common electro-mechanical sensors and actuators, including DC motors, stepper motors, relays, solenoid valves, optical encoders, proximity sensors, and micro-switches.
• Know how to read and generate simple wiring schematics, and how to construct circuits using standard industrial components.
• Know some basics of Matlab, and how to use it to perform data acquisition and control functions. Know how to set up logic-based sequential control algorithms and simple single-loop feedback control programs.
• Know how to write a simple engineering proposal for design and development of a product in response to a design specification.
• Know how to work in a team to subdivide, coordinate and integrate pieces of a design project and to develop a working prototype.
• Have developed sense and a practice of professionalism

Instructor: Dr. Giampiero Campa
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Instructor Office Hours: My office hours are from 10 AM to 12 AM Tuesday and Thursday. In general you will not find me in the office in other times, since I am normally around touring different labs.

Class Attendance: There will be two lectures per week on average. If you miss a class, it is your responsibility to obtain notes from one of your classmates.

Homeworks: Homeworks will be assigned and although they will not be mandatory you are strongly advised to do them, that way you can develop problem-solving skills before exams and quizzes take place.

Teaching Assistants:
Brandon Wilcox—bwilcox1@mix.wvu.edu
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TA’s Office Hours: Office hours will be held during regularly scheduled labs (Tues,Wed, Thurs – 2:00-4:00).

Lab Attendance: There will be one lab per week on average. Attendance for all labs is mandatory. Attendance will be taken at the completion of each lab. If you know that you must be absent, please see the instructor or the TAs and make arrangements before the lab so you can attend the lab one of the other days of the week. Additionally, ONE make-up lab will be given near the end of the semester; attendance for the make-up lab is not required if you are not missing any labs.

Lab Reports: Each person must hand in a copy of the lab report. All submissions must have your name, the lab number and your lab section time in the title block. A sample lab report will be provided with our expected format. It is STRONGLY advised that the format be followed as grading of lab reports will be strict. All lab assignments are due at the beginning of lab on the day of your lab. Any work submitted after this time will be accepted at a deduction of 20 percent per day. Lab reports submitted for labs not attended will not be accepted. Each lab report will carry an equal contribution of the final lab grade for the course. The make-up lab can replace one missed lab. If you have any questions about the grading of a particular lab assignment, you are welcome to discuss it with one of the TAs and they will review the grade and explain the reasoning for any missed points.

Quizzes: You will sometimes take a short quiz over the material covered during the preceding weeks. The quizzes will cover both lecture material and lab material. Quizzes will be announced at least one class period ahead of time.
**Exams:** There will be a midterm exam and a final one. The final exam will cover material within the whole course, including labs.

**Makeups:** If you must miss an exam or quiz, you must inform the instructor before the scheduled start of the exam. Failure to do so may result in denial of the opportunity to make up the exam.

**Projects:** Toward the end of the semester you will divide yourselves into teams of 4 people and undertake a major design project, as specified in a request for proposal, which will be distributed by the instructor. The project will consist of two phases: development of a design proposal and the actual construction of the hardware and software for the project. We generally set a final contest among all the teams to evaluate the “winning” projects.

**Readings:** There is not a lot of reading to do in this course, but what materials we have prepared should be treated as important and studied. This includes the material lab writeups. You will be held responsible for information presented in the lab writeups, irrespective of whether or not it is specifically covered in lecture.

**Final Grading:** I grade on a straight scale as shown below, that way, at any point in the semester you should be able to calculate your average and know what grade you are earning. At the end of the semester, the grades will be based on 100-90 % = A; 90-80 % = B; 80-70 % = C; 70-60 % = D; 60-0 % = F. Work will be weighted as follows:

- Exams: 30%
- Quizzes: 15%
- Lab Reports: 30%
- Projects: 25%

**Instructors Expectations:** You are in training to become a respected leader in your community and workplace. To do so, you must think and behave in a manner that bespeaks the qualities we associate with professionals in any endeavor: competence, pride in one’s work, attention to detail, diligence, responsibility, punctuality and integrity among others. In this class I will expect you to manage your time and resources to keep track of assignments, keep up with readings and to submit carefully prepared work that represents your personal sense of pride and professionalism.

**Academic Dishonesty:** Academic dishonesty includes, but is not limited to, plagiarism of lab write-ups, and copying materials from previous years or other students. The first occurrence will result in an F for the assignment. Repeat occurrences will be pursued for an unforgivable F for the course. Please refer to the West Virginia University Student Handbook for further information on academic dishonesty.

**WVU Social Justice Statement:**
West Virginia University is committed to social justice. I concur with that commitment and expect to foster a nurturing learning environment based upon open communication, mutual respect, and non-discrimination. Our University does not discriminate on the basis of race, sex, age, disability, veteran status, religion, sexual orientation, color or national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate needing any type of accommodation in order to participate in this class, please advise me and make appropriate arrangements with Disability Services (293-6700).