ECE 210 - Analog Signal Processing

Instructors:

This course is currently directed by Professor Erhan Kudeki. Instructors vary from semester to semester. However, Professors Trick, Kudeki, Franke, O'Brien, and other professors from the areas of signal processing, control systems, and communications have made repeat appearances. Professors He and Basar have made repeated appearances in recent semesters. This past semester (Spring 2018), the instructor list includes Jing Jiang, Su Yan, and Professor Juan Alvarez.

Prerequisites:

ECE 110, PHYS 212, and credit or concurrent registration in MATH 285 or MATH 286 are listed as prerequisites of this course; EE and CompE majors pick MATH 286 because it is a requirement. PHYS 212 is listed as a prerequisite, but ECE 210 can be taken concurrently. Although MATH 285/286 can be taken concurrently, it is strongly recommended to take it beforehand. A student that takes them concurrently might have to learn a topic in ECE 210 before MATH 286, which can be tricky. Fourier series and transforms, for example, are covered in ECE 210 before they are covered in MATH 286.

Relevant topics from ECE 110 and PHYS 212 include basic circuit analysis and lab work involving breadboards, oscilloscopes, and function generators. In MATH 285/286, paying extra attention on topics of first order solution, Fourier series, Fourier transforms, and Laplace transforms will come in handy. An ability to understand topics in PHYS 212 and MATH 285/286 will be beneficial towards the latter half of the course when dealing with topics of phasors, time-invariant systems, Fourier transforms, and Laplace transforms.

When to Take It:

Students interested in EE should take ECE 210 as soon as possible. It is strongly recommended for EE majors to take this course by second semester of their sophomore year to graduate in time. It is a prerequisite for many required and elective EE courses, such as ECE 310, 329, 330, 340, and 342. To some extent, ECE 210 is the backbone of the EE curriculum. While ECE 210 vastly covers basic circuit analysis and analog signal processing, the course develops one's intellectual maturity applicable in other areas of EE. CompE students can be more flexible with when they take this class.

FAQ: Should I take ECE 210 and ECE 220 concurrently?

This depends on the individual's academic capacity. A student who has performed well above average in ECE 110 and ECE 120 should have no issue taking both concurrently. This will train the student to prepare for the heavier workload in coming semesters by instilling time management and organization. In short, it exposes the student to the wrath of taking multiple ECE courses later in their career. Note that if a student has no prior programming experience outside of ECE 120, ECE 220 can be a big time sink.

Class Content:

ECE 210 will be, for most students, the first real synthesis of electrical engineering and mathematics. The first quarter of the course reviews basic circuit analysis. This includes source-transformation, Thevenin/Norton equivalent circuits, and transient/steady-state analysis. Students will learn methods of working with linear time-invariant systems. They will recognize that an analog circuit is a linear system with inputs being voltage/current sources and outputs being voltages and currents.

The course becomes increasingly mathematical when first-order differential equations, phasor analysis, Fourier series, and Fourier and Laplace transforms are introduced (in the order mentioned). EE majors will find many future uses of Fourier transforms, and should master their understanding of the topic. Note that there will be General Engineering students taking this course as ECE 211 (which only covers up to Fourier series).

To complement the material covered in lecture, lab work involves the development of an AM radio receiver. In each lab, students construct and analyze a component of the receiver using oscilloscopes and function generators. Students are expected to complete a total of five lab assignments within the time given, though extra hours are available. An additional weekly honors section led by upperclassmen is also available to students who want to use MATLAB and Python for technical computing on course relevant material. The honors section consists of a weekly 1-2 hour tutorial/demo section where students are taught about MATLAB and Python concepts. The student must then complete a short assignment that usually takes about 1-2 hours. Completing the 4 MATLAB assignments and the 4 Python assignments will earn the student honors credit. The honors section is a great way to learn introductory MATLAB and Python skills, but it is harder compared to some other James Scholar honors classes.

Work:

The work primarily come from weekly written homework assignments and the 5 lab assignments. Homework problems are assigned from the textbook, which is absolutely essential for the class. Note that each chapter contains many examples that are comparable to homework problems. Making an effort to fully understand the concepts behind every problem will shorten the amount of time required to prepare for exams.

Lab meetings are bi-weekly and do not begin until one month into the semester. Each lab assignment consists of a pre-lab due before beginning of lab. The lab questions will be due within a week of the lab session. Aside from completing unfinished lab questions, there is no additional work involved for the lab. Comparatively, the lab work for ECE 210 is significantly less than the lab work for ECE 110’s final project. Nonetheless,
students interested in the practical use of the mathematical concepts in ECE 210 should enjoy lab, which features real-world electronics applications. The mathematical concepts become clear when students put effort into their labs.

Exams reflect material covered in homework, but most likely will contain 1-2 tricky problems that test the student’s ability to apply concepts to somewhat unfamiliar situations. Practicing with the past exams and having a strong conceptual understanding will help one perform well on exams, as will reading the textbook. Overall, ECE 210 requires an average weekly time commitment in relation to other ECE courses. Past students said they have spent between 4.5 and 7.9 hours per week on this course.

**Life After:**

The follow up required courses, ECE 313 and ECE 329, as well as certain technical electives under the EE curriculum build on the mathematical principles and practice introduced in ECE 210. Students should develop a better idea of their academic interests after taking this course. Generally, students who dislike this class do not intend to pursue EE as a major. Be aware that ECE 210 is only the tip of the iceberg of EE, and not liking this course does not necessarily indicate disinterest in EE. Students who especially find the signal processing portion of ECE 210 interesting should consider taking ECE 310 and ECE 420 in the following semesters. ECE 330 builds on the power-related topics in 210 such as circuit equivalents, resonance, and phasors. This course will give the student a better idea on what to specialize in for EE majors, as well as aid in choice of technical electives (especially among the 3-of-5 for EE and the 1-of-6 for CompE).