Course Information

ECE 212 Spring 2017
Circuit Analysis II

Catalog Description

With lab. Continuation of ECE 211. Analyzing and solving ac networks using complex forcing functions. AC power analysis, including average, reactive, and complex power. Applications of techniques to polyphase power systems and transformers. Circuit analysis in the s-domain (Laplace), including transfer functions and resonance. Frequency response, including filters and Bode diagrams. Fourier analysis, including harmonics; even, odd, and half-wave symmetry; and Fourier coefficients. Bi-weekly lab meetings include simulating circuits by hand and/or using PSpice, then building the circuits and taking measurements for comparison. Prerequisite: grade of C or better in E&C-ENG 211 or its equivalent. (4 credits).

Goals and Objectives

The objective of this course is to continue to show you the methodology of electrical and computer engineering and lay a foundation for future work in the field through the study of electrical circuits. After taking this course, you should be able to:

- develop models of circuits in terms of differential equations;
- analyze circuits comprised of resistors, capacitors, inductors and op-amps driven by sinusoidal inputs (employ the concepts of phasors, impedances, admittances and compute power);
- use Laplace transforms for the analysis of circuits in the s-domain (including filters, frequency response and Bode plots);
- perform Fourier circuit analysis; and
- construct simple electric circuits and make measurements in the laboratory (using basic laboratory equipment and working in teams).

Instructional Approach

As in ECE 211, we are using the "Mastery" approach. Course credit is earned entirely and exclusively through mastery of 18 online modules, 5 labs, and 5 computer exercises covering all the topics of the course. There are still lectures and recitations, but there are no midterm exams and no required homework. Since the modules are administered online, you may retake them. This means that if you do not master a module, it does not count against you, but if you do master a module, it counts toward your semester grade. The questions and contexts will change with every attempt, but the central concepts and techniques do not change. Thus, if you have truly mastered the material, you can be given any circuit, be asked any question, and you will be able to answer it correctly.

It is strongly recommended that you attend all lectures and recitations. These will help you learn the concepts and techniques needed to demonstrate mastery in the online modules and computer assignments.

Course Format

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Lecture: Three 50-minute lectures per week (MoWeFr, 10:10â€“11:00, in Thompson 104)

Recitation: One 75-minute recitation per week (Tu, 11:30â€“12:45, in ELAB II 119)

Mastery Modules: 18 online tests, administered by OWL

Electronics Lab: 5 bi-weekly labs (M, Th, or F; 2:30â€“5:30, in Marston 221)

Computer Exercises: 5 problems to solve on the computer, done on your own, using MATLAB

Instructors

Bill Leonard
Marcus 8B
545-3513
leonard@ecs.umass.edu
Office Hours: Any time I am in my office
Responsibilities: Overall class organization and administration, lectures, OWL, Moodle, discussion, grading exercises

[to be determined]

Office Hours: [to be determined]
Responsibilities: grading labs, performing skills assessments in lab

Undergraduate Assistants

Head Lab TA

Aidan Fitzpatrick
ajfitzpatric@umass.edu
Responsibilities: Preparing TAs to run the lab sections, coordinating make-up labs, making sure there is enough equipment, kits, and supplies in the lab

Prelab / MATLAB Help (Marston 34)

Alex Bonstrom
abonstro@umass.edu
Availability: Monday, 6:30â€“8:00; Thursday, 5:00â€“6:30; and by appointment

Elizabeth Cole
ekcole@umass.edu
Availability: Monday, Wednesday, 5:00â€“6:30; and by appointment

Kristina Georgaderellis
kgeorgadare@umass.edu
Availability: Sunday, 5:30â€“8:30; and by appointment. (Note different beginning and ending times.)

Tim Reardon

treardon@umass.edu
Availability: Wednesday, Thursday, 6:30â€“8:00; and by appointment

Mastery Tutors (Marcus 8B)

Trevor Berry
ttberry@umass.edu
Availability: Monday, Wednesday, 5:00â€“6:30; and by appointment

Aidan Fitzpatrick
ajfitzpatric@umass.edu
Availability: Sunday, Monday, 6:30â€“8:00; and by appointment

Moe Mohamed
mamohamed@umass.edu
Availability: Tuesday, 5:00â€“8:00; and by appointment

Evan Tyra
etyra@umass.edu
Availability: Thursday, 5:00â€“8:00; and by appointment

Prerequisites

A grade of C or better in ECE 211 (or its equivalent) is required to take this course.

Textbooks

Required

PSpice for Linear Circuits (with CD-ROM), by J.A. Svoboda; Wiley, 2002

Recommended

Engineering Circuit Analysis, Seventh Edition, by Hayt, Kemmerly, and Durbin; McGraw-Hill, 2007.

Course Components

There is no required homework in this course. There are no semester exams, and there will not be a final exam. Instead, your grade will be determined by the number and type of online modules you successfully master. Electronics labs and computer exercises are also required, as described below.

Electronics Labs. During this semester, you will do 5 labs, constructing actual circuits and taking measurements. Each lab will have a prelab assignment, usually a PSpice simulation. Each lab is worth a maximum of 30 points. Make-up labs are on selected Friday afternoons.

Computer Exercises. There are five computer problems, designed to extend your abilities with MATLAB. The problems are worth a total of 50 points (10 points each), with up to an additional 10 Mastery points available for perfect scores, as well as another 10 Bonus points for perfect scores before a certain date.

Mastery modules. There are a total of 18 online modules, administered by OWL. Two cover "Prerequisite" knowledge. Fourteen are "Basic" modules, covering definitions and basic techniques

"Prerequisite" knowledge. Fourteen are "Basic" modules, covering definitions and basic techniques. One is an "Intermediate" module, which integrates topics within the first five Basic modules and encourages efficient decision-making. There is one "Cumulative" module, covering the entire course. You can earn up to 6 "Mastery" points for a perfect score on each module.

Each module is worth 10 points. To earn mastery, you must answer all questions correctly in a designated secure setting.

At least 12 attempts will be made available in OWL for each module. Attempts will be due periodically until the end of the course, Tuesday, 5/2/17. (After an assignment is past due, you will not be able to attempt it.)

You only need to master **one** of the attempts. If you fail to master any particular attempt, it does not count against you. You simply make another attempt at that module. Only the best score counts in your total score.

For more information, go to Modules.

Grading

To earn a guaranteed C in this course, you must earn...

- at least 220 points on Mastery modules, including Mastery points, but not including Bonus points;
- at least 180 points on labs and exercises, also including Mastery points, but not including Bonus points.
- at least 9/10 (each) on B1 and I1;
- at least 6/10 (each) on P1, P2, and B2 through B14; and
- at least 42 points (total) on B12 through B14, including Mastery points.

In other words, B1 and I1 are critical for future success, so you must earn at least 9/10 on each one. Also, you are expected to at least attempt every module (except C1) and earn at least 6 points on it. Finally, the whole course is designed to help you understand and do Fourier, so you need at least 42 points in this last group of modules.

Once you have fulfilled all of these criteria, every 20 points is a grade increment, e.g., C to C+. Thus, you need 520 points for a guaranteed A.

If you do not reach one or more of these minimum scores, talk to Prof. Leonard about your options. (If you are close, there will usually be a way to pass with at least a C.)

For more information, go to Grading.

Exams

There are **no** evening exams, and there is no final exam. Your grade is determined entirely by your score on labs and the number and type of online modules you master.

Homework

There is **no** required homework in this course. However, associated with each Mastery module will be a set of Practice modules, also administered by OWL. Although these are completely optional, they will serve the role of homework, as they help you to prepare to master the required modules. We recommend that you do all of the Practice modules associated with each Mastery module.

Electronics Laboratory

There are 5 bi-weekly laboratories, held in the Electronics Lab (MRST 221). You will work in teams to construct circuits and answer questions about them.

Each laboratory meeting has a preparatory assignment associated with it (prelab). Usually this is a PSpice simulation. You must complete this assignment **before** you will be allowed to work on the lab. The TA will collect the prelab assignments at the beginning of lab.

You will be assigned to a group (A or B) at a brief information meeting at the beginning of the semester. This group assignment will determine which week of the cycle you should attend lab. (This will help keep the maximum number of students in each lab meeting relatively small.) The first meeting will be held on Monday, January 30.

The lab schedule can be found at "Lab Schedule".

Electronics labs are worth a maximum of 150 points. (MATLAB exercises are worth another 60 points.)

Collaboration vs. Cheating

You are encouraged to work together, especially on Practice attempts and in the Lab; however, ultimately you must master modules on your own at the secure site, so do not rely too heavily on other students for help. You also may not work too closely with someone on the computer exercises. In particular, you can brainstorm before you start programming, and you can compare results after you are finished, but you should not be sharing lines of code with each other. Occasionally, you might need or know a useful command or function, and you may collaborate. But the intent is that your code is your own. It should reflect your own understanding and your own way of organizing the solution. If you need additional help, you should be asking me or the TA for help, not your classmates.

I will deal informally with most cases of academic dishonesty, however, I am required to report all cases, formal or informal, to the Ombuds Office. Note that the Ombuds Office is required, in turn, to inform the University administration if there are three or more reports of academic dishonesty regarding the same individual, who then decides if more serious disciplinary action is warranted.

Rough Course Outline

1. Sinusoidal Steady-State Analysis (Chapter 10)
2. AC Circuit Power Analysis (Chapter 11)
3. Polyphase Circuits (Chapter 12)
4. Magnetically Coupled Circuits (Chapter 13)
5. Complex Frequency and the Laplace Transform (Chapter 14)
6. Circuit Analysis in the s-Domain (Chapter 15)
7. Frequency Response (Chapter 16)
8. Fourier Circuit Analysis (Chapter 18)