

## ECE 213 Circuit Analysis II

### Overview

#### Course Catalog Description: Circuit Analysis II (3 credits)

General transient analysis of electrical circuits. Laplace transform with applications to circuit analysis. State-space equations. Fourier series analysis. The network function; convolution; frequency response.

**Prerequisites:** C- or better in both 203L and Math 316.

**Co-requisite:** Math 314.

**Textbook:** J.D. Irwin and R.M. Nelms, *Basic Engineering Circuit Analysis, 9<sup>th</sup> ed.*, J. Wiley and Sons. ISBN: 978-0-470-12869-5.

**Class Goals:** To gain a strong foundation in advanced linear circuit analysis.

**Course Coordinator:** Professor Chaouki T. Abdallah

**Table I: Objectives, Implementation, and Assessment**

Objectives		Implementation	Assessment	A	B	C	D	E	F	G	H	I	J	K
O <sub>1</sub>	Understand basic AC steady state circuit analysis	2-1/2 hrs. lecture in first week (review)	HW 1, Exam I	X				X						
O <sub>2</sub>	Understand AC steady state power (single phase)	2.5 hrs. lecture in 2nd week	HW 2, Exam I	X				X						
O <sub>3</sub>	Understand three phase power circuit analysis with balanced loads	5 hrs. lecture in weeks 3,4	HW 3 Exam II	X				X						X
O <sub>4</sub>	Understand variable frequency performance of linear networks, Bode plots, linear scaling	5 hrs lecture in weeks 5,6	HW 4,5 Exams II, III	X				X						X
O <sub>5</sub>	Understand linear frequency filter networks	2.5 hrs lecture in week 7, term paper assignment	HW 5, Term paper Exam III	X				X		X				X
O <sub>6</sub>	Understand Laplace transforms and their applications to linear circuit analysis	7.5 hrs lecture in weeks 8,9,10	HW 5,6, Exam III	X				X						X

O <sub>7</sub>	Understand Fourier series, Fourier transform, and their application to linear circuits	7.5 hrs lecture weeks 12,13,14	HW 7, Exam III	X							X					X
O <sub>8</sub>	Understand basics of state variable analysis	2.5 hrs lecture weeks 15, 16	HW 8, Final Exam	X							X					X

**Table II: Expectation and Assessment Outcome  
Fall 2008, Dr. M. Gilmore**

**Contents:** This course will cover AC power, and transient and steady state analysis of electric circuits in the frequency domain. We will also discuss state variable analysis, and three phase circuits. We will cover chapters 9, 11 - 15 in the Irwin and Nelms book (though not all of every chapter), plus supplementary material.

1. Review of ECE 203 (chapter 1 - 8)
2. Chapter 9: Steady-state power analysis
3. Chapter 11: Polyphase (3 phase) circuits
4. Chapter 12: Variable-frequency network performance
5. Chapter 13: The Laplace Transform
6. Chapter 14: Application of Laplace Transforms to Circuits
7. Chapter 15: Fourier Analysis
8. State Variable Analysis

**Grading:** Homework 20%, three exams 15% each, term paper 15%, final exam (cumulative) 20%

**Homework:** Homework assignments will be approximately weekly. Late homeworks will not be accepted unless arrangements for late submission have been made prior to the due date.

Some homeworks will involve computer solutions and plotting, so you will need access to software with math and plotting functions, such as MATLAB, IDL, C/C++, FORTRAN with math & plotting libraries, etc. MATLAB is available in the ECE Dept. computer lab on the 2<sup>nd</sup> floor of the ECE building.

**Exams:** Three exams will be given during class time 11 AM – 12:15 PM). The dates will be:

- Exam #1: Thurs Sept 25
- Exam #2: Thurs Oct 23
- Exam #3: Thurs Nov 20

**Final Exam:** Tuesday, Dec. 16, 12:30 – 2:30 PM

**Term Paper:** A 4 –6 page paper on a topic of your choice in linear circuits. Details TBA.

**Academic Integrity:** Academic dishonesty will not be tolerated. All cases of cheating and plagiarism will be reported to the Dean of Students office for disciplinary action. UNM academic policies are described in the section “General Academic Regulations” in the course catalogue: <http://registrar.unm.edu/Catalogs/2008-09Catalog.pdf> . Also see the handout on academic integrity from the UNM English department:

[http://www.unm.edu/~english/Resources/pdf/Academic\\_Integrity\\_students.pdf](http://www.unm.edu/~english/Resources/pdf/Academic_Integrity_students.pdf). If you have any questions about academic practices that are and are not acceptable, come speak with me.

**Holidays (no class):** Thurs Oct 16 (Fall Break), Thurs Nov 27 (Thanksgiving)

**Tips for Success in this (and any) Class:**

1. Come to class! (In the worst case, it can't hurt!)
2. Do all the reading
3. Work problems beyond those given for homework (examples in the text and other books, problems online, etc)

Tentative Lecture Schedule

<u>Week</u>	<u>Day</u>	<u>Date</u>	<u>Topic</u>	<u>Text Sections</u>
1	Tues	Aug-26	Review of ECE 203 – AC Steady State Analysis	chap 1 - 8
	Thurs	Aug-28	Review of ECE 203 – AC Steady State Analysis cont.	chap 1- 8
2	Tues	Sept-02	Steady State Power Analysis	chap 9
	Thurs	Sept-04	Steady State Power Analysis cont.; Three-phase circuits	chap 9, chap 11
3	Tues	Sept-09	Three-phase circuits cont.	chap 11
	Thurs	Sept-11	AC Power Systems	-
4	Tues	Sept-16	Variable Frequency Response; Transfer Functions;	
	Thurs	Sept-18	Poles & Zeros, Bode plots Series & parallel resonance	12.1 – 12.2 12.3 – 12.4
5	Tues	Sept-23	PSpice tutorial	-
	Thurs	Sept-25	Exam #1	
6	Tues	Sept-30	Filters	12.5 – 12.7
	Thurs	Oct-02	Filters cont.	12.5 – 12.7
7	Tues	Oct-07	Laplace Transforms: Definition, common pairs, properties	13.1 – 13.4
	Thurs	Oct-09	Inverse Laplace transforms by partial fractions	13.5
8	Tues	Oct-14	Convolution, initial & final value theorems	13.6 – 13.8
	Thurs	Oct-16	Holiday, no class (Fall Break)	
9	Tues	Oct-21	Catch up and Review for Exam	
	Thurs	Oct-23	Exam #2	
10	Tues	Oct-28	Convolution, initial & final value theorem cont.	13.6 – 13.8
	Thurs	Oct-30	Laplace Transform circuit solutions & models	14.1 – 14.3
11	Tues	Nov-04	Transfer functions, pole-zero plots	14.4 – 14.5
	Thurs	Nov-06	Steady state response via Laplace Transforms	14.6 – 14.8
12	Tues	Nov-11	Fourier series	15.1
	Thurs	Nov-13	Fourier series cont.	15.1
13	Tues	Nov-18	Fourier Transforms	15.2
	Thurs	Nov-20	Exam #3	
14	Tues	Nov-25	Fourier Transform applications	15.3 – 15.4
	Thurs	Nov-27	Holiday, no class (Thanksgiving)	
15	Tues	Dec-02	State Variable Analysis	-
	Thurs	Dec-04	State Variable Analysis cont.	-
16	Tues	Dec-09	State Variable Analysis cont.	-
	Thurs	Dec-11	Review for Final Exam	
	Tues	Dec-16	Final Exam, 12:30 – 2:30 PM	

**Exams:** Expect 75% of the students to score 70% or better on all exams.

Objectives		Outcome Assessment	Evaluation
O <sub>1</sub>	Understand basic AC steady state circuit analysis	87.5 % of students completed HW 1 satisfactorily. Avg. on Exam I was 63.5%, with 37.5% scoring 70% or better	Some students did not grasp basic concepts adequately
O <sub>2</sub>	Understand AC steady state power (single phase)	77 % of students completed 100% of exercise in HW 2. Avg. on Exam I was 63.5%, with 37.5% scoring 70% or better	Some students did not grasp basic concepts adequately.
O <sub>3</sub>	Understand three phase power circuit analysis with balanced loads	88% of the students completed HW 3 satisfactorily. Avg. on Exam II was 72.4%, with 53.5% scoring 70% or better	More students appeared to grasp basic concepts. Fewer very low test scores.
O <sub>4</sub>	Understand variable frequency performance of linear networks, Bode plots, linear scaling	93% of the students completed HW 4 satisfactorily.	
O <sub>5</sub>	Understand linear frequency filter networks		
O <sub>6</sub>	Understand Laplace transforms and their applications to linear circuit analysis		
O <sub>7</sub>	Understand Fourier series, Fourier transform, and their application to linear circuits		
O <sub>8</sub>	Understand basics of state variable analysis		