

# **EGR 220, Fall 2008**

## **Engineering Circuit Theory**

**Professor:** Judith Cardell; Room EGR 105b

**Office Hours:** Tuesday 2:30 - 3:30, Wednesday 9:30am - 10:30am

**Class Time:** T Th 10:30 - 11:50, in EGR 201

**Lab:** M 1:00 - 4:00, in EGR 101

**Master Tutor:** Emma Dalton

**Master Tutor Group Hours:** Sunday 2-4, Tuesday & Wednesday 7-9; in EGR 201/202

**Master Tutor Individual:** by email

**Pre-/ Co-requisites:** Physics 117, Physics 210

**Text:** *Fundamentals of Electric Circuits*, Alexander and Sadiku, McGraw-Hill, 2007, 3rd ed.

### **Course Overview and Objectives**

The basic objective of this course is to introduce students to the fundamental theory and mathematics for the analysis of electrical circuits. Through the material presented in this course, students will learn:

1. The fundamental principles in electric circuit theory and be able to extend these principles into a method of thinking for problem solving in mathematics, science and engineering
2. To analyze analog circuits that include energy storage elements in the time and frequency domains, both theoretically and experimentally
3. How to predict the behavior of basic electric circuits
4. Ways in which electrical engineering shapes and benefits society
5. To improve oral, graphical and written communication skills
6. How to learn and to work effectively both individually and in groups
7. To evaluate personal learning process and understanding of the concepts and skills from class

### **Course Concept Map**

A set of concept maps will be used throughout the semester to bring together the course topics and analysis techniques. The maps will be gradually introduced, and are provided here for easy reference.

### **Assignments**

There will be weekly homework assignments and weekly lab assignments. There will also be short reading and homework quizzes most weeks in class, two in-class midterm exams and a

final exam.

### **Homework format**

All homework solutions must be written on standard engineering paper (or typed and printed when appropriate, e.g., Matlab code and computer plotted results). Students are encouraged to work together to understand the concepts, but each student must work out and hand in her own solutions. All assignments are to be neatly written or typed, and stapled, with your name and date. *Note that students are expected to follow the Honor Code for all work in this course. Copying on homework, labs or quizzes/exams, and other violations will be brought to the honor board.*

The purpose of the homework is for you to have the opportunity to practice - practice - practice the skills and concepts from class. Since homework is the time to practice, you are not expected to have perfect solutions at all times. You are expected to do your best work for each problem however. In recognition of these goals, each homework problem will be evaluated on a 0-10 point scale as follows:

- 0 No effort
- 2 Problem statement written out but not attempted
- 6 Incomplete attempt
- 9 Complete attempt, incorrect solution
- 10 Complete attempt, correct solution

A complete attempt includes identifying what is known, articulating what you are solving, stating any assumptions, properly labeling figures, including units and a reasonable number of significant figures in your answer, and clearly and neatly documenting your progression towards a final result.

### **Laboratory**

The weekly lab sessions will include pre-lab assignments, performing the laboratory experiments and a professional, post-lab write-up. The pre-lab must be completed and signed before the lab is to be performed. There will be no make-up labs scheduled - if you are going to miss a lab, inform Prof. Cardell and Sue Froehlich *beforehand* to set up a time that you will be able to use the lab equipment. Be sure that the final lab that you hand in is clearly written, well labeled and professionally presented.

**All labs must be completed to pass the course - any student who does not hand in all labs will fail the course.**

Lab write-ups must follow the Lab Report Guidelines

### **Projects**

There will be laboratory group projects in which students will gain practical experience in designing and building a circuit, artifact or piece of technology related to the material in the course. The projects must be designed, built, demonstrated to be functioning and presented to

classmates and instructors.

## Quizzes and Exams

There will be weekly -quizzes that are used to assess progress and ensure students do not fall behind.

### *micro-Quizzes*

The  $\mu$ -quizzes will be given once a week should take 5 to 10 minutes to complete. The questions on these  $\mu$ -quizzes will be related to the homework due the previous week. In addition to providing the instructor with feedback on the class progress, these tools are also a great opportunity for student self-assessment on learning course material. Average quiz grades of 9 or 10 may be used to raise a student's final grade at the end of the semester.

### *Exams*

There will be two midterm exams and a final exam, used to solidify concepts and assess the learning progress.

## Class attendance

Students are required to attend class and participate in class discussions and problem solving exercises.

## Grading

Grades in this course are designed to represent your achievement of the objectives listed above. The course components that will make up your grade are listed below.

ASSIGNMENT	GRADE CONTRIBUTION
Homework sets	15%
Labs	30%
Class participation	5%
Midterm exams (together)	30%
Final exam	20%

## Late Policy

All homework assignments are to be submitted at the beginning of class, labs are to be submitted at the beginning of lab; late assignments will be penalized at the rate of **one point per minute** unless you have requested and received an extension at least 24 hours before the deadline. However, each student will have a total of 1 hour (60 minutes) grace time to be used as desired by that student over the course of the semester, such that you can have a semester total of 60 tardy minutes for homework and labs without penalty (note that these minutes cannot be used for in-class reading questions,  $\mu$ -Quizzes or exams!).

## Honor Code

The weekly homework assignments and lab reports that you submit must be your own work. You are encouraged to discuss the problems and experiments with your classmates and work on

them together, but each student must work out her own solutions. It is not okay to copy answers from another student's homework - doing so is a violation of the Honor Code. Note that it is a violation of the honor code to 1) use or copy another student-s work, and 2) provide another student with your work. Projects will be done in small groups. Exams must be exclusively each student's own work, following the instructions provided with each exam. Do not hesitate to ask any questions that you may have concerning the honor code!

### Matlab Hints and Tutorials:

- Appendix E, page A-46 of the text
- [Matlab Basics](#)
- [Matlab's own tutorial](#)
- [Utah tutorial](#)
- [MIT-Strang Linear Algebra Matlab Hints](#)
- [MIT-Signals Matlab Tutorial](#)
- [Smith CS370 tutorial](#)

## EGR 220 Class and Assignment Schedule, Fall 2008

Date	Topic	Reading	Monday Labs	HW due (Thursdays by 4pm to EGR 105B)
Sep 4	<i>Time Domain - Statics:</i> Basic concepts, Ohm's Law Intro Slides	1.1-1.9, 2.1-2.2	No Lab	HW 1
Sep 9	Kirchhoff's Laws (Voltage + current dividers)	2.3-2.9, (skim 2.7)	Lab 1: Intro to lab equipment Lab Report Guidelines	
Sep 11	Nodal and mesh analysis	3.1-3.7, 3.9-3.10		
Sep 16	Circuit theorems I: linearity and superposition	4.1-4.4 Quiz 2 Sol'n	Lab 2: Verifying Req and measuring internal resistance	
Sep 18	<b>No Class</b>			HW 2 due
Sep 23	Circuit theorems II: Thevinin & Norton;	4.5-4.6, 4.8 4.10-4.11	Lab 3: Thevinin circuits; Maximum	

	Maximum Power Transfer	No Quiz 3	Power Transfer	
Sep 25	Operational amplifiers	5.1-5.8, 5.10-5.11		HW 3 due
Sept 30	<b>Time Domain Dynamics:</b> Capacitors and Inductors	6.1-6.7	Lab 4: Operational Amplifiers	
Oct 2	First order circuits I	7.1-7.4		HW 4 due
Oct 7	First order circuits II	7.5-7.6, 7.9-7.10	<b>Exam 1 during lab</b>	
Oct 9	Second order circuits I	8.1-8.2		
Oct 14	<b>Fall Break!</b>			
Oct 16	Second Order Circuits II: Natural Response	focus on section 8.2, 8.3		HW 5 due
Oct 21	Second order circuits III: Natural and Forced Response	8.4 Quiz 5 Sol'n	Lab 5: First Order Circuits	
Oct 23	Second Order Circuits IV: Complete Response, General 3rd Order Circuits Ch 8.4 Slides	8.5-8.7, 8.12		HW 6 due
Oct 28	<b>Phasor Domain - SSS I:</b> Sinusoids and phasors Phasor Animation Link Ch 9.1 Slides	9.1-9.3	Lab 6: Second Order Circuits	
Oct 30	SSS II: Impedance and circuit theorems	9.4-9.9		HW 7 due
Nov 4	SSS III: Analysis	10.1-10.7 10.9-10.10 Quiz 7 Sol'n	Lab 7: ... Peer editing of Lab 6	
Nov 6	<b>Frequency Domain -</b> Transfer Functions & the Decibel	14.1-14.3		HW 8 due
Nov 11	Bode Plots	14.4	<b>Exam 2 During Lab</b>	

Nov 13	Series and Parallel Resonance <b>Final Lab Design Projects Assigned</b>	14.5-14.6		
Nov 18	Passive & Active Filters	14.7 - 14.8 Quiz 8 Sol'n	Lab: Deisgn Project	
Nov 20	Filters: Matlab and Applications	14.8 - 14.13 (skip 14.10)		HW 9 due
Nov 25	<i>Phasor Domain</i> - Concepts of electric power	1) 11.1-11.4 2) HowStuffWorks: ElectricPower 3) 1965 Blackout Archive	Lab: Projects, Progress memo due	
Nov 27	<b>Thanksgiving Break</b>			
Dec 2	Power System Blackouts: The August 2003 Blackout		Lab: Projects	HW 10a: Blackout discussion questions
Dec 4	No Class			
Dec 9	<i>Phasor Domain</i> - AC power analysis	11.5-11.10 Quiz 9 Sol'n	Design Project Presentations	HW 10b: Blackout Reflection
Dec 11	Course Summary			HW 11