ENGR 2170 – Electrical Circuits, Spring 2009

Biological and Agricultural Engineering Department, UGA

Description

Circuit element, circuit models, and techniques for circuit analysis. The course emphasizes the application of Kirchhoff's laws in determining the transient and steady state response of circuits. 3 credit hours.

Location & Times

Driftmier Room 310
Monday, Wednesday 8:00 am – 8:50 am (50 min. lecture)
Friday 8:00 am – 9:55 am (115 min., including lab)

Instructor

Mike Yoder, Ph.D.
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Office Hours

By appointment or whenever I'm in my office.

Course Prerequisite

PHYS 1212/ 1212L – Electricity and Magnetism, Optics, Modern Physics

Course Prerequisite or corequisite

MATH 2700 – Elementary Differential Equations

Courses that require this course as as prerequisite

ENGR 3210 – Electrical Machines and Power Distribution
ENGR 3270 – Electronics 1
ENGR 3720 – Engineering Physiology
ENGR 4210/ 6210 – Linear Systems
ENGR 4230/ 6230 – Sensors and Transducers
ENGR 4240 – Introduction to Microcontrollers
ENGR 4630 – Engineering Design of Residential Structures

Text

Fundamentals of Electric Circuit Analysis, by Clayton R. Paul
© 2001, John Wiley & Sons, Inc., ISBN 0-471-37195-5
(caution: despite what is stated on page iv, the book is NOT free of errors!)

******The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

Tentative Lecture Schedule (total of 45 class days, Spring 2009 semester)

Ch. 1 – Basic Definitions and Laws (6 lectures).
Charge, voltage, current, lumped circuit elements, Kirchoff's Current Law (KCL), Kirchoff's Voltage Law (KVL), conservation of power, series and parallel circuits, redrawing circuits. (pages 1 – 39)

Ch. 2 – Basic Circuit Elements and Analysis Techniques (9 lectures)
Independent voltage and current sources, Ohm's Law, single-loop circuit, single-node-pair circuit, resistors in series and parallel, circuit reduction, voltage and current division, source transformations, controlled voltage and current sources.
(pages 51 – 85, (skip section 2.6), 90 – 100, (skip section 2.8.2 and section 2.9), 116 – 119.

Ch. 3 – Additional Circuit Analysis Techniques (7 lectures)
Superposition, Thevenin and Norton equivalent circuits, maximum power transfer, node-voltage method, mesh-current method.
(pages 135 – 172; skip sections 3.7 and 3.8)

Ch. 5 – The Energy Storage Elements (6 lectures)
Capacitor, inductor, mutual inductance, the ideal transformer, response of capacitor and inductor to dc, differential equations of a circuit
(pages 213 – 235; skip sections 5.6 and 5.7 and 5.8).

Ch. 6 – Sinusoidal Excitation of Circuits (8 lectures)
The sinusoidal source, intro. to Fourier series, Complex numbers, the phasor circuit, impedances, power, power factor, rms values, three-phase power.
(pages 261 – 303; 310 – 312; 327 – 333)

Ch. 7 – General Excitation of Circuits (2 lectures)
First-order circuit response for RL and RC circuits.
(pages 361 – 373)

Student Responsibilities

1. Because this is a 3 credit-hour course that is lab intensive, it is every student's responsibility to spend at least 9 hours each week outside of lecture working on the course material.
2. It is each student's responsibility to ask for help when needed. Questions concerning course material are encouraged both during and outside of class. I'm willing to help you at any reasonable time. Please do not hesitate to approach me about setting up an appointment.
3. Distractions are not welcome in class. It is each student's responsibility to help maintain an efficient learning environment. The following items are prohibited in the classroom: all forms of tobacco, hats, and noise making devices (e.g. ringing cell phones/ pagers and beeping PDAs/ laptops).

Do not use computers during lecture (unless specifically directed to do so)!
Violations will result in the entire class losing computer privileges.

Method of Grading

Labs	10%
Test #1	19%
Test #2	17%
Test #3	17%
Final Exam	17%
Homework, quizzes	10%
Special project (report)	10%

GRADING SCALE

A	94 -100	C+	77 - 79
A-	90 - 93	C	74 - 76
B+	87 - 89	C-	70 - 73
B	84 - 86	D	65 - 69
B-	80 - 83	F	64 and less

Weekly Assignment Schedule

Homework assignments are due at the beginning of the next class period, but they will only be graded sporadically. Lab reports are due one week after the lab, at the beginning of class.

Test #1 ---- Friday, February 13, 2009

Test #2 ---- Friday, March 20, 2009

Test #3 ---- Friday, April 17, 2009

Final Exam ---- Monday, **May 4**, 2009, at **8:00 am** – 11:00 am.

Special project (written report)

Topic – must be selected by **February 9**, 2009.

Examples: How a lead-acid battery works, How solar cells work, Electrolysis/making hydrogen, How LEDs work, Electric shock, How Christmas tree lights work, Tesla coils, How to make a generator, What is an electric arc?, etc.
beware of getting into too much electronics and semiconductors…

The presentation and written report must include:

- One page of some example calculations, even if they are very simple.
- Pictures and figures
- At least 5 references (with complete details)
- About 4 – 5 pages of double-spaced text
- *No plagiarism !!*

More details on separate handout.

The written report is due in class, Friday, **April 10**, 2009.

Grading Policies

1. There will be no make-ups of exams except for those who present an official UGA excuse at least one full day prior to the exam.

2. Working with others on homework is allowed. However, all work turned in must be the result of *your own understanding*. **Copying is not allowed**!

3. Homework will be graded on both the correctness of solutions and the effort put into solving the problems, so be sure to show all your work. It is much better to try to work a problem and not get the right answer than to not try.

4. Neatness counts. All pertinent work must be shown on your papers to receive credit. Work that is illegible to the instructor **will not receive credit**.

5. **Class attendance is required.** A student who incurs an excessive number of absences may be withdrawn from a class at the instructor's discretion. An "excessive number of absences" is defined as being absent more than 20% of class time (9 days).

ACADEMIC HONESTY

The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. **All academic work must meet the standards contained in "A Culture of Honesty." All students are responsible to inform themselves about those standards before performing any academic work.** More specific details pertaining to academic honesty may be found at the web site for The University of Georgia Office of the Vice President for Instruction http://www.uga.edu/honesty/

ENGINEERING PROFESSIONALISM POLICY

Engineers make great contributions to society. Engineering is a very satisfying profession that provides many rewards but is demanding and requires hard work. The engineering profession is governed by a code of ethics. Engineering faculty at UGA expect students to act in a professional manner at all times and develop the work ethics required for a successful engineering career. Engineering students at UGA are responsible for maintaining the highest standards of professionalism and professional practice.

DEPARTMENTAL GRADING POLICY REGARDING COMMUNICATION SKILLS

Thirty percent (30%) of the grade on all written assignments (lab reports and papers) and oral presentations will be based on quality of communication. Spelling, grammar, punctuation, and clarity of writing are evidence of written communication quality. Enunciation, voice projection, clarity and logical order of the presentation and effective use of visual aids are evidence of oral communication quality.

Course Learning Objective Matrix

Course Learning Objectives	Course Assessment Methods*	Extent of Coverage of Program Outcomes** (ABET Criterion 3)
1. Analyze DC circuits using KCL & KVL, nodal & mesh analysis, superposition, and Thevenin and Norton theorems.	A, B, C, D, E	a-xxx, b-xxx, e-xx, k-xx
2. Use maximum power transfer theorem.	A, B, C, E	a-xxx, b-xx, c-xx, e-xx, k-xx
3. Calculate power dissipation of circuit elements in DC and AC circuits.	A, B, C, E	a-xxx, c-xx, e-xx, k-xx
4. Analyze AC circuits in steady-state.	A, B, C, D, E	a-xxx, b-xx, c-xx, e-xx
5. Analyze 3-phase AC circuits.	A, B, C, E	a-xxx, e-xx
6. Analyze first order RL and RC circuits.	A, B, C, D, E	a-xxx, b-xx, c-xxx, e-xx, k-xx
7. Observe and document laboratory experiments.	D, E	a-xxx, b-xxx, g-xxx, k-xxx
8. Written paper of a student-selected topic.	F	a-xx, g-xxx, i-xx, j-xx, k-xx

* Course Assessment Methods : A – Homework ; B – In-Class Exams; C – Final Exam ; D – Lab Reports; E – Student Evaluation; F – Written report.

** Extent of Coverage : x – some, xx – moderate, xxx - extensive

ABET EC-2000 Criterion 3 Program Outcomes

Engineering programs must demonstrate that their students attain the following outcomes:

a) an ability to apply knowledge of mathematics, science and engineering.
b) an ability to design and conduct experiments, as well as to analyze and interpret data.
c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) an ability to function on multidisciplinary teams.
e) an ability to identify, formulate, and solve engineering problems.
f) an understanding of professional and ethical responsibility.
g) an ability to communicate effectively.
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
i) a recognition of the need for, and an ability to engage in life-long learning.
j) a knowledge of contemporary issues.
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Overall Course Contribution to Program Outcomes

a – extensive, b – extensive, c – moderate, e – moderate, g – moderate, i – some, j – some, k – extensive