Prerequisites: Circuit/Network Analysis. Signals course. Energy Conversion I.


This course will build upon your knowledge of circuits, signals, electronic devices and classical electric machines and power systems to add electronic energy processing circuits. Electronic energy processors, "power electronics," manipulate electrical energy sources with high efficiency, flexibility, and controllability. You will learn to analyze power electronic systems, and in the process gain a wide ranging review of topics from circuits, signals, electronics, and energy courses. Detailed learning objectives are on the following page.

Week | Material
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1 | Ch. 1,2 Switching devices
2 | Ch. 3 Review of electric/magnetic circuit analysis
3 | Ch. 3 Review of electric/magnetic circuit analysis
4 | Ch. 5 Diode rectifiers
5 | Ch. 5 Diode rectifiers
6 | Ch. 6 Phase-controlled rectifiers
7 | Ch. 6 Phase-controlled rectifiers, Test I
8 | Ch. 7 DC/DC converters
9 | Ch. 7 DC/DC converters
10 | Ch. 8 DC/AC inverters
11 | Ch. 8 DC/AC inverters
12 | Ch. 8 DC/AC inverters, Test II
13 | Ch. 10 DC power supplies
14-15 | Ch. 10 DC power supplies
16 | Ch. 10 DC power supplies

Grading:
- Homework --- 10%
- Quizzes ----- 10%
- Test I ------ 20%
- Test II ----- 20%
- Final -------- 40%
Student Learning Objectives for EECS 4480

The student will be able to . . .

1) describe the basic operating characteristics of high-power semiconductor switching devices, including the diode, power MOSFET, BJT, IGBT, and thyristor.

2) perform circuit analytical techniques for solving transient circuits in the time domain.

3) use the concept of cyclic steady state behaviors in circuit analysis.

4) calculate average and rms values of signals in the time domain, and from the Fourier series expressions of the same.

5) characterize power transfer for non-sinusoidal periodic signals, including displacement factor, power factor, and harmonic distortion, in dc, single-phase, and three-phase systems.

6) analyze basic single-phase and three-phase controlled and uncontrolled rectifiers.

7) analyze basic non-isolated dc/dc switching converters.

8) analyze basic single-phase voltage-sourced inverters using square wave or sine-triangle modulation.

9) effectively extract cyclic steady state information, including average, rms, power factor, and harmonic content, from SPICE simulations of switched systems.

10) succinctly state the basic concepts of the course using one or two sentences per concept.

ABET Outcomes Supported

Criterion 3a. Ability to apply knowledge of math, science, and engineering. 
Supported by SLO's 2, 4, 5, 6, 7, 8

Criterion 3e. Ability to identify, formulate, and solve engineering problems. 
Supported by SLO's 1, 3, 6, 7, 8

Criterion 3k. Ability to use techniques, skills, and modern engineering tools needed for engineering practice. 
Supported by SLO's 5, 9
Web Site: To locate the course web site, go to http://www.eng.utoledo.edu/~rking/ and navigate to the course page. The link will be labeled "Electronic Energy Processing I."

Withdraw Policy: The student may withdraw (W) through the date published on the University academic calendar. The instructor cannot initiate a withdrawal or drop.

Grading Policy: The grade weightings for the course activities are on the first page. In most circumstances, the available grades are A, B, C, D, and F - no plus/minus or IN. The approximate grade breakpoints are 80-A, 70-B, etc. The final exam will be comprehensive, and will resolve the letter grade when a student's average is near to a breakpoint.

Homework: Students are expected to write out their homework solutions independently; however, it is OK to discuss problems with one another and to exchange suggestions. Homework turned in after the assignment has been discussed in class will receive no credit.

Quizzes: There will be a few unannounced quizzes throughout the semester. These will be one-sentence essays. No makeup quizzes will be given.

Tests: Tests will be announced about 1 week in advance. No makeup tests will be given. If you must miss a test, call before the test. The final exam will also count for one test missed for acceptable reasons. Tests are closed book, one page of notes.

Homework Solutions: Homework solutions will be available for discussion in class on the days that the homework is collected. In addition, I will post the homework solutions on my web site in the form of *.pdf files.

Attendance Policy: The official University policy on absences can be found at http://web00.utad.utoledo.edu/publicinfo/policy/newapril2002/3360-20-15.htm. My written policy on absences in EECS undergraduate courses is the following.

1. Attendance is not taken. Absences, of themselves, do not need to be excused.
2. The student is responsible for getting notes and copies of course material missed due to an absence.
3. Missed homework may be turned in upon the student’s return to classes. Unannounced quizzes which are missed will be excluded from the grade average if an acceptable written excuse is provided. Tests which are missed will be excluded from the grade average, and replaced by the final exam, if an acceptable written excuse is provided. A final exam which is missed may be made up if there is notification and an acceptable written excuse is provided.
4. An acceptable written excuse may include a doctor’s note, a funeral program, or whatever is appropriate to the occasion in the judgment of the instructor.
5. Notification may be made by email addressed to Dr. King at rking@eng.utoledo.edu (preferred), or a written note to EECS Dept., MS 308, NI-2064. Be sure to include your full name.