

**Professor:** Alexis Kwasinski, ENS528, 232-3442, [akwasins@utexas.edu](mailto:akwasins@utexas.edu)

**Co-teach TA:** Hunter Estes

**Office Hours:** Dr. Kwasinski's office hours for this course are Monday from 2 to 3 pm, and W and F from 12 to 1 pm. He is often in the power lab during the scheduled lab sessions.

**Course Web Page:** Materials will be posted on the course website

(<http://users.ece.utexas.edu/~kwasinski/EE462LS13.html>)

**Reference Textbooks (recommended, but not required):** N. Mohan, T. M. Undeland, W. P. Robbins, *Power Electronics: Converters, Applications, and Design*, Third Edition, John Wiley & Sons, Inc., 2003. P. T. Krein, *Elements of Power Electronics*. New York and Oxford: Oxford University Press, 1998.

**Description:** Analysis, design, and operation of power electronic circuits. Emphasis on single-phase power conversion from AC to DC, DC to DC, DC to AC, and maximizing the power from photovoltaics (PV). Design and construction of 150W power electronic circuits in the power laboratory, and comparison of their performance to theory. A working circuit model will be available for observation, study, and improvement. Use of the ECE machine shop is not required, but those of you who want to use the shop are welcome to do so. But, to use the shop, you must first be "machine shop certified." See ECE technician Daryl Goodnight about shop certification and use.

**Detail Course Description:** It can be found in the course description file which can be downloaded from the course web site.

#### **Class, Lab Sessions, and Work Schedules:**

- Lectures on MWF 11 am - 12 pm, in ENS 127.
- Lab sessions in the power lab, ENS212:
  - Sections 16590 and 16940: Thur. from 9:30 am to 12:30 pm
  - Sections 16595 and 16945: Thur. from 3:30 pm to 6:30 pm
  - Sections 16600 and 16950: Wed. from 6:30 pm to 9:30 pm
- Use lab stations 15-22 during your scheduled lab time. These are the stations without PCs, so bring a hardcopy of the lab document. The hardcopy is useful for making notations as you proceed. You can also use the black cabinet tops, which are handy for construction and soldering.
- The group lab session times shown above may or may not be sufficient to complete your projects. Work with your assigned partner for that project to meet other times as needed during the regular 2<sup>nd</sup> floor ENS undergraduate teaching lab hours.
- If you have a highly constrained schedule (work hours, sports, Longhorn band, etc.) that will make it difficult to coordinate work times with a partner, or if there are good reasons that you should work by yourself, discuss with Dr. Kwasinski the possibility of being a *solo* student (i.e., no partner) for the semester. However, solo-teams will only be granted in extreme rare exceptions with well justified reasons
- Regarding conduct, it will be appreciated if students are 1. on-time, 2. refrain from eating, drinking, and disturbing others, and 3. conduct themselves in a manner consistent with a professional environment.
- Cell phones and laptops: In class, turn them off (unless you clear it with Dr. Kwasinski). In lab, laptops are OK.
- In some few weeks when additional time for completing the project is needed, lab work will replace either lecture times.
- Group arrangements and projects format or schedule may be modified due to unforeseen logistical issues. Any such changes will be posted online and announced in class.

**TAs:**

Lab: Juyoung Jung and Youngsung Kwon.

Lectures: Hunter Estes. Hunter will co-teach the class with Dr. Kwasinski so each will teach about half of the lectures.

**Prerequisites:** Electrical Engineering 331 (or 331K) or 438 with a grade of at least C-; and credit with a grade of at least C- or registration for Aerospace Engineering 333T, Biomedical Engineering 333T, Chemical Engineering 333T, Civil Engineering 333T, Electrical Engineering 333T, Mechanical Engineering 333T, or Petroleum and Geosystems Engineering 333T..

**Grading Formula:** Lab circuits and reports -----50%  
Two tests ----- 10% each test  
(note – one 8½ x 11” sheet of notes is permitted at each test)  
Comprehensive final exam (according to the official U.T. schedule - Tuesday,  
May 14, 9:00 am–12:00 pm) -----20%  
(note – one 8½ x 11” sheet of notes is permitted at the final exam)  
Attendance (taken at all lab sessions, and at most lectures)-----10%

Fractional letter grade (A, A-, B+....) will be used for the final grade. . A is equivalent to 100 % and according to <http://registrar.utexas.edu/students/grades>, B is equivalent to 75% (3/4) and so on.

**Disclaimers and general policies:**

Although unlikely, this syllabus and course topics may change according to my judgment as to what is best for the class. Any changes will be declared in class.

General course schedule and administrative deadlines follow The UT Austin calendar, long session 2012-2013, which can be found at <http://registrar.utexas.edu/calendars/12-13>

Any student with a documented disability who requires academic accommodations should contact Services for Students with Disabilities at 471-6259 (voice) or 232-2937 (Video Phone) as soon as possible to request an official letter outlining authorized accommodations.

The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity and responsibility. Each member of the University is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Since such dishonesty harms the individual, all students, and the integrity of the University, policies on scholastic integrity will be strictly enforced. Academic misconduct including, but not limited to, plagiarism and/or copy previous years reports will be treated according to the university policy detailed in <http://deanofstudents.utexas.edu/sjs/>. I keep copies of previous years reports. So be wise!! Besides the moral issues, a few more points added to your grade does not worth the risk and consequences of being caught cheating.

University policy on course drop dates states: “A student may not drop a course after the twelfth class day in the long session except for good cause (e.g., health or serious personal problems, or a demonstrated need to work more hours). A graduate student seeking to drop a class after the twelfth class day should go to the department offering the course.” For this course, the department offering the course is ECE.

University policy on holy days states: “A student who misses classes or other required activities, including examinations, for the observance of a religious holy day should inform the instructor as far in advance of the absence as possible, so that arrangements can be made to complete an assignment within a reasonable time after the absence.”

**Schedule:**

Week	Lecture Periods	Lab Periods
Jan. 14	Course overview. Basic circuit components.	Orientation. Soldering demonstration and construction tips.
Jan. 21 (Monday is a holiday)	Basic circuit components (continue). SCRs, triacs, and light dimmers.	Assign Light Dimmer and Teams #I.
Jan. 28	Transformers, diode bridge rectifiers (DBR). Waveforms and definitions.	Tool check. Assign DBR.
Feb. 4	Waveforms and definitions. (cont.) Photovoltaics and renewable energy. MOSFETs and MOSFET firing circuits. .	<b>Light dimmer circuit and report due.</b> Review DBR progress. Assign Solar. The solar lab does not require lockers. Show your hand plotted solar data on the lab document graph to the TAs <b>before March 8.</b>
Feb. 11	MOSFETs and MOSFET firing circuits (cont). DC-DC buck converters. ( <i>Dr. K away on Monday</i> )	<b>DBR circuit and report due.</b> Tool check. Assign MOSFET firing circuit.
Feb. 18	Boost Converter	<b>MOSFET Firing Circuit and report due.</b> Assign Buck Converter.
Feb. 25	DC-DC SEPIC (converter). <b>Test #1 on Monday Tentatively, Dr. K leading Superstorm Sandy investigation team</b>	<b>Buck Converter circuit and report due.</b> Assign Boost Converter.
Mar. 4	PI controller for DC-DC converters.	<b>Boost Converter circuit and report due.</b> Assign SEPIC.
Mar. 11	Spring Break	Spring Break
Mar. 18	H-bridge inverter – basics and unipolar PWM controller.	<b>SEPIC Converter circuit and report due.</b> Assign PWM Controller.
Mar. 25	H-bridge inverters – isolated firing circuits.	Continue with ongoing projects.
Apr. 1	H-bridge inverters – bridge section and output filtering. <i>Dr. K attending GreenTech 2013 on F.</i>	<b>PWM Controller circuit and report due.</b> Assign H-Bridge inverter circuit.
Apr. 8	H-bridge inverter – audio amplifier.	<b>Solar report due.</b> Assign Audio Amplifier and continue with ongoing project.
Apr. 15	H-bridge inverter – renewable power to grid. <b>Test #2 on Friday</b>	Continuation of on-going project.
Apr. 22	Motor drives and Reliable power. <i>Dr. K attending PEDS</i>	<b>H-Bridge Inverter report due.</b> Start Power to Grid.
April 29	Additional applications and course evaluation	<b>Audio Amplifier report due.</b> Equipment check-in during the usual lab periods. <b>Power to Grid report due to the TAs or in Dr. Kwasinski's office door slot anytime before Friday, May 3.</b>

Notes – Unless told otherwise, reports are due at the beginning of your lab period (or, in some instances, during the following Monday's class). Hardcopy only. Partners are going to be announced with the first assignment. Teams are going to remain unchanged during the semester. Partner requests for the entire semester will be considered if both partners sign and submit their request in writing no later than Monday 1/21. Partners must be in the same lab session. All trips that Dr. K needs to take and he is aware of by the date of preparation of this syllabus are indicated in the above schedule. However, some additional trips unknown at this time may come up during the course of the semester. For example, due to the particular nature of his research Dr. K may need to travel to disaster areas on short notice. Although Dr. K will communicate these trips in advance along with any potential changes that these trips may cause, it is not possible to know at this time when those trips may occur.

The lab projects require a significant number of components and parts. Sometimes these parts need to be ordered during the semester and sometimes important parts may become unavailable without notice at the time of ordering them which may cause the postponement of a class project. If this situation happens, it will be communicated to the class along with the modified schedule.