

## EE 394V NEW TOPICS IN ENERGY SYSTEMS – ADVANCED TOPICS IN POWER ELECTRONICS

**Meetings:** Tuesdays and Thursdays from 3:30 to 5:00 PM in ENS 116

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

**Course Home Page:** <http://users.ece.utexas.edu/~kwasinski/EE394VAPEFa09.html>

**Office Hours:** Mondays (1:30 – 3:00 pm); Wednesdays (12:00 – 1:30 pm), or by appointment.

**T.A.:** To be announced in the future.

**Prerequisites:** Fundamentals of power electronics, control systems, and semiconductors or consent from the instructor. Familiarity with at least one computer simulation software. Knowledge on how to browse through professional publications.

**Reference Textbook(s):** There is no required textbook. Reference textbooks are:

Krein, *Elements of Power Electronics*; Banerjee and Verghese, *Nonlinear Phenomena in Power Electronics*; Mohan, Undeland, Robbins, *Power Electronics: Converters, Applications, and Design*; selected papers;

**Course Description:** The course will discuss, but it will not be limited to, the following selected topics:

- Modeling and analysis of dc-dc converters. Analysis of switched systems.
- Linear and nonlinear control methods in power electronics.
- Effects of real components in power electronics circuits, including semiconductor switches, capacitors, inductors, loads, and sources.
- Design issues in highly-efficient energy conversion systems.
- Practical issues such as thermal management and transient overshoots control
- Inverter controls and application to variable speed drives for induction machines.
- Elements of reliability in power electronics circuits.

The course has two objectives:

- To discuss advanced topics in power electronics.
- To prepare the students to conduct research or help them to improve and/or develop their research skills.

### Schedule:

Th., Aug. 27	Introduction. Course description. Power electronics perspectives. Review of fundamental concepts.
Week 1 (Aug. 31).	Continuation of the fundamental concepts review. Power electronic circuits modeling.
Week 2 (Sept. 7).	Mon. Holiday. Power electronic circuits modeling. Single-input and multiple-input dc-dc converters.
Week 3 (Sept. 14).	Power electronics control. Linear methods.
Week 4 (Sept. 21).	Power electronics control. Nonlinear methods (Dr. K. at ECCE)
Week 5 (Sept. 28).	Real components. Real loads.
Week 6 (Oct. 5).	Real components. Real sources.
Week 7 (Oct. 12).	Real components. Inductors and capacitors.
Week 8 (Oct. 19).	Real components. Diodes and MOSFETS (Dr. K at INTELEC 2009)
Week 9 (Oct. 26).	Real components. IGBTs and other switches.
Week 10 (Nov. 2).	Snubbers. Losses and thermal issues.
Week 11 (Nov. 9)	Inverter topologies. PWM
Week 12 (Nov. 16)	Inverters control (Nov. 17 Dr. K. at INTELEC 2010 Management Committee)
Week 13 (Nov. 23)	Induction machines control.
Week 14 (Nov. 30)	Induction machines control. Reliability issues.

**Grading:**

Homework: 25%

Project preliminary evaluation: 15%

Project report: 25%

Final exam: 25%

Class participation: 10%

Letter grades assignment: 100% – 96% = “A+”, 95% – 91% = A, 90% – 86% = A-, 85% – 81% = B+, and so on.

**Homework:**

Homework will be assigned approximately every 2 weeks. Making mistakes is part of the learning process. For this reason the lowest score for an assignment will not be considered to calculate the homework total score. However, all assignments need to be submitted in order to obtain a grade for the homework.

**Project:**

The class includes a project that will require successful students to survey current literature. The project consists of carrying out a short research project throughout the course. The students need to identify some topic related with the application of distributed generation technologies. The project is divided in two phases:

- 1) Preliminary phase. Due date: Oct. 13. Submission of references, application description, and problem formulation (1 to 2 pages long).
- 2) Final phase. Due date: Nov. 24. Submission of a short paper (the report), at most 10 pages long, single column.

**Participation:**

Participation points are assigned at instructor’s discretion based on the perceived attitude of individual students towards learning during the semester.

**Final Exam:**

The format of the final exam will be announced during the semester. The official date and time for the final can be found at <http://registrar.utexas.edu/schedules/099/finals/index.html>. (Tentatively Wednesday, December 9, 2:00–5:00 pm)

**Disclaimers:**

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 2009-2010, which can be found at <http://registrar.utexas.edu/calendars/09-10/index.html>.

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.