TEXAS A&M UNIVERSITY

SYLLABUS

ECEN 689 – Special Topics in Power Electronic Energy Conversion for Sustainable Energy Systems – Photovoltaic Energy Systems
Fall 2010

TIME AND LOCATION: TR 11:10am – 12:25pm, 107 Mitchell Physics Building (MPHY)

INSTRUCTOR: Dr. Robert S. Balog
216P Zachry Engineering Center
Tel: 979-862-4985
Email: rbalog@ece.tamu.edu

OFFICE HOURS: TBD

GRADER: Mehran Mirjafari
30G Zachry Engineering Center
Email: sardis@neo.tamu.edu
Office hours by appointment only

TEXTBOOK: None required. Textbooks have been placed on reserve in the library, journal and conference papers available through IEEE Explorer.

PREREQUISITE: **ECE graduate student status in power and energy or permission from the instructor.**

COURSE DESCRIPTION:

Sustainable energy sources such as photovoltaic (PV) energy conversion require power electronics to perform energy conversion and conditioning in order to convert their native form of electrical generation to a format compatible with the ac utility grid. They are also fundamentally different than conventional sources that rely on a thermal cycle for energy conversion. This course will explore the electrical characteristics of PV energy sources, the requirements for grid-connection and the system-level power electronic circuits and controls needed to perform the interconnection. In addition, the class will explore the economic cost drivers for commercial systems and investigate emerging technologies that hold promise to lover the cost of ownership. The focus of this class will be on residential-scale energy systems, purported by some researchers to be the "holy grail" energy solution. We will also examine IEEE, NEC, UL and other regulatory standards that govern PV systems.

SUGGESTED REFERENCES:

†*G. M. Masters, *Renewable and Efficient Electric Power Systems.* Hoboken, NJ: John Wiley & Sons, 2004.

†A. R. Jha, *Solar Cell Technology and Applications.* Boca Raton: CRC Press, 2010.

†R. A. Messenger and J. Venture, *Photovoltaic Systems Engineering.* 3rd ed, Boca Raton, FL: CRC Press/Taylor & Francis, 2010.

†I. Batarseh, *Power Electronic Circuits.* Hoboken, NJ: John Wiley, 2004.

†F. L. Luo and H. Ye, *Power Electronics: Advanced Conversion Technologies.* Boca Raton: CRC Press/Taylor & Francis, 2010.

A. Keyhani, M. Marwali, and M. Dai, *Integration of Green and Renewable Energy in Electric Power Systems.* Hoboken, N.J.: Wiley, 2010.

J. A. Fay and D. Golomb, *Energy and the Environment*. New York: Oxford University Press, 2002.

J. Andrews and N. A. Jelley, *Energy Science: Principles, Technologies, and Impacts*. New York: Oxford University Press, 2007.

F. Kreith and D. Y. Goswami, *Handbook of Energy Efficiency and Renewable Energy*. Boca Raton: CRC Press, 2007.

†On reserve at Evans Library, *Available electronically via TAMU library

USEFUL RESOURCES:

Photon International – http://www.photon-international.com/

Solar Buzz – http://www.solarbuzz.com/

NREL – http://www.nrel.gov/pv/

US Department of Energy – http://www.eere.energy.gov/

Renewable Energy, an international journal – http://www.sciencedirect.com/science/journal/09601481

Progress in Photovoltaics: Research and Applications –

TOPICS (TENTATIVE):

- Characteristics of PV systems
- Impact on the utility system
- Power conditioning requirements and technologies (the inverter)
- Economic cost drivers in residential PV systems
- Regulatory issues governing PV systems at the residential level

SCHEDULE (TENTATIVE):

8/31	First Class
9/14, 9/16, 9/28	Selection and preliminary planning of project groups
10/18	Mid-semester grades due
11/25	Thanksgiving – No Class
12/7	Last day of class
12/8-12/9	Reading Period
12/10	Scheduled Final Exam 3pm-5pm

GRADING (TENATIVE):

Mid-Term Exam:	25%
Homework / Projects	25%
Final Project	40%
Class Participation:	10%
Total	100%

Topical homework will be assigned as the material is covered in class.

Grades will be calculated on the basis of total earned points according to the following standard: A (90% – 100%), B (80% – 89%), C (70% – 79%), D (60% – 60%), F (50% and lower). Final grade may be curved lower to reflect the actual class average.

LATE POLICY:

Homework and projects turned in after the due date will be subject to a penalty of 5% per day that is it is late.

SOFTWARE:

You are free to use the simulation package of your choice for this class. MATLAB / SIMULINK is widely available on campus computers and at special discounted prices for installation on personal computers. PSIM 8.0.3 will be available for as a softkey version that can be installed and run from any computer with an internet connection. You may contact the grader to receive a copy of this software. PSIM 8.0.3 (softkey) and Pspice (student version) are also installed on ECE open access lab computers. DYMOLA is also available for advanced power electronic simulations and will be distributed as needed.

ACADEMIC FAIR-USE, COPYRIGHT, AND PLAGIARISM

Papers and articles from current literature may be discussed in class. These and all other handouts are the copyright of the original authors as must be used in accordance with academic fair-use provisions of applicable copyright laws.

AMERICANS WITH DISABILITIES ACT (ADA) POLICY STATEMENT:

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact the Department of Student Life, Services for Students with Disabilities, in Room 126 of the Koldus Building or call 845-1637.

ACADEMIC INTEGRITY STATEMENT

"An Aggie does not lie, cheat, or steal or tolerate those who do." The Honor Council Rules and Procedures are located at http://www.tamu.edu/aggiehonor