

ENEE 498R: Topics in Electrical Engineering: Special Topics in Renewable Energy – Course Outline Fall 2012

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Grading:	Homework	10%
	Mid-Term Exam 1	30%
	Mid-Term Exam 2	30%
	Final Exam	30%
	Course Grade	100%

Class hours: Mondays and Wednesdays: 3:30 pm - 4:45 pm

Office hours: Mondays and Wednesdays: 2:00 pm - 3:30 pm

Prerequisites: ENEE322, ENEE380, and completion of all lower-divisions in the electrical engineering curriculum.

Course Description:

Solar Energy Conversion Systems: History of Photovoltaic (PV) Systems, PV Cell, Module and Array Models and Equivalent Circuits, Characteristic Resistance, Fill Factor, Effects of Parasitic Resistances, Mismatch Effects, Shading, Bypass Diodes, Sun Tracking Systems, Maximum Power Point Tracking (MPPT) Techniques, Isolated and Non-isolated Switch-mode DC/DC for PV Systems, Inverter Design and Control, Sizing the PV Panel and Battery Pack in PV Applications.

Wind Energy Conversion Systems: Horizontal and Vertical Wind Systems, Fundamentals of Wind Energy Harvesting Systems, Wind Turbines and Different Electrical Machines in Wind Applications, Induction Generator Models, Synchronous Generators and Dynamic Model of SG, Power Converters in Wind Applications (AC Voltage Controllers and Interleaved Converters), Wind Energy System Configurations (Variable Speed and Fixed Speed WECS).

Course Purpose:

There is contest among people that oil and gas are finite sources, which are becoming scarce and expensive. Renewable energy systems are being investigated extensively by researchers and companies to replace the conventional systems. Currently, there is no course in the area of renewable energy sources for students, especially students in electrical engineering. The purpose of this course in renewable energy sources is to give an overview of the major aspects of renewable energy systems with emphasize on solar and wind energy conversion systems. Applications of power electronics as well as grid-connected systems will be explained.

Course Text:

Instructor will use technical papers and notes. The following books can be used as reference.

- [1] A. Khaligh, O. Onar, *Energy Harvesting: Solar, Wind, and Ocean Energy Conversion Systems*, Boca Raton, FL: CRC Press, ISBN: 978-1-4398-1508-3, Dec. 2009.
- [2] O. Anaya-Lara, N. Jenkins, J. Ekanayake, P. Cartwright, and M. Hughes, *Wind Energy Generation: Modeling and Control*, John Wiley & Sons, Ltd., 2009.
- [3] B. Wu, Y. Lang, N. Zargari, and S. Kouro, *Power Conversion and Control of Wind Energy Systems*, John Wiley & Sons, Ltd., 2011.
- [4] A. Khaligh and O. Onar, Chapter 43, *Energy Sources, Elsevier Power Electronics Handbook*, 3rd edition, Elsevier, 2011.