Engineering Technology –ECET Option

Course Number and name: ET 381 Renewable Energy Technologies
Credits & Contact Hours: 3cr. Each week has two lectures of 75 min. Total semester contact hours are approximately 45 hr.

Instructor's name: Thomas Jenkins

Textbook: G. Masters, "*Renewable and Efficient Electric Power Systems*", Wiley, 2004 ISBN 0-471-28060-7
References: G. Boyle, "*Renewable Energy*", Oxford University Press, 2004

Specific Course Information:

a) **Course Catalog Description -** Renewable energy systems, including topics in thermal-solar, photovoltaic, wind, geothermal systems, and other current topics. Theory, practical applications, safety considerations and the economics of renewable energy systems compared to conventional systems.
b) **Prerequisite –** Math 121
c) This course is required for the ECET majors and can be used as a technical elective for MET, IET, and CET degrees

General Course Goals: The main goals and objectives of this class are:

- To learn the engineering and technology terminologies associated with renewable energy technologies (RET);
- To learn the engineering theory foundations which enable the generation of energy from RET sources;
- To gain an understanding of the cost-benefit ratio and economics of various RET compared to traditional sources;
- To understand some of the various obstacles associated with actual implementation of production and distribution of RET facilities in large and small scale systems;

To introduce social and environmental issues related to basic human needs and ideas of sustainability.

Related ABET Objectives and Outcomes: The department of Engineering Technology and Survey Engineering ECET option has an objective of having its graduates possess the following skills and knowledge.

a. **an appropriate mastery of the knowledge, techniques, skills and modern tools of their disciplines;** including:

1. Digital circuit analysis and design techniques, analysis of analog and digital electronics, architecture and applications of microcomputer systems, local area networks, **and the building, testing, operation and maintenance of electronic, instrumentation**, communications, control, and/or computer systems (both hardware and software). **Also ABET 2.b, 2.c, 2.d, 2.f**

4. **The use of** statistics and probability, transform methods, discrete and/or Boolean **mathematics, algebra**, trigonometry and/or calculus mathematics **in support of the analysis, design, and application of electronic, instrumentation, communications, control,** and/or computer systems.

Course topics and lecture hours devoted to each topic:

TOPICS	**HRS.**
• Review of electrical principles, current electrical production	2
• Solar electrical energy principles	9
• Wind energy production principles	9
• Biomass, Hydroelectric and Geothermal energy principles	9
• Social, political and economic issues	4
• Miscellaneous topics	4
• Tests and Quizzes, Review, Problem Solving and Examples	8

Laboratory Projects: In the past, this class had a weekly laboratory session. Beginning in spring 2011 the class has been modified to be 3cr. without a laboratory section. The material which has been in these labs has been incorporated into work sessions and moved to ET 382 and ET 384 classes (complementary classes).

There was approximately twelve laboratory sessions per semester with each laboratory replacing a lecture class of two hours and thirty minutes. Laboratory exercises are done in teams and in conjunction with the text readings and the lecture materials. The laboratories are designed to apply the theory of renewable energy technologies. A *formal* lab write-up is required by each group. **Equipment utilized by the students include (but not limited to):** Digital Multimeters, Oscilloscopes, variety of sensors (thermocouples, pyronometers, etc.), solar PV panels, wind turbines, batteries, and "balance of system" components.

Example of topics for laboratories in which a team component existed, included:

- Determine via calculations and direct measurements, the solar azimuth and elevation angles, tilt angles, and "predicted" (**calc**) solar insolation values for the time and day of the lab experiment (use 2:00pm local) – use your previously designed EXCEL spreadsheet. Look up the appropriate values in the text p618 (**table**) appendices for the closest date to the day of the lab – record for later comparison to calculated and test values.
- Go to the NMSU weather site (use the link above) and get the hourly weather data for the 1st five days in March 2009 from the Leyendecker station – note the wind readings at this location are taken at a **3m height**. Enter ONLY the necessary hourly data into an EXCEL spreadsheet – use the median values. Assume a wind turbine that is placed in the **grassy field** at this site has a **blade axis height of 50m** and **blade diameter of 10m**. Determine the **air density, *wind speed and wind classification, wind power at the hub height, and power generated by the turbine*** (Assume a **Betz limit** efficiency on your wind turbine). Calculate the power in the wind using the formula of $P = (.5 * \rho) * A * V^3$.

Prepared by: Thomas Jenkins **Date: 9/1/10**