Miami Dade College

Course Description

ETP3320| Introduction to Renewable Energy Technology | 3.00 credits

In this course, students will learn renewable energy theory and applications. This course focuses on solar photo-voltaics, solar power and tracking systems, charge controllers and inverters, wind power systems, biomass and geothermal power generation. In addition, this course covers the integration with electrical grid, production and end user systems. Prerequisite: EET 2101C.

Course Competencies

Competency 1: The student will demonstrate the ability to explain an overview of the Energy sources principles and resources by:

1. Defining and describing Fossil fuel sources and major sectors used in
2. Explaining how a pressurized water reactor generates electricity
3. Comparing and contrasting fusion reactors as future option versus the current technology
4. Identifying best locations suitable for resources of solar, wind and geothermal energy
5. Analyzing Operational Amplifier circuits containing resistors and a single capacitor

Competency 2: The student will demonstrate the ability to explain basic concepts of three phase ower-generating systems and principles and resources by:

1. Identifying typical components of a three phase power-generation system
2. Analyzing the functionality of the components of a three phase power generation system
3. Performing a cost-benefit analysis of electric power systems
4. Employing the per unit system analysis method to compare the efficiency and output power of systems
5. Developing written design recommendations based on system characteristics

Competency 3: The student will demonstrate the ability to understand terminologies of Solar Photovoltaics systems by:

1. Defining and describing the photovoltaics (PV) cell structure and operation
2. Discussing various semiconductor material used in photovoltaics (PV) cell
3. Defining and describing several characteristics of a photovoltaics (PV) cell
4. Analyzing and calculating the conversion efficiency of a photovoltaics (PV) cell
5. Discussing the integration of photovoltaics (PV) cells to create solar modules and arrays
6. Calculating output voltage, current and power of specific solar module or array system
7. Explaining multi-junction cells and laser scribing
8. Discussing Concentrating photovoltaics (CPV)

Competency 4: The student will demonstrate the ability to understand different Solar Power Systems by:

1. Describing the components and basic block diagrams for stand-alone solar electric system
2. Evaluating electrical requirement by explaining how to perform an energy audit to be able to select the correct photovoltaics (PV) modules
3. Calculating the proper wiring seizing for photovoltaics (PV) modules and systems
4. Describing and analyzing basic components required for a grid-tied systems
5. Discussing advantages and disadvantages of various types of solar concentrations
6. Explaining the difference between open-loop and closed-loop hot water systems

Competency 5: The student will demonstrate an understanding of sun tracking mechanism and its benefit by:

1. Describing the motion of the sun from various points on earth, including explaining the effect of the earth's tilt on the diumal variation of the sun's motion
2. Defining term and terminologies used in locating points in earth's surface including latitude, longitude, meridian, ecliptic, synodic, and other terms
3. Analyzing the costs and benefit of tracking

4. Compare advantages and disadvantages of different types of solar tracker, including altazimuth and equatorial trackers
5. Discussing the use of motors in solar tracking systems
6. Analyzing Torques and power in a motor
7. Explaining the concepts of stepper motors
8. Describing the process of micro stepping a stepper motor

Competency 6: The student will demonstrate the ability to understand charge controllers and inverters in Solar systems by:

1. Describing battery trickle chargers and float chargers
2. Describing the concept of floating charges and the three stages involved
3. Analyzing the concept of Pulse Width Modulation in charger controllers
4. Analyzing Maximum Power Point Tracking Charge controller
5. Evaluating charge controller specifications and datasheets
6. Analyzing the Inverters and understanding its functionalities
7. Evaluating Inverter's specifications and datasheets

Competency 7: The student will demonstrate the ability to understand and explain the wind energy, and the operation of wind turbines by:

1. Identifying and describing the terminologies such as lift, drag, and angles of attack with respect to wind turbines
2. Describing Betz's law and how it relates to wind turbines
3. Discussing and analyzing location criteria for wind turbines
4. Explaining how wind energy is converted to electrical energy in wind turbines
5. Discussing advantage and disadvantages of single-bladed two-bladed, and three bladed wind turbines
6. Explaining the concepts of Pitch and Yaw control for horizontal wind turbine
7. Explaining the wind turbine orientation
8. Explaining and describing the Drive Train Gearing and Direct-Drive Turbines
9. Explaining the braking mechanism of the wind turbine
10. Explaining why the speed of the generator must be controlled

Competency 8: The student will demonstrate an understanding of the major types of biomass and the systems used for converting biomass into oil or electrical power, and heat energy by:

1. Describing the carbon cycle in the biomass power generation
2. Describing Several sources of biomass
3. Describing how ethanol, biodiesel, and green diesel are produced
4. Explaining how energy is obtained from algae
5. Explaining the types of Combined Heat and Power (CHP) systems

Competency 9: The student will demonstrate the ability to explain and analyze usage of Geothermal power generation by:

1. Identifying the five levels of the earth where Geothermal power generation is best located
2. Explaining and analyzing the operation of binary-cycle steam electrical generation plant
3. Explaining the operation of a geothermal heat pump
4. Explaining the operation of a dry-steam electrical generating plant
5. Explaining the operation of a flash- steam electrical generating plant

Learning Outcomes:

- Use quantitative analytical skills to evaluate and process numerical data
- Demonstrate an appreciation for aesthetics and creative activities
- Describe how natural systems function and recognize the impact of humans on the environment