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Course Description

ETP2501C | Introduction to Alternative and Renewable Energy | 3.00 credits

This course is an introductory course designed to prepare students to enter the field of renewable energy and green technology and to the concepts of renewable energy. The student will examine Solar photo-voltaics, solar power and tracking systems, charge controllers and inverters, Wind power systems, Biomass and geothermal power generation. Prerequisite: EET1033C

Course Competencies

Competency 1: The student will demonstrate an understanding of energy sources and Environmental Effects by:

1. Defining and describing Fossil fuel sources and major sectors in which they are used
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

Competency 2: The student will demonstrate the ability to understand terminologies of Renewable Energy and photovoltaics systems by:

1. Defining and describing the photovoltaics (PV) cell structure and operation
2. Discuss 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

Competency 3: 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. Discussing advantages and disadvantages of various types of solar concentrations

Competency 4: The student will demonstrate the ability to understand basic 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 Maximum Power Point Tracking Charge controller
4. Understanding Charge controller specifications and datasheets
5. Understand and analyzing the Inverters and understanding its functionalities
6. Understanding Inverter's specifications and datasheets

Competency 5: The student will demonstrate the ability to understand and explain the wind turbines systems by:

1. Identifying and describing the terminologies such as lift, drag, and angles of attack with respect to wind turbines
2. Discussing and analyzing location criteria for wind turbines
3. Explaining how wind energy is converted to electrical energy in wind turbines
4. Discussing advantage and disadvantages of single-bladed two-bladed, and three bladed wind turbines
5. Explaining the wind turbine orientation
6. Explaining and describing the Drive Train Gearing and Direct- Drive Turbines
7. Explaining the braking mechanism of the wind turbine

Competency 6: 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 7: 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

<u>Learning Outcomes:</u>
- Use quantitative analytical skills to evaluate and process numerical data
- problems using critical and creative thinking and scientific reasoning
- Describe how natural systems function and recognize the impact of humans on the environment