

COURSE OUTLINE

**Electronics and Computer Technology 162  
Introduction to Solar Principles**

**I. Catalog Statement**

Electronics and Computer Technology 162 covers key aspects of solar power. This class covers the basics of solar energy and prepares the student to enter the job market as a solar technician in sales, installation, or repair. Topics also include the concepts behind installing and troubleshooting solar panels. This class helps in preparing students to pass the Photovoltaic Installer examination and becoming certified by Electronics Technician Association (ETA) International.

Units – 3.0

Lecture Hours – 3.0

Recommended Preparation: ECT 110, Math 146, 141, or 246B

**II. Course Entry Expectations**

Skills Level Ranges: Reading 5; Writing 5; Listening/Speaking 5; Math 3.

**III. Course Exit Standards**

Upon successful completion of the required coursework, the student will be able to:

1. describe the current solar energy industry and the history of solar energy systems used for heating, lighting, and converting the sun's energy into AC electrical power with solar photovoltaic panels;
2. explain how solar energy fits into the supply of green energy;
3. describe the basic scientific principles of how photovoltaic materials convert sunlight to AC electrical power;
4. discuss electrical concepts such as voltage, current resistance, and power as they relate to photovoltaic panels;
5. discuss advantages and disadvantages of the different types of batteries available for use with solar energy systems;
6. demonstrate the steps for installing residential and commercial solar photovoltaic panels;
7. discuss the electrical knowledge needed to install, troubleshoot, and repair electrical parts of the solar energy systems;
8. explain the new "Smart Grid" and how it will help make electrical transmission more efficient;

**IV. Course Content**

**Total Contact Hours = 48**

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|---|----------------|
| <p>A. Introduction to Solar Energy</p> <ol style="list-style-type: none"> <li>1. Modern solar energy systems and producing electricity from solar energy</li> <li>2. Types of photovoltaic cells</li> <li>3. Solar energy dispersion</li> <li>4. Weather effects on solar energy</li> <li>5. Solar energy storage</li> <li>6. Financial implications and return on investment calculations</li> </ol>   | <p>6 Hours</p> |
| <p>B. Electrical and Energy Demands for the United States and the World</p> <ol style="list-style-type: none"> <li>1. The need for an uninterrupted and continuous power supply</li> <li>2. Ways to work around varying amounts of electricity generated by solar energy</li> <li>3. Transmission limitations for electricity</li> <li>4. The electrical demand for the United States</li> </ol>  | <p>4 Hours</p> |
| <p>C. Types of Solar Energy Systems</p> <ol style="list-style-type: none"> <li>1. Modern solar energy systems</li> <li>2. Solar lighting and solar heating used to provide hot water</li> <li>3. Using a solar water heating system to heat a swimming pool</li> <li>4. Passive hot water heating systems</li> <li>5. Solar heating using air and PV modules</li> </ol>   | <p>5 Hours</p> |
| <p>D. Solar Installations</p> <ol style="list-style-type: none"> <li>1. Project development and solar energy site assessment</li> <li>2. Visual and landscape assessment</li> <li>3. Small residential solar energy systems</li> <li>4. Homemade solar energy system systems</li> <li>5. Solar energy farms and electrical energy produced by parabolic trough solar collectors</li> </ol>  | <p>6 Hours</p> |
| <p>E. Basic Photovoltaic (PV) Principles and Types of Solar PV Cells (Converting Solar Energy to Electricity)</p> <ol style="list-style-type: none"> <li>1. Conductors, Insulators, and Semiconductors in the periodic table of elements</li> <li>2. Simplified structure of a conductor and creating a PN junction</li> <li>3. Simplified structure of an insulator</li> <li>4. Simplified structure of a semiconductor and combining silicon atoms</li> <li>5. Combining phosphorous or arsenic with silicon to make N-Type material</li> <li>6. Combining boron and silicon to make P-Type material</li> </ol> | <p>5 Hours</p> |
| <p>F. Construction and manufacturing of solar PV panels</p>   | <p>4 Hours</p> |

1. Panel test standards
2. Making a rigid frame solar panel
3. Making solar panels from polycrystalline cells

G. Photovoltaic (PV) Controllers and Inverters 3 Hours

1. Types of applications that need charge controllers
2. Basic operation of a solar charger controller
3. Basic control diagrams for photovoltaic systems
4. Anti-islanding circuits and other protection circuits
5. Inverters DC-to-AC voltage conversion

H. Storing Electrical Energy and Batteries 3 Hours

1. Solar high-powered batteries
2. Effects of temperature on batteries
3. Batteries in series and parallel for solar banks
4. Periodic maintenance for storage batteries

I. The Grid and Integration of Solar-Generated Electricity into the Grid 5 Hours

1. Understanding the grid and overview of power quality issues
2. Transformers, transmission, and distribution infrastructures
3. NEC and other requirements for PV
4. Voltage, true power, and power quality
5. UF and OF circuits

J. Installing, Troubleshooting, and Maintaining Solar Energy Systems 7 Hours

1. Installing solar panels at a residential location
2. Installation of ground panels on a large solar farm
3. Installing a solar panel on a pole
4. Theory of servo systems
5. Troubleshooting solar PV panels

V. **Methods of Instruction**

The following instructional methodologies may be used in the course:

1. lecture;
2. demonstration;
3. guest speakers;
4. videotapes.

VI. **Out of Class Assignments**

The following out of class assignments may be used in the course:

1. final project;
2. regular quizzes onsite;
3. examination at the end of each instructional module;
4. final onsite examination.

## **VII. Methods of Evaluation**

The following methods of evaluation may be used in the course

1. regular quizzes;
2. mid-term examination;
3. final examination.

## **VIII. Textbook**

Dunlop, J., Photovoltaic Systems, Current Edition.  
Orland Park: American Technical Publishers, 2009.  
10<sup>th</sup> Grade Textbook Reading Level. ISBN: 978-0826913081.

## **IX. Student Learning Outcomes**

1. The student will be able to describe the current solar energy industry and the history of solar energy systems.
2. The student will be able to describe the basic scientific principles of how photovoltaic materials convert sunlight to AC electrical power.
3. The student will be able to discuss electrical concepts such as voltage, current resistance, power, and battery technology as they relate to photovoltaic panels.
4. The student will be able to discuss the technology and installation for the installation residential and commercial solar photovoltaic panels.

## **IX. Justification for Need**

This course reflects a new requirement in Electrical technology which is required for the Electrical technology AS degree/certificate. This course reflects the knowledge required by Electrical engineers, Electrical Contractors and Electrical technology technicians