ALTERNATIVE ENERGY CONVERSION
EET 2940

Class Hours: 1  Credit Hours: 2
Laboratory Hours: 3  Date Revised: Fall 2013

Catalog Course Description:

This course provides an introduction to a variety of residential and commercial distributed generation technologies, with an emphasis on photovoltaic systems. Topics include the basic understanding of direct current and alternating current systems, on-grid and off-grid systems, electrical generation techniques, load assessment, system sizing, system installation, and applications for this technology. In addition, the course introduces the student to other alternative energy conversion techniques, including wind technology, fuel cells and other methods.

Entry Level Standards:

Students entering this course must have college-level math skills.

Prerequisites:

EET 1012 or consent of program coordinator

Corequisites:

None

Textbook(s) and Other Course Materials:


I. Week/Unit/Topic Basis:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to Power Systems: Generation, Transmission, Distribution</td>
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<td>2</td>
<td>Overview of Energy Alternatives &amp; Distributed Generation</td>
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<td>3</td>
<td>DC/AC Circuits Review</td>
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<td>4</td>
<td>AC Systems</td>
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<td>5</td>
<td>AC Generation Principles</td>
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<td>6</td>
<td>Introduction to Photovoltaic Systems</td>
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<td>7</td>
<td>System Components and Configurations</td>
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</table>
II. Engineering Technology General Outcomes (Educational objectives)

I. Apply basic engineering theories and concepts creatively to analyze and solve technical problems

II. Utilize with a high degree of knowledge and skill equipment, instruments, software, and technical reference materials currently used in industry.

III. Communicate effectively using developed writing, speaking, and graphics skills.

IV. Assimilate and practice the concepts and principles of working in a team environment.

V. Obtain employment within the discipline or matriculate to a four year program in engineering or industrial technology

III. Engineering Technology Concentration Competencies*

Students will:

A. Apply the knowledge, techniques, skills, and modern tools for the concentration of study to specifically defined engineering technology activities

B. Demonstrate the knowledge of mathematics, science, engineering and technology to engineering technology problems using developed practical knowledge

C. Conduct and report the results of standard tests and measurements, and conduct, analyze and interpret experiment or project results

D. Function effectively as a member of a technical team

E. Identify, analyze and solve specifically defined engineering technology-based problems

F. Employ Written, oral and visual communication in a technical environment

- At the program level all 6 competencies apply to roman numerals I – V of the Engineering Technology General Outcomes (Educational objectives) listed above.

IV. Course Goals*:

The course will
1. Understanding basic electricity. (A, B, C, E)
2. Understanding of basic units of electricity. (A, B, C, E)
3. Understanding the generation, transmission, and distribution of electricity. (A, B, C, E)
4. Understanding electrical generation principles. (A, B, C, E)
5. Understanding distributed generation principles. (A, B, C, E)
7. Sizing a Photovoltaic system. (A, B, C, E)
8. Understanding the difference between on-grid and off-grid systems. (A, B, C, E)
9. Understand fundamentals of various co-generation techniques. (A, B, C, E)
10. Understanding application safety risks when working with residential power generation. (A, B, C, E)
11. Expand student experience in applying, as an individual and as a team member, information skills, problem-solving skills, project execution skills, and communication skills. (D, E, F)

*Capital letters after course goals reference the competencies of the Engineering Technology concentrations listed above.

V. Expected Student Learning Outcomes*:

Students will: be able to:

a. Explain the theory of electricity. (1, 2)
b. Explain the basic terminology and units of electricity. (1, 2)
c. Explain and apply basic electrical equations. (1, 2)
d. Explain the characteristics of series and parallel circuits. (1)
e. Define AC & DC power and typical sources of each. (1)
f. Define the principle of "electromagnetic induction". (1)
g. Explain the structure of a single phase alternating current system. (1, 3, 4, 6, 7, 9, 10)
h. Explain the principles of transformer operation. (1, 3)
i. Identify the methods of energy conversion. (1, 3, 4, 5, 6, 7, 9)
j. Understand solar behavior and how solar energy can be harnessed. (5)
k. Explain the components of a solar photo-voltaic power generation system. (5, 6, 7)
l. Explain on-grid and off-grid principles. (7)
m. Understand the technical specifications for PV modules: Open circuit voltage, short circuit
current, maximum power voltage, maximum power current, etc… (4, 5, 6, 7)

n. Understand the temperature effects on PV module’s electrical parameters. (4, 5, 6, 7)

o. Perform a site assessment for a solar PV system. (4, 5, 6, 7)

p. Understand shading effects on PV systems. (6, 7)

q. Understand the application of single phase residential power systems. (1, 3, 4, 6, 7, 8, 9, 10)

r. Identify the different utilization voltages for residential and commercial power systems. (1, 3, 4, 6, 7, 8, 9, 10)

s. Perform a load assessment for a Photo-Voltaic system. (6)

t. Explain the advantages and disadvantages of wind power. (10)

u. Identify areas that are ideal for wind generation. (10)

v. Perform online research for PV equipment. (11)

w. Complete a PV project design. (11)

* Numbers after Expected Student Learning Outcomes reference the course goals listed above.

VI. Evaluation:

A. Testing Procedures: 60% of grade

   Chapter Tests 40%
   Quizzes & Homework 20%
   Final Exam    20%

B. Laboratory Expectations: 10% of grade

   The laboratories for all EET courses are an essential part of conveying the concepts to the student. The labs would closely follow the classes in content and in time of presentation so that the student is actually verifying these concepts to his or her self. The student will be able to apply the theory learned in class. The laboratory grade will be determined by a combination of performance within the lab and the quality and demonstrated comprehension of the lab report. There will be at least twelve labs during the semester to go along with the classroom material.

C. Field Work:

   None

D. Other Evaluation Methods: Project (10%)

   Students will complete an assigned project for the course. Each student will provide a laboratory report on the project. The report shall include:
   Title Page
   Project Description
   Sun chart (s)
   Calculations
   Block Diagram Schematic
   Bill of Material
E. Grading Scale:

A   93 - 100
B+  88 - 92
B    83 - 87
C+  78 - 82
C    70 - 77
D    60 - 69
F  Below 60

VII. Policies:

A. Attendance Policy:

Pellissippi State expects students to attend all scheduled instructional activities. As a minimum, students in all courses (excluding distance learning courses) must be present for at least 75 percent of their scheduled class and laboratory meetings in order to receive credit for the course. Individual departments/programs/disciplines, with the approval of the vice president of Academic Affairs, may have requirements that are more stringent. In very specific circumstances, an appeal of the policy may be addressed to the head of the department in which the course was taken. If further action is warranted, the appeal may be addressed to the vice president of Academic Affairs.

B. Academic Dishonesty:

Academic misconduct committed either directly or indirectly by an individual or group is subject to disciplinary action. Prohibited activities include but are not limited to the following practices:

- Cheating, including but not limited to unauthorized assistance from material, people, or devices when taking a test, quiz, or examination; writing papers or reports; solving problems; or completing academic assignments.
- Plagiarism, including but not limited to paraphrasing, summarizing, or directly quoting published or unpublished work of another person, including online or computerized services, without proper documentation of the original source.
- Purchasing or otherwise obtaining prewritten essays, research papers, or materials prepared by another person or agency that sells term papers or other academic materials to be presented as one’s own work.
- Taking an exam for another student.
- Providing others with information and/or answers regarding exams, quizzes, homework or other classroom assignments unless explicitly authorized by the instructor.
- Any of the above occurring within the Web or distance learning environment.

Please see the Pellissippi State Policies and Procedures Manual, Policy 04:02:00 Academic/Classroom Conduct and Disciplinary Sanctions for the complete policy.

C. Accommodations for disabilities:

Students that need accommodations because of a disability, have emergency medical information to share, or need special arrangements in case the building must be evacuated should inform the instructor immediately, privately after class or in her or his office. Students must present a current accommodation plan from a staff member in Services for Students with Disabilities (SSWD) in order to receive accommodations in this course. Services for Students
with Disabilities may be contacted by sending email to disabilityservices@pstcc.edu, or visiting Goins 127, 132, 134, 135, 131. More information is available at http://www.pstcc.edu/sswd/.