

Course Outline of Record

1. Course Code: ESYS-012B
2.
 - a. Long Course Title: Module 2 Residential Solar Installation
 - b. Short Course Title: MOD 2 RES-SOLAR INST
3.
 - a. Catalog Course Description:

This entry level course is Module 2 of 3 for students interested in installing and maintaining photovoltaics systems and obtain a career in the solar industry. The installation principles, techniques and functions of the photovoltaic will be presented along with installation and maintenance of all necessary components for a photovoltaic system. Discussion and instructions will also serve current solar installers wanting to earn industry recognized credential. Installation practices are aligned to help students prepare for the North American Board of Certified Energy Practitioners (NABCEP).

The NABCEP PV Installation Professional certification is a voluntary certification that provides a set of national standards by which PV Installation Professionals with skills and experience can distinguish themselves from their competition. Certification provides a measure of protection to the public by giving them a credential for judging the competency of practitioners.
 - b. Class Schedule Course Description:

This entry level course is Module 2 of 3 for students interested in installing and maintaining photovoltaics systems and obtain a career in the solar industry.
 - c. Semester Cycle (if applicable): N/A
 - d. Name of Approved Program(s):
 - NEW CERTIFICATE IN PROGRESS Certificate of Completion
4. Total Units: 2.00 Total Semester Hrs: 36.00
 Lecture Units: 2 Semester Lecture Hrs: 36.00
 Lab Units: 0 Semester Lab Hrs: 0
 Class Size Maximum: 20 Allow Audit: No
 Repeatability No Repeats Allowed
 Justification 0
5. Prerequisite or Corequisite Courses or Advisories:

Course with requisite(s) and/or advisory is required to complete Content Review Matrix (CCForm I-A)

 Prerequisite: ESYS 312A
6. Textbooks, Required Reading or Software: (List in APA or MLA format.)
 - a. Dunlop, J., P. (2012). Photovoltaic Systems (3rd/e). American Tech Publishers. ISBN: 9781935941057
 College Level: Yes
 Flesch-Kincaid reading level: 11.0
7. Entrance Skills: *Before entering the course students must be able:*
 - a.
 Explain electrical and mechanical safety.
 - ESYS 312A - Explain electrical and mechanical safety. Satisfy SLO (1)
 - b.
 Explain application of varies mechanical roof attachments.
 - ESYS 312A - Explain application of varies mechanical roof attachments. SLO(2)
 - c.
 Describe the relationship between row spacing of tilted modules and sun angle.

- ESYS 312A - Describe the relationship between row spacing of tilted modules and sun angle. SLO (3)

d.

Describe typical system design errors.

- ESYS 312A - Describe typical system design errors. SLO (1)

8. Course Content and Scope:

Lecture:

1. PV Module Fundamentals

- 1.1. Explain how a solar cell converts sunlight into electric power
- 1.2. Label key points on a typical amps/ voltage (IV) curve
- 1.3. Identify key output values of solar modules using manufacturer literature
- 1.4. Illustrate effect of environmental conditions on IV curve
- 1.5. Illustrate effect of series/parallel connections on IV curve
- 1.6. Define measurement conditions for solar cells and modules Standard Test Conditions (STC)
- 1.7. Compute expected output values of solar module under variety of environmental conditions
- 1.8. Compare the construction of solar cells of various manufacturing technologies
- 1.9. Compare the performance and characteristics of various cell technologies
- 1.10. Describe the components and construction of a typical flat plate solar module
- 1.11. Calculate efficiency of solar module
- 1.12. Explain purpose and operation of bypass diode
- 1.13. Describe typical deterioration/failure modes of solar modules

2. System Components

- 2.1. Describe most common solar module mounting techniques (ground, roof, pole)
- 2.2. Compare features and benefits of different solar mounting techniques
- 2.3. Explain the relationship between solar module cell temperature and environmental conditions, given mounting method
- 2.4. Describe purpose and operation of main electrical Balance of Systems (BOS) components inverter, charge controller, combiner, ground fault protection, battery banks, generator)
- 2.5. Identify types and key specifications of main electrical Balance of Systems (BOS) components inverter, charge controller, combiner, battery banks

Lab: *(if the "Lab Hours" is greater than zero this is required)*

9. Course Student Learning Outcomes:

1.
Find and document mechanical loads on a PV array (e.g., wind, snow, seismic) during a job site survey.
2.
Apply measurement meters to power system output and explain results to end user.
3.
Use tools needed to perform residential solar energy survey.

10. Course Objectives: *Upon completion of this course, students will be able to:*

- a. Explain mechanical roof attachments and their load limitations. Satisfy SLO(1)

ESYS 012B-Module 2 Residential Solar Installation

- b. Perform calculations on conductor ampacity and conductor derating factors. SLO(2)
- c. List equipment needed for typical system performance analysis SLO(3)

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*

- a. Activity
- b. Collaborative/Team
- c. Discussion
- d. Lecture
- e. Participation
- f. Technology-based instruction

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*

In Class Hours: 36.00

Outside Class Hours: 72.00

a. In-class Assignments

- 1. Examine mechanical roof attachments. SLO (1)
- 2. Calculate electrical load for a common house in group settings. SLO (2)
- 3. Used industry tools. SLO (3)

b. Out-of-class Assignments

- 1. Read assigned text.
- 2. Assigned worksheets

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*

- True/false/multiple choice examinations
 - Student participation/contribution
 - Organizational/timelines assessment
- Be in class on time. Organize assignments in order.

14. Methods of Evaluating: Additional Assessment Information:

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*

PO - Career and Technical Education

Fulfill the requirements for an entry- level position in their field.

Apply critical thinking skills to execute daily duties in their area of employment.

Display the skills and aptitude necessary to pass certification exams in their field.

IO - Scientific Inquiry

Recognize the utility of the scientific method and its application to real life situations and natural phenomena.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
--------------------------	---------------	----------------------	---------------------	---------------------

17. Special Materials and/or Equipment Required of Students:

18. Materials Fees: Required Material?

Material or Item	Cost Per Unit	Total Cost
-------------------------	----------------------	-------------------

19. Provide Reasons for the Substantial Modifications or New Course:

This entry level course is Module 2 of 3 for students interested in installing and maintaining photovoltaics systems and obtain a career in the solar industry. The installation principles, technics and functions of the photovoltaic will be presented along with installation and maintenance of all necessary components for a photovoltaic system. Discussion and instructions will also serve current solar installers wanting to earn industry recognized credential. Installation practices are aligned to help students prepare for the North American Board of Certified Energy Practitioners (NABCEP).

The NABCEP PV Installation Professional certification is a voluntary certification that provides a set of national standards by which PV Installation Professionals with skills and experience can distinguish themselves from their competition. Certification provides a measure of protection to the public by giving them a credential for judging the competency of practitioners

This course is developed to meet the goals of the California Energy Efficiency Strategic Plan (CEESP) which mandates that 100 percent of all new homes in California will be Zero Net Energy starting in 2020 and 50 percent of commercial buildings by 2030. Solar technology is the leading technology used to offset electrical demand from the power grid. California has acknowledged the shortage of qualified and available work force to meet these new mandates. Residential solar Installation, the course is designed to develop the highly trained technical workforce necessary to meet the goals of the California Energy Efficiency Strategic Plan (CEESP).

- 20. a. Cross-Listed Course (*Enter Course Code*): *N/A*
- b. Replacement Course (*Enter original Course Code*): *N/A*

21. Grading Method (*choose one*): Letter Grade Only

22. MIS Course Data Elements

- a. Course Control Number [CB00]: *N/A*
- b. T.O.P. Code [CB03]: 94610.00 - Energy Systems Technology
- c. Credit Status [CB04]: D - Credit - Degree Applicable
- d. Course Transfer Status [CB05]: C = Non-Transferable
- e. Basic Skills Status [CB08]: 2N = Not basic skills course
- f. Vocational Status [CB09]: Clearly Occupational
- g. Course Classification [CB11]: Y - Credit Course
- h. Special Class Status [CB13]: N - Not Special
- i. Course CAN Code [CB14]: *N/A*
- j. Course Prior to College Level [CB21]: Y = Not Applicable
- k. Course Noncredit Category [CB22]: Y - Not Applicable
- l. Funding Agency Category [CB23]: Y = Not Applicable
- m. Program Status [CB24]: 1 = Program Applicable

Name of Approved Program (*if program-applicable*): NEW CERTIFICATE IN PROGRESS

Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment

First Year: 20
 Third Year: 40

24. Resources - Faculty - Discipline and Other Qualifications:

- a. Sufficient Faculty Resources: Yes
- b. If No, list number of FTE needed to offer this course: *N/A*

25. Additional Equipment and/or Supplies Needed and Source of Funding.

N/A

26. Additional Construction or Modification of Existing Classroom Space Needed. (*Explain:*)

N/A

ESYS 012B-Module 2 Residential Solar Installation

27. FOR NEW OR SUBSTANTIALLY MODIFIED COURSES

Library and/or Learning Resources Present in the Collection are Sufficient to Meet the Need of the Students Enrolled in the Course: Yes

28. Originator Ramiro Galicia Origination Date 09/17/16