COLLEGE OF THE DESERT

Course Code ESYS-012A

Course Outline of Record

1. Course Code: ESYS-012A
2. a. Long Course Title: Module 1 Residential Solar Installation
   b. Short Course Title: MOD 1 RES-SOLAR INST
3. a. Catalog Course Description:
   This entry level course is Module 1 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

   b. Class Schedule Course Description:
   This course is Module 1 of 3 for students interested in installing and maintaining photovoltaics systems, and furthering their 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.
   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 (CCForm1-A)
   Advisory: ESYS 311C
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Dunlop,J.,P. (2012). *Photovoltaic Systems* 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.
   Describe efficiency of solar modules.
   - ESYS 311C - Describe efficiency of solar modules. satisfy SLO 1.

   b.
   Describe common solar module mounting techniques (ground, roof, pole).
   - ESYS 311C - Describe common solar module mounting techniques (ground, roof, pole) * SLO2.

c.
Identify system components (inverter, charge controller, combiner, batteries, etc.)

- ESYS 311C - Identify system components (inverter, charge controller, combiner, batteries, etc.)

d.
Explain DC system output versus AC production.

- ESYS 311C - Explain DC system output versus AC production.

e.
Explain string inverters versus micro-inverters.

- ESYS 311C - Explain string inverters versus micro-inverters*SLO3.

8. Course Content and Scope:

Lecture:

1. PV Markets and Applications

1.1. Describe history of Photovoltaic (PV) technology and industry
1.2. Describe markets and applications for Photovoltaic (PV) (grid-tie, remote homes, telecom, etc.)
1.3. Identify types of PV systems (utility-interactive, standalone, direct-coupled, etc.)
1.4. Be aware of current trends

2. Safety Basics

2.1. Identify safety hazards of PV systems
2.2. Identify safety hazards, practices, and protective equipment during PV system installation and maintenance (electricity, batteries, roof work)

3. Electricity Basics

3.1. Define basic electrical units and terms

3.2. Use digital multi-meters to take various measurements
3.3. Use amp clamp to measure solar module current
3.4. Understand series, parallel, and series-parallel circuits
3.5. Understand overcurrent protection devices

4. Solar Energy Fundamentals

4.1. Define basic solar terms (e.g., irradiation, Langley, azimuth)
4.2. Determine true (solar) south from magnetic (compass) south given a declination map
4.3. Analyze celestial movements and calculate effects on PV systems
4.4. Predict solar position using solar path diagrams
4.5. Describe angular effects on the irradiance of array
4.6. Identify factors that reduce/enhance solar irradiation
4.7. Determine average solar irradiation
4.8. Calculate environmental effects on solar module output
4.10. Review the use of Solar Pathfinder, Solmetric Sun-Eye, and sun charts

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

9. Course Student Learning Outcomes:
   1.
   Describe the dangers and safety considerations of electricity.

   2.
   Describe various roof attachment methods used in the installation of solar systems.

   3.
   Apply optimize angle to a solar array during installation.

   4.
   Apply safety measures when specifications are not clearly stated on manufacturer specifications.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Explain electrical and mechanical safety. Satisfy SLO (1)
    b. Explain application of varies mechanical roof attachments. SLO(2)
    c. Describe the relationship between row spacing of tilted modules and sun angle. SLO (3)
    d. Describe typical system design errors. SLO (1)

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Activity
    b. Collaborative/Team
    c. Demonstration, Repetition/Practice
    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. Practice installing personal protective safety equipment, e.g. gloves, safety eye wear, ladder safety harness.SLO (1)
    2. Read and describe the varies mechanical roof attachments currently available. SLO (2)
    3. Group interaction and group presentations on best angle for maximum power found during the laboratory exercise. 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.
    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:

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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. 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

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