COLLEGE OF THE DESERT

Course Code ESYS-005

Course Outline of Record

1. Course Code: ESYS-005
2. a. Long Course Title: Zero Net Energy Building Science
   b. Short Course Title: ZNE BUILDING SCIENCE
3. a. Catalog Course Description:
   Zero Net Energy (ZNE) Building Science includes an overview of many progressive measures that improve the energy performance of buildings. Studies focus on architectural design of building, construction methodology, green HVAC systems, renewable energy systems and the terminology used in the ZNE Industry. A survey of projects, policies and programs driving ZNE performance in residential and non-residential buildings will be studied.
   b. Class Schedule Course Description:
   Zero Net Energy (ZNE) Building Science includes an overview of many progressive measures that will improve the energy performance of buildings. A survey of projects, policies and programs driving ZNE performance in residential and non-residential buildings will be studied.
   c. Semester Cycle (*if applicable*): *N/A*
   d. Name of Approved Program(s):
   - ENERGY SYSTEMS TECHNOLOGY Certificate of Achievement
4. Total Units: 4.00 Total Semester Hrs: 72.00
   Lecture Units: 4 Semester Lecture Hrs: 72.00
   Lab Units: 0 Semester Lab Hrs: 0
   Class Size Maximum: 30 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: RDG 061
   Advisory: ESYS 004
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Petit,F.,Randy. Earl Delatte, Earl. (2012). *System Performance verification* (1st /e). Mount Prospect escogroup.org. ISBN: 1930044313
   College Level: Yes
   Flesch-Kincaid reading level: 12
   b. Krigger,John., Dorsi,Chris. (2013). *Residential Energy* (6th /e). Helena Saturn Resource Management .
   College Level: Yes
   Flesch-Kincaid reading level: 12
7. Entrance Skills: *Before entering the course students must be able:*

   a.
   Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers.

   - ESYS 004 - Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers.

   b.
   Apply the order of operations to simplify expressions involving several operations.

   - ESYS 004 - Apply the order of operations to simplify expressions involving several operations.

   c.

Apply the basic operations to solve application problems.

- ESYS 004 - Apply the basic operations to solve application problems.

d.
Comprehend the concept of a fraction as a part of a whole.

- ESYS 004 - Comprehend the concept of a fraction as a part of a whole.

e.
Use the concept of ratio to determine the solution to a proportion problem.

- ESYS 004 - Use the concept of ratio to determine the solution to a proportion problem.

f.
Use various reading strategies to prepare, read and comprehend expository text

- RDG 061 - Use SQ3R &/or SOAR along with outlining, note-taking, mapping summarizing and other strategies to prepare, read, & comprehend expository text.

g.
Read a variety of texts fluently

- RDG 061 - Read a variety of texts fluently.

h.
Write organized summaries & reactions that capture main idea and supporting details.

- RDG 061 - Write organized summaries & reactions that capture main idea and supporting details.

i.
Understand multiple word meanings, uses & synonyms

- RDG 061 - Understand multiple word meanings, uses & synonyms

8. Course Content and Scope:

Lecture:

I. Introduction to Zero Net Energy (ZNE)
  A. ZNE definition and terminology
  B. Sustainable design issues
  C. Basic principles in sustainable design
    1. Climate regions
    2. Site design
    3. Building orientation
    4. Passive cooling
    5. Landscaping
    6. Overhangs and shading
    7. Role of color in pasive design
II. Introduction to ZNE building construction
  A. The Building Shell
    1. Thermal conductivity of building materials
    2. Heat transmission
  B. Air Leakage
    1. Identifying air leaks
    2. Construction flaws and air leakage
    3. Air-sealing methods and materials
  C. Thermal Insulation
    1. Insulation characteristics
    2. Insulation types
    3. Thermal boundary
  D. Windows and Doors
    1. Window structure

2. Thermal transmittance
3. Solar heat gain coefficient
4. Door components
5. Door types

III. Survey of the power industry
A. Industry Terminology
B. Industry energy conversions
C. Electrical power generation
D. Power transmission and distribution
E. Types of energy
F. Renewable energy
1. Biomass/Biofuels
2. Hydro-Power
3. Wind Energy

IV. Survey of the Solar industry
A. Industry Terminology
B. Battery and Storage

V. Survey of Heating, Ventilation and Air conditioning systems (HVAC) used in ZNE buildings
A. HVAC Industry terms
B. Heat transfer properties.
C. Equipment rating systems
D. Identification of common systems

VI. Lighting systems and controls.
A. Intro to Califonina Energy Commissinon.
B. Industry terminology
C. Introduction to lighting controls
1.Shedding load methods

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

9. Course Student Learning Outcomes:

1.
Describe multiple sustainable energy systems and how they are designed to support ZNE Buildings.

2.
Describe best practices in designing and selecting an HVAC system for optimum performance on a ZNE building.

3.
Explain sustainable design strategies used to improve the energy efficiency of a building.

4.
Differentiate the thermal properties of common building materials.

5.
Describe the thermal performance of different wall assemblies.

6.
Compare best practices in building construction for energy conservation.

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

a. Define energy and name of its source.
b. Identify the different methods of converting energy into electricity.

c. Explain how electricity is transmitted and distributed.
d. Describe the environmental impacts of producing and distributing electricity.
e. Define the refrigerant cycle.
f. Describe how HVAC system are sized.
g. Describe energy efficient rating systems, SEER EER, part load EER and COP.
h. Describe HVAC systems used in ZNE buildings.
i. Describe construction flaws and air leakage.
j. Explain different methodologies in building construction.
k. Describe the different types of thermal insulation.
l. Describe the proper placement and installation of thermal insulation.
m. Describe the Thermal Transmittance (U-Factor)of glass.
n. Explain the importance of Solar Heat Gain Coefficient (SHGC) of a glass assembly.
o. Explain the importance of sustainable design of buildings.
p. Describe the role of shading and light colors in sustainable design.
q. Explain the importance of site design and building orientation.
r. Discuss the different climate regions.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Activity
    b. Collaborative/Team
    c. Demonstration, Repetition/Practice
    d. Discussion
    e. Individualized Study
    f. Lecture
    g. Participation
    h. Supplemental/External Activity
    i. 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: 72.00
    Outside Class Hours: 144.00
    a. In-class Assignments

1. Reading assigned chapters.
2. Class discussion.
3. Group interaction and presentation.
4. Evaluate industry
5. Evaluate industry tools
6. Present ZNE current events.

    b. Out-of-class Assignments

1. Read assigned text.
2. Industry journal entry.
3. Assigned worksheets.
4. Evaluate energy bill.
5. Evaluate energy rebates and incentives.
6. Prepare for in-class discussions on specific energy topics.
7. Case studies.
8. Review end of chapter questions.
9. Define vocabulary terms.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
    - Guided/unguided journals
    - Portfolios
    - Reading reports
    - Field/physical activity observations
    - Computational/problem solving evaluations
    - Presentations/student demonstration observations
    - Group activity participation/observation
    - True/false/multiple choice examinations
    - Mid-term and final evaluations
    - Student participation/contribution
    - Student preparation
    - Organizational/timelines assessment

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.
    Apply critical thinking skills to research, evaluate, analyze, and synthesize information.
    Display the skills and aptitude necessary to pass certification exams in their field.
    Exhibit effective written, oral communication and interpersonal skills.

    PO-BS Critical Thinking

    Assess relevant information and come to thought-out conclusions and solutions.
    Value open-mindedness.
    Communicate meaningfully with others.

    IO - Personal and Professional Development

    Self-evaluate knowledge, skills, and abilities.
    Develop realistic goals.
    Display habits of intellectual exploration, personal responsibility, and physical well being.
    Demonstrate an understanding of ethical issues to make sound judgments and decisions.
    Value the feedback of others.

    IO - Critical Thinking and Communication

    Apply principles of logic to problem solve and reason with a fair and open mind.

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:

    Change requisite and entrance skills to Reading 061

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]: CCC000576117
    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)*: ENERGY SYSTEMS TECHNOLOGY
    Attach listings of Degree and/or Certificate Programs showing this course as a required or a restricted elective.)

23. Enrollment - Estimate Enrollment
    First Year: 34
    Third Year: 60

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 Gary Bergstrom Origination Date 11/10/17