COLLEGE OF THE DESERT

Course Code ESYS-003

Course Outline of Record

1. Course Code: ESYS-003
2. a. Long Course Title: Energy Systems Technology
   b. Short Course Title: ESYS TECH
3. a. Catalog Course Description:
   This course will explore various methods of power generation with an emphasis on renewable energy technologies. Students will take a hands on approach in the examination of the rankin cycle, steam generation, gas turbine operation, biofuel production, geoexchange systems, solar power production, wind power production and hydro-power production. Students will engage in discussion regarding; cost effectiveness, viability and practicality of each of these technologies. A lab uniform is required for this course.
   b. Class Schedule Course Description:
   This course will provide a platform for the discussion and experimentation of multiple forms of power generation with an emphasis on renewable energy technologies. A lab uniform is required for this course.
   c. Semester Cycle (*if applicable*): Every Semester
   d. Name of Approved Program(s):
   - ENERGY SYSTEMS TECHNOLOGY Certificate of Achievement
4. Total Units: 3.00 Total Semester Hrs: 90.00
   Lecture Units: 2 Semester Lecture Hrs: 36.00
   Lab Units: 1 Semester Lab Hrs: 54.00
   Class Size Maximum: 30 Allow Audit: Yes
   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)
   Prerequisite: ESYS 004 or concurrent enrollment
   Advisory: RDG 061
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Warmke, J., A. Warmke (2009). *Green Technology Concepts and Practices* (1st/e). ETG/Marcraft. ISBN: 9781581221114
   College Level: Yes
   Flesch-Kincaid reading level: 12.8
   b. NCCER (2011). *Alternative Energy* (1st/e). Upper Saddle River, NJ Pearson Education Inc.. ISBN: 978013266625
   College Level: Yes
   Flesch-Kincaid reading level: 9.3
7. Entrance Skills: *Before entering the course students must be able:*
   a.
   Demonstrate proficiency in basic number facts (addition, subtraction, multiplication, division).
   - ESYS 004 - Demonstrate proficiency in basic number facts (addition, subtraction, multiplication, division).

   b.
   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.

c.
Compute the value of expressions containing natural number exponents.

- ESYS 004 - Compute the value of expressions containing natural number exponents.

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

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

e.
Apply the basic operations to solve application problems.

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

f.
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.

g.
Convert between improper fractions, mixed numbers, and decimals

- ESYS 004 - Convert between improper fractions, mixed numbers, and decimals.

h.
Apply prime factorization to simplify fractions and find least common multiples.

- ESYS 004 - Apply prime factorization to simplify fractions and find least common multiples.

i.
Use the fundamental property of fractions and prime factorizations to write equivalent fractions.

- ESYS 004 - Use the fundamental property of fractions and prime factorizations to write equivalent fractions.

j.
Employ decimal notation and place value to compare, order, and round numbers.

- ESYS 004 - Employ decimal notation and place value to compare, order, and round numbers.

k.
Apply methods of conversion between percentages, decimals, and fractions.

- ESYS 004 - Apply methods of conversion between percentages, decimals, and fractions.

l.
Use unit measure appropriately in applications.

- ESYS 004 - Use unit measure appropriately in applications.

m.
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.

n.
Read a variety of texts fluently

- RDG 061 - Read a variety of texts fluently.

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

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

p.

Understand multiple word meanings, uses & synonyms

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

8. Course Content and Scope:

Lecture:

1. Introduction to electricity generation
    1. History of the electricity generation industry.
    2. The evolution of electricity generation technologies
    3. The politics of electricity
    4. The size of the industry
2. Environmental considerations.
    1. The evolution of environmental awareness
    2. The environmnetal effects of power generation
    3. The Hydrogen economy
    4. Externalities
    5. Life-cycle assessment
3. Coal-fired power plants
    1. Types of coal
    2. Traditional coal burning power plant technology
    3. Emission control for traditional coal burning plants
    4. The cost of coal fired electricity generation
4. Gas turbines and combined cycle power plants
    1. Natural gas
    2. Gas turbine technology
    3. Advanced gas turbine design
    4. Distributed generation
    5. Combined cycle power plants
    6. Micro turbines
    7. The cost of gas turbine power stations
5. Combined heat and power
    1. History
    2. Applications
    3. CHP Technology
    4. Energy efficiency
    5. Cost of CHP
6. Piston-engine-based power plants
    1. Piston engine technology
    2. Co-generation
    3. Combined cycle
    4. Costs
7. Fuel Cells
    1. Fuel cell principles
    2. Fuel cell chmistry
    3. Types of fuel cells
    4. Environmental considerations
    5. Fuel cell costs
8. Hydropower
    1. The hydropower resource
    2. Hydro sites
    3. Dams and barrages
    4. Turbines
    5. Small hydropower
    6. The environment
    7. The cost of hydropower

9. Tidal Power
    1. Tidal motion
    2. The tidal resource
    3. Tidal technology
    4. Environmental considerations
    5. The cost of tidal power
10. Storage technologies
    1. Types of energy storage
    2. Pumped Water Storage (PWS)
    3. Compressed Air Storage (CAS)
    4. Large scale batteries
    5. Flywheels
    6. Capacitors
    7. Hydrogen
    8. Costs
11. Wind Power
    1. Wind sites
    2. Wind turbines
    3. Offshore wind technology
    4. Environmental considerations
    5. Costs
12. Geothermal power
    1. The geothermal resource
    2. Geothermal energy conversion technology
    3. Geoexchange technology
    4. The costs of geothermal power
13. Solar Power
    1. The solar energy resource
    2. Sites for solar power generation
    3. Solar technology
    4. Solar thermal power generation
    5. Photovoltaics
    6. Solar cell deployment
    7. The cost of solar power
14. Ocean Power
    1. Ocean energy resource
    2. Ocean thermal energy conversion
    3. Wave energy
    4. Ocean current power generation
    5. Cost of Ocean power
15. Biomass -based power generation
    1. Types of biomass
    2. Biomass energy conversion technology
    3. Environmental considerations
    4. The cost of biomass generated power
16. Power from waste
    1. Landfill waste disposal
    2. Waste sources
    3. Waste composition
    4. Waste collection
    5. Waste power generation technologies
    6. The cost of energy from waste
17. Nuclear power
    1. Fundamentals of Nuclear power generation
    2. Nuclear reactors
    3. Nuclear fusion
    4. Environmental considerations
    5. Financial risks of nuclear power
    6. The cost of nuclear power

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

1. Geothermal Lab
    1. Introduction to geothermal energy
    2. Ground loop characteristics
    3. Heat pump connections and interior piping
    4. The refrigeration cycle
    5. Geothermal heat pumps
    6. Heat exchangers
    7. Heat pump control and safety devices
    8. System characterization
    9. Maintenance and troubleshooting
2. Wind Lab
    1. Wind turbine power generation system operation
    2. Gearbox design
    3. Power grid integration
    4. Wind turbine maintenance
3. Rankine Cycler Lab
    1. Introduction to the rankine cycler
    2. Operational safety
    3. Principles of operation
    4. System components
    5. Component theory of operation
    6. Start up, operation and shut down
    7. Data acquisition
    8. Performance plotting
    9. Operational variations
    10. Data collection and interpretation
4. Solar Lab
    1. Introduction to the solar trainer
    2. Operational safety
    3. Principles of operation
    4. System components
    5. Component theory of operation
    6. DC and AC measurements
    7. Performance plotting
    8. Operational variations
    9. Data collection / interpretation
5. Lab final will be project based on student renewable energy specific interest.

9. Course Student Learning Outcomes:
    1.
    Describe how legislation and government subsidies affect renewable energy technology development.

    2.
    Explain the importance of a diversified power generation portfolio.

    3.
    Discuss the economic and environmental impact of renewable energy technology deployment.

    4.

Explain how our local geographic region is so very unique in terms of renewable energy resources.

5.
Explain Zero Net Energy.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Differentiate between; fossil fuels, alternative fuels and renewable fuel sources.
    b. Discuss in detail the various renewable energy resources and how that resource is converted into electricity.
    c. List the advantages and disadvantages of each renewable energy resource
    d. Describe how legislation and government subsidies affect renewable energy technology development.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Collaborative/Team
    b. Demonstration, Repetition/Practice
    c. Discussion
    d. Experiential
    e. Individualized Study
    f. Journal
    g. Laboratory
    h. Lecture
    i. Observation
    j. Participation
    k. 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: 90.00
    Outside Class Hours: 72.00
    a. In-class Assignments
        1. Short assignments as individuals or teams.
        2. Take notes on lecture material.
        3. Complete tests and quizzes.
        4. Complete laboratory experiments.
        5. View assign videos.
        6. Present topics from their journal.
    b. Out-of-class Assignments
        1. Students will be responsible for the development of a renewable energy journal.
        2. Students will need to develop an individual paper.
        3. Students will be responsible to read assigned text.
        4. Students will be required to develop a learning team based paper.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Written homework
      Student will be graded upon the accuracy, neatness and timely submission of the homework assignments.
    - Guided/unguided journals
      Student will be graded upon the accuracy, neatness and timely submission of the renewable energy journal.
    - Laboratory projects
      Student will be graded upon the accuracy, neatness and timely submission of the experimentation reports.
    - Presentations/student demonstration observations
      Student may be graded upon the verbal presentation of their renewable energy journal entries.
    - True/false/multiple choice examinations

Students will be graded upon the accuracy of answers on quizzes/tests.

- Mid-term and final evaluations
  Students will be graded upon the accuracy of answers on tests.
- Oral and practical examination
  Students will be graded upon the accuracy of answers on tests.

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.
    IO - Global Citizenship - Scientific & Technological Literacy
    Utilize quantitative expression in a variety of contexts. These would include units of measurement, visual representations, and scales and distributions.
    Synthesize, interpret, and infer, utilizing information, data, and experience to solve problems, innovate, and explore solutions.
    Produce oral and written information in various modes and media, using technology such as computers, the Internet, and library databases.

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]: CCC000554900
    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]: A = Fully Economic Development funds
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: 20
Third Year: 30

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