COLLEGE OF THE DESERT

Course Code ESYS-021

Course Outline of Record

1. Course Code: ESYS-021
2. a. Long Course Title: Residential Energy Modeling
   b. Short Course Title: BLDG Energy Modeling
3. a. Catalog Course Description:
   This course is for students interested in a career in the building energy consulting industry. Energy consultant selects the energy systems, documents, and verifies energy code is being met. Energy consultants work in a team environment, coordinating directly with architects, engineers, subcontractors, and the building owner to oversee, and examine multiple pathways to achieve the energy goals set by the owner. The student will model the building with alternative wall systems, roofs, window, and energy systems to meet the owner's energy goals. The student will receive comprehensive training in energy analysis software programs that may be used to document compliance with CA Building Energy Efficiency Standards (Title 24, Part 6), ASHRAE 90.1 Standards, HERS energy rating systems as well as residential and nonresidential Green Building rating systems, such as GreenPoint Rated and LEED.
   b. Class Schedule Course Description:
   This course is for students interested in a career in the building energy consulting industry. Energy consultant selects the energy systems, documents, and verifies energy code is being met.
   c. Semester Cycle (*if applicable*): *N/A*
   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: 20 Allow Audit: No
   Repeatability 0x
   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: BIT 024
   Prerequisite: ESYS 005
   Prerequisite: ARCH 011
   Prerequisite: ESYS 004
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)* *N/A*
7. Entrance Skills: *Before entering the course students must be able:*
   a.
   Demonstrate an understanding of a complete set of working drawings.
   - ARCH 011 - Demonstrate an understanding of a complete set of working drawings.

   b.
   Define energy and name of its source.
   - ESYS 005 - Define energy and name of its source.

   c.
   Describe energy efficient rating systems, SEER EER, part load EER and COP.
   - ESYS 005 - Describe energy efficient rating systems, SEER EER, part load EER and COP.

d.
Explain the importance of site design and building orientation.

- ESYS 005 - Explain the importance of site design and building orientation.

e.
Explain the importance of Solar Heat Gain Coefficient (SHGC) of a glass assembly.

- ESYS 005 - Explain the importance of Solar Heat Gain Coefficient (SHGC) of a glass assembly.

f.
BIT 024 - Apply the codes in construction, regulation, and design.

- BIT 024 - Apply the codes in construction, regulation, and design

g.
Determine needed compliance documents for various project scenarios.

- BIT 024 - Determine needed compliance documents for various project scenarios.

h.
Demonstrate skills for employment in private or public construction fields, or become inspector or plans examiners.

- BIT 024 - Demonstrate skills for employment in private or public construction fields, or become inspector or plans examiners

i.
Provide pertinent information for completion, submission, and registration of compliance documents.

- BIT 024 - Provide pertinent information for completion, submission, and registration of compliance documents.

j.
Demonstrate proficiency in basic number facts (addition, subtraction, multiplication, division).

- ESYS 004 - Demonstrate proficiency in basic number facts (addition, subtraction, multiplication, division).

k.
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.

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

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

m.
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.

8. Course Content and Scope:

Lecture:

1. Introduction to Energy Modeling
    1. General history of the California Energy Commission (CEC)
    2. Navigating the CEC Website
    3. Energy Code Cycles
    4. California's Long Term Energy Efficiency Plan
    5. Zero Net Energy Building Goals
    6. History of Energy Modeling for Compliance
    7. Meet the Energy Consultant
    8. End Users / Participants: Architects, Designers, Contractors, Building Dept. Staff, Plan Check Staff, Engineers, HERS Raters, Support Staff, Attorneys, Property Managers, Building Owners, Program Administrators
    9. Entry Level Skills for an Energy Consultant - Residential & Light Commercial
    10. Advanced Skills for an Energy Consultant - High-Rise, Multi-Family, Heavy Commercial, Process / Manufacturing, Refrigerated Warehouses, Institutional, OSHPD
    11. Industry Trade Organization for Energy Consultants - CABEC, Certified Energy Analyst (CEA)
    12. Intro to Special Programs: CTCAC, CDLAC, CUAC, NSHP, MASH, SASH, EUCA, CAHP, CMFNH, Build It Green, LEED
    13. Navigation Skills for Study and Energy Efficiency Research
2. Fundamentals of Compliance Software
    1. CEC Approved Compliance Software - CBECC, EnergyPro, IES VE, RightEnergy T24, Simergy
    2. 2D vs. 3D modeling
    3. Alternative Calculation Method (ACM) Manuals - Residential and Non-Residential
    4. User's Manuals and Software Support
    5. Special Features and Modeling Assumptions
    6. Heat Transfer
    7. Time Dependent Valuation (TDV)
    8. Basic Requirements of all programs
    9. Collecting Input Data
    10. Modeling the Building
    11. Generating Reports
3. Basic EnergyPro
    1. Tutorial of EnergyPro Features & Functions / Learning the Program / Defaults
    2. Calculations
    3. Reports
    4. Lab Assignment: Build a skeleton model without respect to data
4. Take-Offs - Data Collection & Mark-Up
    1. Identifying Plan Set Sheets and Locating Pertinent Data
    2. Project Data
    3. Climate Zone / Weather File
    4. Construction Types - Opaque Surfaces, Fenestration, DHW, HVAC
    5. The Building Tree
    6. Lab Assignment: Demonstrate Blueprint/Plan Set Reading Skills and Mark-Up
       Input specified data into project file
5. Take-Offs - Walls
    1. Identifying the envelope and thermal barriers
    2. Identifying zones
    3. Determining Conditioned Floor Area (CFA)
    4. Roof and Floors
    5. Building an Excel Wall Schedule
    6. Lab Assignment: Take-off Wall Dimensions and Build a Wall-Schedule
       Input the Walls into the model
6. Take-Offs - Fenestration - Windows/Skylights/Exterior Doors
    1. Identifying fenestration for energy modeling
    2. Determining Window Values - NFRC, Defaults, COG
    3. Window Sizing and Call-Outs

4. Overhangs and sidefins
5. Building an Excel Window Schedule
6. Lab Assignment: Take-Off Fenestration and Build a Window Schedule
   Input the windows into the model

7. DHW / HVAC / Mechanical
   1. Identify Mechanical Components
   2. Mechanical Input Instructions
   3. Lab Assignment: Input DHW / HVAC / Mechanical into the model
8. HERS Modeling & Renewables
   1. Types of HERS Measures
   2. HERS Triggers
   3. Compliance Effect of HERS Measures
   4. Solar PV and Renewables
   5. HERS Provider Registration Process
   6. Lab Assignment: Run multiple "what-if" calculations; Input into Model
9. Prescriptive Practice
   1. Prescriptive Compliance and the Standard Reference Model
   2. Lab Assignment: Input/compare Prescriptive Exercises
10. Compliance
    1. Analyzing the report, understanding and locating input errors
    2. Making Recommendations
    3. Lab Assignment: Compliance Problem Solving Exercises
11. Commercial Lighting - Indoor
    1. Mandatory Lighting / Controls / Demand Response
    2. Daylighting / Skylit / Sidelit
    3. Complete Building, Area Category, and Tailored Category Methods
    4. Lighting Power Density (LPD)
    5. Compliance Forms
    6. Lab Assignment: Calculate LPDs; Input Basic Lighting Model
12. Commercial Outdoor Lighting
    1. Mandatory Lighting / Controls / Zones
    2. Lighting Compliance Triggers
    3. Parking Lots / Hardscape / Landscape
    4. Lab Assignment: Identify and Calculate Lighting Requirements for Compliance
13. Report Analysis
    1. Reading / Analyzing the Report
    2. Forms and Form Generation

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

1. Use EnergyPro, Energy Plus, and department of energy compliance software to model building's energy compliance
   1. Tutorial of EnergyPro Features & Functions / Learning the Program / Defaults
   2. Calculations
   3. Reports
   4. Lab Assignment: Build a skeleton model without respect to data
2. Take-Offs - Data Collection & Mark-Up
   1. Identifying Plan Set Sheets and Locating Pertinent Data
   2. Project Data
   3. Climate Zone / Weather File
   4. Construction Types - Opaque Surfaces, Fenestration, DHW, HVAC
   5. The Building Tree
   6. Lab Assignment: Demonstrate Blueprint/Plan Set Reading Skills and Mark-Up
3. Produce professional energy reports using sketching and excel software.

9. Course Student Learning Outcomes:
   1.
   Understand the heat transfer characteristics of building construction assemblies and how they perform, both individually and as an integrated part of a whole building system.

   2.
   Describe energy compliance software approved by the California Energy Commission (CEC).

   3.

   Use energy terminology appropriately when discussing energy trades offs.

   4.
   Understand the dangers of not back checking and scaling final energy calculation results.

   5.
   Explain the two common building design methods, prescriptive and performance to comply with California energy code.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Describe the technics and methods necessary to show compliance with the California Energy Standards.
    b. Describe the energy modeling features of a building, including their characteristics and function.
    c. Describe the heat transfer characteristics of building construction assemblies and how they perform, both individually and as an integrated part of a whole building system.
    d. Collect and analyze building and energy efficiency data from plan set take-offs or on-site field inspections.
    e. Determine if the proposed building construction, design, and installation meet mandatory code requirements.
    f. Describe energy compliance software approved by the California Energy Commission (CEC).
    g. Demonstrate the energy modeling skills needed to create a computer generated certified energy analysis report.
    h. Make sound recommendations for energy efficient and cost-effective building design.
    i. Determine needed compliance documents for various project scenarios and provide needed information for completion, submission, and registration.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Activity
    b. Collaborative/Team
    c. Demonstration, Repetition/Practice
    d. Discussion
    e. Laboratory
    f. Lecture
    g. Participation
    h. 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: 180.00
    a. In-class Assignments

1. Collect and analyze building and energy efficiency data from plan set take-offs or on-site field inspections

2. Determine if the proposed building construction, design, and installation meet mandatory code requirements

3. Reading assigned chapters.

4. Class discussion.

5. Group interaction and presentation.

6. Evaluate industry.

7. Make sound recommendations for energy efficient and cost-effective building design

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.

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

Locate questions and problems as a result of conversation, reading, and lectures
Value open-mindedness.
Communicate meaningfully with others.

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 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. California has acknowledged the shortage of qualified and available work force to meet these new mandates. Residential Energy Modeling, the course is designed to develop the highly trained technical workforce necessary to meet the goals of the California Energy Efficiency Strategic Plan (CEESP). This course covers computer modeling methods, using compliance software as approved by the California Energy Commission (CEC), to show performance compliance with the California Building Energy Efficiency Standards, and as specified in the Alternative Calculation Methods (ACM) Reference Manuals.

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]: 0000.00 -
    c. Credit Status [CB04]: *N/A*
    d. Course Transfer Status [CB05]: *N/A*
    e. Basic Skills Status [CB08]: *N/A*
    f. Vocational Status [CB09]: *N/A*
    g. Course Classification [CB11]: *N/A*
    h. Special Class Status [CB13]: *N/A*
    i. Course CAN Code [CB14]: *N/A*
    j. Course Prior to College Level [CB21]: *N/A*
    k. Course Noncredit Category [CB22]: *N/A*
    l. Funding Agency Category [CB23]: *N/A*
    m. Program Status [CB24]: *N/A*

    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 Ramiro Galicia Origination Date 09/25/16