

Course Outline of Record

1. Course Code: ESYS-006
2.
 - a. Long Course Title: Fundamentals of Building Commissioning
 - b. Short Course Title: BLDG COMMISSIONING
3.
 - a. Catalog Course Description:
 Building Commissioning (Cx) is the process of verifying that a building's systems operate as intended. Commissioning Technicians (CxT) and Commissioning Agents (CxA) work in a team environment, coordinating directly with architects, engineers, subcontractors, and the building owner to oversee, examine, and verify that the building systems are designed, installed, and tested according to the project's design specifications. This introductory course focuses on how the building commissioning process is applied to new and existing buildings. Students will learn the fundamentals of the commissioning process through each step of a construction project – from predesign to occupancy and operations.
 - b. Class Schedule Course Description:
 This introductory course focuses on how the building commissioning process is applied to new and existing buildings. Students will learn the fundamentals of the commissioning process through each step of a construction project – from predesign to occupancy and operations.
 - c. Semester Cycle (if applicable): Spring
 - d. Name of Approved Program(s):
 - ENERGY SYSTEMS TECHNOLOGY Certificate of Achievement
4. Total Units: 3.00 Total Semester Hrs: 72.00
 Lecture Units: 2.5 Semester Lecture Hrs: 45.00
 Lab Units: 0.5 Semester Lab Hrs: 27.00
 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 (CCForm I-A)
 Advisory: ACR 075
 Advisory: ESYS 004
 Prerequisite: ACR 090 or concurrent enrollment
 Prerequisite: ARCH 011
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
 - a. Shadpour, Frank (2012). Fundamentals of HVAC Direct Digital Control (3rd/e). Hacienda Blue. ISBN: 9780970447135
 College Level: Yes
 Flesch-Kincaid reading level: 11.8
 - b. Energy Pro. Energy Soft, (7th/e).
7. Entrance Skills: *Before entering the course students must be able:*
 - a.
 Use the appropriate ACCA Manual to determine the load factors and use the standard estimate form.
 - ACR 075 - Use the appropriate ACCA Manual to determine the load factors and use the standard estimate form.
 - 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.

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c.

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

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

d.

Apply the basic operations to solve application problems.

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

e.

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.

f.

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.

g.

Present the history of control systems

- ACR 090 - Explain the history of control systems.

h.

Adjust or repair pneumatic transmitters and receiver controllers.

- ACR 090 - Perform adjustments or repairs on pneumatic transmitters and receiver controllers.

i.

Adjust or repair pneumatic sensors and controlled devices final

- ACR 090 - Perform adjustments or repairs on pneumatic sensors and controlled devices final.

j.

Compare Analog vs. Digital.

- ACR 090 - Compare analog vs. digital control signals.

k.

Demonstrate the ability to recognize the appropriate use of standard conventions and symbols used in the design professions.

- ARCH 011 - Demonstrate the ability to recognize the appropriate use of standard conventions and symbols used in the design professions.

l.

Demonstrate the ability to draw appropriate solutions of assigned construction details.

- ARCH 011 - Demonstrate the ability to draw appropriate solutions of assigned construction details.

m.

Demonstrate the ability to use the in-class library resources to evaluate the appropriate response to construction details.

- ARCH 011 - Demonstrate the ability to use the in-class library resources to evaluate the appropriate response to construction details.

n.

Demonstrate an understanding of a complete set of working drawings.

- ARCH 011 - Demonstrate an understanding of a complete set of working drawings.

8. Course Content and Scope:

Lecture:

- A. Building Commissioning
 - 1. Essentials of building commissioning
 - 2. Maximizing the value of building commissioning
 - 3. HVAC system commissioning
 - 4. Costs and benefits of building commissioning
- B. Background
 - 1. Ethics and sustainability
 - 2. Basic concepts and vocabulary
 - 3. Major environmental and resource concerns
- C. Indoor Environmental Quality
 - 1. IEQ issues
 - 2. Indoor environmental factors
 - 3. HVAC systems
 - 4. Building materials
 - 5. Best practices for IAQ.
- D. Building assessment
 - 1. Building assessment standards
 - 2. LEED certification process
 - 3. International building assessment systems

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

- 1. Application of construction safety procedures and equipment.
- 2. Application of electrical multimeters.
- 3. Measurement of airflow with industry recognized tools.
- 4. Adjust building control simulation training boards.
- 5. Collaboration with multimedia tools. (i.e. teleconferencing)

9. Course Student Learning Outcomes:

- 1.
Explain the process of building commissioning, with distinctions between new and existing buildings.
- 2.
Describe the building system fundamentals.
- 3.
Explain commissioning terminologies.

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

- a. Commission and air distribution system.
- b. Perform a commissioning on an air distribution fan.
- c. Determine the speed, amperage, voltage and wattage of a air distribution supply fan.
- d. Explain and perform commissioning and balance of a chilled water system.
- e. Explain and perform commissioning and balance of a condenser water system.
- f. Determine the operating characteristics of a cooling tower, including wet bulb, dry bulb, fan speed, Relative humidity.
- g. Determine the operating characteristics of the boiler operation and efficiency.
- h. Determine and explain the operation of a Variable Frequency Drive on all fans and pumps.
- i. Determine the operation and functionality of the Energy Management System
- j. Perform calculations and inspections to determine the building envelope infiltration and ex filtration.

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. Role Playing
- 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: 90.00

a. In-class Assignments

1. Each homework project requires an analysis by the student of the commissioning process. This is a written explanation of how the commissioning process accomplishes a specific task. The student also is required to determine which commissioning remedy will yield the most efficient results, in which there could be several right answers, constantly making decisions based on "critical thinking".
2. Review Associated Air-Balance Council Commissioning Group (ACG) Commissioning guidelines.
3. Review assigned textbook.

b. Out-of-class Assignments

1. Students will visit a building of their choice and perform a preliminary inspection and make suggestions for energy upgrades that would ultimately require commissioning.
2. End of chapter review questions.
3. Terminology

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

- Written homework
- Critiques
- Portfolios
- 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

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.

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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.

Conduct research, gather and evaluate appropriate information, organize evidence into oral and written presentation, using proper MLA, APA, and other discipline-specific formats to cite sources.

16. Comparable Transfer Course

University System	Campus	Course Number	Course Title	Catalog Year
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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:

Per approval of Energy Industry Advisory Committee

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]: CCC000575155

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: 20

Third Year: 30

24. Resources - Faculty - Discipline and Other Qualifications:

a. Sufficient Faculty Resources: Yes

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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 04/04/16