COLLEGE OF THE DESERT

Course Code ACR-091

Course Outline of Record

1. Course Code: ACR-091
2. a. Long Course Title: Advanced Building Control Networks
   b. Short Course Title: ADVANCED BLDG CONTRL
3. a. Catalog Course Description:
   Building Control Network implementations and protocol standards including web based applications, Building Automation and Control Networks (BACnet), local operating network (LonTalk), and proprietary Zero Net Energy (ZNE) monitoring systems will be introduced. BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO 16484-5 standard [1] protocol. LonTalk is a networking platform specifically created to address the needs of control applications. Routers, installation, and troubleshooting will also be studied.
   b. Class Schedule Course Description:
   Advanced Building Controls. Energy(ZNE)monitoring systems. Routers, installation, and troubleshooting will also be studied.
   c. Semester Cycle (*if applicable*): *N/A*
   d. Name of Approved Program(s):
   - AIR CONDITIONING AND REFRIGERATION AS Degree for Employment Preparation
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: 27 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 004
   Advisory: ENG 070
   Prerequisite: ACR 090 or corequisite
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. International Pipe Trades Joint Training Committee (2014). *Building in Controls* (First/e). Annapolis American Technical Publisher. ISBN: 9780826920249
   College Level: Yes
   Flesch-Kincaid reading level: 11.2
   b. ASHRAE. Standard 135-2008 -- BACnet® . A Data Communication Protocol for Building Automation and Control Networks (ANSI Approved), . ASHRAE , 01-01-2009.
7. Entrance Skills: *Before entering the course students must be able:*
   a.
   Demonstrate the ability to generate, develop and organize ideas into a cohesive essay using multiple paragraphs.
   - ENG 070 - Demonstrate the ability to generate, develop and organize ideas into a cohesive essay using multiple paragraphs.

   b.
   Read and identify main ideas and supporting details.
   - ENG 070 - Read and identify main ideas and supporting details.

c.
Recognize and explain patterns of idea development in readings.

- ENG 070 - Recognize and explain patterns of idea development in readings.

d.
Identify and employ transitions and connectors to show unity between ideas.

- ENG 070 - Identify and employ transitions and connectors to show unity between ideas.

e.
Demonstrate through the writing process the ability to apply standard rules of grammar, punctuation and spelling in academic writing.

- ENG 070 - Demonstrate through the writing process the ability to apply standard rules of grammar, punctuation and spelling in academic writing.

f.
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.

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

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

h.
Apply the basic operations to solve application problems.

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

i.
Present the history of control systems.

- ACR 090 - Explain the history of control systems.

j.
Adjust or repair pneumatic transmitters and receiver controllers.

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

k.
Adjust or repair pneumatic sensors and controlled devices final.

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

l.
Adjust or repair digital controllers.

- ACR 090 - Perform adjustments or repairs on digital controllers.

m.
Adjust air distribution control components.

- ACR 090 - Perform adjustments on air distribution control components.

n.
Adjust or repair digital sensors and final controlled devices.

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

o.

Compare Analog vs. Digital

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

8. Course Content and Scope:

Lecture:

1. Introduction To Building Control
    1. What is BACnet
    2. BACnet application layer
    3. BACnet objects and services
    4. What is LonWorks
2. Control Concepts
3. Modern Control Concepts
4. Network Data Communications
5. Electrical System Control Systems
6. HVAC Systems Energy Source
7. HVAC Systems Control Devices
8. Plumbing Systems Controls
9. Automate Building Operation
10. System Integration

a. BACnet network, data link, and physical layer

1. Trends In Building Automations
2. Proprietary systems

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

1. Operating pneumatic inputs and outputs.
2. Applying pneumatic transmitters and receiver controllers.
3. Calibrating thermostats.
4. Setting up, calibrating and operating control systems.
5. Analyzing air distribution.
6. Practice control failures with control simulators.
7. Practice controlling valves and dampers by adjusting multiple parameters.

9. Course Student Learning Outcomes:

1.
Identify various control networks to be able to cross reference hardware between networks during service calls or installation.

2.
Compare and contrast applications and uses of BACnet and LonWorks. The student will then be able to explain the limitations of both to current and future clients.

3.
Evaluate equipment selections to determine if the equipment will meet the control requirements set by the client.

4.
Define and use control network terminology. The student will be able to interact and carry a technical discussion with control engineers and building owners effectively.

5.

Evaluate the effectiveness of control networks to determine if a better network or upgrades on the

network are needed.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Identify various control networks.
    b. Describe the Ethernet
    c. Compare and describe proprietary systems
    d. Describe BACnet
    e. Describe BACnet application layers
    f. Discuss BACnet objects and services
    g. Describe BACnet network, data link, and physical layer
    h. Describe Native BACnet and gateways
    i. Describe LonWorks network and applications

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Activity
    b. Demonstration, Repetition/Practice
    c. Discussion
    d. Laboratory
    e. Lecture
    f. Participation
    g. Role Playing
    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: 72.00
    a. In-class Assignments

    1.Draw a control diagrams for HVAC systems, Lighting systems and plumbing systems.
    2. Prepare a synopsis, in writing, of the differences between pneumatic and digital control systems.
    3. Reading assigned chapters.
    4. Class discussion.
    5. Group interaction and presentation.
    6. Evaluate industry.
    7. Evaluate industry tools.

    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.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - Laboratory projects
    - 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.
IO - Critical Thinking and Communication
Summarize, analyze, and interpret oral and written texts, with the ability to identify assumptions and differentiate fact from opinion.

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:

Advanced Building Control Networks course is designed to develop the highly trained technical workforce necessary 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. The course will cover energy efficient maintenance and repair of automation controls which are mandated by California 2013 energy code and necessary to monitor and keep energy consumption low.

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]: CCC000578626
b. T.O.P. Code [CB03]: 94600.00 - Environmental Control Tec
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)*: AIR CONDITIONING AND REFRIGERATION

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 09/05/16