COLLEGE OF THE DESERT

Course Outline of Record

1. Course Code: ACR-090
2.   a. Long Course Title: Building Automation Fundamentals
      b. Short Course Title: BLDG AUTOMATION FUND
3.   a. Catalog Course Description:

   Basics of commercial HVAC control theory as it applies to electric, pneumatic, and digital control systems. Principles of chiller plant operation, air distribution, variable air volume (VAV), constant air systems, and multizone systems are discussed. A lab uniform is required for this course.

      b. Class Schedule Course Description:

   Basics of commercial HVAC controls. A lab uniform is required for this course.

      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: RDG 061

   Advisory: ESYS 004

6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*

      a. Auvil,Ronnie j. (2013). *HVAC Control Systems* (Third /e). Orland Park American Technical Publishers.
   ISBN: 9780826907646
   College Level: Yes
   Flesch-Kincaid reading level: 11.5

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:

Control Principles
1. Control Systems History
2. Commercial Building Control Systems
3. Self-Contain Control systems
4. Electrical Control Systems
5. Automated Controls Systems
Pneumatic Actuators, Dampers and Valves
1. Actuators
2. Damper Construction and Linkage
3. Damper Maintenance
4. Valve Sizing and Selection
Pneumatic Thermostats, Humidistats, and Pressure Switches
1. Pneumatic Thermostats Operation
2. Deadband Control
3. Pneumatic Humidistat
4. Pneumatic Pressure Switch
Pneumatic Transmitters
1. Pneumatics Transmitter Range
2. Room Temperature Transmitter
3. Pipe Pressure Transmitters
4. Proportional/ Integral Control
Pneumatic Receiver Controllers
1. Remote Bulb Controller
2. Receiver Controller Operation
3. Piping lengths Requirement
Building Automation Systems and Controllers
1. Central Supervisory Control Systems
2. Central- Direct Digital Control Systems
3. Building Automation Control Systems
4. Universal Input- Output Controller

5. Network Communication Modules
6. Interface Modules

Operator Interfaces
1. On-Site Operation Interface
2. On-Site Desktop PCs
3. Off Site Portable Terminals
4. Smart Phones Interface

Building Automation System Inputs and Outputs
1. Analog Inputs and Outputs
2. Digital Inputs and Outputs
3. Temperature Sensors
4. Humidity Sensors
5. Light Sensors
6. Flow Switches

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

9. Course Student Learning Outcomes:

1.
Define the common terms related to pneumatic and digital controls.

2.
Compare and contrast pneumatic and digital control systems.

3.
Design and construct pneumatic control systems.

4.
Compare and contrast processing plant applications.

5.
Demonstrate the application of controlled devices.

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Explain the history of control systems.
    b. Perform adjustments or repairs on pneumatic transmitters and receiver controllers.
    c. Perform adjustments or repairs on pneumatic sensors and controlled devices final.
    d. Describe air compressor stations and the need for air dryers.
    e. Perform adjustments or repairs on digital controllers.
    f. Explain the application of controls in a processing plants.
    g. Perform adjustments on air distribution control components.
    h. Perform adjustments or repairs on digital sensors and final controlled devices.
    i. Describe transmission signals.
    j. Compare analog vs. digital control signals.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Collaborative/Team

    b. <u>Demonstration, Repetition/Practice</u>
    c. <u>Discussion</u>
    d. <u>Laboratory</u>
    e. <u>Lecture</u>
    f. <u>Role Playing</u>

12. Assignments: *(List samples of specific activities/assignments students are expected to complete both in and outside of class.)*
In Class Hours: <u>90.00</u>
Outside Class Hours: <u>72.00</u>
    a. In-class Assignments

> 1. Draw a diagram of the piping of a 3-way mixing valve on a heating coil. Include the identity of all ports. Assume the controller is reverse acting.
> 2. Prepare a synopsis, in writing, of the differences between pneumatic and digital control systems.
> 3. Class discussion.
> 4. Group interaction and presentation.
> 5. Evaluate industry.
> 6. Evaluate industry tools.

    b. Out-of-class Assignments

> 1. Assemble a basic pneumatic system to control water flow based on a given set point.
> 2. Read assigned text.
> 3. Industry journal entry.
> 4. Assigned worksheets.
> 5. Evaluate an energy bill.
> 6. Evaluate energy rebates and incentives.
> 7. Prepare for in-class discussions on specific energy topics.
> 8. Read assigned case studies.
> 9. Review end of chapter questions.
> 10. Define vocabulary terms.

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
- Computational/problem solving evaluations
- 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
    <u>Fulfill the requirements for an entry- level position in their field.</u>
    <u>Apply critical thinking skills to execute daily duties in their area of employment.</u>
    <u>Apply critical thinking skills to research, evaluate, analyze, and synthesize information.</u>
    <u>Display the skills and aptitude necessary to pass certification exams in their field.</u>
PO-BS Problem Solving
    <u>Use a variety of solution methods and techniques, for example, making a sketch, systematic listing, using the solution of a simpler (but related) problem.</u>
    <u>Recognize that a solution may not be possible, given limits of time, money, or other finite resources.</u>
    <u>Restate (formulate) a problem mathematically.</u>
    <u>Use background information in a subject to understand the nature of a problem and transfer information to new</u>

problems accordingly.

Identify what isn't known, but needs to be known in order to solve a problem (depending on the problem domain, reading and/or mathematical skills are helpful).

IO - Personal and Professional Development

Self-evaluate knowledge, skills, and abilities.

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 advisory from English to Reading

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]:　CCC000578628
    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]:　Possibly 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:　50

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 George Brown   Origination Date 10/24/17