COLLEGE OF THE DESERT

Course Code ACR-075

Course Outline of Record

1. Course Code: ACR-075
2. a. Long Course Title: HVACR Systems Design
   b. Short Course Title: SYSTEMS DESIGN
3. a. Catalog Course Description:
   Presents current industry practices for quality installation and design of residential air distribution systems as well as calculating heating and cooling loads to properly select air conditioning and heating systems.
   b. Class Schedule Course Description:
   Residential air distribution design and load calculation.
   c. Semester Cycle (*if applicable*): *N/A*
   d. Name of Approved Program(s):
   - AIR CONDITIONING AND REFRIGERATION Certificate of Achievement
   - AIR CONDITIONING AND REFRIGERATION AS Degree for Employment Preparation
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: 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: ACR 060
6. Textbooks, Required Reading or Software: *(List in APA or MLA format.)*
   a. Stanfield,C.,Skaves,D. (2013). *AHRI-Fundamentals of HVACR-ACR 075 SYSTEMS DESIGN* (Second/e). New Jersey Pearson. ISBN: 9781323347119
   College Level: Yes
   Flesch-Kincaid reading level: *N/A*
7. Entrance Skills: *Before entering the course students must be able:*
   a. History, overview of refrigeration and air conditioning industry, career opportunities, and field entry level requirements.
   - ACR 060 - Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.

   b. Heat, heat transfer and measurement of heat.
   - ACR 060 - Explain the operation of the mechanical refrigeration cycle.

   c. Mechanical refrigeration cycle.
   - ACR 060 - Explain the operation of the mechanical refrigeration cycle.

   d. Operation, refrigerant state changes, heat flow, pressure division and refrigerant flow.
   - ACR 060 - Explain the operation of the mechanical refrigeration cycle.

   e. Components including compressors, evaporators, condensers, metering devices and refrigerants.
   - ACR 060 - Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.

   f. Accessory devices and components.
   - ACR 060 - Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.

   g. Types of air conditioning systems.

- ACR 060 - Demonstrate an understanding of the two aspects of comfort air conditioning.

h. Pressure estimating and performance testing.

- ACR 060 - Explain the operation of the mechanical refrigeration cycle.
- ACR 060 - Demonstrate an understanding of the two aspects of comfort air conditioning.
- ACR 060 - Identify the chemical make-up of the refrigerant gasses and their place on the temperature scale.

8. Course Content and Scope:

Lecture:

a. Heat Loss of a Structures
    i. Outside Design Conditions
    ii. Inside Design Conditions
    iii. Design Temperature Difference
    iv. Building Losses
    v. System Losses
b. Heat Loss Calculations
    i. Window and Door Losses
    ii. Wall and Partition Losses
    iii. Ceiling and Roof Losses
    iv. Floors
    v. Ventilation Air and Duct Heat Losses
c. Example Problem – Heat Loss Calculation
d. Heat Gain of a Structure
    i. Outside Design Condition
    ii. Daily Range
    iii. Inside Design Condition
    iv. Design Temperature Difference
    v. Sun Position
    vi. Storage and Building Gains
e. Heat Gain Calculations
    i. Building Component Areas
    ii. Heat Gain through Windows
    iii. Heat Gain through Ceiling and floors
    iv. Sensible Heat Gain
    v. Duct Gains, Insulation, Ventilation
f. Example Problem – Heat Gain Calculation
g. Detailed Infiltration Estimate
h. Layout an air distribution system for specified residential building
i. Size the duct runs to industry accepted velocity and pressure drop standards.
j. Compile a material list for material ordering including duct material, duct fitting and termination devices.
k. Select proper filter size and replacement.
l. Use standard tables and charts to calculate total pressure drop.

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

1. Air flow measurements
2. Computer heat loss and gain simulations
3. Duct evaluation
4. Computer design programs
5. Quality installation practices
6. Selection of equipment
7. Duct layout
8. Blueprint reading and takeoffs
9. Thermal Imaging Cameras and building envelope analyses

9. Course Student Learning Outcomes:

1. Use ACCA Manuals to determine the load factors and use the standard estimating forms to compute the duct size and layout and heating/cooling load requirements.

2. Specify appropriate air conditioning equipment for the assigned application.
3.
Utilize Load calculation software to properly size Equipment and design a duct System

10. Course Objectives: *Upon completion of this course, students will be able to:*
    a. Survey a residential building to gather information for a heating and cooling load calculation.
    b. Use the appropriate ACCA Manual to determine the load factors and use the standard estimate form.
    c. Compute the heating and cooling load.
    d. Use the load calculation information and manufacturers specifications to select air conditioning equipment for the specified application.
    e. Layout an air distribution system for specified residential or light commercial building.
    f. Size the duct runs to industry accepted velocity and pressure drop standards.
    g. Compile a material list for material ordering including duct material, duct fitting and termination devices.
    h. Select proper filter size and replacement.
    i. Use standard tables and charts to calculate total pressure drop.

11. Methods of Instruction: *(Integration: Elements should validate parallel course outline elements)*
    a. Demonstration, Repetition/Practice
    b. Laboratory
    c. Lecture
    d. Participation
    e. Technology-based instruction

    Other Methods:

    Reading assignments Hands on use of measurement instruments

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: 103.50
    a. In-class Assignments

    1. Worksheet for Manual J & D
    2. Blueprint reading and takeoffs
    3. Learn basic use of Wrightsoft HVAC system design software
    4. Project involving sketch of home and doing system analysis and system design

    b. Out-of-class Assignments

    1. Periodic reading assignments
    2. Worksheet for Manual J & D
    3. Chapter review questions
    4. Sketch of home for system design project

13. Methods of Evaluating Student Progress: *The student will demonstrate proficiency by:*
    - True/false/multiple choice examinations
    - Mid-term and final evaluations
      Final exam questions based on textbook and classroom assignments
    - Student participation/contribution

14. Methods of Evaluating: Additional Assessment Information:

    Completion of Worksheet for Manual J & D Completion of lab and computer projects

15. Need/Purpose/Rationale -- *All courses must meet one or more CCC missions.*

PO - Career and Technical Education

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 - Critical Thinking and Communication

Apply principles of logic to problem solve and reason with a fair and open mind.
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:

Periodic review

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]: CCC000513167
    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,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: 25
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.

    Hand held calculator, 3 ring binder, tabs, note paper, pencils, pens, architectural scale, engineering scale, Protractor, duct sizing calculator.
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 02/16/18