

COLLEGE OF THE DESERT

Course Code ACR-060

Course Outline of Record

1. Course Code: ACR-060

2. a. Long Course Title: Air Conditioning & Refrigeration I

b. Short Course Title: AIR CONDNG/REFRG I

3. a. Catalog Course Description:

This course is a basic study of the theory of thermodynamics and heat transfer as applied to mechanical vapor compression refrigeration cycle and system components. Classes include lectures with practical demonstrations and hands-on experience including laboratory projects demonstrate heat transfer theories and vapor compression mechanical system cycle components and accessories.

b. Class Schedule Course Description:

This course is a basic study of thermodynamics, heat transfer, the mechanical vapor compression refrigeration cycle and system components. Classes include lectures with practical demonstrations and hands-on experience including laboratory projects.

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 (CCForm I-A)

Advisory: ENG 070

Advisory: ESYS 004

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

- a. John Tomczyk; Eugene Silberstein, B.A., M.S., BEAP, CMHE; Bill Whitman; Bill Johnson (2017). Refrigeration Air Conditioning Technology (8th/e). Boston, MA 02210 Cengage Learning. ISBN: 9781305578296

College Level: Yes

Flesch-Kincaid reading level: 11.1

7. Entrance Skills: *Before entering the course students must be able:*

a. Compose simple, organized responses to readings.

- ENG 070 - Comprehend and summarize readings.
- ENG 070 - Read and identify main ideas and supporting details.

b. Demonstrate the ability to participate in class discussions and assigned projects.

- ENG 070 - Improve editing and revision strategies both individually and in peer review.

c.

Introduce basic business writing.

- ENG 070 - Introduce basic business writing [letter, resume, email etiquette].

d.

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Describe work completed on an invoice.

- ENG 070 - Demonstrate annotation skills for improving understanding.
- ENG 070 - Construct sentences that demonstrate variety and effective word choice, using mostly college level diction.
- e. Understand the four basic operations of addition, subtraction, multiplication, and division on the whole numbers, integers, and rational numbers.
 - ESYS 004 - Demonstrate proficiency in basic number facts (addition, subtraction, multiplication, division).
 - ESYS 004 - Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers.
- f. Apply the order of operations to simplify expressions involving several operations.
 - ESYS 004 - Apply the order of operations to simplify expressions involving several operations.
- g. Understand the use of whole number exponents and compute with them.
 - ESYS 004 - Compute the value of expressions containing natural number exponents.
- h. Understand the use of rounding and estimation and use these skills to solve problems.
 - ESYS 004 - Employ decimal notation and place value to compare, order, and round numbers.
 - ESYS 004 - Use rounding and estimation skills to solve problems.
- i. Understand 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.
- j. Understand the concept of a ratio and use ratios to solve proportion problems.
 - ESYS 004 - Use the concept of ratio to determine the solution to a proportion problem.
- k. Understand percent and convert between percents, decimals, and fractions.
 - ESYS 004 - Apply methods of conversion between percentages, decimals, and fractions.
- l. Recognize and convert between units of measurements in both the American and metric systems, especially units of length, volume and weight.
 - ESYS 004 - Convert units within the US and metric systems and between the US and metric system units using unit fractions.
- m. Understand and use basic concepts and formulas from geometry, including perimeter, area and volume.
 - ESYS 004 - Apply the order of operations to simplify expressions involving several operations.
 - ESYS 004 - Apply the basic operations to solve application problems.
 - ESYS 004 - Determine the solution to equations involving percentages by deductive reasoning.
 - ESYS 004 - Use unit measure appropriately in applications.

8. Course Content and Scope:

Lecture:

1. History, overview of refrigeration and air conditioning industry, career opportunities, and field entry level requirements.
2. Heat, heat transfer and measurement of heat.
3. Pressure, pressure systems and measurement.
4. Pressure/temperature relationship of refrigerants.
5. Mechanical refrigeration cycle
 1. Operation, refrigerant state changes, heat flow, pressure division and refrigerant flow.
 2. Components including compressors, evaporators, condensers, metering devices and refrigerants.
 3. Accessory devices and components.
6. Types of air conditioning systems.
7. Refrigerant systems.
8. Service procedures and safe use of tools and instruments.
 - i. Leak testing, evacuation and charging.
 - ii. Pressure estimating and performance testing.
1. Silver brazing techniques for copper steel, and brass refrigerant lines and fittings.

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

- a. Identification of copper tube and fittings by size and application.
- b. Safe use of acetylene-air and oxyacetylene brazing torches.
- c. Brazing copper tubing and fittings.
- d. Swaging and flaring copper tubing.
- e. Safe use of refrigerant gauges, manifold, hoses and low-loss fittings.
- f. Use of thermometers.
- g. Leak testing, evacuation and charging.

9. Course Student Learning Outcomes:

1. Discuss safe and efficient operation of residential air conditioning and light commercial refrigeration systems.
2. Analyze critical information and make suggestions for improved operation.
3. Use industry hand tools to perform repairs for service and installation

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

- a. Apply and define the industry vocabulary appropriate to understand and describe any mechanical vapor compression refrigeration system and its operating characteristics to support field service operations.
- b. Explain the operation of the mechanical refrigeration cycle.
- c. Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.
- d. Use tools, equipment and materials to perform silver brazing operations on copper, steel and brass refrigeration lines and fittings.
- e. Describe the significance of a Saturated, superheated and subcooled refrigerant as applied to an operating refrigeration system for the analysis of system performance.
- f. Sketch a refrigeration schematic of an operating single stage refrigeration system and identify all system components, describe and distinguish the refrigerant flow and characteristics in each part of the cycle.

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. Observation
- h. Participation
- i. Technology-based instruction

Other Methods:

Videos/slides/CD presentation

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. Nate core preparation through Utility sponsored website. Student will test for core credential.
2. Student skills inventory to promote critical thinking.
3. Complete laboratory assignments.
4. Delmar Online Training Simulation
5. NATE online preparation for core and or specialty certificate
6. Mind Tap

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b. Out-of-class Assignments

1. Reading assignments.
2. Assign problems and questions appearing in the textbooks.
3. Notebooks
4. Delmar Online Training Simulation
5. NATE online preparation for core and or specialty certificate
6. Mind Tap

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

- Written homework
- Laboratory projects
- Field/physical activity 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:

Skill demonstration lab
work

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.

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
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17. Special Materials and/or Equipment Required of Students:

1. Loose leaf notebook
2. Pocket calculator
3. Temperature/Pressure Chart
4. Superheat/Subcooling Calculator, Carrier GT24-01
5. Safety Glasses
6. Ear Plugs
7. Work Gloves

18. Materials Fees: ☐ Required Material?

Material or Item

Cost Per Unit

Total Cost

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19. Provide Reasons for the Substantial Modifications or New Course:

At our advisory meetings there has been overwhelming support to change the delivery pattern of our courses to support student success by enabling students to take introductory courses at the beginning of each semester. The cohort structure has two 8 Week back to back schedules with the pairing of introductory and advanced level courses at the beginning of each semester and the pairing of two advanced courses in the second half of each semester. This new schedule supports student success by allowing students to start in introductory level courses at the beginning of each semester. These course pairings also support student success by keeping their course load more manageable. They can meet in each course twice a week for 8 weeks allowing them to be focused in only two courses a week rather than 4 separate courses a week and still complete 4 courses in a semester. MATH 60 advisory has been removed and ESYS-004 advisory has been added to help students develop the applied math skills necessary for the trades.

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]: CCC000294355
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: 27

Third Year: 27

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 03/11/16