

Course Outline of Record

1. Course Code: ACR-083
2.
 - a. Long Course Title: All Weather Heating & Cooling Systems
 - b. Short Course Title: ALL WEATHER SYSTEMS
3.
 - a. Catalog Course Description:
Presents current industry practices for year-round conditioned air including air to air heat pumps, geothermal heat pumps, water source heat pumps, electric heat and fuel oil heating.
 - b. Class Schedule Course Description:
Industry practices for All Weather Heating and Cooling Systems.
 - 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 (CCForm I-A)
 Advisory: ACR 060 and/or
 Advisory: ACR 064
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:
-978130557829
 College Level: Yes
 Flesch-Kincaid reading level: 11.1
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. Pressure, pressure systems and measurement.
 - ACR 060 - Explain the operation of the mechanical refrigeration cycle.
 - ACR 060 - Identify the chemical make-up of the refrigerant gasses and their place on the temperature scale.
 - d. Pressure/temperature relationship of refrigerants.
 - ACR 060 - Explain the operation of the mechanical refrigeration cycle.
 - ACR 060 - Identify the chemical make-up of the refrigerant gasses and their place on the temperature scale.
 - e. Mechanical refrigeration cycle.
 - ACR 060 - Explain the operation of the mechanical refrigeration cycle.
 - f. Operation, refrigerant state changes, heat flow, pressure division and refrigerant flow.

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- ACR 060 - Explain the operation of the mechanical refrigeration cycle.
- ACR 060 - Identify the chemical make-up of the refrigerant gasses and their place on the temperature scale.

g. 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.

h. Accessory devices and components.

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

i. Types of air conditioning systems.

- ACR 060 - Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.
- ACR 060 - Demonstrate an understanding of the two aspects of comfort air conditioning.

j. Refrigerant systems.

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

k. Service procedures and safe use of tools and instruments.

- ACR 060 - Use tools, equipment and materials to perform silver brazing operations on copper, steel and brass refrigeration lines and fittings.

l. Leak testing, evacuation and charging.

- ACR 060 - Identify and explain the operation, purpose and construction of the major components found in the mechanical refrigeration cycle.
- ACR 060 - Use tools, equipment and materials to perform silver brazing operations on copper, steel and brass refrigeration lines and fittings.

m. 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.

n. Silver brazing techniques for copper steel, and brass refrigerant lines and fittings.

- ACR 060 - Use tools, equipment and materials to perform silver brazing operations on copper, steel and brass refrigeration lines and fittings.

o.

Read electrical diagrams.

- ACR 064 - Read electrical diagrams.

p.

Use electrical test equipment.

- ACR 064 - Use electrical test equipment.

q.

Troubleshoot electrical circuit.

- ACR 064 - Troubleshoot electrical circuit.

r.

Demonstrate an understanding of how components work together to control A/C equipment.

- ACR 064 - Demonstrate an understanding of how components work together to control A/C equipment.

8. Course Content and Scope:

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Lecture:

- a. Five processes for conditioning air
- b. Add-On Air Conditioning
- c. Phasing two low voltage transformers
- d. Servicing the All Weather System
- e. Reverse cycle refrigeration
- f. Heat Sources for winter
- g. Four Way reversing valves
- h. Air to Air Heat Pump
- i. Coefficient of Performance
- j. Controls
- k. Defrost Cycle
- l. Geothermal heat pump classifications
- m. Close loop, ground loop, water to water heat exchange systems
- n. Oil fired furnaces
- o. Hydronic heating

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

- a. Controls checkout for all weather systems
- b. Air Source heat pump operation
- c. Water Source heat pump operation
- d. Familiarization with all weather components
- e. Trouble shooting all weather systems
- f. Heat Pump performance check
- g. Auxiliary and Emergency heat check out
- h. Using computer simulations for diagnosing all weather problems

9. Course Student Learning Outcomes:

1. Describe the safe and efficient operation of all weather systems.
2. Maintain all weather systems.
3. Diagnose and repair all weather systems.
4. Identify appropriate installation of all weather systems.

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

- a. Describe the operation of all weather cooling and heating systems
- b. Use diagnostic tools to determine proper operation of all weather systems
- c. Make repairs to all weather systems
- d. Perform routine maintenance on all weather systems

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

- a. Demonstration, Repetition/Practice
- b. Laboratory
- c. Lecture
- d. Technology-based instruction

Other Methods:

Reading assignments Computer simulation programs 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: 90.00

a. In-class Assignments

1. Periodic reading assignments
2. Lab projects

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- 3. Computer exercises
- 4. Sill checks
- 5. NATE online preparation for core and or specialty certificate

b. Out-of-class Assignments

- 1. Periodic reading assignments
- 2. Review Questions
- 3. Computer exercises
- 4. NATE online preparation for core and or specialty certificate

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

- Laboratory projects
 - Completion of lab and computer projects
- True/false/multiple choice examinations
- Mid-term and final evaluations
- Student participation/contribution

14. Methods of Evaluating: Additional Assessment Information:

Completion of lab and computer projects

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 |
|--------------------------|---------------|----------------------|---------------------|---------------------|

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]: CCC000513172
- b. T.O.P. Code [CB03]: 94600.00 - Environmental Control Tec

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- 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.

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: No

1. John Tomczyk; Eugene Silberstein, B.A., M.S., BEAP, CMHE; Bill Whitman; Bill Johnson. *Refrigeration Air Conditioning Technology*, 8th ed. Boston, MA 02210: Cengage Learning, 2017, ISBN: 9781305578296.

28. Originator George Brown Origination Date 03/31/16