

Course Outline of Record

1. Course Code: ACR-077
2.
  - a. Long Course Title: Energy Conservation Methods for HVACR
  - b. Short Course Title: ENERGY CONSERVATION
3.
  - a. Catalog Course Description:
 

Presents current industry practices for auditing energy losses in residential and light commercial buildings. Methods of conserving energy and sustaining natural resources are presented. Blower door diagnostics are featured. A lab uniform is required for this course.
  - b. Class Schedule Course Description:
 

Methods for conservation of energy in HVACR applications. 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: 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
6. Textbooks, Required Reading or Software: (List in APA or MLA format.)
  - a. Krigger, John (2012). Residential Energy Cost Savings and Comfort for Existing Buildings (6th /e). Saturn. ISBN: 9781880120231  
 College Level: Yes  
 Flesch-Kincaid reading level: 12th
  - b. Chitwood, Rick (2012). Measured Home Performance (ver. 2/e). Mt. Shasta, CA Gas Technology Institute. College Level: Yes  
 Flesch-Kincaid reading level: 12
  - c. "2013 Building Energy Efficiency Standards." CALIFORNIA ENERGY COMMISSION 07-05-1905.
  - d. CALIFORNIA ENERGY COMMISSION "2013 Reference Appendices." CALIFORNIA ENERGY COMMISSION 07-05-1905.
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 - Explain the operation of 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.
    - ACR 060 - Demonstrate an understanding of the two aspects of comfort air conditioning.
  - b. Heat, heat transfer and measurement of heat.
    - ACR 060 - Explain the operation of the mechanical refrigeration cycle.
    - ACR 060 - Demonstrate an understanding of the two aspects of comfort air conditioning.

## c. Pressure, pressure systems and measurement.

- 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 - 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.

- 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 - Explain the operation of the mechanical refrigeration cycle.
- 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.

## 8. Course Content and Scope:

### Lecture:

1. Ethics and Customer Relations
2. Energy Consumption and Quality Control
3. Inspecting the Building Shell
4. Diagnosing Shell Air Leakage
5. Evaluating Heating and Cooling Systems
6. Evaluating Base Load
7. Evaluating Windows, Doors and Exterior Insulation
8. Analyzing Facility Health and Safety
9. Blower Door Testing
10. Duct Leakage Testing
11. Cooling Coil Airflow Verification
12. Fan Efficacy Testing
13. Static Pressure Reading
14. Combustion Safety as per BPI Standards

# ACR 077-Energy Conservation Methods for HVACR

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

1. Instrument and Tool familiarization
2. Measuring Energy Consumption
3. Inspecting the Building Shell
4. Diagnosing Shell Air Leakage
5. Evaluating Heating and Cooling Systems
6. Evaluating Base Load
7. Evaluating Windows, Doors and Exterior Insulation
8. Analyzing Facility Health and Safety
9. Blower Door Testing
10. Duct Leakage Testing
11. Cooling Coil Airflow Verification
12. Fan Efficacy Testing
13. Static Pressure Reading
14. Combustion Safety as per BPI Standards

## 9. Course Student Learning Outcomes:

1.  
Measure energy losses due to duct leakage.
2.  
Identify area and amount of energy losses.
3.  
Identify appropriate steps to remedy energy losses.

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

- a. Survey a building to gather information on energy losses
- b. Measure and analyze facility energy consumption
- c. Compute costs of energy losses
- d. Make recommendations for energy conservation
- e. Use blower-door test equipment to evaluate building envelope leakage
- f. Use Duct blaster test equipment to evaluate duct leakage
- g. Perform refrigerant charge verification test using proper tools and analysis.
- h. Cooling Coil Airflow Verification, Fan Efficacy Testing, Static Pressure Reading, Combustion Safety as per BPI Standards

## 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<br>3. Computer exercises |
|--|

b. Out-of-class Assignments

- |   |
|---|
| 1. Periodic reading assignments<br>2. Lab projects<br>3. Computer exercises<br>4. Sketch home and gather information for energy audit<br>5. Homework Review questions |
|---|

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

- Laboratory projects
  - Completion of lab and computer projects
- Group activity participation/observation
- Product/project development evaluation
- True/false/multiple choice examinations
- Mid-term and final evaluations
- Student participation/contribution

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.

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:

Update course to include uniform costs.

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

# ACR 077-Energy Conservation Methods for HVACR

- a. Course Control Number [CB00]: CCC000513169
- 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: 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: Yes

28. Originator Ramiro Galicia Origination Date 05/05/17