

### Definition

Air Conditioning and Refrigeration is a constantly changing, self gratifying program designed to satisfy the mechanically oriented person. The goal of the AC&R program is to provide entry level skills in the rapidly growing service industry. A student may specialize in either air conditioning or refrigeration. A combination of both is recommended.

### Staff

To access faculty and staff, dial (661) 722-6300, then the 4-digit extension.

Dean:

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Administrative Assistant:

Mari-Ali Baiza ext. 6327

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Adjunct Faculty:

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	V.M.
Robert Nemita	2521
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### Program Description

The program is built on the block principle with refrigeration divided into domestic and commercial, and air conditioning divided into residential and commercial. Alternate energy concepts are included in the commercial refrigeration and residential air conditioning courses. State of the art electronics, as used in this industry, is included in the commercial air conditioning course. Students perform tests and repairs on actual equipment as well as built-up trainers. Field trips to various course-related installations are taken, familiarizing students with actual application.

Students must receive a minimum grade of “C” or better in all required core courses and the specific courses listed as program electives in order to qualify for the degree or certificate.

### Career Options

- AC&R Contractor
- Dispatcher
- Manufacturers Service Representative
- Sales Engineer
- Service Engineer
- Service Manager

### Service Technician

(Some of these careers may require education beyond the two-year college level.)

### Program Learning Outcomes

#### Refrigeration Specialist

1. Install, analyze, diagnose and repair refrigeration equipment using proper hand-tools, meters, gauges and test instruments.
2. Demonstrate proper refrigerant handling techniques in recovery, recycling and reclamation when installing, repairing and removing refrigeration equipment.
3. Analyze systems and components for proper installation, operation and efficiency.
4. Analyze prints and drawings including mechanical and electrical schematics and pictorials for job specifications, equipment location and diagnostics.
5. Diagnose and facilitate repair to the smallest repairable unit on a refrigeration unit.

#### Air Conditioning Specialist

1. Install, analyze, diagnose and repair refrigeration equipment using proper hand-tools, meters, gauges and test instruments.
2. Demonstrate proper refrigerant handling techniques in recovery, recycling and reclamation when installing, repairing and removing refrigeration equipment.
3. Analyze systems and components for proper installation, operation and efficiency.
4. Analyze prints and drawings including mechanical and electrical schematics and pictorials for job specifications, equipment location and diagnostics.
5. Diagnose and facilitate repair to the smallest repairable unit on a refrigeration unit.

### Certificate Programs

The air conditioning and refrigeration curriculum is designed to provide pre-employment instruction in the manipulative skills, technical knowledge, and related trade information which will prepare the student for employment in the air conditioning and refrigeration industry.

#### Refrigeration Specialist

The following courses (20 units) are required for the certificate.

Required Courses:	units
ACRV 115, Basic Refrigeration Systems and Controls <i>or</i>	
ACRV 112, Basic Refrigeration Systems <i>and</i> ACRV 113, Basic Refrigeration Controls**	10
ACRV 212, Commercial Refrigeration Systems <i>and</i>	
ACRV 213, Commercial Refrigeration Controls**	10
<b>Total</b>	<b>20</b>

For a recommended plan of study for the certificate, please refer to the Associate Degree plan minus the general education requirements.

\*\*These courses intended for night students.

## Air Conditioning Specialist

The following courses (20 units) are required for the certificate.

Required Courses:	units
ACRV 125, Residential Air Conditioning Systems and Controls <i>or</i> ACRV 122, Residential Air Conditioning Systems <i>and</i> ACRV 123, Residential Air Conditioning Controls**	10
ACRV 222, Commercial Air Conditioning Controls and ACRV 223, Commercial Air Conditioning Systems**	<u>10</u>
<b>Total</b>	<b>20</b>

For a recommended plan of study for the certificate, please refer to the Associate Degree plan minus the general education requirements.

## Air Conditioning–Refrigeration Specialist

A certificate in Air Conditioning-Refrigeration Specialist may be earned by completing the requirements for the Air Conditioning Specialist and the Refrigeration Specialist. Duplicate courses need only be taken once.

ACRV 115, Basic Refrigeration Systems and Controls <i>or</i> ACRV 112, Basic Refrigeration Systems <i>and</i> ACRV 113, Basic Refrigeration Controls**	10
ACRV 212, Commercial Refrigeration Systems <i>and</i>	5
ACRV 213, Commercial Refrigeration Controls	5

ACRV 125, Residential Air Conditioning Systems and Controls <i>or</i> ACRV 122, Residential Air Conditioning Systems <i>and</i> ACRV 123, Residential Air Conditioning Controls	10
ACRV 222, Commercial Airconditioning Controls <i>and</i>	5
ACRV 223, Commercial Systems	5

**The requirements for an associate degree may be satisfied by completing the certificate requirements in addition to the associate degree requirements.**

## Associate Degrees

### Refrigeration

The requirements for an associate degree in Refrigeration may be satisfied by completing 20 units of required courses, 21 units of general education requirements, and sufficient elective credits to total 60 units. (See Graduation/Associate Degree Requirements.)

Students who complete the associate degree in Refrigeration have enhanced employability in the field of Refrigeration. They are well prepared for entry level service positions with eventual leadership roles. Additionally, they have shown that they are capable of advanced training, and able to comprehend and apply complex theory. The associate degree will also provide students

with a broad range of knowledge with which to evaluate and appreciate the diverse field of opportunity in the Refrigeration Industry.

Except in cases of a prerequisite requirement, it is not required to take courses in exactly this sequence; they are recommended in this order to facilitate success.

### Recommended Plan of Study

First Semester	units
ACRV 115, Basic Refrigeration Systems and Controls <i>or</i> ACRV 112, Basic Refrigeration Systems <i>and</i> ACRV 113, Basic Refrigeration Controls**	10
Course from GE requirement Area D1	<u>3</u>
<b>Total</b>	<b>13</b>

Second Semester	units
ACRV 212, Commercial Refrigeration Systems <i>and</i> ACRV 213, Commercial Refrigeration Controls**	10
Course from GE requirement Area D2	3
Electives	<u>3</u>
<b>Total</b>	<b>16</b>

Third Semester	units
Course from GE requirement Area A	3
Course from GE requirement Area E	3
Course from GE requirement Area F	3
Electives	<u>6</u>
<b>Total</b>	<b>15</b>

Fourth Semester	units
Course from GE requirement Area B	3
Course from GE requirement Area C	3
Electives	<u>10</u>
<b>Total</b>	<b>16</b>

**Degree Total 60**

### Air Conditioning

The requirements for an associate degree in Air Conditioning may be satisfied by completing 20 units of required courses, 21 units of general education requirements, and sufficient elective credits to total 60 units. (See Graduation/Associate Degree Requirements.)

Students who complete the associate degree in Air Conditioning have enhanced employability in the field of Air Conditioning. They are well prepared for entry level service positions with eventual leadership roles. Additionally, they have shown that they are capable of advanced training, and able to comprehend and apply complex theory. The associate degree will also provide students with a broad range of knowledge with which to evaluate and appreciate the diverse field of opportunity in the HVAC Industry.

Except in cases of a prerequisite requirement, it is not required to take courses in exactly this sequence; they are recommended in

this order to facilitate success.

**Recommended Plan of Study**

<b>*First Semester</b>	<b>units</b>
ACRV 125, Residential Air Conditioning Systems and Controls <i>or</i> ACRV 122, Residential Air Conditioning Systems <i>and</i> ACRV 123, Residential Air Conditioning Controls**	10
Course from GE requirement Area D1	3
	<b>Total 13</b>
<b>*Second Semester</b>	<b>units</b>
ACRV 222, Commercial Air Conditioning Controls <i>and</i> ACRV 223, Commercial Air Conditioning Systems**	10
Course from GE requirement Area D2	3
Electives	3
	<b>Total 16</b>
<b>*Third Semester</b>	<b>units</b>
Course from GE requirement Area A	3
Course from GE requirement Area E	3
Course from GE requirement Area F	3
Electives	6
	<b>Total 15</b>
<b>*Fourth Semester</b>	<b>units</b>
Course from GE requirement Area B	3
Course from GE requirement Area C	3
Electives	10
	<b>Total 16</b>

**Degree Total 60**

\* Students may begin the program at any point in the degree plan.

\*\*Semester order for classes and time to complete may vary for night students.

**Air Conditioning and Refrigeration**

The requirements for an associate degree in Air Conditioning and Refrigeration may be satisfied by completing 40 units of required courses and 21 units of general education requirements to total 61 units. (See Graduation/Associate Degree Requirements.)

ACRV 115, Basic Refrigeration Systems and Controls <i>or</i> ACRV 112, Basic Refrigeration Systems <i>and</i> ACRV 113, Basic Refrigeration Controls**	10
ACRV 212, Commercial Refrigeration Systems <i>and</i> ACRV 213, Commercial Refrigeration Controls	5
	5
ACRV 125, Residential Air Conditioning Systems and Controls <i>or</i> ACRV 122, Residential Air Conditioning Systems <i>and</i> ACRV 123, Residential Air Conditioning Controls	10
ACRV 222, Commercial Airconditioning Controls <i>and</i> ACRV 223, Commercial Systems Systems	5
	5

Students who complete the associate degree in Air Conditioning and Refrigeration have increased employability with firms that work in both Air Conditioning and Refrigeration Industries. They are well prepared for entry-level service positions with eventual leadership roles. Additionally, they have shown that they are capable of advanced training, and able to comprehend and apply complex theory. The associate degree will also provide students with a broad range of knowledge with which to evaluate and appreciate the diverse field of opportunity in the HVAC/R Industry.

**Transfer**

Not a transfer major.

**Prerequisite Completion**

If a course is listed as a prerequisite for another course, that prerequisite course must be completed with a satisfactory grade in order to enroll in the next course. According to Title 5, Section 55200(d), a satisfactory grade is a grade of "A," "B," "C" or "P". Classes in which the Pass/No Pass option is available are indicated with an asterisk (\*) before the course title. See "Pass/No Pass Option" in the catalog for full explanation.

**Air Conditioning and Refrigeration Courses**

**ACRV 100 INTRODUCTION TO REFRIGERATION AND AIR CONDITIONING**

*4 units*  
*4 hours weekly*  
**Advisories:** Eligibility for ENGL 099, READ 099 and MATH 70  
 An entry level course intended for students interested in exploring career opportunities in the refrigeration and air conditioning industry. Topics include history of refrigeration, safety in the lab and the workplace, career opportunities and working conditions, refrigeration theory, properties of heat and electrical energy, and the purpose of major components in a vapor compression system. Math used in the industry will be introduced. (AVC)

**ACRV 112 BASIC REFRIGERATION SYSTEMS**

*5 units*  
*10 hours weekly*  
*(2.5 lecture hours and 7.5 lab hours)*  
 Study of refrigeration fundamentals including heat transfer, energy, and the basic refrigeration system. Basic tools with some specialty tools and basic refrigerant handling skills will also be covered. Topics include: brazing of copper tubing; repair and replacement of components, along with maintenance on domestic refrigeration equipment. Recommended for students desiring to enter the air conditioning and refrigeration industry. (AVC)

**ACRV 113 BASIC REFRIGERATION CONTROLS**

5 units

10 hours weekly

(2.5 lecture hours and 7.5 lab hours)

Study of electrical diagrams and circuits in domestic refrigerators and freezers. Includes terminology, legends, ATL and pictorial electrical diagrams used in domestic refrigeration equipment. The testing and repair or replacement of specialized circuitry on refrigeration equipment including types of motors and start components, temperature controls and defrost timers used on domestic refrigeration equipment will also be covered. Recommended for students desiring to enter the air conditioning and refrigeration industry. (AVC)

**ACRV 115 BASIC REFRIGERATION SYSTEMS AND CONTROLS**

10 units

20 hours weekly

Study of refrigeration fundamentals including heat transfer, energy, and the basic refrigeration system. Basic tools with some specialty tools and basic refrigerant handling skills will also be covered. Topics include: brazing of copper tubing; study of electrical diagrams and circuits in domestic refrigerators and freezers including the terminology, legends, and both ATL and pictorial electrical diagrams used in domestic refrigeration equipment. Testing and repair or replacement of specialized circuitry on refrigeration equipment including types of motors and start components, temperature controls and defrost timers used on domestic refrigeration equipment. Recommended for students desiring to enter the air conditioning and refrigeration industry. (AVC)

**ACRV 122 RESIDENTIAL AIR CONDITIONING SYSTEMS**

5 units

10 hours weekly

(2.5 lecture hours and 7.5 lab hours)

Study of air conditioning fundamentals including methods of heating, cooling and humidification. Topics include: repair and replacement of components along with maintenance on residential air conditioning equipment. Environmental controls are introduced with basic electrical schematics using temperature and humidity controls. (AVC)

**ACRV 123 RESIDENTIAL AIR CONDITIONING CONTROLS**

5 units

10 hours weekly

(2.5 lecture hours and 7.5 lab hours)

Study of air conditioning fundamentals including methods of heating, cooling and humidification. Load calculations along with air flow, duct design, air quality and air handling are covered. The characteristics of air and psychrometrics are introduced. A residential system is designed from calculating load to laying out the air handling system (blower and ducts). Also includes system evaluation and diagnostics of the air side of the system. Recommended for students entering the air conditioning industry. (AVC)

**ACRV 125 RESIDENTIAL AIR CONDITIONING SYSTEMS AND CONTROLS**

10 units

20 hours weekly

(5 lecture hours and 15 lab hours)

Study of air conditioning fundamentals including methods of heating, cooling and humidification. Topics include: repair and replacement of components along with maintenance on residential air conditioning equipment. Environmental controls are introduced with basic electrical schematics using temperature and humidity controls and the characteristics of air and psychrometrics. Load calculations along with air flow, duct design, air quality and air handling are also covered. A residential system is designed from calculating load to laying out the air handling system (blower and ducts). Course also includes system evaluation and diagnostics of the air side of the system. Recommended for students entering the air conditioning industry. (AVC)

**ACRV 199 \*OCCUPATIONAL WORK EXPERIENCE**

1–8 units

hours vary

**Prerequisite:** To participate in work experience, students must have a job or internship which is either paid or voluntary and have the approval of the supervisor and instructor supervising work experience in the specific subject area. **PRIOR TO ENROLLING**, students must attend a scheduled orientation or meet individually with the supervising instructor for an individual orientation.

Occupational Work Experience Education is supervised employment designed to provide students a realistic learning experience through work. The ultimate goal is to teach students those skills and attitudes that will equip them to function and adapt as an employee in a variety of situations and jobs. Occupational Work Experience Education is supervised employment extending classroom-based occupational learning at an on-the-job learning station related to the student's educational major or occupational goal. Credit may be accrued at the rate of one to eight units per semester. For the satisfactory completion

of all types of Cooperative Work Experience Education (WE 197 and WE 199), students may earn up to a total of sixteen semester credit hours. (AVC) (R3)

### **ACRV 212 COMMERCIAL REFRIGERATION SYSTEMS**

*5 units*

*10 hours weekly*

*(2.5 lecture hours and 7.5 lab hours)*

**Prerequisite:** *Completion of ACRV 112 and 113 or ACRV 115.*

Study of commercial refrigeration applications and design concerns including calculating of heat loads and equipment sizing. Installation and service procedures including maintenance practices are covered in the “hands-on” lab portion of class. Emphasis on the refrigerant handling and recovery practices used in the repair and replacement of components. Recommended for students desiring to enter the refrigeration industry. (AVC)

### **ACRV 213 COMMERCIAL REFRIGERATION CONTROLS**

*5 units*

*10 hours weekly*

**Prerequisite:** *Completion of ACRV 112 and 113 or ACRV 115.*

Equipment specific refrigeration principles and applications are studied. Commercial refrigeration applications and design concerns including analyzing efficiency and optimizing performance. Diagnostics, service and repair are covered in the “hands-on” lab portion of class. Emphasis on the refrigerant handling and recovery practices used in the repair and replacement of components. Recommended for students desiring to enter the refrigeration industry. (AVC)

### **ACRV 222 COMMERCIAL AIR CONDITIONING CONTROLS**

*5 units*

*10 hours weekly*

*(2.5 lecture hours and 7.5 lab hours)*

**Prerequisite:** *Completion of ACRV 122 and 123 or ACRV 125.*

Study of commercial air conditioning covering electricity and controls. Reviews basic electrical theory and takes the student through electrical schematics and controls as they apply to the light commercial air conditioning industry. Topics include: motors, magnetic line starters, transformers, solid-state devices and programmable logic controllers. ATL and pictorial schematic wiring diagrams for commercial single and three-phase systems are also covered. Recommended for students desiring to enter the air conditioning industry. (AVC)

### **ACRV 223 COMMERCIAL AIR CONDITIONING SYSTEMS**

*5 units*

*10 hours weekly*

**Prerequisite:** *Completion of ACRV 122 and 123 or ACRV 125.*

Study of commercial air conditioning covering building environments. Course covers the commercial facility and its systems management and control. Energy conservation using economizers. Occupant comfort and productivity are issues considered in system design and control. Equipment types to include boilers, heat recovery and economizer packages, cooling towers and hydronic systems along with air handling and filtration are introduced. Control strategies for occupant comfort, and facility control management are discussed. (AVC)