

# APPT 156: RF 302 HVACR CONTROL SYSTEMS

## Foothill College Course Outline of Record

Heading	Value
<b>Effective Term:</b>	Summer 2024
<b>Units:</b>	7
<b>Hours:</b>	72 lecture, 36 laboratory per quarter (108 total per quarter)
<b>Prerequisite:</b>	Per California Code of Regulations, this course is limited to students admitted to the Air Conditioning & Refrigeration Technology Apprenticeship Program.
<b>Advisory:</b>	Not open to students with credit in APPR 135.
<b>Degree &amp; Credit Status:</b>	Degree-Applicable Credit Course
<b>Foothill GE:</b>	Non-GE
<b>Transferable:</b>	None
<b>Grade Type:</b>	Letter Grade (Request for Pass/No Pass)
<b>Repeatability:</b>	Not Repeatable

## Student Learning Outcomes

- A student will be able to describe the operation of pneumatic control valves.
- A student will be able to describe the operation of pneumatic thermostats.
- A student will be able to demonstrate pump alignment procedure.

## Description

Introduction to HVAC fundamentals, energy sources, and control system principals. Focus on pneumatic, electrical, electronic, and building automation control systems and components.

## Course Objectives

The student will be able to:

1. Describe HVAC system requirements and heat transfer principals
2. Identify various types of HVAC system components and system energy sources
3. Describe control system principals and components
4. Describe pneumatic control system components and applications
5. Define electrical control system principals and devices
6. Identify and define solid state devices
7. Perform electronic control system applications
8. Perform building automation system installation, testing, and troubleshooting

## Course Content

1. Describe HVAC system requirements and heat transfer principals
  - a. Proper temperature and humidity
  - b. Filtration

- c. Circulation and ventilation
  - d. Thermodynamics
  - e. Heat transfer and measurement
2. Identify various types of HVAC system components and system energy sources
    - a. Heating systems and cooling systems
    - b. Ventilation systems
    - c. Ductwork and dampers
    - d. Air handlers, filters, and VAV units
  3. Describe control principals and components
    - a. Sensors
    - b. Controllers
    - c. Control devices
    - d. Control agents
  4. Describe pneumatic control system components and applications
    - a. Control air compressor stations
    - b. Pneumatic actuators, dampers, and valves
    - c. Pneumatic thermostats, humidistats, and pressure switches
    - d. Pneumatic transmitters and receiver controllers
    - e. Pneumatic control diagrams and system applications
    - f. Calibrating and trouble shooting pneumatic control devices
  5. Define electrical control system principals and devices
    - a. Power, AC and DC circuits
    - b. Operating controls
    - c. Safety controls
    - d. Testing and troubleshooting with digital multi meter
  6. Identify and define solid state devices
    - a. Semiconductors
    - b. Diodes
    - c. Transistors
    - d. Rectifiers
    - e. Integrated circuits
  7. Perform electronic control system applications
    - a. Sensors
    - b. Electronic thermostats
    - c. Multizone unit control
    - d. Boiler and chiller control
  8. Perform building automation system installation and testing and troubleshooting
    - a. History of automated control systems, central supervisory, central direct digital
    - b. Distributed direct digital control systems
    - c. Building automation system controllers

## Lab Content

Students will work individually and in teams on troubleshooting and repairing pneumatic, electric, and electronic control devices.

## Special Facilities and/or Equipment

1. Personal protective equipment
2. Laboratory with air conditioning equipment
3. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address

## Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Results of written quizzes and final examination  
Satisfactory completion of hands-on projects  
Maintenance of a student's workbook with questions drawn from text  
Group and classroom participation

## Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture  
Lab assignment  
Group discussion  
Demonstration

## Representative Text(s) and Other Materials

International Pipe Trades Joint Training Committee, Inc.. Pneumatic Controls. 2016.

Auvil, Ronnie J.. HVAC Control Systems, 4th ed.. 2017.

Auvil, Ronnie J.. HVAC Control Systems: Work Book, 4th ed.. 2017.

Riesberg, Marty, Terry Coleman, and Jim Simpson. Building Automation: Control Devices and Applications. 2008.

Although these textbooks are older than 5 years, they conform to national training standards and are considered seminal works in the discipline. We will adopt the next edition of each text, as it is published.

## Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Readings from textbook HVAC Control Systems
  - a. Chapter 9: Pneumatic Transmitters
  - b. Review questions from HVAC Control Systems Work Book: Session 9, Pneumatic Transmitter Control Principals
2. Writing assignments given in the laboratory
  - a. Make a schematic drawing of a basic pneumatic control system with components
  - b. Describe the properties at each component in the system

## Discipline(s)

Air Conditioning, Refrigeration, Heating