

APSM 151C: HEAT, MATTER & ENERGY IN HVAC SYSTEMS

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2022
Units:	2.5
Hours:	35 lecture, 5 laboratory per quarter (40 total per quarter)
Prerequisite:	Per California Code of Regulations, this course is limited to students admitted to the Sheet Metal Apprenticeship Program.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	None
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

Student Learning Outcomes

- A successful student will be able to explain the relationship between pressure and temperature as related to HVAC systems.
- A successful student will be able to explain the basic refrigeration cycle.

Description

Students are introduced to the physical laws governing heat and energy transfer as it pertains to HVAC.

Course Objectives

The student will be able to:

1. Define energy and the states of matter
2. Understand the different types, properties, and application of refrigerants
3. Define heat and understand the relationship between pressure and temperature
4. Review specific safety for service technicians involving electrical, pressure, heat and cold, and chemicals
5. Understand the basic refrigeration cycle
6. Demonstrate the safe use of service hand tools and hardware
7. Use manifold gauges to take super heat and sub cooling readings
8. Describe characteristics of refrigerant blends and oils

Course Content

1. Define energy and the states of matter
 - a. Define matter (Lec)
 - b. List the states of matter (Lec)
 - c. Define density (Lec)
 - d. Define specific gravity and specific volume (Lec)
 - e. State two forms of energy important to the HVAC industry (Lec)
 - f. Describe work and state the formula used to determine the amount in a given task (Lec)

- g. Define horsepower (Lec)
 - h. Convert horsepower to watts (Lec and Lab)
 - i. Convert horsepower to BTUs (Lec and Lab)
2. Understand the different types, properties, and application of refrigerants
 - a. List and describe the various types of refrigerants and their applications (Lec and Lab)
 - b. Describe ozone depletion and global warming (Lec and Lab)
 - c. Discuss how CFCs deplete the earth's ozone layer (Lec and Lab)
 - d. Differentiate between CFCs, HCFCs, HFCs, and HCs (Lec and Lab)
 - e. Discuss popular refrigerants (including R-410A) and their applications (Lec and Lab)
 - f. Discuss refrigerant blends (Lec and Lab)
 - g. Discuss temperature glide and fractionation as it applies to refrigerant blends (Lec and Lab)
 3. Define heat and understand the relationship between pressure and temperature
 - a. Discuss Boyle's law (Lec)
 - b. State Charles's law (Lec)
 - c. Discuss Charles's law (Lec)
 4. Review specific safety for service technicians involving electrical, pressure, heat and cold, and chemicals
 - a. Describe the proper procedures for working with pressurized systems and vessels (Lec and Lab)
 - b. Describe the proper procedures for working with live electrical circuits (Lec and Lab)
 - c. Explain the importance of proper ventilation when working in confined spaces (Lec and Lab)
 5. Understand the basic refrigeration cycle
 - a. Diagram a basic refrigerant cycle, noting components, refrigerant phase changes and pressure changes (Lec and Lab)
 6. Demonstrate the safe use of service hand tools and hardware
 - a. Describe instruments used in heating, air conditioning and refrigeration (Lec and Lab)
 - b. Test and calibrate a basic thermometer at low and high temperature ranges (Lec and Lab)
 - c. Check an ohmmeter for accuracy (Lec and Lab)
 - d. Describe the comparison test for an ammeter and a voltmeter (Lec and Lab)
 - e. Describe the procedures for checking pressure instruments above and below atmospheric pressure (Lec and Lab)
 - f. Check flue gas analysis instruments (Lec and Lab)
 7. Use manifold gauges to take super heat and sub cooling readings (Lec and Lab)
 8. Describe characteristics of refrigerant blends and oils (Lec and Lab)

Lab Content

1. Test and calibrate a basic thermometer at low and high temperature ranges

Special Facilities and/or Equipment

1. Laboratory with sheet metal service tools
2. Personal protective 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 tests
Responses in class discussions
Comprehensive written final examination
Demonstration of assigned skills to acceptable level per instructor

Method(s) of Instruction

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

Lecture
Discussion
Demonstration
Lab assignments followed by discussion

Representative Text(s) and Other Materials

Whitman, B., B. Johnson, J. Tomczyk, and E. Silberstein. Refrigeration and Air Conditioning Technology, 8th ed.. 2016.

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

These are the standard sheet metal textbooks/workbooks used for this course. Although one or more may not be within five years of the required published date, they are the most current books used when teaching this course.

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

1. Sample reading assignment: From the Refrigeration and Air Conditioning Technology textbook, read unit, "Calibrating Instruments"
2. Sample writing assignment: Complete review questions related to assigned reading

Discipline(s)

Sheet Metal or Air Conditioning, Refrigeration, Heating