

**Course Outline**

**COURSE:** HVAC 204                      **DIVISION:** 50                      **ALSO LISTED AS:**

**TERM EFFECTIVE:** Spring 2022    **CURRICULUM APPROVAL DATE:** 05/10/2022

**SHORT TITLE:** AIR-COND AND HEAT PUMPS

**LONG TITLE:** Air-Conditioning and Heat Pumps

<u>Units</u>	<u>Number of Weeks</u>	<u>Type</u>	<u>Contact Hours/Week</u>	<u>Total Contact Hours</u>
4	18	Lecture:	3	54
		Lab:	3	54
		Other:	0	0
		Total:	6	108

**COURSE DESCRIPTION:**

This course provides instruction on the service and installation of Air-Conditioning and Heat Pump systems (commercial rooftop package equipment and residential split systems). Charging methods will be covered which include superheat, sub-cooling, by weight and using the manufacturers charging charts. Emphasis is placed on proper installation techniques required by code. The student will repair an air- conditioning system, using mechanical and electrical troubleshooting techniques such as electrical wiring diagram interpretation. Upon completion the student should be able to service, repair and perform preventative maintenance on residential/ commercial air-conditioning and heat pump systems. **PREREQUISITE:** HVAC 201 and HVAC 202 with a grade of "C" or better.

**PREREQUISITES:**

Completion of HVAC 201, as UG, with a grade of C or better.  
AND Completion of HVAC 202, as UG, with a grade of C or better.

**COREQUISITES:**

**CREDIT STATUS:** D - Credit - Degree Applicable

**GRADING MODES**

L - Standard Letter Grade

**REPEATABILITY:** N - Course may not be repeated

## **SCHEDULE TYPES:**

- 02 - Lecture and/or discussion
- 03 - Lecture/Laboratory
- 04 - Laboratory/Studio/Activity
- 04A - Laboratory - LEH 0.65
- 05 - Hybrid
- 71 - Dist. Ed Internet Simultaneous
- 72 - Dist. Ed Internet Delayed
- 73 - Dist. Ed Internet Delayed LAB
- 73A - Dist. Ed Internet LAB-LEH 0.65

## **STUDENT LEARNING OUTCOMES:**

By the end of this course, a student should:

1. Perform the wiring of a heat pump thermostat.
2. Complete superheat and sub-cooling readings.
3. Perform electrical troubleshooting on an air-conditioning system.
4. Perform mechanical troubleshooting on an air-conditioning system and heat pump system.

## **COURSE OBJECTIVES:**

By the end of this course, a student should:

1. Describe how to properly attach and read manifold gauges.
2. Describe three types of air-conditioning compressors.
3. Identify and describe an air-conditioning evaporator.
4. List different types of evaporator coils and state the relationship of the evaporator to the rest of the system.
5. Identify different types of air-conditioning condensers and state their relationship to the total systems performance.
6. Describe an air-conditioning metering device.
7. Discuss and demonstrate how to properly recover, evacuate and recharge heat pumps and air-conditioning systems.
8. Describe the design typical operating conditions for air-conditioning equipment.
9. Perform basic tests in troubleshooting electrical problems in an air-conditioning system.
10. Describe and list the components of a reverse-cycle heat pump.
11. Compare the concepts of electric heating and heat pump heating.
12. Discuss and perform recommended preventive maintenance procedures for heat pump systems.
13. Define psychrometrics and plot air conditions using a psychrometric chart.
14. Define wet-bulb and dry-bulb temperature and measure the moisture content of air using a combination of dry-bulb and wet-bulb temperatures.
15. Perform various troubleshooting exercises related to comfort and psychrometrics.

## **CONTENT, STUDENT PERFORMANCE OBJECTIVES, OUT-OF-CLASS ASSIGNMENTS**

Curriculum Approval Date: 05/10/2022

### **LECTURE CONTENT:**

14 Hours

Content: Manifold Gauges, Measuring Superheat and Sub-cooling, Compressors (Reciprocating, Scroll and Rotary), Evaporators (A-Coil, Slant Coil and H Coil), Standard and High Efficiency Condensers, Variable Frequency Drive Models, Metering Devices (Thermostatic Expansion Valves, Actuator Piston and Electronic Expansion Valves), SEER and ERR Ratings, Heat Pumps and Air- Conditioning Systems, Split Systems

12 Hours

Content: Troubleshooting Air-Conditioning Systems, Air-Conditioning Wiring Diagrams (Ladder, Pictorial and Schematic)

13 Hours

Content: Defrost Cycle, Defrost Circuit Boards and Electromechanical Timers, Defrost Thermostats, Auxiliary Heat, Emergency Heat, Charging a Heat Pump in the Cooling Mode, Charging a Heat Pump in the Heating Mode, Reversing Valve Operation, Heat Pump Wiring, Sequencers, Limit Switches

13 Hours

Content: Psychrometrics, Wet-Bulb/Dry-Bulb, Relative Humidity, Specific Humidity, Dew Point, Winter and Summer Comfort Zones, Enthaply, Specific Volume

2 Hours

Final Exam

### **LAB CONTENT:**

14 Hours

Content: Heat Pumps and Air-Conditioning Systems, Split Systems, Package Equipment, Air-Conditioning Equipment: How to properly recover, evacuate and recharge heat pumps and air-conditioning systems. How to install and service split systems. How to install and service package equipment.

12 Hours

Content: Content: Troubleshooting Air-Conditioning Systems, Air-Conditioning Wiring Diagrams (Ladder, Pictorial and Schematic):

Selecting the correct instruments. Using an ohmmeter to check the various components of the electrical system. Performing basic tests in troubleshooting electrical problems in an air-conditioning system.

13 Hours

Content: Defrost Cycle, Defrost Circuit Boards and Electromechanical Timers, Defrost Thermostats, Auxiliary Heat, Emergency Heat, Charging a Heat Pump in the Cooling Mode, Charging a Heat Pump in the Heating Mode, Reversing Valve Operation, Heat Pump Wiring, Sequencers, Limit Switches: Performing recommended preventive maintenance procedures for heat pump systems.

13 Hours

Content: Psychrometrics, Wet-Bulb/Dry-Bulb, Relative Humidity, Specific Humidity, Dew Point, Winter and Summer Comfort Zones, Enthaply, Specific Volume: Performing various troubleshooting exercises related to comfort and psychrometrics.

2 Hours

Final Exam

**METHODS OF INSTRUCTION:**

Lecture, discussion, multi-media presentation, demonstration, guided practice.

**OUT OF CLASS ASSIGNMENTS:**

Required Outside Hours: 28

Assignment Description: Out of Class Assignments: Read corresponding information in Unit 36 and Unit 40 of textbook. Complete Review Questions at end of Units. Study for quizzes/examinations.

Required Outside Hours: 24

Assignment Description: Out of Class Assignments: Read corresponding information in Unit 41 of textbook. Complete Review Questions at end of Unit. Study for quizzes/examinations. Homework: Troubleshoot an air-conditioning system. Complete the Service Technician Calls scenarios.

Required Outside Hours: 26

Assignment Description: Out of Class Assignments: Out of Class Assignments: Read corresponding information in Unit 43 of textbook. Complete Review Questions at end of Unit. Study for quizzes/examinations. Homework: Complete the Service Technician Calls scenarios.

Required Outside Hours: 24

Assignment Description: Out of Class Assignments: Read corresponding information in Unit 35 of textbook. Complete Review Questions at end of Unit. Study for quizzes/examinations.

**METHODS OF EVALUATION:**

Writing assignments

Evaluation Percent 20

Evaluation Description

10% - 30% Homework, Lab Reports

Problem-solving assignments

Evaluation Percent 20

Evaluation Description

20% - 40% Lab Projects

Skill demonstrations

Evaluation Percent 30

Evaluation Description

20% - 50% Lab Projects/Troubleshooting

Objective examinations

Evaluation Percent 30

Evaluation Description

20% - 40% Quizzes/Examinations

**REPRESENTATIVE TEXTBOOKS:**

Refrigeration and Air Conditioning Technology, 9th Edition, Eugene Silberstein, Jason Obrzut, John Tomczyk, Bill Whitman, Bill Johnson, Cengage Learning, 2021.

ISBN: 9780357122273

12th Grade Verified by: MS Word

Lab Manual for Refrigeration and Air Conditioning Technology, 9th Edition, Silberstein, Obrzut, Cengage Learning, 2021.

ISBN: 9781337399388

12th Grade Verified by: MS Word

**ARTICULATION and CERTIFICATE INFORMATION**

Associate Degree:

CSU GE:

IGETC:

CSU TRANSFER:

Not Transferable

UC TRANSFER:

Not Transferable

**SUPPLEMENTAL DATA:**

Basic Skills: N

Classification: Y

Noncredit Category: Y

Cooperative Education:

Program Status: 1 Program Applicable

Special Class Status: N

CAN:

CAN Sequence:

CSU Crosswalk Course Department:

CSU Crosswalk Course Number:

Prior to College Level: Y

Non Credit Enhanced Funding: N

Funding Agency Code: Y

In-Service: N

Occupational Course: C

Maximum Hours:

Minimum Hours:

Course Control Number: CCC000587349

Sports/Physical Education Course: N

Taxonomy of Program: 094600