

Course Outline

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

TERM EFFECTIVE: Spring 2018 **CURRICULUM APPROVAL DATE:** 10/23/2017

SHORT TITLE: AIR-COND AND HEAT PUMPS

LONG TITLE: Air-Conditioning and Heat Pumps

Units	Number of Weeks		Contact Hours/Week		Total Contact Hours
4	18	Lecture:	3	Lecture:	54
		Lab:	3	Lab:	54
		Other:	0	Other:	0
		Total:	6	Total:	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

STUDENT LEARNING OUTCOMES:

1. Perform the wiring of a heat pump thermostat.

Measure of assessment: demonstration

Year assessed, or planned year of assessment: 2018

Semester: Fall

2. Complete superheat and sub-cooling readings.

Measure of assessment: demonstration, homework

Year assessed, or planned year of assessment: 2018

Semester: Fall

3. Perform electrical troubleshooting on an air-conditioning system.

Measure of assessment: demonstration, exam, homework

Year assessed, or planned year of assessment: 2018

Semester: Fall

4. Perform mechanical troubleshooting on an air-conditioning system and heat pump system.

Measure of assessment: demonstration, exam, homework

Year assessed, or planned year of assessment: 2018

Semester: Fall

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

Curriculum Approval Date: 10/23/2017

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

Student Performance Objectives: Describe how to properly attach and read manifold gauges. Describe three types of air-conditioning compressors. Describe an air-conditioning evaporator. List different types of evaporator coils. State the relationship of the evaporator to the rest of the system. Describe an air-conditioning condenser and identify different types of condensers. Describe the relationship of the condenser to the total system performance. Describe an air-conditioning metering device.

12 Hours

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

Student Performance Objectives: Establish reference points when working on unfamiliar equipment to know what the typical conditions should be. Explain how to use an ohmmeter and state its purpose. List and identify different types of wiring diagrams.

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

Student Performance Objectives: Describe a reverse-cycle heat pump. List the components of a reverse-cycle heat pump. State the various heat sources for heat pumps. Discuss the terminology of heat pump components. Describe techniques being used to improve the efficiency of heat pump systems.

12 Hours

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

Student Performance Objectives: Recognize the four factors involved in comfort. Explain the relationship of body temperature to room temperature. Define psychrometrics. Define wet-bulb and dry-bulb temperature. Define dew point temperature. Explain vapor pressure of water in air. Describe humidity.

2 Hours

Final

Lab Content:

14 Hours

Content: Heat Pumps and Air-Conditioning Systems, Split Systems, Package Equipment, Air-Conditioning Equipment

Student Performance Objectives: Discuss and demonstrate how to properly recover, evacuate and recharge heat pumps and air-conditioning systems. Explain and demonstrate how to install and service split systems. Explain and demonstrate how to install and service package equipment. Describe the design and typical operating conditions for air-conditioning equipment.

12 Hours

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

Student Performance Objectives: Select the correct instruments for checking an air-conditioning unit with a mechanical problem. Select the correct instruments for troubleshooting electrical problems in an air-conditioning system. Check the line and low-voltage power supplies. Use an ohmmeter to check the various components of the electrical system. Perform 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

Student Performance Objectives: Identify and explain a four-way valve. Compare the concepts of electric heating and heat pump heating. Determine by the line temperatures whether a heat pump is in cooling or heating mode. Identify and describe the control sequence of an air-to-air heat pump. Discuss and perform recommended preventive maintenance procedures for heat pump systems.

12 Hours

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

Student Performance Objectives: Plot air conditions using a psychrometric chart. Measure the moisture content of air using a combination of dry-bulb and wet-bulb temperatures. Measure the relative humidity. Perform various troubleshooting exercises related to comfort and psychrometrics.

2 Hours

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

Percent of total grade: 20.00 %

Homework, Lab Reports

Problem-solving assignments

Percent of total grade: 20.00 %

Lab Projects

Skill demonstrations

Percent of total grade: 20.00 %

Lab Projects/Troubleshooting

Objective examinations

Percent of total grade: 40.00 %

Quizzes/Examinations

REPRESENTATIVE TEXTBOOKS:

Required Representative Textbooks

John A. Tomczyk, Eugene Silberstein, William C. Whitman, William M. Johnson. Refrigeration and Air Conditioning Technology, 8th Edition. Boston, MA: Cengage Learning,2017.

ISBN: 978-1-305-57829-6

Reading Level of Text, Grade: 12th Verified by: MS Word

Tomczyk, Silberstein, Whitman, Johnson. Lab Manual for Refrigeration and Air Conditioning Technology, 8th Edition. Boston, MA: Cengage Learning,2017.

ISBN: 978-1305578708

Reading Level of Text, Grade: 12th 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: 6
Minimum Hours: 6
Course Control Number:
Sports/Physical Education Course: N
Taxonomy of Program: 094600