

JEFFERSON COLLEGE

COURSE SYLLABUS

HRA240

HEAT PUMPS AND MINI-SPLITS

3 Credit Hours

Prepared by
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HRA240 Heat Pumps and Mini-Splits

I. CATALOGUE DESCRIPTION

- A. Prerequisite: HRA125 Refrigeration and A/C Mechanical Systems with a minimum grade of “C” or better
COMPASS pre-algebra score of at least 33 within the past two years, ACT pre-algebra score of 16 or higher within the past two years, or MTH001 with a grade of “B” or better
Reading Proficiency
- B. 3 Semester Credit Hours
- C. Heat Pumps and Mini-Splits will cover theory for heat pumps and mini-splits, different styles of equipment, and installations. It will also cover routine maintenance and troubleshooting of both systems. (F,S)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

Identify all components and installation of heat pumps and mini-splits	Exams Homework Quizzes Projects Lab
Diagnose electrical problems in heat pumps and mini-splits	Exams Homework Lab
Diagnose refrigerant flow problems in heat pumps and mini-splits	Exams Homework Quizzes Lab
Describe different types of installations and characteristics of various heat pumps and mini-splits	Exams Homework Quizzes Lab

III. OUTLINE OF TOPICS

- A. Unit 43 Air Source Heat Pumps
 1. Reverse-Cycle Refrigeration
 2. Heat Sources for Winter
 3. The Four-Way Reversing Valve
 4. The Air-To-Air Heat Pump
 5. Refrigerant Line Identification

6. Metering Devices
7. Thermostatic Expansion Valves
8. The Capillary Tube
9. Combinations of Metering Devices
10. Electronic Expansion Valves
11. Orifice Metering Devices
12. Liquid-Line Accessories
13. Application of the Air-To-Air Heat Pump
14. Auxiliary Heat
15. Balance Point
16. Coefficient of Performance
17. Split-System Air-To-Air Heat Pump
18. The Indoor Unit
19. Air temperature of the Conditioned Air
20. The Outdoor Unit Installation
21. Package Air-To-Air Heat Pumps
22. Controls for the Air-To-Air Heat Pump
 - a) Cooling Cycle Control
 - b) Space Heating Control
 - c) Heat Anticipator
23. The Defrost Cycle
 - a) How is Defrost Accomplished
 - b) Initiating the Defrost Cycle
 - c) Terminating the Defrost Cycle
 - d) Electronic Control of Defrost
24. Indoor Fan Motor Control
25. Auxiliary Heat
26. Servicing the Air-To-Air Heat Pump
27. Troubleshooting the Electrical System
28. Troubleshooting Mechanical Problems
29. Troubleshooting the Four-Way Valve
30. Troubleshooting the Compressor
31. Checking the Charge
32. Special Applications for Heat Pumps
33. Heat Pumps Using Scroll Compressors
34. Heat Pump Systems with Variable-Speed Motors
35. Service Technician Calls

- B. Unit 44 Geothermal Heat Pumps
1. Reverse-Cycle Refrigeration
 2. Geothermal Heat Pump Classifications
 3. Open-Loop Systems
 4. Water Quality

5. Closed-Loop Systems
6. Ground-Loop Configurations and Flows
7. System Materials and Heat Exchange Fluids
8. Geothermal Wells and Water Sources
9. Water-To-Water Heat Pumps
10. Troubleshooting
11. Waterless, Earth-Coupled, Closed-Loop Geothermal heat Pump Systems
 - a) Waterless Systems
 - b) Installation and Refrigerant-Loop Piping
12. Service Technician Calls

C. Mini-Split Systems

1. History and Theory of Mini-Splits
2. Installation Practices
 - a) Line Set Sizing and Installation
 - b) Wiring Requirements and Proper Connection Methods
 - c) Condensate Removal
3. Determining Proper Equipment and Use
 - a) Wall Mounted
 - b) Floor Mounted
 - c) Ceiling Recessed
 - d) Outdoor Units
 - e) Thermostats
 - f) Condensate Removal
 - g) Duct Accessories
 - h) Filters and Accessories
 - i) Valves, Adaptors, and Headers
4. Wiring Diagrams
5. Servicing
 - a) Temperature/Pressure Charts
 - b) Diagnostic Flow Charts
 - c) Indoor Unit Troubleshooting (Flash Codes)
 - d) Outdoor Unit Troubleshooting (Flash Codes)

IV. METHOD(S) OF INSTRUCTION

- A. Classroom Lecture
- B. Lab Demonstrations
- C. Specialty Lectures by Industry Personnel

V. REQUIRED TEXTBOOK(S)

Whitman, Johnson, Tomczyk, Silberstein; *Refrigeration and Air Conditioning Technology* (Current Edition); Delmar Publications

VI. REQUIRED MATERIALS

HRA Tool Kit

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHODS OF EVALUATION

A.	Theory, Tests, Quizzes, Homework	45%
B.	Shop/Lab	45%
C.	Attendance/Participation	10%

IX. ADA AA STATEMENT

Any student requiring special accommodations should inform the instructor and the Coordinator of Disability Support Services (Technology Center 101; phone 636-481-3169).

X. ACADEMIC HONESTY STATEMENT

All students are responsible for complying with campus policies as stated in the Student Handbook (see College website, <http://www.jeffco.edu>).

XI. ATTENDANCE STATEMENT

Regular and punctual attendance is expected of all students. Any one of these four options may result in the student being removed from the class and an administrative withdrawal being processed: (1) Student fails to begin class; (2) Student ceases participation for at least two consecutive weeks; (3) Student misses 15 percent or more of the coursework; and/or (4) Student misses 15 percent or more of the course as defined by the instructor. Students earn their financial aid by regularly attending and actively participating in their coursework. If a student does not actively participate, he/she may have to return financial aid funds. Consult the College Catalog or a Student Financial Services representative for more details.

XII. OUTSIDE OF CLASS ACADEMICALLY RELATED ACTIVITIES

The U.S. Department of Education mandates that students be made aware of expectations regarding coursework to be completed outside the classroom. Students are expected to spend substantial time outside of class meetings engaging in academically related activities such as reading, studying, and completing assignments. Specifically, time spent on academically related activities outside of class combined with time spent in class meetings is expected to be a minimum of 37.5 hours over the duration of the term for each credit hour.