

**JEFFERSON COLLEGE**

**COURSE SYLLABUS**

**HRA216**

**RESIDENTIAL AIR CONDITIONING SYSTEMS**

3 Credit Hours

Prepared by:  
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## HRA216 Residential Air Conditioning Systems

### I. CATALOG DESCRIPTION

- A. Prerequisite: HRA101 Electricity for HVAC with a grade of “C” or better  
HRA105 Principles of Refrigeration with a grade of “C” or better  
EPA Certification 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. Residential Air Conditioning Systems covers the theory, installation, diagnosis, and service of residential air conditioning systems. (F,S)

### II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

Wire low-voltage and high-voltage wiring on A/C units	Exams Homework Lab
Develop skills in control wiring and will install control wiring on A/C units	Exams Lab
Become proficient at diagnosing and troubleshooting electric wiring and control wiring on A/C	Exams Homework Quizzes Lab
Diagnose and troubleshoot components of A/C units	Exams Homework Quizzes Projects
Use psychometric principals to check unit efficiency	Exams Homework

### III. OUTLINE OF TOPICS

- A. Unit 35 Comfort and Psychrometrics
1. Comfort
  2. Food Energy and the Body
  3. Heat Transfer to and From the Body
  4. The Comfort Chart
  5. Psychrometrics
  6. Moisture in Air

7. Absolute and Relative Humidity
8. Superheated Gases in Air
9. Dry-Bulb and Wet-Bulb Temperatures
10. Dew Point Temperatures
11. Enthalpy
12. The Psychrometric Chart
13. Plotting on the Psychrometric Chart
14. Fresh Air, Infiltration, and Ventilation

B. Unit 36 Refrigeration Applied to Air Conditioning

1. Refrigeration
2. Structural Heat Gain
3. Evaporative Cooling
4. Refrigeration Cooling or Air Conditioning
  - a) Package Air Conditioning
  - b) Split-System Air Conditioning
5. The Evaporator
  - a) The A Coil
  - b) The Slant Coil
  - c) The H Coil
  - d) Coil Circuits
6. The Function of the Evaporator
7. Design Conditions
8. Evaporator Application
9. The Compressor
10. The Reciprocating Compressor
11. Compressor Speeds (RPM)
12. Cooling the Compressor and Motor
13. Compressor Mountings
14. Rebuilding the Hermetic Compressor
15. The Rotary Compressor
  - a) Stationary Vane Rotary Compressor
  - b) Rotary Vane Rotary Compressor
16. The Scroll Compressor
17. The Condenser
18. Side-Air-Discharge Condensing Units
19. Top-Air-Discharge Condensing Units
20. Condenser Coil Design
21. High-Efficiency Condensers
22. Cabinet Design
23. Expansion Devices
24. Air-Side Components
25. Installation Procedures

- C. Unit 39 Controls
  - 1. Controls for Air Conditioning
  - 2. Prime Movers---Compressors and Fans
  - 3. Low-Voltage Controls
  - 4. Some History of Residential Central Air Conditioning
  - 5. Economics of Equipment Design
  - 6. Operating Controls for Older Air-Cooled Systems
  - 7. Safety Controls for Older Air-Cooled Systems
  - 8. Operating Controls for Modern Equipment
  - 9. Safety Controls for Modern Equipment
  - 10. The Working Control Package
  - 11. Electronic Controls and Air-Conditioning Equipment
  
- D. Unit 40 Typical Operating Conditions
  - 1. Mechanical Operating Conditions
  - 2. Relative Humidity and the Load
  - 3. System Component Relationships Under Load Changes
  - 4. Evaporator Operating Conditions
  - 5. High Evaporator Load and a Cool Condenser
  - 6. Grades of Equipment
  - 7. Documentation with the Unit
  - 8. Establishing a Reference Point on Unknown Equipment
  - 9. Metering Devices for High-Efficiency Equipment
    - a) Operating Conditions Near Design Space Conditions for Standard-Efficiency Equipment
    - b) Space Temperature Higher Than Normal for Standard-Efficiency Equipment
    - c) Operating Conditions Near Design Conditions for High-Efficiency Equipment
    - d) Other-Than-Design Conditions for High-Efficiency Equipment
  - 10. Equipment Efficiency Rating
  - 11. Typical Electrical Operating Conditions
  - 12. Matching the Unit to the Correct Power Supply
  - 13. Starting the Equipment with the Correct Data
  - 14. Finding a Point of Reference for an Unknown Motor Rating
  - 15. Determining the Compressor Running Amperage
  - 16. Compressors Operating at Full-Load Current
  - 17. High Voltage, the Compressor, and Current Draw
  - 18. Current Draw and the Two-Speed Compressor
  
- E. Unit 41 Troubleshooting
  - 1. Introduction

2. Mechanical Troubleshooting
3. Approach Temperature and Temperature Difference
4. Gage Manifold Usage
5. When to Connect the Gages
6. Low-Side Gage Readings
7. High-Side Gage Readings
8. Temperature Readings
  - a) Inlet Air Temperatures
  - b) Evaporator Outlet Temperatures
  - c) Suction-Line Temperatures
  - d) Discharge-Line Temperatures
  - e) Liquid-Line Temperatures
9. Charging Procedures in the Field
  - a) Fixed-Bore Metering Devices---Capillary Tube and Orifice Type
  - b) Field Charging the TXV System
10. Electrical Troubleshooting
11. Compressor Overload Problems
12. Compressor Electrical Checkup
13. Troubleshooting the Circuit Electrical Protectors---Fuses and Breakers
14. Service Technician Calls

#### IV. METHODS OF INSTRUCTION

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

#### V. REQUIRED TEXTBOOKS

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/jeffco/index.php?option=com\\_weblinks&catid=26&Itemid=84](http://www.jeffco.edu/jeffco/index.php?option=com_weblinks&catid=26&Itemid=84)).

## XI. ATTENDANCE STATEMENT

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. Student's grade will also be based on participation in class and attendance.