JEFFERSON COLLEGE

COURSE SYLLABUS

HRA225

RESIDENTIAL HEATING SYSTEMS

5 Credit Hours

Prepared by
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Revised by
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HRA225 Residential Heating Systems

I. CATALOGUE DESCRIPTION

A. Prerequisite: HRA101 Electricity for HVAC, HRA105 Principles of Refrigeration, EPA Certification (acquired on own or through HRA125 Refrigeration and Air Conditioning Mechanical Systems class), and Reading Proficiency

B. 5 Semester Credit Hours

C. Residential Heating Systems studies the theory, installation, diagnosis, and service of residential heating systems. This course covers high efficiency gas heating systems, heat pump, and electric heating systems (F, S)

II. EXPECTED LEARNING OUTCOMES / ASSESSMENT MEASURE

| Students will diagnose and check electric forced air heating systems, with electric heat functioning with heat pump systems | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will practice and wire gas furnaces and gas furnace controls | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will calculate ductwork sizes for residential heating and cooling equipment | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will diagnose gas furnace controls for high efficiency and standing pilot | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will perceive gas piping and pipe sizing | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will determine fuel oil characteristics for oil furnaces | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will master servicing oil furnace electric systems and control systems | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will achieve competency in servicing gas fueled hydronic heating with electric wiring and control wiring | In-class exam as well as homework and/or quizzes, and/or in-class projects |
| Students will be proficient at checking indoor air quality problems and how to correct them | In-class exam as well as homework and/or quizzes, and/or in-class projects |
III. OUTLINE OF TOPICS

A. Unit 30 Electric Heat
   1. Introduction
   2. Portable Electric Heating Devices
   3. Radiant Heating Panels
   4. Electric Baseboard Heating
   5. Unit Heaters
   6. Electric Hydronic Boilers
   7. Central Forced-Air Electric Furnaces
   8. Automatic Controls for Forced-Air Electric Furnaces
   9. The Low-Voltage Thermostat
   10. Controlling Multiple Stages
   11. Wiring Diagrams
   12. Control circuits for Forced-Air Electric Furnaces
   13. Fan Motor Circuits
   14. Contactors for Controlling Electric Furnaces
   15. Airflow in Electric furnaces
   16. Service Technician Calls

B. Unit 31 Gas Heat
   1. Introduction to Gas-Fired, Forced-Hot-air Furnaces
   2. Types of Furnaces
   3. Gas Fuels
   4. Gas Combustion
   5. Gas Regulators
   6. Gas Valve Solenoid Valve
   7. Solenoid Valve
   8. Diaphragm Valve
   9. Heat Motor-Controlled Valve
   10. Automatic Combination Gas Valve
   11. Manifold
   12. Orifice
   13. Burners
   14. Heat Exchangers
   15. Fan Switch
   16. Limit Switch
   17. Pilots
   18. Safety Devices at the Standing Pilot
   19. Ignition systems
   20. Flame Rectification
   21. High-Efficiency Gas Furnaces
   22. Electronic Ignition Modules and Integrated Furnace Controllers
   23. Two-Stage Gas Furnaces
24. Modulating Gas Furnaces
25. Venting
26. Gas Piping
27. Gas Furnace Wiring Diagrams and Troubleshooting Flowcharts
28. Troubleshooting the Safety Pilot-Proving Device – The Thermocouple
29. Troubleshooting spark Ignition and Intermittent Pilot Systems
30. Combustion Efficiency
31. Service Technician Calls

C. Unit 32 Oil Heat
1. Introduction to Oil-Fired Forced-Warm Air Furnaces
2. Physical Characteristics
3. Fuel Oils
4. Oil Storage
5. Fuel Oil Supply Systems
6. Combustion
7. Preparation of Fuel Oil for Combustion
8. By-Products of Combustion
9. Gun-Type Oil Burners
10. Oil Furnace Wiring Diagrams
11. Stack Switch Safety Control
12. Cad Cell Safety Control
13. Combustion chamber
14. Heat Exchanger
15. Condensing Oil Furnace
16. Service Procedures
17. Combustion Efficiency
18. Service Technician Calls

D. Unit 33 Hydronic Heat
1. Introduction to Hydronic Heating
2. The Heat Source
3. The Basic Hydronic system
4. The Point of No Pressure Change
5. Other Hydronic System Components
6. High-Temperature Hydronic Piping systems
7. Radiant, Low-Temperature Hydronic Piping systems
8. Combination (High- and Low-Temperature) Piping Systems
9. Tankless Domestic Hot Water Heaters
10. Service Technician Calls
E. Unit 34 Indoor Air Quality
   1. Introductions
   2. Sources of Indoor Air Pollution
   3. Controlling Indoor Air Contamination
   4. Common Pollutants
   5. Contamination Source Detection and Elimination
   6. Ventilation
   7. Air Cleaning
   8. Duct Cleaning
   9. Air Humidification
  10. Sizing Humidifiers
  11. Installation
  12. Service, Troubleshooting, and Preventive Maintenance

IV. METHOD(S) OF INSTRUCTION
A. Classroom Lecture
B. Lab Demonstrations
C. Specialty Lectures by Industry Personnel

V. REQUIRED TEXTBOOK(S)

Clifton Park, NY: Delmar Cengage Learning

VI. REQUIRED MATERIALS

HRA Tool Kit – estimated cost - $420 (purchased through the HRA Department)

VII. SUPPLEMENTAL REFERENCES

None

VIII. METHOD OF EVALUATION
A. Theory, Tests, Quizzes, Homework 45%
B. Shop/Lab 45%
C. Instructor Evaluation, Attendance 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.