

JEFFERSON COLLEGE

COURSE SYLLABUS

HRA101

ELECTRICITY FOR HVAC

5 Credit Hours

Prepared by:
William Kaune

Revised Date: March 17, 2014

Dena McCaffrey, Ed.D., Dean, Career & Technical Education

HRA101 Electricity for HVAC

I. CATALOGUE DESCRIPTION

- A. Prerequisites: 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

Corequisites: Reading Proficiency

- B. 5 semester credit hours

- C. Electricity for HVAC is a lecture/lab class including electron theory, series circuits, parallel circuits, relay circuits, control and power wiring, magnetism, alternating current, and direct current. (F, S)

II. EXPECTED LEARNING OUTCOMES/CORRESPONDING ASSESSMENT MEASURES

Demonstrate safety and how electric shocks can affect the human body	Exams Homework Quizzes Projects
Demonstrate how electricity is produced and explain voltage, current, and resistance	Exams Homework Quizzes Projects
Demonstrate use of Ohm’s Law to solve problems in series and parallel circuits	Exams Homework Quizzes Projects
Demonstrate use of hand tools and proper safety procedures	Exams Homework Quizzes Projects Lab
Draw wiring diagrams using appropriate signals	Exams Homework Quizzes Projects
Identify circuit protectors, current carrying conductors, and grounding apparatus	Exams Homework Quizzes Projects Lab

Demonstrate how to wire low and high voltage circuits	Exams Homework Quizzes Projects Lab
---	---

III. OUTLINE OF TOPICS

- A. Unit 1 What You Need to Know to Understand Electricity
 - 1. What is Electricity
 - 2. Types of Electricity
 - 3. Electrical Terms Used in HVACR
 - 4. Combining Volts, Amps, and Resistance

- B. Unit 2 Ohm's Law and Circuit Operation
 - 1. Technical Review
 - 2. Ohm's Law
 - 3. How E, I, and R Influence Each Other
 - 4. Series Circuits
 - 5. Parallel Circuits
 - 6. Combination Circuits
 - 7. Using the Ohm's Law Wheel
 - 8. Using the Watts Formula
 - 9. Combined Ohm's Law and Watts Formula Wheel
 - 10. Calculating Resistance
 - 11. Resistance in Series Circuits
 - 12. Resistance in Parallel Circuits
 - 13. Resistance in Series-Parallel Circuits

- C. Unit 3 Safe Use of Electrical Instruments
 - 1. Read the Directions
 - 2. Digital Multimeters
 - 3. RMS
 - 4. What Do All Those Symbols Mean
 - 5. Voltmeter Function
 - 6. Measuring AC and DC Voltage
 - 7. Measuring Resistance
 - 8. Reading Amperage
 - 9. Optional Features
 - 10. Beware of Ghost Voltage
 - 11. Selecting a Safe Multimeter
 - 12. How Much Electricity Is Too Much
 - 13. Arc Flash
 - 14. What to Wear When Measuring Voltage

15. Safety Tips from Canada
 16. Safety Tips When Using Meters
 17. Lockout/Tagout Procedures
- D. Unit 4 Electrical Fasteners
1. Wire Nuts
 2. Screws
 3. Bolts, Nuts, and Washers
 4. Nails
 5. Nylon Straps
 6. Quick Connectors
 7. Electrical Tape
- E. Unit 18 Resistors
1. The Resistor
 2. Types of Resistors
 3. Power Rating
 4. Operation Temperature and Voltage
 5. Tolerance
 6. Calculating Resistance
- F. Unit 7 Electrical Installation of HVACR
1. New Installations
 2. High Voltage
 3. Control Voltage
 4. Replacing HVACR Equipment
 5. Large HVACR Systems
 6. Additional Electrical Requirements
 7. Installation Information
 8. Installation Notes
 9. Electrical Checklist
 10. Rewiring Equipment
 11. Open Wiring and Conduit
- G. Unit 8 Transformers
1. How Do Transformers Work
 2. Types of Transformers
 3. Calculating Volt-Amps (VA)
 4. Checking Input Voltage on a Transformer
 5. Checking Output Voltage on a Transformer
 6. More Transformer Tips
 7. Wiring Transformers in Parallel

- H. Unit 9 Relays, Contactors, and Motor Starters
 - 1. Common Features
 - 2. Differences Among Relays, Contactors, and Motor Starters
 - 3. Relays
 - 4. Contactors
 - 5. Troubleshooting Contactors
 - 6. Motor Starters
 - 7. Electrical Diagrams
 - 8. Reading Electrical Diagrams
 - 9. Motor Starter Replacement

- I. Unit 10 Capacitors
 - 1. Capacitor Symbol
 - 2. Capacitor Construction
 - 3. Capacitor Operation
 - 4. Types of Capacitors
 - 5. How Are Capacitors Rated
 - 6. Troubleshooting Capacitors
 - 7. Capacitors in Series and Parallel
 - 8. Installing Capacitors

- J. Unit 11 Thermostats
 - 1. Types of Thermostats
 - 2. Parts of a Thermostat
 - 3. Operating Voltage
 - 4. Thermostat Installation
 - 5. Thermostat Wiring
 - 6. Summary of Terminal Connections
 - 7. Mechanical Thermostats
 - 8. Heating Anticipator
 - 9. Cooling Anticipator
 - 10. Types of Mechanical Thermostats
 - 11. Basic Cooling Thermostat Hookup
 - 12. Basic Heating Operation
 - 13. Touch Screen
 - 14. Programmable Thermostat Language
 - 15. Programming Options
 - 16. Dummy Thermostat
 - 17. Thermostat Diagrams
 - 18. General Troubleshooting Steps

- K. Unit 12 Pressure Switches
 - 1. Low-Pressure Switches
 - 2. Low-Pressure Switch Installation
 - 3. Loss of Charge Switch
 - 4. Determining If a Low-Pressure Switch Is Defective
 - 5. High-Pressure Switches
 - 6. High-Pressure Switch Installation
 - 7. Determining If a High-Pressure Switch Is Defective
 - 8. Dual-Pressure Switch
 - 9. Condenser Fan Cycling Switch
 - 10. Oil Pressure Safety Switch
 - 11. Troubleshooting the Oil Safety Pressure Switch

- L. Unit 13 Miscellaneous Electrical Components
 - 1. Crankcase Heater
 - 2. Troubleshooting the Crankcase Heater
 - 3. Solenoid Valve
 - 4. Troubleshooting the Solenoid Valve
 - 5. Electric Unloaders
 - 6. Troubleshooting the Electric Unloader
 - 7. Replacing the Electric Unloader
 - 8. Solid-State Time Delays
 - 9. Troubleshooting the Solid-State Delays
 - 10. Lockout Relay
 - 11. Reset Relay
 - 12. Troubleshooting the Lockout Relay
 - 13. Hot Gas Thermostat
 - 14. Troubleshooting the Hot Gas Thermostat
 - 15. Line Voltage Monitor
 - 16. Explosion-Proof Systems
 - 17. Overload Relay
 - 18. Troubleshooting the Overload Relay

- M. Unit 14 How Motors Work
 - 1. Before We Start!
 - 2. Use of Meters
 - 3. Starting Torque
 - 4. Running Operation
 - 5. Voltage
 - 6. How Do Motors Work
 - 7. Thermal Protection
 - 8. Nameplate Information
 - 9. Rated Voltage

10. Rated Load Amps (RLA)
11. Locked-Rotor Amps (LRA)
12. Frequency
13. Phase
14. Horsepower
15. RPM Speed
16. Multispeed Single-Phase Motors
17. Insulation Class and Rated Ambient Temperature
18. Service Factor (SF)
19. Frame
20. Power Factor (PF)
21. Time Rating or Duty
22. Bearing Types
23. Service Checklist

IV. METHODS OF INSTRUCTION

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

V. REQUIRED TEXTBOOKS

Moravek, Joseph; *Electricity for HVACR* (current edition); Pearson Education Inc.

VI. REQUIRED MATERIALS

HRA Tool Kit (purchased through the HRA Department)

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 (Library; phone 636-797-3000, ext. 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).

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.