JEFFERSON COLLEGE
COURSE SYLLABUS

HRA101
BASIC ELECTRICITY
5 Credit Hours

Prepared by
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HRA101 Basic Electricity

I. CATALOGUE DESCRIPTION

A. Prerequisite: None

B. 5 Hour Semester Course

C. Basic Electricity is a lecture/lab class including electron theory, series circuits, parallel circuits, relay circuits, house wiring, magnetism, alternating current, and power distribution.

II. EXPECTED LEARNING OUTCOMES / ASSESSMENT MEASURES

| Students will understand safety and how electric shocks can affect the human body | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |
| Students will be able to explain how electricity is produced and explain how electricity is produced and explain voltage, current and resistance | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |
| Students will use OHM’s Law to solve problems in series and parallel circuits | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |
| Students will understand used of hand tools and proper safety procedures | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |
| Students will be able to understand and be able to draw wiring diagrams using appropriate signals | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |
| Students will be able to identify circuit protectors, current carrying conductors, and grounding apparatus | In Class Exam as well as Homework and/or Quizzes and/or in Class Projects |

III. OUTLINE OF TOPICS

A. Safety Practices for HVAC
   1. Electrical Shock and how they affect your body
   2. First Aid and CPR
   3. Protecting Electrical Circuits and Equipment
   4. Grounding
   5. Ground Fault Interruption Circuit Breakers
   6. Duplex Grounded Receptacles
   7. Portable Power Tools
   8. Testing the Ground Wire
9. Short Circuits
10. Electrical Safety
11. Working safely around equipment
12. Electrical lockout and tag out procedures
13. Overview of Lockout/Tag out Safety
14. Removing the Lockout/Tag out Devices
15. Removing a coworker’s lockout/tag out equipment
16. Safety glasses, Protective Clothing, and Equipment

B. Fundamentals of Electricity
1. Example of a simple electrical circuit in a heating
2. Example of Voltage in a circuit
3. Example of Current in a Circuit
4. Example of Resistance in a Circuit
5. Electric Power in a circuit
6. Identifying the basic parts of a circuit
7. Comparing Electricity with a water system
8. Using Ohm’s
9. Ohm’s Law Formulas
10. Using Ohm’s Law to Calculate Voltage
11. Using Ohm’s Law to Calculate Volts, Amps, and Ohms
12. Using Ohm’s Law to Calculate Current
13. Using Ohm’s Law Wheel to Remember Ohm’s Law Formulas
14. Calculating Electrical Power
15. Presenting All the Formulas

C. Electrical Circuits
1. Fundamentals of Electrical Circuits
2. Examples of Series Circuits
3. Connecting Switches in Series
4. Other Components that are connected in Series
5. Adding Loads in Series
6. Calculating Voltage, Current, and Resistance in Series Circuits
7. Resister Color Codes
8. Using Ohm’s Law to Calculate Ohms, Volts and Amps for Resistors in Series
9. Solving for Current in a Series Circuit
10. Calculating the Voltage drop Across Each Resistor
11. Calculating the Power Consumption of Each Resistor
12. Calculating the Power Consumption of an Electrical Heating Element
13. Parallel Circuits
14. Calculating Voltage, Current, and Resistance in a Parallel Circuit
15. Calculating Resistance in a Parallel Circuit
16. Calculating Power in a Parallel Circuit
17. Series-Parallel Circuits
18. Series-Parallel Circuits in AC and Refrigeration Systems

D. Meters and Tools for HVAC
1. Measuring Voltage, Current and Resistance
3. Measuring Voltage
4. Solenoid Type Voltage Tester
5. Measuring Electrical Current
6. Measuring Milliamps
7. Reading Current with a Clamp-On Ammeter
8. Measuring DC Volts
9. Measuring and Reading the Milliamp Scales on the VOM
10. Measuring and Reading Resistance on the VOM
11. Making Measurements with Digital VOM Meters
12. Megohmmeters (Meggers)
13. Overview of Electrical Tools Used for HVAC
14. Electrical Pliers, Wire Cutters, and Wire Strippers
15. Screwdrivers for Electrical Installation and Maintenance
16. Wrenches for HVAC Maintenance
17. Electrical Conduit Bending, Cutting, and Threading Tools
18. Tool Pouches and Tool Belts

E. Magnetism, Alternating Current, and Power Distribution
1. Magnetic Theory
2. A Typical Bar Magnet and Flux Lines
3. Electromagnets
4. Adding Coils of Wire to Increase the Strength of an Electromagnet
5. Using a Core to Increase the Strength of the Magnetic Field of a Coil
6. Reversing the Polarity of a Magnetic Field in an Electromagnet
7. An Overview of AC Voltage
8. Electromagnetic Induction
9. Where does AC Voltage Originate?
10. Frequency of AC Voltage
11. Peak Voltage and RMS Voltage
12. The Source of AC Voltage for Heating, Ventilating, and Air-Conditioning Systems
13. Measuring AC voltage in AC circuits
14. Voltage and Current in AC Circuits
15. Resistance and Capacitance in an AC Circuit
16. Calculating Capacitive Reactance
17. Calculating the Total Opposition for a Capacitive and Resistive Circuit
18. Resistance and Inductance in an AC Circuit
19. Calculating Inductive Reactance
20. Calculating the Total Opposition for an Inductive and Resistive Circuit
21. True Power and Apparent Power in an AC Circuit
22. Calculating Power Factor
23. Overview of Power Distribution for HVAC

F. Reading and Writing Schematic (Ladder) Diagrams and Wiring Diagrams
   1. Overview of Diagrams and Symbols
   2. Reading and Writing Schematic (Ladder) Diagrams and Wiring Diagrams
   3. Converting a Schematic (Ladder) Diagram Into a Wiring Diagram
   4. Electrical Diagram of a Residential Split Air-Conditioning System
   5. Loads for the Air-Conditioning System
   6. Controls for the Air-Conditioners
   7. Package Air Conditioners
   8. Window Air Conditioners
   9. Electrical Diagrams of a Simple Heating System (Gas Furnace)
  10. Electrical Diagram of a Simple Refrigeration System
  11. Loads for the Refrigeration System

IV. METHOD(S) OF INSTRUCTION

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

V. REQUIRED TEXTBOOK(S)


VI. REQUIRED MATERIALS

Electronic Calculator with scientific notation, basic hand tools (As outline on attached tool list)
VII. SUPPLEMENTAL REFERENCES


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 (Library 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.
Heating, Refrigeration, and Air Conditioning
Hand Tool List

All of the tools on the following list will be used in the first and second years of training. All tools and equipment should be marked for identification. Any used tools or similar equipment is acceptable provided they are safe to use and are adequate for the program. The tools marked with an * may be purchased through different suppliers at a student discount.

1) Padlock with keys or combination lock
2) Tool pouch with belt or small tool box
3) VOM Fieldpiece SC76
4) Screwdriver 6” blade – square tip – insulated handle only
5) Screwdriver 6” blade – Phillip’s-tip – insulated handle only or multi-bit or combination set
6) Long-nose (needle-nose) pliers #6 – insulated handle only
7) Diagonal (side cutters) pliers #6 – insulated handle only
8) Protective (safety) glasses, clear glass w/side shields only (students must have and use safety glasses in the shop area at all times)
9) Center punch
10) Hammer ball being 8 oz. (no claw hammer)
11) Nut Driver Set 3/16” to ½” (or socket set)
12) 8” adjustable wrench
13) Tool box with tray

Shop Work Schedule

All shop work assignments are in Lab Manual to accompany Kissell. E, Thomas, 4th Electricity, Electronics, and Control Systems for HVAC. Assignments in lab manual will follow scheduled theory lecture chapters. Chapter one In Theory Textbook Refrigeration & Air Conditioning Technology by Bill Whitman, Bill Johnson, John Tomczk, and Eugene Silberstein will be chapter one in lab manual Refrigeration and Air conditioning Technology.