HRA101

BASIC ELECTRICITY

5 Credit Hours

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Revision Date: January 2003
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CAREER & TECHNICAL EDUCATION
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HRA101 Basic Electricity
I. CATALOG DESCRIPTION

Prerequisite: None
5 semester hours credit

Basic Electricity is a lecture/laboratory class including electron theory, series and parallel circuits, test equipment, single- and three-phase motors, and an introduction to household wiring.

II. COURSE GENERAL OBJECTIVES

A. Identify common terms in the electron theory
B. Identify how electricity is produced
C. Identify how a meter works
D. Demonstrate to measure volt, amp, and ohm units
E. Identify and use hand tools and meters
F. Identify to work volts, amps, ohms parallel circuits
G. Calculate the service entrance
H. Identify to wire heavy appliances
I. Identify to work volts, amps, ohms series circuits
J. Wire a four-way switch circuit
K. Identify and wire the five single-phase motors
L. Identify and wire three-phase motors

III. COURSE OUTLINE

A. Safety
   1. Rules
   2. Electric Current
   3. OSHA
   4. MSDS
   5. Lockouts
   6. Protective Clothing
   7. Ladder Safety
   8. Fires
   9. GFCI
  10. Grounding

B. Introduction to Electricity
   1. History
   2. Atoms
   3. Law of Charges
   4. Electron Flow
   5. Conductors
   6. Insulators
   7. Semiconductors
   8. Molecules
9. Sources of Electricity
10. Electrical Effects

C. Ohm's Law and Electrical Quantities

1. Coulomb
2. Ampere
3. Electron Flow
4. Conventional Flow
5. Electric Circuits
6. Volt, Ohm, Watt
7. Power
8. Ohm's Law
9. Scientific Notation
10. Engineering Notation
11. Metric Prefixes
12. SI Units

D. DC Components

1. Switches
2. Fuses
3. Circuit Breakers
4. Resistors
5. Batteries

E. Series Circuits

1. Resistance
2. Voltage
3. Current
4. Power
5. Voltage Dividers
6. Voltage Polarity
7. Ground

F. Parallel Circuits

1. Resistance
2. Voltage
3. Current
4. Power
5. Current Dividers
G. Measuring Instruments

1. Analog Meters
   a. Volt meter
   b. Amp meter
   c. Ohm Meter
2. Digital Meters
3. Reading a Meter

H. Conductors

1. NEC charts
2. Ampacity
3. Correction Factors
4. Conductor Resistance
5. Conductor Sizing
6. Conductor Voltage Drop
7. Conductor Testing

I. Magnetism

1. Permanent Magnets
2. Magnetic Materials
3. Lines of Force
4. Electromagnets
5. Magnetic Measurements
6. Magnetic Polarity
7. Demagnitizing
8. Magnetic Devices

J. Magnetic Induction

1. Electromagnetic Induction
2. Left Hand Generator Rule
3. Magnetic Fields
4. Induced Voltage
5. Lenz's Law
6. Time Constants
7. Voltage Spikes

K. Alternating Current

1. Sine Waves
2. Resistive AC Circuits
3. AC Power
4. Skin Effect in AC Circuits
L. AC Components

1. Capacitors
2. Inductors
3. Relays
4. Contactors

M. Transformers

1. Single Phase Transformers
2. Isolation Transformers
3. Autotransformers
4. Transformer Polarities
5. Phase Relationships
6. Transformer Testing
7. Transformer Nameplates
8. Three Phase Transformers

N. Motors

1. DC Motors
2. AC Motors
   a. Single Phase
   b. Three Phase

O. Residential Wiring Circuits

1. Part Identification
2. Outlet Receptacles
3. Lighting Circuits
   a. Single switch
   b. Three way switch
   c. Four way switch

IV. UNIT OBJECTIVES

A. Safety

Upon completion of this unit the student will be able to:

1. State basic safety rules.
2. Describe the effects of electric current on the human body.
3. Discuss the responsibilities of OSHA.
4. Discuss lockout and tagout procedures.
5. Explain proper placement of a straight ladder.
6. Discuss the use of scaffolds.
7. Discuss classes of fires.
8. Discuss ground-fault circuit interrupters.
9. Discuss the importance of grounding.

Reading Assignment: Delmar=s Standard Textbook of Electricity, 3rd ed.,
pp. 1-27,
Review Questions - pg. 24  1-15
Problem Assignment - None
Lab Assignment - None

B. Introduction to Electricity

Upon Completion of this unit the student will be able to:

1. Give a brief history of electricity.
2. List the three major parts of an atom.
3. State the law of charges.
4. List several sources of electricity.
5. Discuss the differences between semiconductors and insulators.
6. Define a molecule.
7. Discuss effects of electricity.

Reading Assignment: Delmar=s Standard Textbook of Electricity, 3rd ed., pp. 28-50,
Review Questions - pg. 50  1-10
Problem Assignment - None
Lab Assignment - None

C. Ohm=s Law and Electrical Quantities

Upon Completion of this unit the student will be able to:

1. Define a coulomb.
2. Define an ampere.
3. Define a volt.
4. Define an ohm.
5. Define a watt.
6. Compute electrical values using Ohm=s law.
7. Discuss the basic types of circuits.
8. Use the Ohm=s wheel charts.
9. Express numbers in Scientific and Engineering Notation.
10. Express numbers using common electrical unit prefixes.
11. Define S I Units.

Reading Assignment: Delmar=s Standard Textbook of Electricity, 3rd ed., pp. 51-78,
Review Questions - pg. 77  1-14
Problem Assignment - pg. 78  All
Lab Assignment - None

D. DC Components
Upon completion of this unit the student will be able to:

1. Define kinds of switches.
2. Define types of switches.
3. Discuss fuses and circuit breakers as safety devices.
4. List the major types of fixed resistors.
5. Determine the resistance of a resistor using the color code.
6. Discuss how exceeding its power rating can cause damage to a resistor.
7. Discuss the use of a variable resistor as a potentiometer and a rheostat.
8. Discuss the differences between primary and secondary cells.
9. List voltages for different types of cells.
10. Discuss different types of primary cells.
11. Construct a cell from simple materials
12. Discuss different types of secondary cells.
13. Connect batteries in series and parallel to obtain desired voltage and amp-hour ratings.
14. Discuss the operation of solar cells.
15. Connect solar cells in series or parallel to produce the desired output voltage and current capacity.
16. Discuss the operation of thermocouples.
17. Discuss the piezoelectric effect.

Reading Assignment: Delmar’s Standard Textbook of Electricity, 3rd ed., pgs. 113-133, pgs. 354-387
Review Questions - pg. 132  1-10 and pg. 386  1-22
Problem Assignment - pg. 133 All
Lab Assignment - As assigned by instructor

V. METHOD OF INSTRUCTION

VI. REQUIRED TEXTBOOKS

Delmar’s Standard Textbook of Electricity by Stephen L. Herman, 3rd Edition

VII. REQUIRED MATERIALS

Electronic Scientific Notation Calculator

VIII. SUPPLEMENTAL REFERENCES

IX. METHOD OF EVALUATION

70% Theory (tests, quizzes, homework, etc.)
20% Lab
10% Instructor Evaluation (attendance, class participation, etc.)

Class Attendance Policy:

As stated on page 31 of the 2004/2005 college catalog.
Cheating:
Cheating on tests or other assignments will result in a 0% grade being awarded for that test or assignment, and possible suspension from the class with permission to return to class only after meeting with the Associate Dean and/or Dean of Career and Technical Education.
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 are 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.

- Padlock with keys or combination lock
- Tool pouch with belt or small tool box
- Volt ohm meter (no small scales) min. scale 3" x 3" - (easily read) Micronta 18 range #22-201u or equal
- Pump (multi-pliers) pliers - insulated handle only - 10"
- Screwdriver pocket size - square tip
- Screwdriver 6" blade - square tip - insulated handle only
- Screwdriver 6" blade - Phillips's-tip - insulated handle only or multi-bit or combination set
- Long-nose (needle-nose) pliers #6 - insulated handle only
- Slip-joint (wire pliers) pliers #6 - insulated handle only
- Diagonal (side cutters) pliers #6 - insulated handle only
- Protective (safety) glasses, clear glass w/side shields only (students must have and use safety glasses in the shop area at all times)
- FS3L Amprobe with case *
- Center punch
- Hammer ball bein 8 oz. (no claw hammer)
- Allen Screw Wrench set #TL16 or equal (must have 6" shafts)
- Nut Driver Set 3/16" to 2" (or socket set)
- 6-piece open-end wrench set 3/8" to 11/16" (or box-end wrench set)
- 8" adjustable wrench
- Steel-tape rule 6"
- Robinair gauge manifold set #40153 or equal
- 10" adjustable wrench
- Tool box with tray
- Flaring tool set 3/16" to 5/8"
- Tube cutter 3/16" to 5/8"
- Swaging tool set 3/16" to 5/8" (5pc)
- Tubing reamer #208F
- Thermometer pocket -40° to 160° F (no glass)
- Thermometer pocket -20° to 220° F (no glass)
- Reversible ratchet wrench 1/4", 3/8", 3/16", 5/16" *
- Tubing cutter, small (Imp) TC1050n *
- Constrictor wheel #76637 *

Revised 2/98