Electricity Training Course
Basic Electronics
40 hours, 40 NATE CEHs, 4.0 CEUs – 216 pages

Lesson 1 - Back to Basics
Objectives:
- Define resistance and explain how resistors work.
- Define capacitance and explain how capacitors work.
- Define inductance and explain how inductors work.
- Describe how the basic "building blocks" of matter--elements, compounds, molecules, atoms, and so on--are related to each other, and how atomic structure is related to the study of electricity.
- Define the coulomb, volt, ampere, ohm, and watt, and use these units of measurement properly.
- State Ohm's Law.
- Use the equations commonly derived from Ohm's Law to calculate voltage, current, resistance, and power in electric circuits.
- Explain the difference between series circuits and parallel circuits.

Lesson 2 - Solid-State Fundamentals
Objectives:
- Explain how semiconductors differ from conductors and insulators.
- Explain how a semiconductor is affected by doping.
- Define the term diode and give a brief description of its construction and operation.
- Explain how external voltages applied to semiconductor devices create a forward bias or a reverse bias.
- Define the term transistor and give a brief description of its construction and operation.
- Describe the bias polarity requirements for both NPN and PNP transistors.

Lesson 3 - Diodes and Power Supplies
Objectives:
- Define rectification.
- Explain how a diode can be used as a half-wave rectifier.
- Explain how diodes can be used as full-wave rectifiers.
- Describe the basic operation of a bridge rectifier.
- Describe the basic construction, operation, and applications of a variety of special-purpose diodes, including LEDs, Zener diodes, diacs, varactors, tunnel diodes, and photodiodes.

Lesson 4 - Power Supply Regulation and Filtration
Objectives:
- Explain the need for regulation and filtration in power supplies.
- Describe basic resistive/capacitive regulation and filtration.
- Describe basic inductive/capacitive regulation and filtration.
- Explain how a Zener diode can be used in a power supply circuit.
- Describe the operation of a multistage filter network.
- Explain the purpose of fixed and adjustable voltage regulators.
- Discuss the need for heat sinks on regulators.

Lesson 5 - Transistors
Objectives:
- Define the term transistor and give a brief description of its basic construction and operation.
- Explain the difference between NPN transistors and PNP transistors.

- Identify different types of transistors by their schematic symbols. Explain the concepts of current gain, voltage gain, and power gain.
- Explain how a transistor can be used to amplify a signal.
- Explain how a transistor can be used as a switch.
- Describe the basic operation of a unijunction transistor (UJT), a field-effect transistor (FET), and a phototransistor.

Lesson 6 - Silicon-Controlled Rectifiers
Objectives:

- Describe the basic construction and operation of a silicon-controlled rectifier (SCR).
- Explain how the SCR is “gated” on and off.
- Explain what effect the removal of the gate signal has on an SCR.
- Describe the two basic types of gate “turn-on” circuits.
- Explain the difference between single-phase and three-phase alternating current SCR control.
- Describe the basic construction and operation of light-activated SCRs and optocoupled SCRs.

Lesson 7 - Triacs, Diacs, and Solid-State Relays
Objectives:

- Explain how the development of the triac has made HVACR controls more versatile.
- Explain the difference between a triac and an SCR.
- Describe how a triac is “gated” on and off.
- Explain how and why triacs can be used on resistive and inductive loads.
- Describe the operation of three-phase triacs.
- Describe the basic construction and power limitations of a triac.
- Explain how a solid-state relay functions.

Lesson 8 - Peltier Diodes
Objectives:

- Explain what the Seebeck effect is.
- Explain what the Peltier effect is.
- Describe the basic construction and operation of a Peltier diode.
- Identify common applications of electronic refrigeration.

Lesson 9 - Protective Devices
Objectives:

- Explain the need for protection in solid-state electronic equipment.
- Define a transient, and explain how it can damage electronic equipment.
- Describe the operation of a pi filter.
- Explain how a metal-oxide varistor (MOV) functions.
- Describe how and where spark arrestors and snubbers are used.
- Explain how crowbar circuits protect against excessive voltage.

Lesson 10 - Number Systems
Objectives:

- Explain the difference between analog and digital.
- Explain why the standard decimal number system cannot be used in computers.

- Define the basic terms that are common to all number systems--unit, symbol, base, exponent, and power.
- Explain how positional notation works when applied to the decimal and binary number systems.
- Convert binary numbers to their decimal equivalents.
- Convert decimal numbers to their binary equivalents.
- Add binary numbers.
- Describe octal and hexadecimal number systems.

Lesson 11 - Logic Circuits
Objectives:

- Identify general logic conditions, logic states, logic levels, and positive and negative logic as these terms and characteristics apply to the inputs and outputs of fundamental logic circuits.
- Identify basic AND, OR, NOT, NAND, NOR, and exclusive OR gates, and recognize the Boolean expressions for each.
- Construct and interpret truth tables.
- Explain the function of a simple flip-flop circuit.

Lesson 12 - Digital Integrated Circuits
Objectives:

- Interpret a pinout diagram.
- Explain what the abbreviations TTL, CMOS, DIP, SSI, LSI, MSI, and VLSI mean.
- Describe the six basic configurations of TTL integrated circuits, and give examples of typical applications.

Lesson 13 - Analog Integrated Circuits
Objectives:

- Explain how analog ICs differ from digital ICs.
- Describe the basic operation of the op amp.
- Identify the three basic functional applications of the op amp.
- Define and calculate gain.
- Explain how and why negative feedback is used in amplifiers.
- Explain how op amps are used in comparator circuits.
- Describe the basic operating characteristics of the 555 timer, the 3909 LED flasher, and the LM383 power amplifier.

Lesson 14 - Microprocessors and Computers
Objectives:

- Discuss the history and background of computers, and explain how they evolved from mechanical calculating machines.
- Describe the function of a microprocessor.
- Explain the difference between fixed and programmable digital devices.
- Define hardware, software, and firmware.
- Identify the basic components of a computer.
- Explain the difference between parallel and serial transmission of data.
- Use the basic terminology associated with computers.