

# Proposed E&I Curriculum for Basic Panel Building and Maintenance

## Schematics and Symbols

### Topics

*Using schematics; Electrical; Electrical current;*

### Learning Objectives:

- *State the definition of a schematic.*
- *List some characteristics of schematics.*
- *Identify a schematic among other kinds of technical drawings and diagrams.*
- *Explain how flow is indicated on a schematic.*

## Electrical Symbols

### Topics

*Wires and connections; Switches; Power supply; Electrical loads; Coils and transformers; Fuses and circuit breakers; Grounding; Contacts; Resistors; Symbols in a diagram*

### Learning Objectives:

- *State the meaning of symbols and lines on an electrical schematic.*
- *Explain the difference between a fuse and a circuit breaker.*
- *Explain how to trace an electrical circuit.*

## Wiring Equipment and Tools

### Topics

*Wire stripping methods. Installation types and usage: Voltage meters. Continuity testing*

### Learning Objectives:

- *Proper methods of stripping wire of assorted AWG.*
- *Overview of various industrial wiring standards (UL508A, NEC and NFPA 79)*
- *Identify usage of twisted pairs and various shielding practices.*
- *Explain use of wire stripping and crimping tools*
- *Explain how to read voltage with the use of a voltage meter (multi-meter)*
- *Explain how to test continuity within a circuit*

## Basic Voltage, Current and Resistance

### Topics

*Series vs. Parallel; Nodes; Electrical Interference; Power Supplies*

### Learning Objectives:

- *Understanding the characteristics of series and parallel circuits.*
- *Identification of different Electrical interference sources and crosstalk*
- *Understanding of surge suppression; use of MOVs, snubbers, etc.*
- *Understanding of basic power supplies*

## General Safety and Grounding Practices

### Topics

*Lockout Tag out; Disconnects; Work Area Inspection; ESD (Electro- Static Discharge); Matting*

### Learning Objectives:

- *Understanding Lock-out Tag-out procedures (LOTO).*
- *Identification and use of various electrical disconnects and circuit breakers .*
- *Good work area habits to promote safety.*
- *Understanding ESD and use of tools to prevent component damage.*

## DC Electromagnetics

### Topics

*Magnetic forces and fields; Magnetic shielding; Solenoids; Residual magnetism; Relays; Polarized relays; Protecting relay contacts*

### Learning Objectives:

- *State the definition of residual magnetism.*
- *Explain the effects of distance on magnetic field strength.*
- *Discuss the characteristics and uses of solenoids.*
- *Discuss the characteristics of relays.*

## DC Relays

### Topics

*Operating characteristics; Shunt, series, lockout, and inductive time-delay relays; Magnetic blowout coils;*

### Learning Objectives:

- *Name three factors that determine the performance and reliability of a relay.*
- *Name the six types of commonly used relays.*
- *Explain the operation of each type of relay.*

## Maintenance of DC Equipment

### Topics

*Inspection; Replacing field coils; DC motor controllers; Relay contacts; Commutation; Maintaining relays and armatures*

### Learning Objectives:

- *Explain how to test field coils to determine the condition of the insulation.*
- *List the signs of a short-circuited field coil in a machine.*
- *Explain how to replace a field coil in a machine.*
- *Discuss how to maintain relay control.*
- *Name the criteria for satisfactory commutation.*