Foundational Industrial Electrical and Fluid Power Systems

Day 1: Mathematics for Electricity:

Key Concepts:

- Fractions, Fractions operation
- Proportions and percentages and their operation
- Trigonometry and Pythagorean theorem
- Voltage, Current, Resistance, Power
- Ohm's Law and Power Formulas
- Units and Conversions (e.g., Watts, Amps, Volts)
- Basic Electrical Calculations
- Activities- Hands-on calculations in class.

Day 2: DC & AC Theory and Fundamentals:

Key Concepts:

- DC Circuits and Components
- Series and Parallel Configurations
- Combination Circuits
- Close circuit, open circuit, and short circuit.
- Kirchhoff's Laws.
- Grounding and GFCI
- Power Calculations in DC Circuits
- AC Waveforms and Frequency
- RMS Values and Phase Relationships
- Impedance in AC Circuits
- Power Factor and, true power, reactive power, and apparent power.

Day 3: Lab Day about DC&AC circuits and troubleshooting electrical circuits.

Hands-on Activities:

- Building and analyzing DC circuits, series, parallel, and series-parallel combination circuits.
- Troubleshooting common DC circuit issues (open, short, ground fault).
- Measuring AC voltage and current

- Calculating impedance and power factor for resistive load, indicative load, capacitive load, and combination load.
- Building and analyzing simple AC circuits.

Day 4: Transformers, Motors and Motor Control.

Key Concepts:

- Types of DC Motors (Series, Shunt, Compound)
- Motor Characteristics and Speed Control
- Starting Methods (Direct, Star-Delta)
- Control Techniques
- Introduction to Motor Control Circuits
- Overload Protection and Safety
- AC Induction Motors
- AC Synchronous Motors
- Principle of Operation
- Speed and Torque Control
- Programming and Troubleshooting VFDs

Day 5: Lab Day, Transformers and Motor Control.

Hands-on Activities:

- Calculate many examples for different transformers applications for ratio, voltage, current, and VA.
- How to size and select a transformer for an application.
- Wiring and testing Different DC motor control circuits.
- Setting up and operating a VFD
- Diagnosing common VFD issues.

Day 6: Hydraulic Systems and Pneumatic Systems

Key Concepts:

- Definition and significance in industrial applications.
- Comparison between hydraulic and pneumatic systems.
- Pascal's Law and Fluid Power
- Hydraulic Components (Pumps, Cylinders, Valves)
- Hydraulic Schematics
- How to control speed and pressure in a hydraulic application
- Meter-in and Meter-out hydraulic control circuits
- Hydraulic Circuit Design
- Maintenance best practices

- Basic Pneumatic Principles- Pascal's Law and Boyle's Law
- Components (Compressors, Actuators, Valves)
- Pneumatic Schematics
- Speed and pressure control circuits
- Control Systems and Automation
- Maintenance and Troubleshooting:

Day 7: Hydraulic and Pneumatic Systems Lab Day:

Hands-on Activities:

- Reading hydraulic and pneumatics measurement instruments for flow, pressure, level, temperature, and speed.
- Building and testing many hydraulic and pneumatics circuits
- Troubleshooting hydraulic and pneumatics circuits.
- Design, construct, and test your designed circuit given scenarios by the instructor.

Day 8- Electrical Control of Fluid Power Systems- Theory and Lab

Key Concepts & Activities:

- Introduce the basics of electrical control systems used in fluid power applications.
- Relays, timers, sensors, and switches.
- Their role in automation and control.
- Understanding the structure and symbols of a ladder diagram components.
- Designing simple control circuits.
- Electronic sensors, circuit, function, and use.
- Perform actual lab using sensors and control relays to control hydraulic and pneumatic systems.
- Troubleshooting electrical control circuits for both hydraulic and pneumatics applications.