



**Industrial Maintenance Electrician Apprenticeship Program
COURSE DESCRIPTIONS (ALPHABETICAL)**

for
Inland/Desert Employers Apprenticeship Committee

Apprenticeship Training Plan: 480+ hours

AC & DC Variable Speed Drives**40 Hours****REQUIRED COURSE**

Types of DC and AC motors; DC generic control requirements; Effects of operating on variable frequency; Types of variable speed drives; Operation, set-up, and maintenance of variable speed drives. Hands-on lab exercises include programming drive parameters, drive control wiring, and drive diagnostics.

Analog Communications**16 Hours**

Configure, operate and troubleshooting the following circuits: Amplitude modulation (AM) transmitter and receiver, single-sideband (SSB) transmitter and receiver, frequency modulator (FM), phase modulator (PM) and phase locked loop (PLL).

Basic Industrial Electricity**48 Hours****REQUIRED COURSE**

A refresher of the basics of industrial electricity. In addition to basic theories and laws, this class will also cover an overview of electrical safety, protective devices, generators and transformers, and common industrial wiring devices. Additional training topics include: E&I Test Equipment and Intro to Troubleshooting.

Basic Process, Control Elements, Transducers & Transmitters**16 Hours**

Defines and introduces common instrumentation elements and their principles of operation. Covers identification of variables measured by each element and selection of the proper types of devices in an instrument loop using the device's technical manuals, specification sheets, pictures, or actual samples.

Cable Networking the Physical Layer**8 Hours**

Tool use and construction techniques for industry standards. Troubleshooting and repair for technicians in the cabling industry.

Conductor Selections, Calculations & Applications**24 Hours**

Focuses on the types and applications of conductors and electrical cabling and covers proper wiring techniques. Stresses the applicable NEC® requirements. Describes methods of terminating and splicing conductors of all types and sizes, including preparing and taping conductors. Additional training topics include: Conductor Terminations & Splices. Covers the types of conductors used in wiring systems, including insulation, current-carrying capacity, and temperature ratings.

Conduit Bending I & II**32 Hours**

Provides an introduction to conduit bending and installation. Covers the techniques for using hand-operated and step conduit benders, as well as cutting, reaming, and threading conduit. Covers all types of bends in all sizes of conduit up to six inches. Focuses on mechanical, hydraulic, and electrical benders.

Distribution Equipment**16 Hours**

Explains distribution equipment, including grounding, switchboard and ground fault maintenance, transformers, and electrical drawing identification.

Electrical Blueprints & Drawings**16 Hours****REQUIRED COURSE**

Basic ladder diagrams, one line diagrams, electrical symbols, hydraulic symbols, hydraulic diagrams, floor

and elevation plans. Additional NCCER training topics include: Instrument Drawings and Documents, Part 1 and E&I Drawings.

Electro-Pneumatics I & II

32 Hours

REQUIRED COURSE

Introduction to pneumatics; relationships between pressure vs. force, pressure vs. volume, pressure drop vs. flow; vacuum generation; basic controls of cylinders; directional control valves; cylinders in series and parallel; controls of pneumatic motors. Electrical control of pneumatics systems; industrial type electro-pneumatic circuits; troubleshooting in electro-pneumatic circuits.

Electronic Components

8 Hours

Introduces the principles of electronics and semiconductor theory, components, and applications.

Fiber Optic Cabling the Physical Layer

8 Hours

Fiber Optic theory, tool use, and construction techniques. Troubleshooting and repair for technicians in the network cabling industry, with emphasis on fiber optics.

Hydraulics I & II

32 Hours

REQUIRED COURSE

Fundamentals of hydraulic power: pressure limitations, pressure and force, flow rate and velocity, work and power. Basic circuits: cylinder control, cylinders in series and parallel, regenerative circuits. Functional circuits: accumulators, hydraulic motor circuits, pressure reducing valves, remote controlled pressure relief valves. Troubleshooting: hydraulic pumps, directional valve testing, flow meter accuracy. Electrical control of hydraulic systems. Functional systems: hydraulic sequence of cylinders, speed regulation and braking of hydraulic motors. Troubleshooting: electrical control circuits, and electrically controlled hydraulic systems.

Industrial Safety

16 hours

REQUIRED COURSE

Introduction to industrial safety and the basic principles of maintaining a safe electrical and/or mechanical workplace. Includes the protective devices used to protect people and their limitations. Also explains what creates an arc flash and covers all classes of hazardous locations.

Instrumentation & Process Control I

40 Hours

Open and closed loop controls, feedback and feed forward controls, stand-alone controllers, pressure controls, level measurements, differential pressure, and microprocessor-based controllers. Additional training topic includes: Flow, Pressure, Level & Temperature.

Instrumentation & Process Controls II

32 Hours

Continuing from Instrumentation & Process Controls I, this course adds troubleshooting and configuration of process controls and regulating systems (speed regulators, current regulators, etc.). Additional topics include: Instrument Calibration & Configuration; Control Valves, Actuators & Positioners; Performing Loop Checks; Troubleshooting and Commissioning a Loop; Data Networks; and Distributed Control Systems.

Introduction to Mechatronics

32 Hours

Introduces basics of mechanical electronics, PLCs, pick and place feeding, event sequencing, indexing, parts sorting and storage, robotics and Servo robot material handling.

Motor-Operated Valves**8 Hours**

Covers motor-driven valves, ranging from the small, servo-mechanical actuators to the very large valves that could only be operated by several people if they were not motor driven. Includes electrical, pneumatic, and hydraulic operators.

Motors & Controls**48 Hours****REQUIRED COURSE**

Principles of motor operation, beginning with DC motor theory and moving into AC theory. Study of sine waves through phasors and trigonometry theory. Series and parallel AC circuits, motors, generators, and transformers. Includes a hands-on lab using rotating equipment. Additional NCCER training topics include: Alternating Current and Motor Controls.

National Electrical Code**16 hours**

An in-depth look on NEC standards and how to access types of information in the book.

NFPA 70B Electrical Equipment Maintenance**16 Hours**

NFPA 70B details preventative maintenance for electrical, electronic, and communication systems and equipment – such as those used in industrial plants, institutional and commercial buildings and large multi-family residential complexes – to prevent equipment failures and worker injuries.

Process Mathematics**24 Hours**

Covers measurement of mass, weight and flow, conversion of units, and their application instrumentation.

Programmable Logic Controllers**56 Hours****REQUIRED COURSE**

Introduces the basics of programmable logic controllers (PLCs) and how the computer control system relates to industrial electrical machines in manufacturing. PLC concepts, basic operation and logic, programming tools, basic editing, and diagnostic capabilities. Types and classes of I/O interfaces, Different types of programming languages. Hands-on work with PLC's, learning programming tools.

Standby & Emergency Systems**16 Hours**

Explains the NEC® requirements for installation and control of emergency power and lighting systems, including batteries, generators, and uninterruptible power supplies.

Temporary Grounding**16 Hours**

Covers the methods used to eliminate or reduce electrical shock hazards to personnel working on electrical equipment.

Transformer Applications**16 Hours**

Discusses transformer types, construction, connections, protection, and grounding along with capacitors and rectifiers.

Transistor Amplifier Circuits**24 Hours**

Identify and isolate attenuator, common base/emitter, common collector, bias stabilization, RC coupling/Transformer coupling and direct coupling.

Transistor Feedback Circuits**24 Hours**

Perform practical exercises that demonstrate transistor feedback principals including series/shunt feedback, multistage feedback, and differential amplifier.

Transistor Power Amplifiers**24 Hours**

Identify and isolate single-ended power amplifier, phase splitter, push-pull power amplifier, attenuator, complementary power amplifier and Darlington pair.

Troubleshooting Electrical Control Circuits**32 Hours*****REQUIRED COURSE***

A summary class reviewing all of the above topics and designed to bridge the gap between theoretical knowledge and practice. Includes troubleshooting with PLCs. Additional topic includes: Troubleshooting Industrial Controls.

Tubing & Piping Systems**24 Hours**

Introduces piping and tubing layout procedures. Explains the steps in creating a hand-sketched isometric drawing that can be applied in the piping and tubing installation. Introduces methods and procedures used to measure, cut, bend, and support piping and tubing. Introduces a variety of tubing, tubing materials, tools, and work practices. Covers proper storage and handling, cutting, deburring, reaming, bending, and flaring of tubing. Presents safe methods for cleaning, purging, blowing down, pressure testing, and leak testing tubing, piping, and hoses used in instrumentation.

Industrial Maintenance Electrician Training Modules

Required	Course	Hours
*	AC & DC Variable Speed Drives	40
	Analog Communications	16
*	Basic Industrial Electricity	48
	Basic Process, Control Elements, Transducers & Transmitters	16
	Cable Networking the Physical Layer	8
	Conductor Selections, Calculations & Applications	24
	Conduit Bending I&II	32
	Distribution Equipment	16
*	Electrical Blueprints & Drawings	16
	Electronic Components	16
*	Electro-Pneumatics I&II	32
	Fiber Optic Cabling the Physical Layer	8
*	Hydraulics I&II	32
*	Industrial Safety	16
	Instrumentation & Process Controls I	40
	Instrumentation & Process Controls II	32
	Introduction to Mechatronics	32
	Motor-Operated Valves	8
*	Motors & Controls	48
	National Electrical Code	16
	NFPA 70B Electrical Equipment Maintenance	16
	Process Mathematics	24
*	Programmable Logic Controllers	56
	Standby & Emergency Systems	12
	Temporary Grounding	16
	Transformer Applications	16
	Transistor Amplifier Circuits	24
	Transistor Feedback Circuits	24
	Transistor Power Amplifiers	24
*	Troubleshooting Electrical Control Circuits	32
	Tubing & Piping Systems	24

Industrial Maintenance Electrician Recommended Class Schedule

Below are the recommended classes and schedule for an IME apprentice to take. They can be taken within two to four years. Additional supplemental classes will be available based on demand.

Contact your Chaffey College InTech Center representative for more information.

Training Title	Scheduled Day	Hours	Days
Year 1, Quarter 1			
	<i>7AM-3:30PM</i>		
Industrial Safety	Friday	16	2
Process Mathematics	Friday	24	3
Conductor Selections, Calculations & Applications	Friday	24	3
NEC	Friday	16	2
Year 1, Quarter 2			
Electrical Blueprints	Friday	16	2
Basic Industrial Electricity	Friday	48	6
Year 1, Quarter 3			
Motors and Controls	Friday	48	6
Programmable Logic Controllers	Friday	8	1
Year 1, Quarter 4			
Programmable Logic Controllers (cont.)	Friday	48	6
Year 2, Quarter 1			
Electro-Pneumatics I & II	Saturday	32	4
Hydraulics I & II	Saturday	32	4
Motor-Operated Valves	Saturday	8	1
Year 2, Quarter 2			
AC & DC Variable Speed Drives	Saturday	40	5
Basic Process, Control Elements, Transducers & Transmitters	Saturday	16	2
Year 2, Quarter 3			
Instrumentation & Process Controls I	Saturday	40	5
Troubleshooting Electrical Control Circuits	Saturday	16	2
Year 2, Quarter 4			
Troubleshooting Electrical Control Circuits (cont.)	Saturday	16	2
Conduit Bending I & II	Saturday	32	4
		480	60