



Maintenance Craft Skills Course Catalog

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GPAllied is the most diverse reliability and operations consulting and services company in the world. Combined, our unrivaled technical expertise, solutions portfolio and global reach help you achieve rapid bottom-line improvement and sustained cultural change.

GPAllied diversity and expertise result from joining together firms with experts in Maintenance and Reliability, Operational Excellence, and Workforce Development. This winning team allows us to offer you expertise in the fields of Lean, Reliability Engineering, Six Sigma, Condition Monitoring, Change Management, Maintenance Planning and Scheduling, Workforce Development and Maintenance Craft Skills training. However, only GPAllied can offer you solutions that fully integrate these specialties.

To ensure that GPAllied provides you with latest thinking and proven best practices, we have attracted recognized experts to our team, benchmarked best-in-class operations and connected with thought leaders throughout the industry. Furthermore, we ensure that our project team members have technical expertise, as well as expertise as trainers and mentors through a rigorous qualification process and the establishment of work execution standards.

GPAllied has modeled their deliverables based on the following core beliefs:

- The reason our clients are in business is to make money
- The first step to ensuring profitability is to have reliable “systems”
- The term “system” speaks to the combination of the people who operate the equipment, the processes they follow to operate the equipment and the equipment itself
- The definition of reliable is: the ability to perform a given task, at a stated rate, for a given period of time, under a given set of circumstances
- The organization must be motivated and prepared for any change to be sustainable
- Having successfully attained reliability, sustaining the improvements is paramount to on-going success
- Optimization is achieved through the use of a culture of continuous improvement
- Clients require a rapid return on investments

To that end, GP*Allied* offers you complete maintenance training solutions in the following categories:

- Electrical Craft Skills
- Mechanical Craft Skills
- Troubleshooting & Inspection

GP*Allied* prides itself on two (2) things: our passion for helping the client and the flexibility of delivery methods.

Our passion is driven by ***the satisfaction of seeing our company help our customers build, utilize and realize the power of the Return on Asset Reliability (ROAR™).***

Our flexibility in delivery methods comes in any one of four (3) different ways. Each way specifically customized to meet the unique needs of the client. Those four (3) ways are:

Coaching

For the client who wants more than a training solution, but still prefers to implement using their own personnel; GP*Allied* offers a combination training/coaching package. The training class is augmented by a regimen of coaching and mentoring by our experienced consultants.

Training Classes

At GP*Allied*, we understand that you are not interested in “training for training’s sake”. You need hard-hitting, impactful training that addresses the specific need of your employees, delivers value for your training dollars, and produces bottom-line results.

Train the Trainer T³

GP*Allied* offers all of our deliverables as classes for the client who prefers to implement using their own people.

When you select us for your training, you receive:

- Training from practitioners and implementers who are also skilled trainers.
- Courses designed with your learning objectives in mind using professional instructional system design combined with our subject-matter expertise.

You can obtain most of the courses in a format that works best for you:

- **Off the Shelf**— you can select our standard training if a generic course suits your needs.
- **Customized** — you can ask us to make minor modifications to better fit your organization’s existing terminology and culture (which we can do quickly and cost-effectively), or you can ask us to develop a truly custom curriculum.
- **e-Learning** — for certain courses; you can select e-Learning, or a blended solution of e-Learning, instructor-led training, and coaching.

GPAllied's solution, based on years of maintenance training, allows us to deliver the best training solution to your maintenance technicians regardless of their level of need. It all begins with a needs or gap analysis, followed by a training strategy design and customized course development and delivery. Our depth of experience and qualified maintenance experts ensure a highly targeted program that transcends the limitations of canned approaches, and is based on a progression through four competency levels:

- **Level 1:** The Core Competencies level provides the basic essentials for new hires or entry-level employees, and focuses on core math, print reading, and technical skills to ensure that they can perform at the higher levels.
- **Level 2:** The Fundamentals level introduces much of the theory, such as Kirchhoff's Law and Pascal's Law, associated with the maintenance processes and includes basic concepts of hydraulics, pneumatics, pumps, PLCs, motors, etc.
- **Level 3:** The Advanced Fundamentals level transfers the theory and knowledge elements into practical applications. This level ensures that your maintenance professionals are trained to perform all of their required tasks and gives them the hands-on learning opportunities to practice these critical skills.
- **Level 4:** The Equipment Specific Training level ensures that your maintenance team is fully capable and well trained on the use and maintenance practices specific to your equipment.

GPAllied, your total solutions partner, provides the following services:

- **Assessment and Planning.** GPAllied provides Program Evaluations, Training Needs Assessment, Delivery Mode Analysis, Curriculum Architecture, and Training Plan Development.
- **Training Development.** GPAllied provides review of prior training, and the analysis, design, development, and evaluation of customized training.
- **Training.** GPAllied provides structured OJT programs, Train-the-Trainer Programs, On-Site Instruction(classroom or hands-on), Computer/Web-Based Training, and a large number of maintenance skills and maintenance systems description.
- **Training Center Management:** Apprentice programs. GPAllied provides employee testing, screening and selection; establishment, staffing, and management of craft training centers; training administration and logistics; structured on-the-job training; and certification programs.
- GPAllied Course Offerings Table of Contents

GP*Allied* Course Offerings Table of Contents

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AC and DC Drives

COURSE DESCRIPTION

This course provides information on solid-state drive concepts, drive-based motor control, drive and motor setup, and drive programming. There are hands-on exercises for setting up AC and DC drives.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The operation of diodes, SCRs and transistors
- Use an oscilloscope to identify and trace signals
- The control of DC motor speed and direction
- The control of AC motor speed
- Identify and locate the major components of an AC Drive
- Identify and locate the major components of a DC Drive
- Wire power to drives
- Wire drives to motors
- Operate drives via the Human Interface Module (HIM)
- Program a drive via the HIM
- Setup, operate, and troubleshoot an AC Drive and Motor
- Setup, operate, and troubleshoot a DC Drive and Motor

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

AC & DC Generator Theory

COURSE DESCRIPTION

This course provides information on the concepts associated with generators, generator function, generator design, three phase voltage, and load sharing.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The principles of magnetism
- Electromotive force
- The purpose of generators
- The construction of basic DC generators
- How voltage is induced in an armature
- The function of the commutator and brushes
- The construction and operation of a basic D.C. generator commutator
- Why electromagnets are used to produce the field in generators
- Copper loss and its effects
- How voltage is induced in a stationary armature
- How a magnetic field is produced on a rotor
- How three-phase voltage is produced
- The construction of an AC generator stator
- The construction, including advantages and disadvantages, of the following; AC generator salient pole rotors, AC generator turbo rotors
- Armature reaction and its effects in AC generators
- Armature impedance and its effects
- Load sharing

CLASS DURATION

Up to 24 hours depending upon audience and audience experience.

Basic Digital Circuits

COURSE DESCRIPTION

This course provides information on the basic digital electronics concepts, gates, circuits, flip-flop based circuits, and troubleshooting techniques. There are hands-on exercises for circuit construction.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Represent numbers in decimal, binary, octal, binary-coded decimal, and hexadecimal
- Convert between number systems
- Perform binary arithmetic, using ones and twos complement methods
- Create simple Boolean expressions and evaluate the expressions using Boolean algebra
- Recognize symbols for logic gates
- Create logical expressions and truth table for basic gates and circuits composed of multiple gates
- Evaluate logical expressions using Karnaugh Maps
- Troubleshoot circuits by tracing logic
- Trace logic using logic pulsers and logic probes
- Basic flip-flop operation
- Recognize symbols for various flip-flops
- Create State Table for combinations of flip-flop input conditions
- The operation of J-K flip-flops
- Construct simple register circuits
- Construct simple counter circuits

CLASS DURATION

40 hours

Basic Electricity – Alternating Current

COURSE DESCRIPTION

This course provides information on the basic concepts of AC electricity, including AC waveforms, electrical measurements, resistance, inductance, capacitance, impedance, multi-phase circuits, and transformer action. There are hands-on exercises device operation and simple circuit construction and analysis.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Sine wave and explain how one is generated
- identify the peak AC voltage values
- AC phase relationships
- Ohm's Law to solve for the unknown quantity
- The characteristics of and factors controlling inductance
- Inductive reactance and explain how it is affected by frequency
- Impedance
- The relationship between voltage and current in a resistive-inductive (RL) circuit
- How to calculate impedance in an RL circuit
- the operation of a capacitor
- The factors affecting capacitance
- The voltage and current transients that occur in a capacitive circuit
- Capacitive reactance and explain how it is affected by frequency
- The relationship between voltage and current in the following AC circuits; RC circuit, LC circuit, RLC circuit
- How reactive components are used as filters
- What a transformer is and how it operates
- The phase relationship between primary and secondary voltages of like wound and unlike wound transformers
- Turn ratio in power transformers
- Power losses in a power transformer; Copper Losses, Eddy-Current Losses, Hysteresis Loss
- Types of transformers
- The basic components in a power distribution system
- Identify and explain the function of protective devices in a distribution system

CLASS DURATION

40 to 80 hours depending upon audience and audience experience.

Basic Electricity – Direct Current

COURSE DESCRIPTION

This course provides information on the basic concepts of DC electricity and magnetism, including electrostatics, basic circuit concepts, and measurement of electrical quantities and associated numerical concepts, Ohm's Law, practical circuits, electromagnetism, and electrical measurements. There are hands-on exercises device operation and simple circuit construction and analysis.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Technical terms; alternating current (AC), insulators, atom, iron, compound, molecule, conductors, neutron, direct current (DC), polyphase AC, electricity, proton, electron, rectifier, electronics, single-phase AC, and element
- Elements and compounds
- The law of attraction and repulsion related to electrical charges
- Distinguish between AC and DC
- Electron current, and voltage
- How to differentiate between conventional current flow and electron current flow
- The concept of a short circuit
- Proper safety precautions in working with electrical circuits
- Decimal numbers in powers of 10 and vice versa
- Read and interpret meter scales accurately.
- Name various materials classified as either good conductors, poor conductors, or insulators
- The four factors that determine the amount of resistance in a wire
- The aspects of conductivity and resistivity
- Use the charts and tables in this chapter
- wire sizes using the American Wire Gauge
- How to determine the correct values of resistors by using the color code
- Describe the interrelationship of voltage (E), current (I), and resistance (R)
- Apply Ohm's law in calculating an unknown circuit quantity
- Calculate the power dissipation of a resistor
- Use the power equation in conjunction with Ohm's law to find an unknown circuit quantity
- Calculate the cost of electrical energy expended by a load

CLASS DURATION

40 to 80 hours depending upon audience and audience experience.

Basic Math

COURSE DESCRIPTION

This course provides information on the concepts associated with basic Algebra, basic Geometry, Measurements, and basic Trigonometry.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- How to reduce a fraction to its lowest term
- Calculate with mixed numbers
- Perform mathematical operations with fractions; addition, subtraction, multiplication, division
- Perform calculations using decimals, and fractions
- Calculate the percentage of a number
- Convert numbers into percentages
- Perform calculations with measurements
- Perform conversion of measurements
- Perform calculations with exponents
- Write algebraic expressions
- Use algebra to solve known formulas
- To solve an equation with one unknown
- To solve equations with multiple unknowns
- Perform addition and subtraction of polynomials
- Perform multiplication and division of polynomials
- Pythagorean Theorem
- The rules of a triangle to calculate the side lengths and angles of a triangle
- Calculate the perimeter of a polygon
- Calculate the area of a square
- Calculate the perimeter and area of plane figures
- Calculate volume of a solid figure
- Perform calculations using Geometry principles
- Using trigonometric functions calculate the sides of a triangle

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

Batteries

COURSE DESCRIPTION

This course provides information on the concepts associated with industrial batteries and Universal Power Supplies (UPS), battery and UPS function, battery and UPS design, battery maintenance, storage and transportation, installation and removal, and potential faults.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- The differences between a primary cell and a secondary cell
- The purpose of the major components of a large storage battery
- The purpose of the electrolyte in the following batteries; Lead-Acid, Nickel-Cadmium
- How a battery produces electrical energy
- The operation of large storage batteries during the following condition; Steady State, Discharge, Charge
- How to measure the following battery parameters; Total Battery Voltage, Individual Cell Voltage, Specific Gravity of Electrolyte
- The use of total battery voltage and individual cell voltage measurements
- The potential dangers involved with these hazards
- List precautions associated with handling electrolyte
- How to handle an electrolyte spill
- The electric shock precautions
- The hydrogen gas precautions
- Proper battery storage and transportation procedures
- Battery checks, including what is covered on a visual inspection and what pilot cell measurements are taken
- The purpose and procedure for a test discharge
- The importance of maintaining battery records
- Battery replacement criteria and procedure
- Theory of operation of static inverters
- The purpose of an Uninterruptible Power Supply (UPS)
- The role of the battery within the UPS system

CLASS DURATION

8 hours

Bearings

COURSE DESCRIPTION

This course provides information on the concepts associated with bearings, bearing function, bearing design, bearing maintenance, installation and removal, expected load and wear patterns, and bearing faults. There are hands-on exercises for bearing removal and installation.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- The basic concepts behind forces and stress
- The materials used in the construction of bearings, and why the materials are used
- The basic requirements of any bearing
- Differences between radial and thrust bearings
- How to identify the types of bearings and their application
- The types of lubrication systems used for anti-friction and friction bearings
- The importance of and describe how to perform a soft foot check
- The procedure for performing various clearance checks on anti-friction and friction bearings
- The various methods of heating bearings
- The various methods of cold mounting roller bearings
- The various methods of mounting tapered bore bearings
- The purpose of pre-load
- The methods of setting tapered roller bearings
- The various methods of roller bearing removal
- State the importance of crush and torque on a journal bearing
- The various types of failures that occur in bearings
- The methods for reducing the various bearing failures

CLASS DURATION

16 to 40 hours depending upon audience and audience experience.

Bolts & Fasteners

COURSE DESCRIPTION

This course provides information on the concepts associated with threaded and bolted fasteners, retaining rings, clamps, pins, keys, and locking devices; the specifications for fasteners, and the assembly of fasteners.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- Bolted connections and how it functions
- The different types of basic fasteners and their applications
- The appropriate specifications and selection criteria for fasteners
- The effects of fastener system variables and assembly practices The various types of fasteners in common use
- The various types of locking devices in common use
- The use of dowel pins, keys, and cotter pins
- The various screw thread designations
- The materials and grades as they apply to threaded fasteners
- The finishes and coatings sometimes used on threaded fasteners
- The dangers associated with using counterfeit fasteners
- How to identify counterfeit fasteners

CLASS DURATION

8 to 16 hours depending upon audience and audience experience.

Conduit Bending

COURSE DESCRIPTION

This course provides information on the calculating and making conduit bends. There are hands-on exercises for bending and installing conduit.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Basic trigonometry to calculate conduit bends
- How to use offset and shrink tables to calculate conduit bends.
- How to determine bender take-up, bend gains, and offset shrinkage in order to determine a conduit run
- Make various bends with a hand bender
- Make various bends with a “Chicago” style bender

CLASS DURATION

24 hours

Electrical Print Reading

COURSE DESCRIPTION

This course provides the participant with the basic understanding of electrical prints and components associated with electrical print reading, it also provides the participant with the ability to interpret simple ladder logic diagrams used for PLC programming. There are hands-on exercises for print reading.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians, but is also used for cross-training of mechanical maintenance technicians.

YOU WILL LEARN:

- The purpose of the Title Block, Legend, Revisions, and Material List in terms of location and content
- Identify the organizational make-up of the print
- Common electrical print symbols and the components they represent
- To identify and interpret an electrical block diagram and a one-line diagram
- To identify and interpret an electrical three-line diagram
- To identify and interpret connection diagrams
- To identify and interpret simple ladder logic diagrams used for PLC programming
- The purpose of the Piping and Instrumentation Diagram
- Given a P&ID, identify the organizational make-up of the diagram
- Common Process Loop symbols and their functions
- Identify and interpret a P&ID
- Given a simplified P&ID, identify the controlled variable, the measured variable, the manipulated variable and the final control element

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

Electrical Safety & Lockout/Tag-out

COURSE DESCRIPTION

This course provides information potential safety hazards, safety precautions, personnel protection equipment, general emergency response, and the local lockout/tag-out program.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The hazards and precautions/counter-measures for each hazard
- List and explain the personnel protective equipment required for work in mill areas
- Hazards particular to electrical work and the precautions/counter-measures for each hazard
- General responses to plant emergencies
- Energy isolation requirements for safely work on equipment
- local Lockout/Tag-out program and the requirements placed on the personnel doing work

CLASS DURATION

4 to 8 hours depending upon audience and audience experience.

Fans, Blowers, & Compressors

COURSE DESCRIPTION

This course provides information on the concepts associated with air systems, air system functions, air system design, air system maintenance, installation and removal, and air system faults.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- The purpose of a fan as compared to a blower
- The differences in operation between a centrifugal fan and an axial fan
- The major design classification of blowers
- The operation of a positive displacement blower
- The operation of an axial flow blower

CLASS DURATION

16 to 24 Hours depending upon audience and audience experience.

Hydraulics & Pneumatics

COURSE DESCRIPTION

This course provides information on the concepts associated with pneumatics and pneumatic systems, fluid principles, pneumatic system design, and pneumatic schematic symbology.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- The advantages offered by the use of pneumatics
- The relationship between force, pressure, and area
- The compressibility and expansion of gases as defined by Boyle's Law, Charles' Law, and General Gas Law
- The basic principle of fluid dynamics
- Standard symbols used to illustrate the operation of a pneumatic system
- Given a drawing of a plant pneumatic system, identify the components and how they function in that system
- The use of filtration and purification equipment installed in pneumatic systems
- The types and uses of cylinders installed in pneumatic systems
- The types and uses of valves installed in pneumatic systems

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

Industrial Electricity and Electronics for Mechanics

COURSE DESCRIPTION

This course provides information on basic electricity and electronic concepts and devices. There are hands-on exercises for component and circuit operation.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The structure of an atom
- The difference between a compound and an element
- How electrical forces cause objects to attract or repel other objects
- Explain the difference between a conductor and an insulator
- State the definition of grounding
- List the common causes of static electricity in an industrial plant
- Potential hazards when recharging batteries
- Basic law of magnetic force
- How magnetic force operates
- Describe an electromagnet
- How to use lifting magnets, magnetic pulleys, and magnetic clocks
- Characteristics of an electrical conductor and an electrical insulator
- The definition of Ohm's Law
- Symbols for resistors, capacitors, and relays in an electric circuit diagram
- The operating principles of resistors, capacitors, and inductors
- Each band in the resistor color-code system
- Factors to consider when choosing a resistor
- The difference between AC and DC
- The importance of the transformer in AC electricity
- List the main advantages of the three-phase AC system
- The difference between system grounding and equipment grounding
- List the parts of a transistor
- The blocks of the block diagram of a programmable logic controller system
- Explain how each of the blocks functions with the system as a whole
- Describe the relationship of the programmable logic controller system to the real world
- Identify the symbols for common input and output devices

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

Industrial Electronics

COURSE DESCRIPTION

This course provides information on the function and circuit analysis of power supplies, amplifiers, integrators, comparators, and oscillators. There are hands-on exercises for wiring and analyzing the various circuits.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The basic structure of a semiconductor atom and the movement of free electrons and holes
- The purification and doping of semi-conductors
- P-type region, n-type region, and junction of a PN junction diode
- The characteristic curves and specification ratings of a diode
- The operation of a light-emitting diode, a photoconductive device, and a photovoltaic device
- The differences between an NPN transistor and a PNP transistor and identify the schematic symbol for each
- How the three kinds of transistor connections affect circuit values
- Methods for mounting components on PCBs and chassis
- The advantages of PCBs over direct wiring
- Various soldering methods and discuss the advantages and disadvantages of each
- PCB connectors and mountings
- The basic functions of power supplies and power conditioners
- DC-to-DC, AC-to-AC, AC-to-DC, and DC-to-AC power supplies
- Compare the operation of transformer-driven and oscillator-driven inverters
- Discuss the functions of filters, voltage regulators, voltage dividers, switching power supplies, and power supplies
- Why low voltages can be dangerous
- Explain how to interpret diode ratings on a manufacturer's specification sheet
- Compare the effects of connecting diodes in parallel and in series
- The operation of a silicon-controlled rectifier
- Compare the operation of half-wave and full-wave rectifiers
- Discuss the use of capacitors, inductors, and resistors in filter circuits
- The advantages and disadvantages of capacitance, inductance, RC, and LC power supply filters

CLASS DURATION

40 to 80 hours depending upon audience and audience experience.

Instrumentation I

COURSE DESCRIPTION

This course serves as introductory to provide a basic understanding of the fundamentals of measurement. The course will explain the various methods used to measure: pressure, temperature, flow, and PH. Upon completion of this course, the participants will be able to explain these functions and how they can be used in process control.

RECOMMENDED AUDIENCE

This course is recommended for electrical and instrumentation maintenance technicians.

YOU WILL LEARN:

- The fundamentals of measurement
- Pressure measurements
- Temperature measurements
- Flow measurements
- pH measurements
- Consistency measurements

CLASS DURATION

8 hours

Instrumentation II

COURSE DESCRIPTION

This course provides fundamental information on the concepts associated with the various measurement instruments used in process control. The lessons cover a wide range of topics such as measurement methods, pressure measurement devices, temperature measurement devices, flow measurement devices, level measurement devices. Upon completion of this course, the participants will be able to explain the function, design, and operation of these instruments and they function in process control.

RECOMMENDED AUDIENCE

This course is recommended for electrical and instrumentation maintenance technicians.

YOU WILL LEARN:

- The fundamentals of measurement
- Operation and uses for various temperature-measuring instruments
- Operation and uses for various level-measuring instruments
- Operation and uses for various flow-measuring instruments
- Operation and uses for various pressure-measuring instruments
- Operation and uses for various force, weight, and motion-measuring instruments
- Operation and uses for various types of actuators
- Operation and uses for various types of recording devices
- Operation and uses for conductivity and pH-measuring devices

CLASS DURATION

16 hours

Lubrication

COURSE DESCRIPTION

This course provides information on the concepts associated with lubrication, lubrication properties, lubrication testing, lubricant contaminants, and gear lubrication.

RECOMMENDED AUDIENCE

This course is designed for mechanical and electrical maintenance technicians.

YOU WILL LEARN:

- The origin of oil and its chemical makeup
- The basic principles of lubrication
- Explain viscosity and use of viscosity terms
- Differentiate between sliding and rolling friction
- Applications for which oil is used as a lubricant
- The origin of grease and its chemical make-up
- Applications for which grease is used as a lubricant
- How to differentiate between hydrodynamic lubrication and elasto-hydrodynamic lubrication
- Various lubricant contaminants
- Lubrication of gears
- The use of extreme pressure (EP) oils vs. non-EP oils
- Various causes of gear failure
- Lubrication of worm gears, couplings, and bearings
- Basic hydraulic principles
- Characteristics of hydraulic fluid
- The reason for filtering hydraulic fluids
- The differences between synthetic and mineral oils
- The advantages of synthetic oils over mineral oils
- The purpose of a lubrication program
- Aspects of a good lubrication program
- Proper storage and handling procedures for lubricants
- Proper oil sampling techniques, reports, and analysis
- The benefits of a good lubrication program

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

Measurement & Tools

COURSE DESCRIPTION

This course provides information on the proper use of measuring tools to make basic linear and angular measurements, hand tools and power tools.

RECOMMENDED AUDIENCE

This course is designed for electrical and mechanical maintenance technicians.

YOU WILL LEARN:

- Units of measurement and tolerances
- Calculate tolerances
- To make measurements with rulers, calipers, squares, micrometers, and verniers
- Use hand tools to install and remove fasteners
- Use hand tools to cut and strip wires
- Use hand tools to cut and flare tubing
- Use hand tools and power tools to cut and drill hole in metal
- Use hand tools to tap threads
- Apply and measure torque to fasteners
- Use a pipe machine to cut, bend, and thread small pipes

CLASS DURATION

16 to 24 hours depending upon audience and audience experience.

Mechanical Crane Inspections

COURSE DESCRIPTION

This course provides information on the mechanical inspection of EOT Cranes.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The major mechanical assemblies of EOT cranes
- The inspection points on an EOT crane
- How to locate the inspection points on an EOT crane
- The criteria for the inspection points

CLASS DURATION

16 hours

SOURCES

IPT's Crane and Rigging Handbook

Mechanical Print Reading

COURSE DESCRIPTION

This course provides understanding of information found on mechanical drawings and prints, provides the participant with the ability to understand and identify components and how to identify dimensions of tapered and machined surfaces. There are hands-on exercises for print reading.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians, but is also used for cross-training of electrical maintenance technicians.

YOU WILL LEARN:

- The purpose of the Title Block, Legend, Revisions, and Material List in terms of location and content
- The six types of lines used in drawings
- The types of views used in drawings
- Given a drawing, identify its construction, size, and location dimensions.
- Measure and identify screw threads
- The dimensions of tapered and machined surfaces
- The various types of sketches used in drawings
- Pneumatic or hydraulic component by its symbol
- Common pneumatic and hydraulic component symbols
- How to trace the flow of air or fluid through a drawing of a circuit
- How to draw a pictorial of a circuit using a pneumatic or hydraulic schematic as a reference
- How to draw schematics of simple pneumatic and hydraulic systems

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

Mechanical Safety & Lockout/Tagout

COURSE DESCRIPTION

This course provides information potential safety hazards, safety precautions, personnel protection equipment, general emergency response, and the local lockout/tagout program.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The hazards and precautions/counter-measures for each hazard
- The personnel protective equipment required for work in mill areas
- Hazards particular to mechanical work and the precautions/counter-measures for each hazard
- The general response to plant emergencies
- The energy isolation requirements for safely work on equipment
- The local lockout/tagout program and the requirements placed on the personnel doing work

CLASS DURATION

8 hours

Motor Control

COURSE DESCRIPTION

This course provides information on the concepts associated with AC and DC motor fundamentals, motor control fundamentals, control of motor starting, and motors and motor controllers. The lessons cover a wide range of topics such as motor enclosures, nameplate data, AC motors, DC motors, magnetic contactors, control circuits, Wye-Delta starters, speed controllers, AC/ DC machine maintenance, and motor control circuit maintenance.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Motor control terms
- The various types of motor enclosures
- The basic construction and components of a three-phase squirrel cage induction motor
- The relationship between speed, frequency and number of poles in a three-phase induction motor
- How torque is developed in an induction motor
- Define percent slip and speed regulation
- How a three-phase motor's direction is reversed
- How the direction of rotation of a DC motor is changed
- Dual voltage motors and their application
- The methods for determining various motor connections
- General motor protection requirements as delineated in the National Electrical Code
- The common types of motor controller enclosures
- Manual control, semiautomatic control, and automatic control
- Explain the difference between manual starters and automatic starters
- Explain the term starting sequence
- Describe the operation of main and auxiliary contacts
- The difference between two-wire and three-wire control
- State the conditions under which a 120-volt control circuit may operate ungrounded
- Describe how interlocking for reversing control is accomplished
- How to troubleshoot a motor control circuit fault

CLASS DURATION

24 hours

Motor Theory

COURSE DESCRIPTION

This course provides information on the principles of operation associated with motors and motor components, to include AC/DC theory of operation including torque, pullout torque and slip,

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The operation of an elementary DC motor
- The methods used to minimize the effects of armature reaction
- The major components of a basic DC motor
- The purpose of the major components of a basic DC motor
- The operation and characteristics of the following DC motors; Shunt DC motor, Series DC motor, Compound DC motor
- The operating principles of a basic AC motor
- The operation of the following AC motors; Three-phase induction motor, Three-phase synchronous motor, Split-phase induction motor, Shaded-pole induction motor, Capacitor-start induction motor, Capacitor-run motor, Repulsion-start motor, Reluctance motor
- The construction of a squirrel cage and wound rotor motor
- Slip and calculate the percent slip for an induction motor
- The three types of single-phase AC motors
- The differences between multiple winding and consequent pole multiple speed induction motors
- The parameters used to determine a motor's rating
- The four classes of motor insulation
- The information found on a typical motor nameplate
- Delta to wye wiring for voltage, current, and power capabilities

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

National Electrical Code Overview

COURSE DESCRIPTION

This course provides overview of proper wiring practices as presented in the National Electrical Code (NEC).

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Understand the layout of the National Electrical Code
- Understand the relationship between the National Electrical Code and the National Electrical Safety Code
- Differentiate between NEC and OSHA examination, installation and use requirements
- Understand the proper locations for electrical equipment to provide for proper working clearances and free space requirements
- Determine proper methods of identification for grounded conductors, grounding conductors, and multi-wire branch circuits
- Understand installation requirements for services
- Understand bonding and grounding requirements for services, feeders, branch circuits, and utilization equipment
- Select the proper size and location of overcurrent protection for various types of utilization equipment
- Select the proper size of raceway, fitting, and boxes, including wire bending space, component sizing and conductor identification
- Size motor circuits and required components according to recent code changes
- Understand transformer installations including various types of delta and wye connections
- Understand acceptable wiring methods for hazardous (classified) locations

CLASS DURATION

16 hours

SOURCES

National Electrical Code, NEC, Industrial Electricity Training by Training Technology

Pipefitting

COURSE DESCRIPTION

This course provides information on the codes and standards, types of piping and associated components, specifications, and fitting and supporting techniques. There are hands-on exercises for bending fitting and installing pipe.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- Common codes/standards processes
- Codes/standards applicable to pipefitting
- ANSI, ASTM, AWS, and ASNT applicable codes to pipefitting
- Safety precautions associated with pipefitting
- Piping specifications used in pipefitting
- How to Interpret and illustrate piping drawings
- Basic tools used in pipefitting and their appropriate uses.
- Basic pipe bending techniques
- The basic manufacturing techniques employed for the various types of metal piping
- Advantages/disadvantages of the different types of metal piping
- The five major types of non-metallic piping
- The three forms of concrete and their applications
- The types of plastic piping; its uses and advantages
- Types of piping resins
- Differences between tubing and piping
- Identify tube bending techniques commonly used today
- The different methods to perform welding connections
- Identify the types of flanges and their applications
- Identify forms of threaded connections
- Joint preparation and fit-up
- The effects of thermal transients on the hangers/piping systems
- Various pipe hangers and attachments
- Types of snubbers and their uses

CLASS DURATION

24 to 40 hours depending upon audience and audience experience.

Pipe Welding

COURSE DESCRIPTION

This course provides information on SMAW pipe welding. There are extensive hands-on exercises for welding.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- To compare the advantages of welded pipe joints to bolted or screwed connections
- Pipe welding codes and what they cover
- Welding processes used for joining pipe and their advantages and disadvantages
- Special methods and accessories that are used in pipe welding as opposed to flat welding
- The uses of pre-heating and post-heating in pipe welding
- To make 2G and 5G pipe welds

CLASS DURATION

Up to 160 hours depending upon audience and audience experience.

PLC Basics

COURSE DESCRIPTION

This course provides information on PLC concepts, hardware, software, ladder logic functions (relay contacts, timers, counters). There are hands-on exercises for configuration and programming.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Programmable controller operations
- The hardware of a programmable controller
- Programming software features
- The function of the programmable controllers Central Processing Unit (CPU)
- The function of the programmable controllers Input/Output (I/O) interface system
- The function of the ladder diagram
- The inherent features of and benefits of the PLC
- The function of the base of a number system
- Describe the decimal number system
- The binary number system
- The octal number system
- The hexadecimal number system
- Perform conversions from one number system to another
- The purpose of one's and two's complement
- The binary concept
- The purpose of the AND, OR, and NOT functions
- Describe basic Boolean logic
- General PLC circuit and logic contact symbology
- The purpose of the address in memory
- How to use the programming software to configure a PLC
- How to use the programming software to create and edit ladder logic programs
- Create a ladder logic motor controller
- Use the programming software to force bit state
- Create a timer-based program
- Create a counter-based program

CLASS DURATION

40 hours

Power Transmission: Chain Drives

COURSE DESCRIPTION

This course provides information on the concepts associated with chain drives, chain drive function, chain drive design, chain drive maintenance, installation and removal, and chain drive faults.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The purpose of the chain drive
- The three basic functions of the chain
- The advantages and disadvantages of a chain drive
- The principle of operation of the chain drive
- Tolerances of chain length
- Measuring load
- Minimum ultimate tensile strength
- The function of the standard roller chain numbers
- Features of the roller bearings
- The use of the detachable chain
- The use of the silent chain
- The various silent chain assemblies
- The use of the leaf chain
- The basic construction of the roller chain sprocket
- Identify the four designs of sprocket hubs
- The factors that affect shaft location chain drives
- The function of the chain tightener
- The affects of the incorrect chain tension
- The procedure for aligning shaft and sprocket
- How to inspect a chain
- The elements that affect lubrication
- The five methods for chain lubrication

CLASS DURATION

8 hours

Power Transmission: Couplings

COURSE DESCRIPTION

This course provides information on the concepts associated with couplings, coupling function, coupling design, and the difference between a rigid and flexible coupling.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The purpose of a coupling
- The difference between a rigid and flexible coupling
- The following terms as they relate to a coupling; Hub, Shaft, Key, Match marks, Bore, Gap

CLASS DURATION

8 hours

Power Transmission: Gearing

COURSE DESCRIPTION

This course provides information on the concepts associated with gears, gear function, gear backlash, gear lubrication, and gear ratios.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The purpose of gears
- Terminology associated with gears
- Types of gear arrangements; Spur gear, Helical gear, Herringbone gear, Bevel gear, Worm gear, Planetary gear
- How to measure backlash in a gearing arrangement

CLASS DURATION

8 hours

Power Transmission: Pulleys

COURSE DESCRIPTION

This course provides information on the concepts associated with belt drives, belt drive function, belt drive design, belt drive maintenance, installation and removal, and belt drive faults.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The purpose of the belt drive
- The factors affecting the selection of the belt
- The advantages and disadvantages of a belt drive
- The proper technique for belt tensioning
- The construction of the v-belt
- The construction of the double v-belt
- The use of the power band v-belt
- The method for correct v-belt selection
- The advantages of the poly v-belt
- The construction of the variable speed belt
- The use of the variable speed sheave
- The three basic variable speed drives that are used
- The advantages of the positive drive belt
- The construction of the positive drive belt
- The purpose of the pulley
- The positive drive belt codes
- The purpose of the positive idler drives
- The construction of the three common flat belts
- Pulley crown
- The different flat belt pulleys used
- The method for checking belt alignment

CLASS DURATION

8 hours

Power Transmission: Shafts

COURSE DESCRIPTION

This course provides information on the concepts associated with clutches, clutch function, clutch design, clutch maintenance, installation and removal, and basic clutch faults.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The various methods of clutch engagement
- The various types of clutches
- How to properly install a clutch and perform maintenance

CLASS DURATION

8 hours

Pumps & Pump Repair

COURSE DESCRIPTION

This course provides information on the concepts associated with pumps and pump application, operation, hazards, troubleshooting and repair common problems, it also explains how to draw and label simple pump curves. There are hands-on exercises for inspection and repair of pumps and its associated equipment.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The centrifugal pump laws
- The terms used when discussing centrifugal pumps
- The safety hazards associated with rotating equipment
- The hazards associated with pumps
- The operation of a centrifugal pump
- The function of the various centrifugal pump components
- Centrifugal pumps as to position, impeller design, number of stages, and direction of flow
- How slip effects the operation of a centrifugal pump
- Draw and label simple pump curves
- Net positive suction head and cavitation
- The process for troubleshooting a centrifugal pump
- The function of the various positive displacement pump components
- The operation of a positive displacement pump
- How slip effects the operation of a positive-displacement pump
- The process for troubleshooting a positive displacement pump

CLASS DURATION

16 to 24 hours depending upon audience and audience experience.

Rigging

COURSE DESCRIPTION

This course provides information on the concepts and principles associated with rigging equipment, its use, inspection, planning and proper selection of rigging equipment. There are hands on exercises used to familiarize the trainee with equipment selection and safety when tasked with rigging a given load.

RECOMMENDED AUDIENCE

This course is designed for electrical and mechanical maintenance technicians.

YOU WILL LEARN:

- The safety hazards associated with rigging
- The actions necessary for safe operation of rigging equipment
- Wire rope and its proper use
- Wire rope inspection points
- Slings and their proper use
- Sling inspection points
- The different types of rigging hardware and their proper use
- Rigging hardware inspection points
- Chain hand hoists and their proper use
- The proper and safe use of beams
- The proper installation/removal and safe use of beam clamps
- The proper installation/removal and safe use of trolleys
- The proper and safe use of jacks, rollers, and skids
- The proper and safe use of winches
- The proper and safe use of cribbing
- How to properly plan a rigging job
- How to properly select and inspect rigging equipment
- The proper rigging techniques
- Use of arm and hand signals
- Safe operating considerations
- The different methods to safely use while moving and manipulating loads including; drifting a load, rotating a load using one hook, two hooks, and single sling, tipping a load, inverting a load

CLASS DURATION

16 hours depending upon audience and audience experience.

Scaffolding

COURSE DESCRIPTION

This course provides information on the concepts associated with procedures, precautions and limitations for safely erecting and/or dismantling fabricated frame scaffolding. There are hands-on exercises for erecting scaffolding.

RECOMMENDED AUDIENCE

This course is designed for electrical and mechanical maintenance technicians.

YOU WILL LEARN:

- The procedures, precautions, limitations, and practices surrounding the following aspects of erecting, using, and dismantling fabricated frame scaffolding; Base Section, Support Structure, Access, Fall Protection, Platform, Keeping Upright, Electrical Hazards
- Erect and dismantle a two-tier scaffold

CLASS DURATION

16 to 24 hours depending upon audience and audience experience.

Seals & Packing

COURSE DESCRIPTION

This course provides information on identification and installation of packing and mechanical seals and their applications. There are hands-on exercises for removing and installing packing and mechanical seals.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The different types of compression packing, and explain when each is used
- The different types of molded packing, and explain when each is used
- The advantages and disadvantages of pump mechanical seals

CLASS DURATION

8 hours

Shaft & Coupling Alignment

COURSE DESCRIPTION

This course provides information on the importance of proper alignment and alignment methods, cause of misalignment and how to correct for error such as soft foot and thermal growth using dial indicators, and coupling alignment using dial indicators and lasers where applicable. There are hands-on exercises for shaft and equipment alignments.

RECOMMENDED AUDIENCE

This course is designed for electrical and mechanical maintenance technicians.

YOU WILL LEARN:

- The importance of shaft alignment
- The symptoms of misalignment
- The most common causes of misalignment
- The effects of misalignment on machines
- The relationship between vibration and shaft alignment
- The tools used in alignment work
- The effects soft foot has on a machine
- How to measure and correct soft foot
- The phases of alignment and the acceptable methods of completing them
- Make accurate adjustments in each phase of alignment (lab assignment)
- Measure bar sag
- Perform an alignment using the reverse dial indicator method
- Make accurate elevation changes on the machine
- Make controlled horizontal moves
- Calculate thermal growth
- Determine acceptable limits of an alignment
- Perform an alignment on machines with multiple feet
- Perform an alignment on multiple machine trains
- Perform an alignment on non-rotational machines
- Perform an alignment on machines with jackshafts
- Perform an alignment on machines with an unobtainable indicator reading
- The difference between a rigid and flexible coupling

CLASS DURATION

40 hours

System Problem Solving & Troubleshooting

COURSE DESCRIPTION

This course provides information on the concepts associated with systematic troubleshooting of instrumentation systems.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The purpose of troubleshooting
- The need for a troubleshooting methodology
- The four general guidelines for good troubleshooting
- The preferred troubleshooting philosophy
- The importance of maintaining accurate documentation
- The steps of the seven-step troubleshooting method in their logical order
- The concept of using flowcharts
- The steps of the five-step systematic troubleshooting process steps in their logical order
- Discriminate between diagnosis and repair
- To identify sources of problems in instrument systems
- Contrast new versus replacement “in kind”
- The difference between sound and unsound reasons for deviating from ideal troubleshooting strategies
- To identify the steps to take to develop a customized troubleshooting strategy
- The basic steps for troubleshooting intermittent failures
- The importance of finding the root cause of a trouble
- The major elements of a Cause and Effect Diagram
- The six basic steps for constructing a Cause and Effect Diagram
- Given a sample scenario, construct a Cause and Effect Diagram

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

Test Equipment

COURSE DESCRIPTION

This course provides information on the four categories of testing, safety precautions associated with testing and the use and care of different test equipment to include Doble test sets, megohmmeter function and operation and various applications for thermography and infrared scanning. There are hands-on exercises for inspection and use of given test equipment.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The methods of classifying test equipment
- The ten general safety precautions
- The purpose of insulation testing
- The different parameters tested on insulation
- High voltage megohmmeter function and operation
- DC high-potential test
- High-potential tester
- Doble Test
- Thermography
- The factors affecting infrared sensing
- The various applications for infrared scanning
- Infrared imaging

CLASS DURATION

Up to 24 hours depending upon audience and audience experience.

Transformers

COURSE DESCRIPTION

This course provides information on the concepts associated with transformers, transformer function, transformer design, transformer maintenance, transformer faults, and transformer inspecting and testing. There are hands-on exercises for transformer wiring and installation.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- The basic principles of electromagnetic induction
- The application of electromagnetic induction in an elementary transformer
- The major components of a transformer
- The operation of a transformer
- The properties of three-phase circuits
- The construction of a three-phase transformer
- The standard three-phase transformer wiring configurations
- The information found on a transformer nameplate
- The process of changing taps on a three-phase distribution transformer
- Transformer general safety precautions
- The basic types of transformers
- How to size a transformer for a specific application
- The types of transformer malfunctions
- Transformer testing and inspection

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

Valve & Valve Actuators

COURSE DESCRIPTION

This course provides information on the types of valves and actuator used as control elements, valve components, and valve applications. There are hands-on exercises for equipment setup and evaluation.

RECOMMENDED AUDIENCE

This course is designed for mechanical maintenance technicians.

YOU WILL LEARN:

- The major functions a valve performs
- The major parts of a valve
- The function of the following valve components; Actuator, Body, Bonnet, Stem, Disc, Collar or Yoke, Seat, Packing or Stem Seal, Valve Position Indicators
- The advantages of a needle valve over a standard globe valve
- The purpose of bench set information of a pneumatic actuator
- The function of a valve positioner
- How to set up a valve positioner
- The different types of valves
- The information available via valve markings and nameplate information

CLASS DURATION

Up to 40 hours depending upon audience and audience experience.

Welding & Burning

COURSE DESCRIPTION

This course provides information on oxyfuel cutting and SMAW structural welding. There are extensive hands-on exercises for burning and welding.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Sketch the following kinds of joints-butt, lap, tee, corner, and edge
- The following kinds of welds-groove, fillet, plug, slot, spot, and seam
- Name and locate the parts of a weld
- The basic considerations in joint design and fit up
- The importance of good housekeeping in an area where welding is taking place
- Personal protective equipment required when welding
- The precautions to take when using and handling cylinders and regulators
- Briefly describe the oxyfuel welding process and the components of an oxyfuel welding outfit, including the lighting device
- Steps involved in preparing to weld
- The steps in safely shutting down an oxyfuel welding system
- The preparation required for oxyfuel welding, SMAW, GMAW, and GTAW processes
- The procedures involved in oxyfuel welding, SMAW, GMAW, and GTAW processes
- Describe the effects of electrode selection, current, arc length, and travel speed on arc welding procedures
- The common causes of arc blow, a hard-to-start arc, and spatter, and explain why proper fitup is important
- The special equipment or methods used in cutting bevels, piercing holes, cutting circles, and cutting away rivets
- Why gouging, scarfing, and washing are used
- The shielded metal arc welding process works
- How to identify different welding electrodes
- Make t-joint welds using SMAW equipment

CLASS DURATION

Up to 120 hours depending upon audience and audience experience.

Wiring

COURSE DESCRIPTION

This course provides information on the wiring requirements, material identification, and the installation and splicing of wiring. There are hands-on exercises for wiring installation.

RECOMMENDED AUDIENCE

This course is designed for electrical maintenance technicians.

YOU WILL LEARN:

- Wiring and wiring materials
- Use an American Wire Gauge to determine wire size
- Determine the size wire needed for a given installation
- Splice wires
- Install wires

CLASS DURATION

Up to 24 hours depending upon audience and audience experience.