



**Regional Workforce
Development**

Mechanical Maintenance Technician (online)

Program Objectives & Descriptions

INTRODUCTION

REA5-Study Skills

- Construct spoken and numbered outlines
- Summarize a paragraph
- Know the three types of reading: study reading, skimming, and scanning
- Apply study skills to mathematics
- Know a series of steps to solve problems

Maintenance Principles

- Shows workers how solid maintenance principles can be used to reduce the influence of defects that come from 5 sources: Workmanship, Operation, Materials, Design, Failure Events

TRB1 – Maintenance Troubleshooting: Procedures

- Identify the abnormality or symptom based on normal operation behavior
- Determine the faulty element or component based on symptoms
- Plan a course of action to repair the equipment
- Safely perform repairs on the equipment
- Apply observation techniques to prevent reoccurrence once the problem is repaired.

BASIC MATH

MAT1-Whole Numbers

- Learn to recognize and use symbols of arithmetic
- Learn the place value of numbers
- Learn to add, subtract, multiply and divide whole numbers
- Learn to solve arithmetic problems

MAT2-Fractions

- Learn the parts of a fraction
- Learn to determine fractional parts of quantities
- Learn to add & divide fractions
- Learn basic arithmetic functions using fractions and mixed numbers

MAT3-Decimals

- Learn about the use of decimals
- Learn the value of zeros in decimals
- Learn to round off decimals
- Learn to identify repeating decimals
- Learn to add, subtract, multiply, and divide decimals
- Learn to calculate percents

MAT4-Algebra

- Learn about signed numbers and how they are represented on a number line
- Learn to subtract, multiply, and divide signed numbers
- Learn to use variables in solving equations
- Learn to determine the value of square roots
- Learn to use numbers with exponents and powers of 10

- Learn to simplify algebraic expressions by removing grouping symbols
- Learn to perform operations in their proper sequence
- Learn to solve equations that have one unknown

PRINT READING

PRT1-Print Reading: Orthographic Projections

- Identify the principle views used in orthographic projections
- Identify the types of lines used in projection drawings and the purpose of each
- Identify auxiliary and sectional views
- Identify the differences between first and third angle projections

PRT2-Print Reading: Format and Dimension

- Identify characteristics of standard sheet sizes
- Identify features of engineering drawings
- Explain how an object's features are defined and located using dimensions
- Explain tolerance dimensioning

PRT3-Print Reading: Types and Symbols

- Identify the differences between layout, detail, prefix, and assembly drawings
- Recognize general identification and revision notes and symbols
- Identify special markings, including surface texture, welds, rivets, and datums

PRT4-Thread Specifications

- Identify thread features
- Describe the most common thread forms and their characteristics
- Recognize the differences between English and metric thread notes

(TPC) READING SCHEMATICS & SYMBOLS

Covers all types of schematics and symbols used in commercial and industrial settings. Examines symbols on schematics, electrical symbols and diagrams, piping symbols and diagrams, hydraulic and pneumatic diagrams and symbols. Discusses air conditioning and refrigeration systems, including explanations of electrical/electronic control schematics. Covers welding and joining symbols.

SAFETY & HEALTH

Personal Protective Equipment: Don't Start Work without It

At work, every body part is vulnerable to injury and you have to make sure that your employees are well-protected. They face unique dangers depending on the job each one does. Accordingly, their PPE must be customized so that they can cope with the risks. Get this comprehensive PPE course, covering eye, face, hearing, head, hand and foot protection, and other PPE rules. Covers:

- Personal Protective Equipment
- Eye and Face Protection
- Hearing Protection
- Head Protection
- Hand Protection
- Foot Protection

Lockout Tagout: Lightening In A Bottle

- Lockout/Tagout Basics and Standard
 - Energy Types and Lockout/Tagout Basics
 - OSHA's Lockout/Tagout Standard
- Six Steps For Lockout/Tagout
 - Preparation, Shutdown and Isolation
 - Application, Restraint and Verification

- Removal and Re-Energizing
 - Three Steps of Removal/Re-Energizing
 - Inspection and Training

Electrical Safety: Beware the Bite

- Levels of Protection: Conductivity, Engineering Controls
- Safe Work Practices: Safety at Work, Lockout/Tagout, Lockout/Tagout for Energized Systems
- Effective Safety Measures: Personal Protective Equipment, Emergency Rescue and First Aid

ArcFlash: Live to Tell

- Definition of arc flash
- Safety documentation and regulations
- Latest information on NFPA 70E
- Qualified vs. unqualified persons
- Three critical approach boundary areas
- Job planning and hazard analysis
- Lockout/tagout procedures
- Proper PPE application

HAzCom: In Sync with GHS

As you know, the chemicals that your employees work with everyday can cause a multitude of physical and health hazards including chemical burns, respiratory problems, and fires and explosions. The Occupational Safety and Health Administration's (OSHA) Hazard Communication standard has recently been enhanced with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). This new HazCom standard not only gives workers the right to know the chemicals and hazards they face, but the right to understand them and how to protect themselves from danger. DuPont Sustainable Solutions' new HazCom: In Sync With GHS will help employees understand this new standardized process of communicating chemical hazards. Covers:

- Classes of Hazards
 - Hazard Classification
- Labels
 - Labels on Shipped Containers
 - Pictograms
 - Workplace Labeling
- Safety Data Sheets
 - Communicating Chemical Hazards
- Communication
 - Written Program
 - Information for Workers

Chemical Handling: Basic Principles

Get to know chemicals and learn how to handle them safely. This course trains you to identify chemicals, understand the various risks they pose and respond to emergencies. It also examines chemical containers and general and specific safety procedures for each, including those for stacking, labeling, ventilating, transferring, grounding and using static bonding. To help you deal with accidental spills and leaks, the program also discusses the HAZWOPER standard and Title 3 of the SARA standard. Covers:

- Identification of Hazardous Chemicals
- Properties of Chemicals
- Labels
- Handling and Storage Techniques
- Safety Guidelines
- Personal Protective Equipment
- Personal Protective Equipment

- Emergency Response
- Handling Hazardous Situations

TPC INDUSTRIAL SAFETY & HEALTH

Explains government involvement in ensuring a safe workplace. Discusses safety in various situations. Discusses personal protective equipment and fire safety. Includes expanded coverage of many health hazards. Covers ergonomics, environmental responsibility and importance of maintaining a safe work environment.

OSHA 10 HOUR GENERAL INDUSTRY

The 10-hour General Industry Outreach Training Program is intended to provide an entry level general industry worker's broad awareness on recognizing and preventing hazards on a general industry site. Students will be introduced to OSHA policies, procedures and standards as well as general industry safety and health principles and work practices covered in OSHA Act Part 1910. Special emphasis will be placed on areas most hazardous using OSHA standards as a guide. General industry workers must receive additional training, when required by OSHA standards, on specific hazards of the job. Upon successful completion of the course, participants will receive an OSHA 10-Hour General Industry Outreach DOL course completion card within 4-6 weeks.

RIGGING

Rigging: Equipment Basics

- Introduction to Rigging: Rigging Basics, Rigging Equipment, The Rigging Process
- Wire Ropes: Wire Rope Basics, Wire Rope Design and Construction, Wire Rope Splices and End Fittings
- Webbing, Synthetic Web Slings
- Connectors and Attachments, Types of Attachments
- Hooks and Shackles, Eyebolts and Turnbuckles

Rigging: Operations

- Planning the Lift
- Load Characteristics
- Equipment Requirements
- Environmental Factors
- Inspection: Inspection Requirements
- Inspecting Wire Rope, Synthetic Webbing, Hardware Attachments & Assembled Rigging
- Performing the Lift, Lift Preparation, Lifting the Load
- Lift Safety
- Gear Maintenance and Storage
- Sling Care and Use
- Wire Rope and Synthetic Webbing

LUBRICATION

MLU1-Lube Oil: Types Properties and Handling

- Understand the significance of proper lubrication
- Identify the types of oils used, their characteristics, and the various ways to apply lubricants
- Describe the centralized and portable methods for applying lubricants and various fittings that may be necessary for proper lubrication
- Understand the guidelines for proper lubricant storage, both indoors and outdoors

MLU2-Lube Oil: Equipment and Procedures

- Describe lubricant applications and standards

- Properly dispense machinery oils using lubrication equipment and fittings
- Describe the proper procedures for oiling with various lubrication systems

MLU3-Lube Grease: Types Application and Equipment

- Describe the key grease properties and functions
- Identify grease types
- Use manual, powered, and automatic lubricators properly
- Understand safe procedures to handle, store, and dispense grease

INS9-Lubrication System Inspection

- Identify the types of lubrication oils
- Inspect grease packs, pumps, distribution valves, pipes, joints, and bearings
- Inspect suction filters, pump units, and pressure and check valves
- Inspect lubrication parts

DRIVE COMPONENTS

MDR1-Industrial Drive Systems: Belt Drives

- Identify common industrial belt drive systems
- Identify the different drive systems and discuss drive ratios
- Perform basic installation and maintenance procedures
- Troubleshoot

MDR2-Industrial Drive Systems: Chain Drives common belt drive system problems

- Perform basic chain drive installation and maintenance procedures
- Troubleshoot some common chain drive system problems

INS7-Operator Inspection: Belt Drive, chain drive, & gear box inspection

- Identify and describe the types and functions of belts and gears
- Describe the inspection procedures of belt and chain transmission parts and units
- Explain methods for inspecting gears.

CDP1-Complete Drive Packages

- Identify the components of a directly coupled drive system
- Understand the characteristics of operation unique to directly coupled drive systems
- Identify the components of jackshaft and auxiliary drive systems
- Explain the unique properties of jackshaft and auxiliary drive systems
- Explain the effects of changing input and output speeds on auxiliary and jackshaft drive systems
- Compute drive system efficiency
- Understand the principles of operation for spring operated, shear pin, and heat-actuated overload devices
- Learn troubleshooting strategies for drive packages

EDS1 - Enclosed Drive Systems

- Understand the principles of operation and terminology used in enclosed drive systems
- Identify the components used in an enclosed gear drive
- Identify different gear types
- Understand applications for enclosed gear drives
- Identify the various types of adjustable speed enclosed drives
- Understand applications of an enclosed chain drive system
- Identify and describe the component parts and operation of an enclosed chain drive
- Install an enclosed drive
- Explain proper maintenance procedures
- Describe proper procedures when troubleshooting an enclosed drive system

CBR1-Clutches & Brakes: Types, Principles, and Functions

- Describe the different types of mechanical clutches and brakes, their components, and operation

- Describe applications and troubleshooting procedures for mechanical clutches and brakes
- Describe pneumatic and hydraulic clutches and brakes, their components, and operation
- Describe pneumatic and hydraulic control systems
- Describe applications and troubleshooting procedures for pneumatic and hydraulic clutches and brakes
- Explain the purpose and operation of electrically controlled clutches and brakes
- Identify an electric control system

CBR2-Clutches & Brakes: Troubleshooting

- Troubleshoot several problems in mechanical clutch and brake systems
- Troubleshoot several problems in pneumatic and hydraulic clutch and brake systems
- Troubleshoot several problems in electric clutch and brake systems

INS8-Operator Inspection: Clutch & Brake Inspection

- Identify and describe the types and functions of clutches and brakes
- Identify and describe the types and functions of cams and guide surfaces
- Describe the inspection procedures of clutches and brakes
- Describe the inspection procedures of cams and guide surfaces.

GG51 - Gear and Gear Systems

- Understand parallel and perpendicular shaft configurations
- Identify and describe the attributes of gears
- Understand gear considerations, Calculate critical dimensions of gears
- Explain installation procedures specific to spur, helical, bevel, miter, and worm gearing
- Describe the types of wear associated with open gearing systems
- Explain the inspection procedures for spur, helical, bevel, miter, and worm gear sets
- Identify common symptoms and how to determine causes of failure
- Explain solutions for open gear systems. Understand safety procedures with open gear systems

SJC1-Shaft Joining and Coupling Devices

- Identify different types of shaft joining and coupling devices
- Understand the operating principles governing shaft joining and coupling devices
- Identify critical application considerations when selecting a connecting device
- Differentiate between rigid, flexible, fluid couplings, and universal joints based upon construction, purpose, and application
- Understand the safety precautions to follow when performing inspection, maintenance, and repairs
- Install and align mechanical couplings
- Maintain mechanical couplings
- Install, mount, align, test, and maintain a fluid coupling
- Recognize symptoms of and troubleshoot fluid couplings_and Coupling Devices

SEALS

MPS1-Seals: Types Materials and Properties

- Describe the main features of mechanical face and cartridge seals
- Describe the various compression packages used in rotating and reciprocating machinery
- Identify packing and gasket materials by style, composition, and application
- identify the various styles and arrangements of mechanical face seals
- Ensure compatibility between common seal rings, packing and gasket materials, and process fluids

MPS2-Seals: Gaskets and Packing: Inspection and Inst.

- Remove, cut, prepare, and install pipe joint gaskets
- Remove, prepare, and install machine compartment and cover gaskets
- Remove, inspect, and troubleshoot industrial packings
- Cut, prepare, and install packings on valves and pumps utilizing industrial materials

- Remove, inspect, and install lip-type compression packings

MPS3-Seals: Mechanical Face Seals: Troubleshooting and Inst.

- Identify the different types, configurations, and uses of mechanical face seals
- Remove and inspect mechanical face seals
- Troubleshoot the most common failure modes of mechanical face seals
- Prepare, assemble, and install typical mechanical face seals

PUMPS

PUM1-Cent.Pumps: Design and Function

- Explain the differences between centrifugal and positive displacement pumps
- Describe the basic design of a centrifugal pump
- Classify centrifugal pumps according to staging, casing split, shaft coupling, suction position, and volute
- Identify and describe the functions of various centrifugal pump components
- Explain compression packing, lantern rings, and external lubrication in regard to a stuffing box
- Explain the purpose and function of mechanical seals

PUM2-Cent. Pump System Char. and selection

- Explain the system as it operates under normal parameters
- Describe how fluid flows through a centrifugal pump system
- Define terms associated with a centrifugal pump in a system
- Identify factors that affect the normal parameters surrounding pump performance in a system
- Apply system requirement concepts to the selection of an appropriate pump, including how to interpret pump performance curves and Affinity Laws

PUM3-Cent.Pumps: Operation and Maint

- Explain the basics of operation and maintenance of centrifugal pumps
- Describe the proper start-up procedure for a centrifugal pump
- Identify the system components that require monitoring and adjusting during operation
- Recognize abnormal operating conditions and their probable causes
- Describe proper shutdown procedures

PUM4-Cent.Pumps: Trblshtg and Disassembly

- Explain the basics of pump troubleshooting
- Assess pump temperature and possible causes of high motor temperature, overheated packing, and overheated bearings
- Identify signs of and causes for cavitation, vibration, and air entrainment
- Identify causes of low flow rate and low discharge pressure
- Describe the safety precautions to follow prior to working on a pump system
- Recognize procedures for isolating a pump, depressurizing a system, and draining and inspecting fluids from a pump
- Describe the safe and correct steps to remove a pump casing, to remove the impeller, and to handle pump packing, seals, and bearings
- Describe how to check the shaft, seals, packing, and impeller mounting areas
- Identify the location and consequences of pitting, erosion, and scoring in a pump

PUM5-Cent. Pump Reassembling and Installation

- Identify the necessary precautions to take during reassembly, installation, and start-up of a centrifugal pump
- Describe proper inspection and installation of components
- Recognize the precautions and procedures for rigging a pump in place
- Identify soft foot and start-up valve alignment, post start-up checks, and compression packing adjustments

TRB4-Maintenance Troubleshooting: Pumps and Compressors

- Identify different types of pumps and compressors
- Recognize problematic symptoms associated with mechanical failure or fluid flow

Apply corrective measures in repairing these pumps and compressors

BEARINGSBRG1-Ind. Bearings: Application and Technology

- Understand the definition of a bearing
- Understand the different types of bearings, including plain, ball, cylindrical, spherical, tapered, and needle
- Understand bearing wear and life expectancy
- Understand protective housings for bearings
- Explain the different types of loads

BRG2-Ind. Bearings: Maint. and Installation

- Learn the proper way to install and care for both plain and rolling-element bearings
- Identify the different types of fittings for installation
- Check proper operating clearances
- Understand the importance of proper bearing alignment

BRG3-Ind. Bearings: Troubleshooting

- Understand the various ways to identify potential problems and their sources
- Understand how to maintain a schedule of monitoring on four major areas of identification
- Explain the proper procedures for removing failed bearings
- Determine the reasons for failed bearings

PIPING SYSTEMS(TPC) Piping Systems

Examines piping system materials and sizing. Includes coverage of codes, valves and fittings, and the cutting and joining of piping and tubing. Explains the function and unique requirements of the discharge line, liquid line, and suction line. Concludes with a lesson on piping system maintenance, including handling dirt and scale, expansion, vibration, corrosion, and leaks

VALVESFVB1-Shutoff Valve Designs and Application Considerations

- Explain the general characteristics, construction options, and application considerations of various shutoff valves
- Identify the features and limitations of the various valve types
- Evaluate shutoff valve performance

FVB2-Selecting Shutoff Valves and Accessories

- Understand the major considerations for selecting a shutoff valve type
- Identify pressure and temperature requirements
- Identify the unique valve requirements imposed by the nature of the controlled fluid
- Identify the features, limitations, and suitability of different valve styles
- Select an appropriate valve
- Select an appropriate means of operating the valve (handwheel, gear drive, power actuator, etc)

FVB3-Installing Shutoff Valves

- Explain good piping practices, including proper valve location and orientation in the pipeline
- Understand the importance of pipeline and valve supports
- Prevent line hammering

- Explain installation considerations for specific types of shutoff valves, including plug, ball, butterfly, globe, gate, and check valves
- Properly install valves with screwed, flanged, and welded-end connections
- Describe actuator mounting and adjustment

FVB4-Maintaining Shutoff Valves

- Identify components and their functions for various valve types
- Explain routine preventive maintenance procedures for each valve type
- Explain common procedures involved in complete valve repair

CVA1-Basics and Function

- Identify the characteristics, function, and application of the control valve
- Describe the factors that must be considered when selecting the proper control valve
- Describe the functions of a valve actuator and a control valve positioner and how these work within a control system

CVA2-Types and Design

- Describe the functions, applications, and differences of linear motion control valves and rotary motion control valves
- Describe the functions, applications, and differences of pneumatically operated actuators, electrically operated actuators, and rotary motion actuators
- Describe the basic operation and function of the components of the control valve
- Identify factors that affect control valve safety

CVA3-Fundamentals and Selection

- Describe the different types of fluid flow
- Identify the factors that affect fluid flow
- Explain the formulas used for determining valve selection
- Describe the conditions of fluid flowing through a restriction such as a Herschel venture, a concentric orifice, and Vena Contracta
- Explain cavitation, flashing, and fluid flow
- Explain the considerations for selecting a control valve
- Describe the preliminary criteria for selecting the proper actuator and auxiliary devices

CVA4-Sizing and Installation

- Describe the factors to consider for correctly sizing a valve
- Recognize what items are needed to determine proper valve sizing
- Determine the proper control valve to be used for a liquid, gas, and vapor application
- Describe the factors involved with actuator sizing, such as static force, valve leakage classification, and dynamic forces
- Recognize the proper installation and maintenance procedures of a control valve

PNEUMATICS

PNM1-The Power of Compressed Air

Power transmission systems are found in equipment ranging from simple devices to complex industrial machines. This course introduces pneumatics — the transfer, control, and use of energy contained in compressed and flowing air. It provides a basic description of the characteristics of matter and describes the relationship between pneumatic properties. In addition, it describes the factors that affect air flow and velocity as well as the effects that temperature, water vapor, air saturation, and condensation have on a pneumatic system. The course covers: The characteristics of matter, Molecular level, Air, Properties of pneumatics, Specific volume, pressure, and temperature; Air flow, Factors affecting air flow, Air saturation, Condensation.

PNM2-The Pneumatic Circuit

A pneumatic circuit is a combination of components that work together to produce, control, and transmit energy. This course introduces several of these energy-transferring and air control components and the symbols used to represent them. The course covers:

- Energy transferring components, Compressors, Valves, Actuators
- Air control components. Directional control valves, Flow control valves
- Regulators, Tanks and filters
- Pneumatic symbols, Communicating with pictures
- Pumps, filters, and lubricators

PNM3-Processing Air

This course introduces components that process air by compressing, storing, treating, and distributing air to the actuator. Although sometimes overlooked, these components have a major impact on system operation. The course covers:

- Compressors, Single-stage, Multi-stage and dynamic
- Pressure and flow rate capacities, Sustaining compression
- Air storage, Tank accessories, Air sustaining components
- Branch and loop systems.

PNM4-Using Compressed Air

linkages can produce complex motion patterns, the origin of the motion is always one of these two types.

This course focuses on the pneumatic components that produce motion. The course covers:

- Linear actuators, Cylinders, cylinder accessories
- Theory of operation
- Seals, Nonlinear actuators, Rotary actuators
- Air motors, Torque, Nozzles and orifices.

PNM5-Pneumatic Control Valves

To be effective, actuators must move loads in the proper sequence, at the correct time, and at the desired speed. In pneumatic systems, this type of control is accomplished through the use of valves that control the direction of air flow, regulate actuator speed, and respond to changes in air pressure. This course focuses on pneumatic control valves. The course covers:

- Directional control valves, One- and two-way valves, Three- and four-way valves
- Methods of actuation, Flow control valves
- Exhaust valves and air fuses
- Simple and specialized regulators
- Valve performance, Selecting valves.

PNM6-Working Safely with Pneumatic Systems

This course describes the safety hazards associated with pneumatic systems. It also covers the safety rules that should be followed when working with individual pneumatic components. The course covers:

- Pneumatic system safety, Common hazards and remedies
- Working with air tools, Oil and water
- Safe installation and operation
- Compressors, tanks, and actuators
- Control valves
- Air treatment devices

PNM7-Pneumatic System Maintenance

This course explains the importance of a pro-active maintenance program for pneumatic systems. It describes the major categories of tasks that should be part of a preventative maintenance program and identifies some specific tasks that should be performed during routine maintenance. The course covers:

- Pro-active maintenance, Types of maintenance systems
- Inspection, Valves and conductors, Checking alignment
- System cleanliness, Servicing, Preparing for servicing

- Air treatment components, Final maintenance tasks, Testing
- Reconditioning and scheduling.

PNM8-System Troubleshooting

This course explores the concept of troubleshooting and covers one systematic approach to identifying problems and determining their causes. The course also examines the various root causes of bearing failure, including over-lubrication, contamination, and misalignment. The course covers:

- The four indicators for determining bearing condition
- Temperature, Noise and vibration, Seals, Lubrication
- Removing and inspecting failed bearings
- Causes of premature failure
- Pitting and spalling, Electrostatic pitting, True brinelling
- Fretting corrosion, Heat damage, Frictional bearing wear
- Rust or corrosion, Equipment adjustment

INS1-Pneumatic System Inspection

- Understand the basic characteristics of air, including pressure, flow, and volume
- Explain how external conditions can affect air
- Identify the operating principles of pneumatic systems, including Pascal's Law
- Identify the components and function of the air compression system
- Understand the general safety procedures for operating a pneumatic system
- Differentiate between suction pressure and discharge pressure
- Describe the three-step process for establishing the general inspection components and inspection points of the pneumatic system

HYDRAULICS

IDH1- Basic Principles and Application

- Understand the basic principles and components of hydraulic power systems
- Explain proper storage, handling, and maintenance procedures

IDH2-Types and Concepts

- Identify and explain hydraulic piping, fitting, and connections
- Understand hydraulic pumps
- Identify and explain hydraulic system and pump mechanisms
- Understand pressure control valves

IDH3-Function and Operating Principles

- Identify the types and functions of directional control valves and accumulators
- Identify the types of hydraulic cylinders
- Understand operating principles and applications of hydraulic motors
- Identify types, operating principles, and common uses of rotary actuators
- Explain maintenance and troubleshooting practices that apply to the entire hydraulic system

IDH4-Maintenance and Troubleshooting

- Perform reservoir, heat exchanger, and pump maintenance
- Understand maintenance safety
- Explain troubleshooting procedures for hydraulic systems

HDL1-Harnessing Hydraulic Power

- Identify the conditions that cause fluids to flow and exert pressure
- Explain Pascal's law
- Describe the relationship between fluid pressure and fluid flow
- Identify factors that affect pressure level, flow rate, and fluid velocity in a hydraulic circuit

HDL2-The Hydraulic Circuit

- Identify the components of a typical hydraulic circuit
- Describe the function of components found in a basic hydraulic circuit
- Explain the structure and operation of basic hydraulic components
- Identify graphic symbols used to represent basic hydraulic components

HDL3-The Hydraulic Pumps & Actuators

- Describe the basic structure and operation of balanced and unbalanced vane pumps, internal and external gear pumps, and radial and axial piston pumps
- Identify methods of varying the displacement in vane pumps and radial and axial piston pumps
- Describe the basic structure and operation of various types of motors and rotary actuators
- Describe the basic structure and operation of various types of cylinder devices such as rod gland bushings and seals, piston seals, air bleed passages, stroke adjusters, stop tubes, and cushions

HDL4-Hydraulics: Control Valves

- Describe the basic structure and operation of normally closed and normally open pressure control valves
- Describe the uses for relieve, unloading, sequence, counterbalance, brake, pressure-reducing valves, and flow control valves
- Explain how pressure compensation enables a flow control valve to maintain a desired flow rate regardless of pressure fluctuations
- Describe the function and basic operation of one-way, two-way, three-way, and four-way directional control valves
- Identify methods of spool actuation for directional control valves

HDL5-Hydraulic Fluid

- Identify the characteristics that enable hydraulic fluid to perform required functions within a hydraulic system
- Describe the function, structure, and basic operation of reservoirs and accumulators, various types of conductors and fittings, hydraulic seals, and hydraulic filters
- Describe the structure and basic operation of various types of hydraulic heat exchangers

HDL6-Hydraulics: System Safety & Maintenance

- Identify common hazards associated with the workplace
- Describe proper procedures for working with various hydraulic components
- List the safety rules that must be followed when operating or maintaining a hydraulic system
- Describe the factors that determine the intervals at which proactive maintenance tasks should be performed
- Describe the inspections and tests that should be part of a preventative maintenance program

HDL7-The Hydraulic Systems Troubleshooting

- Identify the factors that must be considered when evaluating the operation of a hydraulic system
- Describe the tasks that should be part of a systematic troubleshooting process
- Identify symptoms of several hydraulic components
- Identify possible causes of some common hydraulic component and system failures

HPS1-Identification and Operation

- Describe the operation of basic hydraulic circuits
- Explain how load sensing and demand circuits operate
- Describe how intensification and hydrostatic circuits operate
- Discuss the operation of regenerative, prefill, and high-low circuits
- Explain the importance of using a print when working with hydraulic systems
- Describe the procedure for analyzing a complex hydraulic circuit
- Identify pressure, drain, and control lines in a hydraulic system
- Separate the various functions of a hydraulic circuit for closer analysis

HPS2-Troubleshooting Techniques

- Describe proper troubleshooting techniques
- Describe various kinds of modern hydraulic system test equipment
- Explain how to select proper test points in a circuit
- Describe repair procedures when troubleshooting and repairing a hydraulic system
- Troubleshoot problems that occur in hydraulic power systems, including lack of motion, poor motion, and temperature and system malfunctions

WELDING

(TPC) Welding Principles

Covers fundamentals of welding. Discusses welding safety considerations and precautions. Covers both oxyfuel and arc welding equipment. Describes welding techniques and symbols. Discusses ways to avoid weld faults

BASIC ELECTRICITY

ELS1-Industrial Electricity Basic Principles

- Identify the parts of an atom
- Understand how electrons move and react
- Define terms associated with electricity, static electricity, and magnetism
- Discuss how current flows through basic electrical circuits

ACDC1-Current

- Identify the electronic charge of the atom, electron, proton, neutron, nucleus, and ion
- Describe Coulomb's Law
- Define terms associated with current
- Measure current with an ammeter

ACDC2-Voltage

- Explain how connecting batteries in series or in parallel will affect voltage and current capability
- Differentiate between voltage drop and rise
- Explain ground, negative, and positive voltage
- Measure voltage with a voltmeter

ACDC3-Resistance

- Differentiate between conductors and insulators and describe the characteristics that affect them
- Interpret resistor color codes
- Describe various types of resistors
- Describe how resistors can be connected to achieve different amounts of total resistance

ACDC4-Ohm's Law

- Write Ohm's Law in three different forms
- Select the proper equation to calculate voltage, current, and resistance
- Calculate the amount of power in a circuit

ACDC5-Magnetism

- Define electromagnetic terms
- Explain basic electromagnetic rules and principles
- Describe the operation of generators and motors

ACDC6-Electrical Measurements

- Explain how the VOM works and should be connected to a circuit
- Calculate the value of shunt required to increase the current capability
- Calculate the series dropping resistance required to increase the voltage capability
- Define voltmeter loading

ACDC7-Theory DC Circuits

- Explain how a voltage divider works
- Describe an application for a bridge circuit
- Describe Kirchhoff's Law
- Explain the superposition theorem, Thevenin's Theorem, and Norton's Theorem

MEASUREMENT / INSTRUMENTATION

PME1 - Thermometers and Thermocouples

Temperature scales
Factors affecting accuracy of measurement
Types of thermometers
Thermocouples

PME3 - Pressure 1: Manometers and Gages

Manometers
Mechanical pressure transducers

PME5 - Level 1: Measurement and Gages

Visual level sensors
Variable displacement devices

PME7 - Flow 1: Measurement Overview

Fluid properties
Measuring flow

Kent State University Regional Workforce Development
For more information call Terry Theis at 330.308.7448 or ttheis1@kent.edu