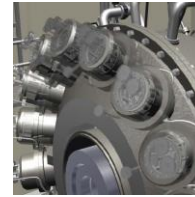




Instructor-Led Training (ILT)



2016 Edition

Technology Transfer Services, Inc.

14497 N. Dale Mabry Hwy, Suite 120-N

Tampa, Florida 33618

813.908.1100 (office) / 813.908.1200 (fax)

www.techtransfer.com



TTS is an *Accredited Provider* by the International Association for Continuing Education and Training (IACET). In obtaining this accreditation, we have demonstrated compliance with the ANSI/IACET Standard which is recognized internationally as a standard of good practice.

As a result of our *Accredited Provider* status, TTS is authorized to offer IACET CEUs for programs that qualify under the ANSI/IACET Standard.

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WELCOME TO TECHNOLOGY TRANSFER SERVICES, INC.

Since 1994, **Technology Transfer Services** (TTS) has been widely recognized as a leader in maintenance and operations services. In recent years, TTS has emerged as the world's largest blended learning company focused on maintenance and operations optimization. In 2012, TTS was awarded the IACET *Exemplar Award for External Training* in maintenance and operations.

Located in Tampa, Florida, we have more than 150 employees who deliver results throughout the world including in the Americas, Africa, Australia, Asia, Europe, and the Middle East. We provide training, engineering, and technical support services to companies in numerous manufacturing, oil and gas, power, automotive, steel, food services, transportation, and other industries.

Mission Statement

*To be a trusted business partner
providing innovative solutions
to improve performance
regardless of the challenge.*

Our Services

TTS builds immersive learning environments through the combination of instructor-led training, site-specific training, custom eLearning, and simulation to cost-effectively train your workforce. Our blended team of industry experts and media developers ***create innovative learning strategies that accelerate skill and knowledge transfer.***

As a Maintenance and Operations optimization organization, TTS has the expertise to offer clients turnkey solutions. Our services include equipment, process, and personnel assessments, maintenance and reliability optimization programs, performance consulting, documentation services, and talent management support.

At TTS, we pride ourselves on the dedication of our employees who work closely with you to ensure that our solutions meet and exceed your expectations. We are always available, as a resource and as a partner, to help you achieve your operations and maintenance goals. We believe this is a key reason some of the largest global companies depend on us to deliver services to them worldwide.

Maintenance Optimization/Performance Improvement

Optimizing your maintenance process includes improving processes, people, and equipment reliability. TTS has helped accelerate reliability improvement projects for clients including ExxonMobil, Caterpillar, Walgreens, and Duke Energy. TTS' comprehensive services provide a path to **world-class maintenance**. We analyze conditions and implement plans to improve staff capabilities, documentation deficiencies, and process weaknesses. Our services include:

- Arc Flash/NFPA 70E Programs
- CMMS Implementation/Optimization
- Criticality Assessments
- KPI Development & Education
- Maintenance Audits
- Procedure Writing
- Safety Program Development
- Staff Augmentation, Staff Competency & Skills Assessments
- Standardization & Compliance of Work Standards

Automotive Facilities

We've completed projects in assembly, metal fabrication, proving grounds, and gasoline/diesel engine facilities. Projects include new product launch, skilled trades/systems training, and system documentation.

Our partners include General Motors, Raytheon, Caterpillar, Allison Transmission, and Delphi.



Power Industry Services



We have extensive experience delivering projects and services to nuclear, fossil, hydro, renewable energy, and both simple and combined cycle Combustion Turbine units. Our partners include TVA, Duke Energy, Con

Edison, Calpine, Pacific Gas & Electric, Baltimore Gas & Electric, PSEG, Southern Company, Penn Power & Light, and SCE&G, to name a few.

Our power industry training services include:

- CEMS, DCS, Emergency Diesel, Turbine Controls, FDS systems
- **Gas Turbines:**
 - ☞ GE Aero Series LM2500, LM5000, LM6000, LMS100
 - ☞ GE Frame 3, 5, 6, 7, & 9 Series
 - ☞ Siemens V84/V94 and SGT-800 Series,
 - ☞ Siemens/Westinghouse/Mitsubishi 501 Series
- **Steam Turbines:** ABB, Alstom, GE, Mitsubishi, Siemens, Toshiba, Westinghouse
- **HRSB:** Alstom, Amec Foster Wheeler, Nooter/Eriksen, Siemens Benson Boiler, and Vogt
- Mechanical, Instrumentation & Controls, and Electrical technician training
- Operator Training and Certification
- OSHA (10-hour & 30-hour) and Arc Flash training
- Supercritical and subcritical coal-fired power plants

Oil, Gas, and Petrochemical Industries

When in need of maintenance plan development, spare parts recommendations, CMMS implementation, warehouse preservation procedures, and equipment strategy assessments, oil and gas companies around the world call on **TTS**. Our innovative approach provides *world class* solutions, under budget and ahead of schedule. ExxonMobil, Phillips 66, Shell Oil, Conoco, and Kinder Morgan all frequently rely on **TTS** for these services and many more.



Job Descriptions, Job/Task Analysis (JTA), Technician Testing and Classification

With increased automation, it may be necessary to hire additional skilled technicians or to reclassify and train existing technicians. TTS conducts a JTA to identify the specific skills required to maintain a fully operational Distribution Center. The data is analyzed to create job descriptions and evaluation programs. A standardized maintenance hiring process and structured staffing levels are developed. Exams and individual development plans provide a clear path for advancement.

Training Programs

Once the skills required are identified, a training program is developed, targeted at the specific needs of the distribution center workforce. Our maintenance training courses are available online in *eLearning* format to establish a good foundation. Instructor-led training complements the eLearning with hands-on applications.

Many of the processes developed by TTS establish a structure needed in the fast-moving, automated distribution center environment where SAFETY is the highest priority.

Manufacturing and Distribution Center Services



Increased automation brings a need for higher skilled maintenance technicians. Across the country, more and more facilities are realizing this problem and taking action to correct it.

Lockout/Tagout (LOTO) Procedures

OSHA requires employers to document energy sources and develop procedures to prevent unexpected activation of equipment and possible injury. OSHA's lockout/tagout standard (29 CFR 1910.14-7), enacted in January 1990, mandates specific ways to de-energize equipment during servicing and maintenance operations.

OSHA 1926 Training (10-hour and 30-hour)

The 10-hour OSHA compliance training course acquaints participants with major CFR 1910 General Industry OSHA standards and answers questions about OSHA procedures. The 30-hour OSHA compliance training course explains current regulations and promotes compliance with those regulations. The course includes both OSHA requirements and OSHA policies and procedures.

Electrical Safe Work Practice (ESWP)

The Electrical Safe Work Practice is a review of electricity properties and provides guidance concerning proper personal protective equipment and techniques for working on electrical systems as defined in OSHA 29 CFR 1910.147 and National Fire Protection Association (NFPA) 70E 2004.

Arc Flash Study and Training

This training complies with NFPA 70E and OSHA CFR 1910 to provide a safe and efficient means for your technicians to work on and in the vicinity of electrical equipment.

Battery Attendant Certification

TTS has developed a certification process to implement proven safe work practices and develop well-trained technicians to service and maintain the industrial truck batteries.

Crane Certification

TTS has developed a multi-tiered certification program for the ASRS. This certification is for technicians who perform corrective and preventive maintenance on the ASRS and AKL cranes.

Maintenance Best Practices

Assessments of the current state of your maintenance organization provide a framework for process improvements. TTS provides a detailed report of current practices from an outside, independent source.

Computerized Maintenance Management System (CMMS) Implementation

TTS has the expertise to implement a new CMMS or enhance an existing CMMS. Our experienced professionals can take your existing CMMS and review it for accuracy and completeness.

Food Services

TTS has provided Nabisco Foods with comprehensive training and performance enhancement programs for operations and maintenance personnel at the bakery, bottling, cannery, and specialty food production facilities both in the US and abroad.

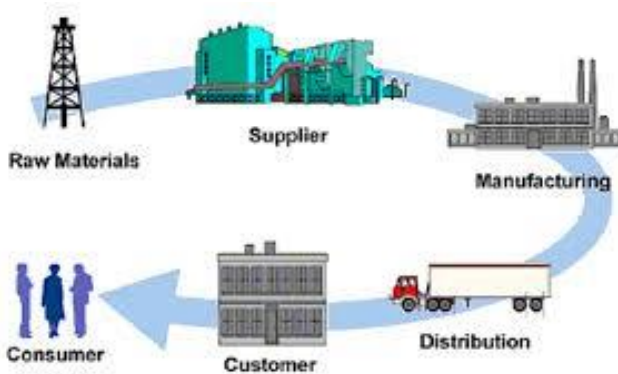
Typical performance instruction materials integrate job and task analysis, student textbooks, instructor guides, training aids, on-site instruction, customized procedures, computerized graphics, and site-specific computer-based training (CBT) development.

TTS has provided training services for several food manufacturers, including Land o' Lakes, Inc. and Pepperidge Farm.



Supply Chain

TTS has consulted and trained companies in all corners of the world in some of the most complex environments.



Customized Programs

TTS has APICS certified instructors with proven experience across a wide range of industries. We facilitate improvements on corporate programs and financial aspects to *Enterprise Resource Planning* functionality and *Lean* systems.

Areas of Expertise

- Warehousing, Receiving, Material Handling
- Inventory and Production Planning
- Sales and Operations Planning
- *Lean* and *Six Sigma*
- Logistics and Distribution
- Planning Systems
- Capital Equipment
- Budgeting and Metrics Development
- Spare Parts Management

TTS will work with your management team to deep dive into issues facing your company. Together, we will establish a prioritized list of changes and a plan to achieve them. We can formalize processes and procedures and train your team. Training can include an instructor-led, on-line, on-the-job, or blended combination.

Technical Training

Improving competencies keep an organization adaptable and competitive, contributing to increased productivity and revenue.

TTS is an Authorized Provider of Continuing Education Units (CEU) by the International Association for Continuing Education and Training (IACET). In 2012, TTS was awarded the prestigious IACET *Exemplar Award for External Training* in maintenance and operations, the only such company to ever win this award.



Technical training is how we began and training industry is our foundation – it's what we do!

Our commitment to our clients' success has resulted in many long-term partnerships. At TTS, we pride ourselves on the dedication of our employees who work closely with you to ensure that **our solutions meet and exceed your expectations**. We are always available, as a resource and as a partner, to help you achieve your operations and maintenance goals. We believe this is a key reason some of the largest global companies depend on us to deliver services to them worldwide.

Technology Transfer Services has a long-standing reputation for providing high-quality technical training through our knowledgeable instructors. TTS prides itself on having the most well-versed, experienced, and accessible instructors in the industry. Our instructors have a wide range of specialized skills and have trained thousands of students in several fields, including Safety, Electrical Operations, Power, Manufacturing/Distribution, and Facility Management. Their attention to detail, thorough hands-on training, and classroom direction make for a highly effective transfer of knowledge.



TTS Awards

2016

2016 Training Outsourcing Companies by TrainingIndustry.com, which recognizes the top Training Outsourcing Companies Watch List, as part of its mission to continually monitor the training marketplace for the best providers of training services and technologies.



2014

Top 20 Workforce Development Providers by TrainingIndustry.com, which recognizes the top workforce development providers of training services and technologies in the training industry.



2014

When Work Works Award is a national initiative, led by the partnership of the Families and Work Institute (FWI) and the Society for Human Resource Management (SHRM), to help businesses of all sizes and types become more successful by transforming the way they view and adopt effective and flexible workplaces.



2013

Bersin by Deloitte *What Works Award for Delivering Innovation* for a specialized, blended online learning experience called *ODESIE* (Online Dynamic Enterprise Solution for Industry Excellence), incorporating videos, social media, serious games, and a basic virtual industrial plant to explore. ODESIE incorporates constant feedback and reinforcement using mixed media.



2013

Top 20 Workforce Development Providers by TrainingIndustry.com, recognizes the top workforce development providers of training services and technologies in the training industry.



2013

Learning Portal Companies Watch List. The list is meant to spotlight the next wave of learning technology leaders and those specializing in niche areas to consider when buyers are researching potential partners.



2013

Alfred P. Sloan Award for Workplace Effectiveness (repeat winner)



2012

The International Association for Continuing Education & Training (IACET) *Exemplar Award for External Training*, which honors exemplary, results-oriented programs or projects that demonstrate a cost-effective and relevant impact on programs that significantly contribute to the field of continuing education and training. ***This award was the first time a maintenance and operations training company had won the award.***



2011

Alfred P. Sloan Award for Business Excellence in Workplace Flexibility. This award recognizes that TTS ranks in the top 20 percent of employers nationally for policies and practices that incorporate workplace flexibility as part of an effective strategy to achieve business objectives.



TECHNICAL TRAINING COURSE DESCRIPTIONS

This section contains brief descriptions of each instructor-led, technical training course we offer in the Electrical, Mechanical, and Instrumentation and Controls (I&C) disciplines. We readily offer to modify any course offering to better fit our client's people, equipment, or process. We also stand ready to develop customized, site-specific or equipment-specific training development and instruction services.

Industrial Electricity and Electronics Series

The *Industrial Electricity and Electronics* series of courses cover various electrical and electronic components, systems, and equipment.



AC/DC Fundamentals

Course #IEE-001

This five-day course begins with a fundamental review of conductors and insulators, EMF and current, resistance, *Ohm's Law* and *Kirchhoff's Law*, power, and magnetism. AC electrical circuit fundamentals are discussed including inductive and capacitive circuits. Other topics include test equipment, semiconductors and diodes, silicon controlled rectifiers, transistors, and power supplies. This course is designed for technicians who require an introduction or a refresher to the principles of electricity and electronics as they apply to plant maintenance.



Advanced Troubleshooting

Course #IEE-002

This five-day course begins with a review of what maintenance actually is and does within a maintenance organization. Next, we review basic troubleshooting principles and the widely used seven-step troubleshooting methodology. We also explain three types of maintenance (preventive, corrective, predictive). We have an in-depth review of data collection and analysis, including data collection techniques and methods, vibration monitoring, thermography data collection and analysis, and equipment and data acquisition. Next, we discuss maintenance and reliability improvement techniques, including root cause failure analysis (RCFA), categories of failures, cause and effect diagrams, and the RCFA process. The last portion explains maintenance reporting using KPIs. This course is designed for new and experienced technicians who troubleshoot and repair plant equipment.

Basic Electrical Safety

Course #IEE-003



This two-day introductory electrical safety course is primarily designed for those without a background in electricity but are required to have electrical safety training. As a prerequisite to understanding the concepts of electrical safety, students are first introduced to basic electrical principles. Students then learn valuable information regarding OSHA 1910 standards and electrical safety practices.

Basic Electronics

Course #IEE-004

This five-day introductory course teaches students the basics of electronics. The course begins with a review of direct current (DC) circuits and students experiment with direct current and series-parallel circuits. The course highlights key concepts of semiconductors and semiconductor devices like diodes, bipolar transistors, other transistor types, and silicon controlled rectifiers (SCR) and triacs. The course includes practical exercises to give students hands-on training.

Basic Protective Relaying

Course #IEE-005

This five-day course is designed to provide technicians with a background in power equipment protection using electromechanical relays. Topics include relaying philosophy and power system analysis at the block diagram level. Also, operating and testing of overcurrent relays, voltage relays, instrument transformers, and synchronism check relays are covered.

Basic Soldering

Course #IEE-006

Although most modern soldering done today is automated, manual soldering is an important skill for plant assembly technicians, especially for repair and re-work. This two-day course teaches the knowledge and techniques required to produce high-quality manually soldered joints. It provides an overview of basic manual soldering equipment, troubleshooting solder problems, and the proper safety precautions for soldering.

Batteries and Battery Chargers

Course #IEE-007

This five-day course begins by reviewing the principles of large battery operation. Battery terms are then explained, followed by battery safety topics, battery maintenance, and uninterruptible power supply operation.

Digital Circuits for Electricians

Course #IEE-008

This four-day introductory course begins with a review of the fundamentals of digital electronics. A brief review of digital numbering systems and digital device construction is provided and an overview of basic logic gates. The use of flip-flops, multi-vibrators, counters, and decoders is emphasized. The function of a microprocessor is presented, as well as analog/digital converters. Finally, we demonstrate how to troubleshoot digital circuits.

Electrical Distribution System

Course #IEE-009

This three-day course covers the electrical distribution system (EDS) including the sub-systems and major equipment such as the generator step-up transformer (GSU), auxiliary transformer, 4160-volt switchgear, 4160-volt breaker, ground and test (G&T) device, 480-volt SUS switchgear, and 125V DC power system.

Electrical Fundamentals

Course #IEE-010

This three-day course includes topics relating to industrial electricity. Topics include concepts of electrical theory and math, electrical print reading, magnetism, and electrical safety. The course uses your plant's prints and diagrams to reinforce the print reading section. This course is designed for plant maintenance personnel.

Electrical Inspection (3-day)

Course #IEE-011

This three-day course covers the codes and standards of the National Electrical Code (NEC) and National Electrical Manufacturers Association (NEMA), inspections for various electrical equipment, motor control

center construction, controller fundamentals, circuit design, and an explanation of designated hazardous locations. Inspection details for safety, proper operation, and equipment deterioration are covered.

Electrical Inspection (5-day)

Course #IEE-012

This five-day course covers the codes and standards of high-voltage electrical theory, rotating machinery, transformer testing and inspections, circuit breakers and relays, batteries, cable raceway inspections, and cable pulling and terminations.



Electrical Motors and Controllers

Course #IEE-013

This five-day course covers AC and DC motor theory including three-phase and single-phase motors, motor inspection, and maintenance. The course also provides an overview of variable frequency drives.

Electrical Safety Seminar

Course #IEE-014

This three-day course covers all aspects of working safely around energized electrical equipment. Course topics include safety policies, general safety rules, vehicle safety, ladder and scaffold safety, chemical safety, fire safety, general electrical safety, and special emergency procedures. Next, we discuss electrical safety topics like testing equipment for energization, working on energized circuits, overhead operations, clearance around energized equipment, substation operations, underground operations, equipment grounding, and lightning protection. Participants have found that the case studies and group discussions of electrical hazards enhance the safety of their operations.

Electrical Training Phase II

Course #IEE-015

This five-day course begins with a review of electrical safety topics. Next, substation equipment is explained, followed by a description of 480V switchgear and 4.16 kV equipment. The final portion of the course explains grounding principles and procedures, using a Fluke multimeter and test equipment.



Electrical Wiring

Course #IEE-016

This five-day course begins by describing conductors, their characteristics, classifications, and terms. The types of conduit and fittings are extensively reviewed, as well as conduit fabrication and wiring, terminations, soldering, insulation of connections, and crane and hoist wiring.

Generators and Generator Voltage Regulation

Course #IEE-017

This five-day course provides a thorough working knowledge of electrical power generators and their associated voltage regulation systems. This course concentrates on large utility equipment and backup emergency generator units, but also applies to smaller equipment (under 500 kW). Emphasis is placed upon generator paralleling, generator/regulator response to changing loads, and VAR flows, maintenance, testing, and regulator settings and protection. Generator theory is backed up by extensive lab demonstrations. Personnel who require an advanced knowledge of generator excitation systems will also benefit from this course.

Industrial Electrical Distribution System Analysis

Course #IEE-018

This five-day course describes the various disturbances and irregularities that commonly occur in electrical systems. Voltage variations such as surges, sags, and impulses are addressed. Also, grounding, bonding, and shielding are explained with references to the National Electrical Code (NEC) requirements. This course is designed for personnel responsible for the proper operation of industrial power distribution systems.

Inverters

Course #IEE-019

This three-day course begins with fundamental concepts common to all inverters such as electronic components, voltage regulation, static switching, and auxiliary circuits. The course then concentrates on the specifics of the inverter installed at your facility. As such, it is necessary to submit to TTS all documentation, prints, manufacturer's literature, maintenance records, and information pertaining to the type of inverter you want to be covered in the course.

Lighting Systems

Course #IEE-020

This two-day course begins with a fundamental review of incandescent lighting. Other topics include fluorescent lighting, high-intensity discharge lighting, and the power requirements for lighting systems.



Low & Medium Voltage Power Systems

Course #IEE-021

This three-day course begins with an overview of electrical power systems. We review calculations required for different power systems, metering, protective relaying and breaker control. Next, we review 480V and 4160V procedures. The final portion discusses maintenance and troubleshooting plant power systems. This course is ideal for technicians who install, maintain, and repair low- and medium-voltage electrical power systems.

National Electrical Code (NEC)

Course #IEE-022

This three-day course reviews the current NEC and an overview of the significant changes from earlier editions. Topics relating to industrial applications include grounding, overcurrent protection, wiring methods, and working clearances. This course includes class exercises, working through typical calculations and determinations that require students to search and find information in the *Code*.

OSHA Safety Awareness

Course #IEE-023

This three-day course is a refresher course concerning OSHA requirements on environmental excellence, asbestos and non-asbestos insulation, PCBs, lead, mercury, respiratory protection, excavations, confined spaces, atmosphere testing, fire safety, hearing conservation, personal protective equipment, and personal safety and preventive actions.

Servo Mechanisms

Course #IEE-024

This three-day course is designed to familiarize technicians with the use, types, and operation of servo mechanisms. Various types of servos are covered, along with the associated encoders and resolvers used to drive the servos.

Substation Maintenance

Course #IEE-025

This five-day lecture and demonstration course is a comprehensive overview of the maintenance requirements of power and distribution substations. We begin with an introduction to power distribution schemes and explain the purpose of substations in these schemes. The course features a large variety of modern test equipment, including circuit breaker high-current test sets, cable fault locators, hi-pots, polarization index testers, microohmmeters, and oil dielectric testers. The course also covers the maintenance and inspection requirements of station relays, transformers, breakers, batteries, and grounding.



Test Equipment

Course #IEE-026

This three-day course begins with an in-depth review of various types of electrical test equipment. The seven-step troubleshooting methodology, as it applies to electrical systems, is thoroughly described. This course

shows participants how to properly use multimeters, megohmmeters, oscilloscopes, clamp-on ammeters, phase sequence meters, and high-voltage detectors. This course is excellent for training new electricians on the multi-craft training needs of process and manufacturing facilities.

Uninterruptible Power Supplies

Course #IEE-027

This five-day course begins by reviewing the fundamental concepts of power inverters, converters, and UPS systems. Other major topics include power conditioning, basic UPS applications, principles of battery operation, power inverters and wave shaping, voltage regulation, static switching and auxiliary circuits, and UPS troubleshooting and maintenance.



Instrumentation & Controls (I&C) Series

The *Instrumentation and Controls* series of courses cover various I&C components, controls, systems, and equipment.

1391 Digital AC Servo Drives

Course #I&C-001

This three-day course introduces technicians to the 1391 Digital AC Servo Drive, which is generally used with computer-aided, closed loop-positioning systems. These systems control the position and rotary motion of various machine members in automated machinery.



Advanced Programmable Logic Controllers

Course #I&C-002

This three-day advanced course teaches students how to use the Allen-Bradley software to edit, document, maintain, and troubleshoot an Allen-Bradley PLC. The course consists of a one-day lecture and two days of hands-on training.

Advanced Protective Relaying

Course #I&C-003

This five-day course provides participants with an advanced background of differential relaying, distance relaying, directional control relays, relay system testing, instrument transformers used for relay applications, and rotating machinery protection.

Advanced SLC 500 Series PLC

Course #I&C-004

This five-day course teaches students how to use the Allen-Bradley software to edit, document, maintain, and troubleshoot the Allen-Bradley SLC 500 Series PLC. It covers more advanced commands and takes an in-depth look at communications drivers used with the PLC. The course is 1½ days of lecture and 3½ days of hands-on training.

Allen Bradley 1336 Variable Frequency Drives

Course #I&C-005

This four-day course provides technicians with an understanding of variable frequency drives. The course covers the major parts of variable frequency drives, including the programming and display panel, control inputs, drive functions, and troubleshooting faults.

Allen Bradley ControlLogix5000

Course #I&C-006

This three-day course covers the Allen-Bradley *ControlLogix* controllers. The hardware components that make up the control system are covered in detail, and the RSLogix 5000 software is covered as it relates to the technician programming and editing ladder logic programs.

Allen Bradley RSLOGIX 5 Software

Course #I&C-007

This 4½-day course provides participants with hands-on instruction on the setup, operation, and use of Allen-Bradley's *RSLogix5* software to configure and program PLCs. The course uses an Allen-Bradley PLC-5 to demonstrate programming, maintenance, and troubleshooting of a PLC. The class consists of 2 days of classroom instruction and 2½ days of hands-on training.

Bailey 820 Common Controller Circuits

Course #I&C-008

This five-day course covers the various controller circuits used in the Bailey 820 control system.

Bailey INFI-90 Controls

Course #I&C-009

This four-day course provides technicians with an understanding of Bailey Infi-90 controls. Topics include a system overview, system modules, configuring modules, architecture, and lab exercises.

Basic Computers

Course #I&C-010

This two-day course provides students with an understanding of the IBM-compatible PC and its associated support equipment. The course covers the major parts of the PC including hard drives, floppy drives, disk sizes, disk capacities, and COM ports/parallel ports. In addition, the course covers PC memory types such as RAM, ROM, hard disk memory, expanded memory, and extended memory.

Basic Electronics

Course #I&C-011

This five-day course provides technicians with an understanding of basic electronic theory and concepts. The course begins with a review of direct current (DC) fundamentals and then explains semiconductors, diodes, bipolar transistors, silicon controlled rectifiers, and triacs.

Basic Electronics and DC Motors

Course #I&C-012

This five-day course provides technicians with an understanding of basic electronic theory and concepts and DC motors. Topics include a review of direct current principles, semiconductors – diodes, bipolar transistors, and other types of transistors, silicon controlled rectifiers and triacs, DC motors and DC motor controls, and routine inspection and maintenance of DC motors.

Basic Instrumentation

Course #I&C-013

This five-day course provides technicians with an understanding of basic instrumentation theory and application. Topics include a review of the fundamentals of electronic instrumentation, instrumentation amplifiers, electronic transmitters, and the transmission of control signals by wire. Next, we review several types of electronic controllers, the Bailey Type 701, Westinghouse Type 7300, and Foxboro Spec. 200 Series Control Unit. We describe various types of electronic control arrangements and explain the operation of transducers and converters



Beta 512 Annunciators

Course #I&C-014



This four-day course begins by introducing the fundamentals of annunciators, followed by reviewing common annunciator digital circuits. An overview of the NSSS is also presented. The operation of the scanners, main controllers, auxiliary controllers, and annunciator output modules is emphasized. The operation and programming of the system via the Remote Configuration Workstation is also covered. Troubleshooting techniques used on the system are described in detail.

CNC Lathe (2-Axis) Programming

Course #I&C-015

This three-day course teaches students the two-axis *Computer Numerical Control* (CNC) lathe programming functions. Topics include an overview of CNC operations, preparing for programming, programming configurations, absolute and incremental positioning, cutter radius compensation, tooling, and diameter and radius programming.

Control Equipment

Course #I&C-016

This ten-day course starts with an introduction and basic working knowledge of PLCs, progresses to advanced PLC programming, and ends with Variable Frequency Drive theory and troubleshooting using the SLC-5, PLC-5, and 1305/1336 VFDs for hands-on. This course is designed to prepare personnel who are technically proficient, but have not previously been exposed to PLCs. This course is progressive in nature. The first module introduces PLCs; the second module presents advanced concepts, and the last module discusses VFD controls.

Common Operator Support System (COSS) Overview

Course #I&C-017

This four-hour course provides technicians with an overview of the *Common Operator Support System* (COSS). We begin with an overview of the COSS, controls integration and operation, including how it interfaces with *PLC Logix5000*, *DeviceNet*, and *ControlNet*. Next, we discuss COSS and Error Proofing, COSS interfaces with VCVS, CQIS, and Flex/SFE. In the final portion, we discuss COSS roles and responsibilities.

Common Operator Support System (COSS)

Course #I&C-018

This five-day course begins with an overview of the *Common Operator Support System* (COSS). Next, we discuss CQIS, including its parts in the COSS system, going online to the *ControlLogix* backplane, defining tasks, programs, and routines. In addition, creating tags, structures, and arrays, ladder logic, sharing data between *Logix5550* controllers, establishing data transfers over a *ControlNet* network, establishing fault handling, configuring DH+/RIO communications, motion instructions, configuring a 1203 for *DeviceNet* communication to the 1394. The course defines a *DeviceNet* network, planning the physical layout,

connecting devices to the network, *DeviceNet* bridge, designing the *ControlNet* cable system, and configuring *ControlNet* networks. In the next section, we review various commands and how they work. Finally, we discuss troubleshooting various problems within the system. **NOTE:** This course requires the customer to supply *ControlLogix* training units with *DeviceNet*, *Panelview 1000*, and *Adaptascan Barcode Readers*.

DeviceNet Network: Maintenance and Troubleshooting Course #I&C-019

This two-day course provides the necessary resources and practices to maintain and troubleshoot a *DeviceNet* network. Throughout the course, the instructor demonstrates procedures such as calculating cable system lengths, supplying power, connecting to the network, clearing scanner error codes, and diagnosing device faults. Demonstrations on adding and configuring devices and modifying scan lists using *DeviceNetManager™* software are also given. After each instructor demonstration, you will be presented with a real-world situation to solve using your *DeviceNet* workstation. Participants will learn how to return a malfunctioning *DeviceNet* network to normal operation by determining the cause of the cable system faults, connecting to the network to troubleshoot and configure devices, clear scanner faults and error codes, and interpret and modify scan lists.

I&C Advanced Training Course #I&C-020

This ten-day course begins with a review of process measurement fundamentals followed by a review of the measurement means: pressure, temperature, flow, and level. Next, process control systems are explained. The final portion of the course instructs the fundamentals of calibration and programmable logic controllers.



Introduction to Programmable Logic Controllers Course #I&C-021

This three-day course provides participants with an introduction and basic working knowledge of PLCs. This course is designed not for personnel directly responsible for maintaining PLCs, but those workers whose equipment is controlled by them and who must troubleshoot that equipment. A key element of this course is a guided discussion between the two groups as to their responsibilities surrounding the PLCs in their facility.

Matrox Imaging Vision System Course #I&C-022

This two-day course reviews the operation of the *Matrox Imaging* high-end video capture system made by *Matrox Electronic Systems, Ltd.*, which is used for machine vision applications, image analysis, and video surveillance. Troubleshooting the system is also explained.

Ovation DCS

Course #I&C-023

This four-day course covers the Westinghouse *Ovation* DCS. Hardware and software are covered in detail.

PanelView 1200e and 1400c: Developing Applications Using Panel-Builder 1400e Configuration Software

Course #I&C-024

This two-day hands-on course teaches participants how to develop graphic screen displays that are used to control a plant floor application. The application example used in this course is a Proportional, Integral, Derivative (PID) application that realistically simulates an operator interface used to control the level and temperature of two separate tanks. Using the *PanelBuilder 1400e* configuration software in a Windows environment, students will operate the operator interface screens and download the application to the enhanced *PanelView 1200e* or *1400c* terminal, then demonstrate proper operation of graphic screens. Functionality that students will incorporate into graphic screens includes pushbutton controls, status indicators, numeric and bar graph displays, and alarm messaging.

Programmable Logic Controllers

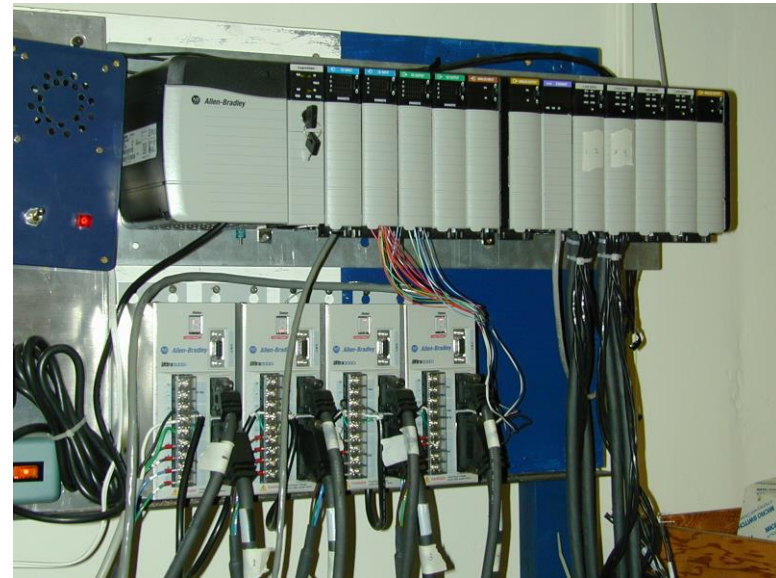
Course #I&C-025

This five-day course provides participants with hands-on instruction on the setup, operation, and maintenance of PLCs. The course uses the Allen Bradley PLC-5 to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs. The class consists of 1½ days of classroom instruction and 3½ days of hands-on exercises.

Programmable SLC 200 Series PLC

Course #I&C-026

This five-day course provides participants with hands-on instruction of the setup, operation, and maintenance of Programmable Logic Controllers (PLCs). The course uses the Allen-Bradley SLC-200 Series PLC to demonstrate the installation, programming, maintenance, and troubleshooting of PLCs.



Process Measurement and Control

Course #I&C-027

This five-day course begins with a review of electronic instrumentation such as instrument amplifiers, electronic transmitters, transmission of control signals by wire, and electronic measuring instrument arrangements. Electronic controllers and their arrangements comprise the remainder of the course study.

Process Measurement Fundamentals

Course #I&C-028

This five-day course begins with a look at the fundamentals of measurement. A brief review of basic electronics is provided. An overview of the modern techniques of measuring pressure, temperature, flow, and level is covered. The use of these instruments in PID process control loops is emphasized. Troubleshooting and tuning of controllers and the calibration of the loop transmitters are also included in the course.

Regulators and Associated Equipment

Course #I&C-029

This five-day course provides technicians with an understanding of the function and operation of the various types of regulators used in gas distribution systems. It also describes the operation and maintenance of the various pieces of equipment used in a piping system in conjunction with pressure regulators.

Robotics

Course #I&C-030

This three-day course is designed to provide an overview of robotics used in plants today. The course provides students with an overview of robot operations. As an introduction to robotics, the components of a robot are covered, as well as their function within the system. The course also covers areas of motion control including topics such as the axis of motion, controls, servo controls, operator interfaces, and how robots communicate with other control systems, such as PLCs. This course is designed for technicians and engineers who work with and maintain plant robots.

Rosemount Smart Transmitters

Course #I&C-031

This two-day course introduces students to the Rosemount smart transmitter. Topics include the hand-held unit operation, model 3051 pressure transmitter, and model 3144 temperature transmitter.



Siemens Basic PLC Programming

Course #I&C-032

This five-day course covers the basics of PLC hardware and PLC programming of the Siemens S300 and S400 PLC systems using *Step 7* software. Although not required, having knowledge of electricity and digital fundamentals greatly aids in understanding Siemens PLC programming. This course is designed for technicians who operate, maintain, repair, and troubleshoot Siemens PLCs.

Siemens Advanced PLC Programming

Course #I&C-033

This five-day course begins with a review of the Siemens Basic PLC Programming course and builds on our previously learned knowledge. We explain basic networking configurations, *Ethernet IP*, and *Profibus* configurations. We learn how to setup and configure distributed I/O, set a “DP Master” *Profibus* configuration, understand how to scale analog modules into a digital signal, and unscale a digital signal into an analog signal. Next, we show how to parameterize an FC and explain its advantages. Finally, we write a program to control a batch mixer project. This course is for plant personnel who operate, maintain, repair, and troubleshoot Siemens PLCs.

Toolbox™ Software

Course #I&C-034

The *Toolbox™* software (by MathWorks®) is used for systematically analyzing, designing, and tuning linear control systems. This three-day course begins with an overview of the *Toolbox™* system’s hardware and software. Students learn how to use the *Toolbox™* system and its functions, including the *Finder* function, batch operations, and file check-in/check-out. The hardware and I/O interfaces are explained.

Ultrasonic Flow Meters

Course #I&C-035

This five-day course discusses various ultrasonic meters for use on pipelines. The primary function of ultrasonic meters is to provide a non-intrusive method of measuring the flow of gas in a pipe. The following types of ultrasonic flow meters are described in this course: Instromet single path meters (GasSonic 400 and Check Sonic), Instromet Multipath meters (3 & 5 path Q Sonic), Daniel Multipath meters (Senior Sonic), and Daniel Multipath meters (Junior Sonic).



Variable Frequency Drives

Course #I&C-036

This four-day course provides technicians with an understanding of variable frequency drives. The course covers the major parts of variable frequency drives, including the programming and display panels, control inputs, drive functions, and troubleshooting faults.

Wonderware®

Course #I&C-037

Wonderware® software is used in real-time plant operations management. *Wonderware®* software enables companies to synchronize production and industrial operations. This three-day, hands-on course is intended to teach students to use the *Wonderware®* software to operate the equipment controlled from the *Wonderware®* software package.

Mechanical Series

The *Mechanical* series of courses cover various mechanical and machinery components, systems, and equipment.

Air Conditioning & Refrigeration

Course #IMS-001



Air Conditioning and Refrigeration is a five-day, lecture-based course that covers the basic mechanical refrigeration cycle, the different refrigerants available, major refrigeration system components, and system operation. The portion of the course on air conditioning deals mainly with air conditioning service techniques. This is a technician-level course for both operating and maintenance personnel, providing the knowledge base necessary to begin working on the equipment and to get the most out of equipment-specific training.

Air Conditioning & Refrigeration for Electricians

Course #IMS-002

This five-day, lecture-based course is designed to cover the fundamentals of air conditioning and refrigeration (AC&R) equipment, systems, and controls. The course is particularly oriented around troubleshooting controls and electrical equipment, such as compressors, fans, and valves.

Air Conditioning & Refrigeration Troubleshooting

Course #IMS-003

This five-day course is designed to provide experienced HVAC technicians with advanced training on complex topics in this field. Topics include control circuits, air balancing, and heat load calculation.

Advanced Welding

Course #IMS-004

This ten-day course is designed to give experienced welders advanced welding skills in arc and gas welding, resistance spot/seam welding, projection welding, thermit welding, pulse arc, flux cored, plasma arc cutting, and pipe welding. Various welding problems are identified and corrected, and weld failure analysis process is explained.

Air Compressor Maintenance

Course #IMS-005

This two-day course introduces participants to the operating principles of air compressors, their construction and classification, auxiliary components, and maintenance requirements.

Ammonia Refrigeration Systems

Course #IMS-006

This is a four-day, lecture-based course that covers the basic mechanical refrigeration cycle, the different refrigerants available, refrigeration system components, system operation, service, and troubleshooting with a focus on ammonia systems. This is a technician-level course for both operations and maintenance personnel, providing the required knowledge base to work on ammonia refrigeration equipment.

Ammonia Refrigeration Unit Operation and Maintenance

Course #IMS-007

This three-day lecture and hands-on course covers the basic mechanical refrigeration cycle, the control and handling of ammonia, major system components, and system operation. The maintenance portion of the course deals mainly with service techniques for the installed equipment. This is a technician-level course for both operating and maintenance personnel, providing the knowledge necessary to begin working on the equipment and to get the most out of equipment-specific training.

Automotive Air Conditioning Systems

Course #IMS-008

This five-day course introduces the principles of automotive air conditioning theory and system applications. Topics include diagnosis, service, and recovery of the air conditioning system.

Basic Mechanisms and Conveyors

Course #IMS-009

This five-day course provides technicians with an understanding of the most common mechanical devices used for the production and application of motive force. Major topics include fasteners, bearings, couplings, gears, drives, lubrication, alignment types, and steel structures. The course also covers basic maintenance procedures.



Bearing Maintenance

Course #IMS-010

This is an in-depth, two-day course covering the design, construction, and installation procedures associated with the major types of bearings used in industry today. Hands-on training is the primary focus of this course, with about 60% of class time spent performing laboratory exercises. This course is designed for maintenance personnel involved with the installation of anti-friction bearings, performing bearing failure analysis, and selecting lubricants.

Belt Drives

Course #IMS-011

This one-day course is designed for plant maintenance personnel responsible for the upkeep and maintenance of belt drive devices, which are studied in detail with a focus on maintenance principles and troubleshooting techniques designed to increase equipment reliability.

Boiler Systems

Course #IMS-012

This three-day course provides participants with a strong foundation in the operation and design theory of boilers and boiler control systems. Students acquire an in-depth knowledge of boiler systems, including topics such as combustion theory, fuel quality, air pollution control, and boiler operation. This course maintains focus on the environmental concerns of boiler system operation and maintenance, including a discussion of Federal laws and guidelines that pertain to boiler systems.

Burner and Igniter Systems

Course #IMS-013

This two-day course covers basic burner and igniter fundamentals and theory, construction, and maintenance. The course starts with fuels and combustion theory, followed by burner and igniter operation and system controls. Maintenance of the burners and igniters closes out the course with lab exercises on typical burner/igniter maintenance. This course covers the following burner/igniter systems: I-Jet Lighters, Mark IV Dual Register Burners, Flamon Flame Detectors, LC 200 Lighter Control System, and Bailey 762 Control Package. **Note:** *Site-specific information can be incorporated into this course.*

Chillers

Course #IMS-014

This three-day course begins with a review of the science of matter, heat transfer, gases, and air conditioning principles. It also covers the basic mechanical refrigeration cycle, the different refrigerants available, major refrigeration system components, and chiller system operation. The course covers chillers used in air conditioning systems, including their components, function, operation, maintenance, and troubleshooting techniques.

Compressor Maintenance

Course #IMS-015

This three-day course introduces technicians to the different types of compressors, their operation, common problems and troubleshooting, and general maintenance performed on compressors.

Conveyor Systems

Course #IMS-016

This three-day course is designed to cover the construction, operation, maintenance, and troubleshooting of various conveyor systems, including power-and-free, inverted power-and-free, chain-on-edge, unibelt, and SKUK types.

Coupling Alignment

Course #IMS-017



This three-day course introduces the principles of power transmission couplings and shaft alignment. Next, the various types and purposes of couplings are discussed. Alignment processes are introduced followed by practical, hands-on exercises. Finally, methods of measuring misalignment in rotating machinery conclude the course. This course is ideal for plant personnel responsible for the installation, operation, maintenance, and reliability of rotating equipment fitted with couplings.

Desulfurization System

Course #IMS-018

This three-day course begins with a review of an old desulfurization system and the new system, including the components and operation. Next, we review desulfurization facility specifications, including the locomotive, de-skulling machine, skimming, re-lading, and storage facility. We review the system P&IDs and general system troubleshooting techniques. The course also explains the facility's electrical system, oxygen injectors, hydraulic system, skimming system, re-lading system, and spectrometer operation and maintenance.

Diesel Engine Fundamentals

Course #IMS-019

This five-day course provides students with a thorough knowledge of diesel mechanics. Topics include engine design, classification, construction, operation, and maintenance.

Diesel Engines

Course #IMS-020

This three-day course provides a comprehensive introduction to the operation and maintenance of the Caterpillar Model 16C and M32 diesel engine. Students gain in-depth knowledge of basic four-cycle engine construction, operation, operating guidelines, pre-start checks, engine operating procedures, maintenance, and troubleshooting.



Electro-Motive Diesel (EMD) Locomotive

Course #IMS-021

This five-day course is designed to provide students with a thorough knowledge of the Electro-Motive Diesel (EMD) locomotive mechanics. Students learn basic locomotive operation, engine starting and cab controls, diesel operation, and general arrangement of components.

We also discuss the auxiliary systems, electrical equipment, and troubleshooting techniques. Classroom discussions give a background in the basic operation, maintenance, troubleshooting, and repair of an EMD engine.

Electric Overhead Traveling (EOT) Crane

Course #IMS-022

This two-day course introduces the electric overhead traveling (EOT) crane, including the safety requirements and boarding procedure, crane operation and inspection, and troubleshooting requirements. Personnel completing this course gain important knowledge with a better understanding of the requirements and responsibilities of Overhead Crane Operators.

Failure Mode Effects Analysis

Course #IMS-023

This two-day course teaches participants how to do process failure mode analysis using storyboards. The course gives an overview of techniques that support the development of Failure Mode Effects Analysis (FMEA). These techniques include block diagrams, experiments, and fault tree analysis to produce an FMEA. Participants practice performing FMEA using a computer software program called *FORMUSER*.

Fans and Blowers

Course #IMS-024

This two-day course provides an overview of how fans and blowers operate and compares them with centrifugal pumps. Hands-on training is the primary focus of this course, with about 50% of class time dedicated to performing laboratory exercises. This course is designed to be conducted in conjunction with our *Bearing Maintenance* and *Precision Measuring Instruments* courses.

Fans and Filters

Course #IMS-025

This two-day course provides an overview of how fans and filters operate and work together. Hands-on training is the primary focus of this course, with about 50% of class time directed to performing laboratory exercises.

Fossil Power Generation

Course #IMS-026

This five-day overview course describes the portion of the sub-systems that support the plant gas turbine operation. This is a technician-level course for both operating and maintenance personnel, providing the knowledge base necessary to begin working on equipment.



Fuels and Combustion

Course #IMS-027

This three-day course provides participants with a working knowledge of the combustion process used in modern power plant applications. Different fuels, the equipment used to burn these fuels, and the monitoring of the emissions are covered in detail. Emission monitoring and the requirements of the *Clean Air Act* are also discussed in detail.

Hand Tools

Course #IMS-028

This three-day course describes various hand tools, including their intended uses, cautions against misuse, and telltale signs for repair or replacement. Also discussed in this course are the required maintenance actions used to keep tools safe and efficient. The course can be tailored to include your specific tools or presented as is. This course is primarily designed for facility maintenance personnel who work with hand tools in their daily duties.

HVAC Fundamentals

Course #IMS-029

This five-day course covers the design, construction, operation, and maintenance associated with air conditioning and refrigeration units. Special attention is placed on the environmental concerns associated with commonly used refrigerants, and recent restrictions placed upon the handling and disposal of these refrigerants by the EPA in accordance with the *Clean Air Act*. This course is designed for maintenance personnel involved in the upkeep and repair of air condition units.

HVAC Fundamentals and Testing

Course #IMS-030

This five-day course is ideal for technicians tasked with ensuring the proper operation and maintenance of industrial HVAC units. The course provides a background in basic air laws, application information, and the refrigeration cycle, as well as a practical knowledge of the various types of instrumentation used in HVAC testing. Minimum testing requirements for over a dozen different applications are detailed, along with balancing testing procedures, air conditioner servicing techniques, and sound and vibration testing.

HVAC Programmable Logic Controllers

Course #IMS-031

This course teaches the fundamentals of how to use the Allen-Bradley software to edit, document, maintain, and troubleshoot an Allen-Bradley PLC. The goal of this course is to give the HVAC technician a stronger understanding of the strengths, limitations, and workings of an Allen-Bradley PLC. The course consists of two days of classroom instruction and one day of hands-on training.

Hydraulics (Hands-On)

Course #IMS-032

This five-day course provides participants with an excellent understanding of the principles of hydrostatics and hydrodynamics, which serve as the foundation of hydraulic system component functions and operations. The course then progresses to troubleshooting methodology as applied to hydraulic systems, both simple and complex.

Hydraulics/Pneumatics (Hands-On)

Course #IMS-033

This five-day course provides participants with an excellent understanding of the principles of hydrostatics and hydrodynamics operation and maintenance principles involved with hydraulic and pneumatic systems, including pipes and piping components. The course then progresses to a hands-on application of hydraulic and pneumatic systems, including troubleshooting methodology as applied to both simple and complex systems.

Industrial Hydraulic Fundamentals

Course #IMS-034

This three-day course reviews the fundamentals of industrial hydraulic theory, hydraulic components, and hydraulic systems.



Industrial Hydraulics

Course #IMS-035

This five-day course primarily focuses on hydraulic system troubleshooting. A comprehensive study of hydraulic system components and their major causes of failure are examined in detail. Plant maintenance personnel will be asked to bring plant-specific prints for review and study during the print reading section of the course. Also, a detailed examination of hydraulic system contamination control is included, with an emphasis on component and system design changes that should be incorporated into all existing and future systems.

Industrial Mathematics

Course #IMS-036

This five-day course is designed to give industrial technicians the mathematical skills required to effectively accomplish jobs requiring mathematics. The course consists of classroom instruction and labs using real-world examples where these skills are applied. The examples used are tailored to the specific industry of the client.

Industrial Mechanical Skills

Course #IMS-037

Industrial Mechanical Skills is an intense, fast-paced, two-week training program designed to teach the basic concepts of industrial mechanical equipment. All maintenance personnel from apprentice level to journeyman are encouraged to attend this course as it provides the terminology and understanding of mechanical equipment basics and equipment interaction.

Industrial Pneumatics

Course #IMS-038

This three-day course is designed to give maintenance personnel a complete understanding of the operation and maintenance principles of industrial pneumatic systems. Topics such as compressed air safety, pneumatic component design and installation, and system cleanliness are the primary focus of this course. All maintenance personnel who work on compressors or are involved in the repair and operation of pneumatic systems are strongly encouraged to attend this course.

Industrial Rigging

Course #IMS-039

This two-day course covers the basic principles of lifting and handling equipment used by plant personnel. The primary focus of this course is safety. OSHA and ANSI standards are discussed as they apply to the types of rigging equipment used at your facility. Participants will learn how to determine load weights, select the proper rigging hardware, and safely use the equipment to move heavy loads.

Insulation Installation and Repair

Course #IMS-040

This five-day course is designed to provide participants with the basic knowledge and skills to safely complete pipe insulation repairs, removal, and installation at the job site. The course provides both theoretical and practical applications. Topics include a review of the theory of heat transfer, tools of the trade, material handling and storage. We also review pipe characteristics. The course then reviews the methods of installing calcium silicate pipe insulation, flexible foam insulation, fiberglass pipe insulation, and rigid foam insulation. We review cement and fabric finishes and mastics, adhesives, and their uses. The final portion reviews sheet metal lagging including fabrication and installation, flashing, and sealing techniques.

Introduction to Predictive Maintenance

Course #IMS-041

Introduction to Predictive Maintenance is a three-day seminar designed to give workers an introduction to the methods, procedures, and philosophies used in performing predictive maintenance. Students are introduced to the various techniques used to predict and prevent failure of various types of industrial equipment found in the workplace.

Laser Alignment

Course #IMS-042

Vibration problems are the cause of 50-70% of all rotating mechanical equipment failures. Most vibration problems can be traced back to the alignment condition of the machine. Of all the alignment methods for aligning shafts, laser alignment is the fastest and most accurate. This two-day course teaches this highly specialized alignment technique used in industry today. The course is designed for plant technicians who need proficiency in alignment techniques to troubleshoot difficult and complex shaft alignment problems.



Lubrication Fundamentals

Course #IMS-043

This three-day course is designed for plant personnel responsible for the proper lubrication of industrial equipment. The primary focus of this course is the proper selection and application of lubricants. In addition, oil testing and system cleanliness are discussed with an emphasis placed on the major causes of lubrication-related failures. Maintenance supervisors are strongly recommended to attend this course as maintenance philosophies relating to lubrication and lubricating systems are also discussed.

Machinery Diagnostics

Course #IMS-044

This three-day course is designed for plant personnel responsible for the maintenance and repair of vibration problems in industrial equipment. The primary focus of this course is the formats for vibration plotting and malfunction identification. Machinery in industrial applications is required to perform at higher speeds and pressures. For this very reason, industrial facilities are closely monitoring their equipment vibration problems.

Maximo

Course #IMS-045

Maximo Asset Management is an enterprise asset management (EAM) software solution product produced by IBM. *Maximo* is a computer software program for maintenance management systems. This system helps automate all aspects of maintenance operations, including equipment history, scheduling, preventive maintenance, work orders, labor and expense tracking, procurement, and reporting. This three-day course begins with an introduction to the *Maximo* environment. Database login requirements and main menus are then described. We also cover how to create preventive maintenance (PM) sheets and job plans, and guidance on setting up and maintaining equipment hierarchies. An in-depth look at the work order processing, labor reporting, and entering purchase requisitions is also provided.

Mechanical Fundamentals

Course #IMS-046

This five-day course provides participants with a working knowledge of blueprints and mechanical drawings, measuring devices, hydraulics, pneumatics, mechanical drive systems, fasteners, and bearings. This course is designed for new maintenance employees to increase their mechanical repair skills.

Mechanical Training (Level I)

Course #IMS-047

This five-day course is the first level of a fifteen-day training program designed to give plant technicians a greater depth of knowledge and skills in performing various mechanical equipment job functions. Course topics include basic soldering, basic tools (hand/power), bearing maintenance, bolting and torque, hydraulics, rigging, lubrication, mechanical (power) transmission, orifice meters, pneumatics, precision measuring instruments, print reading, fans and blowers, technical math, troubleshooting, and valve maintenance.

Mechanical Training (Level II)

Course #IMS-048

This ten-day course is the second level of a fifteen-day training program designed to give plant technicians a greater depth of knowledge and skill in various mechanical equipment job functions. Major course topics include compressor maintenance, cranes and hoists, emergency diesels, pipes and pipefitting, pump maintenance, shaft alignment, static and dynamic sealing, and welding fundamentals.

Mechanical Maintenance: Pumps and Shaft Alignment

Course #IMS-049

This five-day course covers pump design, operating theory, rotary pumps, reciprocating pumps, and centrifugal pumps, compression packing and gaskets, couplings, and alignment fundamentals.



Motor-Operated Valve (MOV) Maintenance

Course #IMS-050

This three-day course is designed for technicians who are responsible for the operation and maintenance of motor-operated valves (MOV). Topics include MOV construction, controls, inspection, lubrication,

troubleshooting, disassembly, reassembly, preventive maintenance, diagnostic testing, and valve installation. Repair procedures are presented and applied using a Limitorque SMB-000 series operator. Limit switch and torque switch adjustment, and the selection and interchangeability of valve actuators are also discussed.

Orifice Metering

Course #IMS-051

Accurate and timely measurement is a critical function to a company's bottom line. Even a small error in calculating the flow rate can represent a significant dollar error. This three-day course is designed to help technicians better understand the components and equipment that go into making an orifice measurement, and the importance of each of these components as it applies to orifice metering.

P&ID Reading

Course #IMS-052

A piping and instrumentation diagram/drawing (P&ID) is a diagram that shows the piping of a process flow with the installed equipment and instrumentation. This two-day course introduces technicians to blueprints, why they are used, the information they contain, and types of drawings and their use.



Pipes and Piping Components

Course #IMS-053

This five-day course is designed to teach maintenance mechanics the importance of pipe installation, selection, and testing. This course encompasses the vast types of tubular products that are available for use when transporting fluids. The course includes hands-on exercises and is targeted for those plant personnel who routinely install piping or perform maintenance of fluid delivery system components.

Piping, Tubing, and Fittings

Course #IMS-054

This three-day course is designed to teach the importance of proper installation and testing of tubular products. The course is comprised of classroom and hands-on training. Plant personnel who routinely install tubing or are involved in the daily maintenance of components in a tubing (piping) system will benefit from this course.

Power Transmission Systems

Course #IMS-055

Power Transmission Systems is a three-day course designed for maintenance personnel who are responsible for the upkeep and maintenance of power transmission devices. Gears, belt drives, chain drives, and clutches are studied in detail with a focus on maintenance principles and troubleshooting techniques designed to increase equipment reliability.

Precision Measuring Instruments

Course #IMS-056

This three-day course begins with a review of measurement fundamentals and measurement errors followed by a review of the principles of metrology. Standard tools used for measuring and inspection are covered, including scales, calipers and dividers, Vernier calipers and dial calipers, micrometers, gauge blocks, mechanical indicators, and dial indicators, as well as a review of torque measurement. The last portion of the course covers fixed gauges.

Print Reading

Course #IMS-057

This three-day course provides fundamental knowledge on reading and interpreting electrical diagrams. It provides information on interpreting electrical symbols and reading various types of prints, drawings, and schematics used in an industrial environment. This course will benefit facility electricians, mechanics, operators, and others who work with electrical equipment.

Pump and Heat Exchanger Maintenance

Course #IMS-058

This three-day course begins with a review of the cooling system components and operation. Various types of centrifugal and positive displacement pumps and their design characteristics are described. Fans, gearboxes, couplings, and maintenance of these components complete the course.

Pump Maintenance

Course #IMS-059



This five-day course is designed to describe pump design, operation, and theory. Various types of pumps are discussed. Hands-on exercises are performed to reinforce the concepts taught in the classroom. In addition, a review of pump maintenance on rotary, reciprocating, and centrifugal pumps gives participants a complete understanding of typical pump problems and solutions.

Pump Maintenance (Advanced)

Course #IMS-060

This five-day course is designed for plant personnel responsible for the installation and maintenance of positive displacement and centrifugal pumps. Hands-on exercises account for about 50% of the course, where concepts such as soft-foot, pipe strain, and alignment are emphasized. This course is ideal for maintenance personnel from apprentice level to journeyman.

Radiation Safety

Course #IMS-061

This three-day course begins with a fundamental review of radiation. Methods of measuring radiation and radioactivity, effects of radiation exposure, ways to detect and shield against radiation are presented. Standard operating procedures and emergency procedures of a radiation safety program are also stressed.

Reduction in Variance and Root Cause Failure Analysis

Course #IMS-062

This one-day course is composed of two parts. The first part of the course is focused on the reduction or analysis of variance and quality on your organization. The second part focuses on the root cause failure analysis methods for evaluating opportunities for improvement.



Refrigeration and Air Conditioning Controls

Course #IMS-063

This four-day course begins with a review of refrigeration fundamentals and refrigeration systems. An overview of the major refrigeration system components is included. The theory of electromagnetic motors and their use in compressors is covered. The electrical circuit controls used in refrigeration and air conditioning is discussed, along with the electrical troubleshooting of these controls.

Refrigeration Systems

Course #IMS-064

This five-day, lecture-based course covers the basic mechanical refrigeration cycle, the different refrigerants available, major refrigeration system components, system operation, service, and troubleshooting. This is a technician-level course for both operating and maintenance personnel, providing the knowledge base necessary to work on refrigeration equipment.

Relief Valve Maintenance

Course #IMS-065

This three-day course covers relief valve and safety valve fundamentals and theory, their construction, maintenance, testing, and adjustment. Regulatory guidelines are also discussed. This course includes about 1 day of classroom lecture with 1½ to 2 days of hands-on exercises.



Rigging and Load Handling

Course #IMS-066

This one-day course covers the basic principles of rigging and load handling equipment used by plant personnel. Students will learn how to plan a rigging job, use appropriate rigging components, and inspect the selected rigging equipment prior to moving a load.

Root Cause Failure Analysis

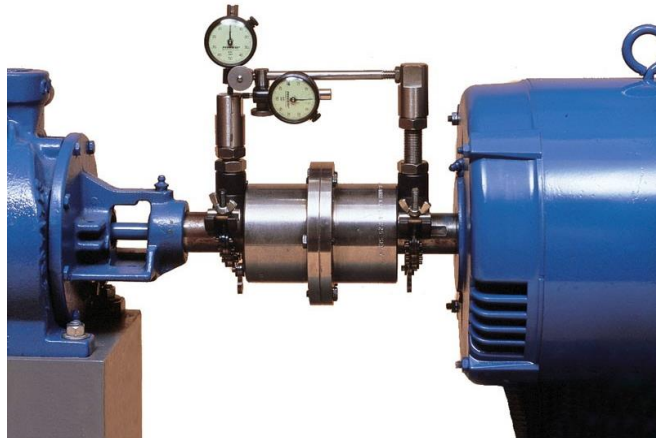
Course #IMS-067

This 2 ½ day course teaches students how to perform root cause failure analysis, including how to collect facts, analyze those facts, pinpoint the problem, recommend solutions to eliminate the problem, and track the progress of the implemented recommendations. Additionally, students will learn who is responsible for monitoring, identifying, documenting, and implementing improvements for equipment, processes, or human failures.

Safety, Hand Tools, and Print Reading

Course #IMS-068

This 2 ½ day course covers the fundamentals of safe work practices and job setup. Maintenance personnel gain a thorough understanding of how to read prints and select the proper tools for the job. Participants are asked to bring their own plant prints to class for review and study, allowing them to compare classroom materials to their daily job duties.



Shaft Alignment

Course #IMS-069

This five-day course is designed to reduce alignment problems at your facility by teaching the most current alignment techniques used in industry today. Vibration problems are the cause of 50-70% of all rotating mechanical equipment failures. Most vibration problems can be traced back to the alignment condition of the machine. As alignment is historically the number one cause of component failure, this course is the foundation for all maintenance personnel involved in the installation and repair of rotating mechanical equipment.

Static and Dynamic Sealing

Course #IMS-070

This three-day course is designed for a maintenance target group comprised of the following: apprentice maintenance personnel, journeyman refresher, electrical or electrical test personnel required to perform mechanical maintenance, supervisors and inspection personnel. The course is roughly 50% “hands-on” laboratory sessions and 50% classroom instruction.

Sulzer Valve Maintenance

Course #IMS-071

This three-day course (two days mechanical and one day electrical) discusses the maintenance, inspection, and repair of Sulzer valves.

Thermography

Course #IMS-072

This three-day course covers the fundamental concepts of thermography; that is, how to properly use infrared cameras to collect quality data. Students learn how to calculate accurate, repeatable temperature measurements. This course also covers your camera’s critical parameters and setup. Students learn infrared thermographic

interpretation through class exercises and in-plant examples. A wide variety of thermography applications is covered in this course. We focus on improving students' equipment operational skills, image acquisition, interpretation, and report generation abilities. Using site-specific equipment, we perform practice exercises to ensure proper equipment use and interpretation.

Troubleshooting Methods

Course #IMS-073

This two-day course teaches the fundamentals of troubleshooting to technicians. It covers the areas that are common to most problems encountered in industry, and how to approach these problems with a systematic approach to troubleshooting. This course is split between classroom and hands-on troubleshooting exercises.



Valve Maintenance

Course #IMS-074

This five-day course discusses valve fundamentals and construction, maintenance and testing, relief and safety valves, valve actuators and operators, and Limitorque valves.

Vibration Analysis

Course #IMS-075

This three-day course begins with an introduction to vibration monitoring, the types of data, and sequence of operations. Next, the fundamentals of vibration are introduced, followed by a review of monitoring equipment, monitoring programs, considerations for balancing machines, and vibration sensors.

Welding

Course #IMS-076

This five-day course provides participants with hands-on instruction of the tools, procedures, and processes used in the welding and cutting of metals. This course is designed for students with a limited knowledge of welding and focuses on the hands-on skills and techniques used in modern welding.



Plant Operations Series

The *Plant Operations* series of courses cover various plant machinery components, systems, and equipment.

Auxiliary Generators Operation and Maintenance

Course #POS-001

This three-day course covers the fundamentals of electric power generation, a practical understanding of electric switchgear and protective devices, and the basic operating theory behind electric synchronization and load sharing. Students are taught how to start, stop, synchronize, load share, and monitor the operation of an electric generator. Students will also understand electrical power generation and be able to operate and maintain auxiliary generators. This course is designed for industrial/utility technicians responsible for maintenance and troubleshooting of auxiliary generators and their associated equipment.

Auxiliary Generators Maintenance and Troubleshooting

Course #POS-002



This two-day course begins with a review of auxiliary generator operating principles, governor control system functions and operation, and voltage regulator operation. The last part of the course includes

typical preventive maintenance and troubleshooting of auxiliary generators. This course is designed for industrial and utility technicians responsible for maintenance and troubleshooting of auxiliary generators and their associated equipment.

Balance of Plant

Course #POS-003

This ten-day course begins with a review of gas turbine Combined Cycle operation. Operation and control of the combined unit are also discussed. This course describes the sub-systems that support the plant operation. Topics include the auxiliary steam system, HRSG blowdown system, circulating water system, closed cycle cooling water system, compressed air system, compressed gases system, condensate system, demineralized water system, feed water system, fire protection system, plant drains system, potable water system, service water system, HP, HRH, CRH, and LP steam systems, and condenser air removal system. This is a technician-level course for both operating and maintenance personnel, providing the knowledge necessary to begin working on equipment.

Balance of Plant (Simple Cycle)

Course #POS-004

This two-day overview course describes the portion of the sub-systems that support the overall simple cycle plant operation. This is an operator-level course for both operating and maintenance personnel, providing the knowledge base necessary to begin operating equipment.

Balance of Plant (Combined Cycle)

Course #POS-005

This ten-day overview course describes the portion of the sub-systems that support the overall combined cycle plant operation. This is a technician-level course for both operating and maintenance personnel, providing the knowledge base necessary to begin working on equipment. This course includes walking down all systems and identifying major components.

Continuous Emissions Monitoring System

Course #POS-006

Continuous Emissions Monitoring (CEM) is the continuous measurement of pollutants emitted into the atmosphere in exhaust gases from combustion or industrial processes. The EPA has established requirements for continuous monitoring of various contaminating constituents. The CEM rule also contains requirements for equipment performance specifications, certification procedures, and recordkeeping and reporting. This 2½ day course covers these requirements, specifications, and procedures.

DeltaV™ Digital Automation System

Course #POS-007

The DeltaV system fully integrates “smart plant” capabilities including HART®, Foundation™ Fieldbus, high-speed discrete busses, and embedded advanced control. This seamless, intelligent field integration enables Asset Management Solutions (AMS) for quick, easy re-ranging, configuration, and diagnostics. The result is better process efficiency and reduced process variability. This 4-day course introduces students to the control tools available within DeltaV and how they may be used to improve plant operations.

Fired Heater Theory

Course #POS-008



Fired heaters serve a range of functions in chemical and petroleum processing facilities. Petroleum processing facilities frequently use fired heaters to induce *cracking* in heavy hydrocarbons, breaking them down into lighter, more useful hydrocarbons. In the petroleum chemistry, *Cracking* is the breakdown of a large alkane into smaller, more useful alkanes and alkenes. This one-day course reviews the function of fired heaters, the two major types, their operation, and their associated safety concerns. We explain the startup and shutdown steps, variables that affect fired heater efficiency, and basic troubleshooting.

Fluid Flow Theory

Course #POS-009

Fluid flow theory defines the physical properties of fluids, both liquid and gas. It involves various properties of fluids including flow velocity, pressure, density, and temperature as functions of space and time. This one-day course teaches technicians the principles of fluid flow mechanics, including *Bernoulli's Principle* and the *venturi effect*. We also explain the concept of viscosity using *Newton's Law of Viscosity*, pressure head, velocity head, potential head, and total head in a pipeline. Students learn how to use these basic principles for accurate predictions of how a fluid system will respond to a given change in a system.

Fractionation

Course #POS-010

This two-day course reviews the process of *Fractionation* as it applies to the oil and gas industry. *Fractionation* is the process used to separate and remove a mixed stream of different natural gas liquids (NGL) into their base components to be useful. The course begins by defining various terms associated with fractionation. Next, we describe the fractionation process, the fractionation sequence, and product specifications. We review how variations in feed rate or composition can affect the *fractionation* process, including the effects of reflux flow rate and temperature on the composition of top product, and the effects of control temperature on the composition of bottom product. We also describe problems in fractionation, explain mole percent, and various tools used to monitor product quality. The final portion of the course explains how to perform surveillance on equipment associated with the fractionation process, how to bring a fractionation train up from cold start, and typical operator responses to process upsets or off-spec products.

Gas Law Theory

Course #POS-011

This one-day course provides an understanding of the importance of gas laws when operating oil and gas systems. We begin with a review of gas law terms such as absolute pressure, absolute temperature, volume, moles, and the ideal gas constant. We then review the difference between gauge pressure, atmospheric pressure, and absolute pressure. Then, we explain the relationships and effects of temperature, pressure, and volume. We discuss Gas Laws (Boyle's and Charles'), the Ideal Gas Law, and how these laws change in the operating system conditions.

Gas Sweetening and Acid Gas Theory

Course #POS-012

Gas treating in the oil and gas industries is getting more complex due to emission requirements established by environmental regulatory agencies. In response to this trend, gas conditioning, before or after the gas-treating unit, is emerging as the best option to comply with the most stringent regulations. This two-day course begins with a review of various terms and then reviews the gas sweetening process, the components used in their process and operation, and basic troubleshooting of high H₂S or CO₂ levels.

Heat Exchanger Theory and Operation

Course #POS-013

This one-day course reviews the theory and operation of heat exchangers, their classifications (direct or indirect), construction, and operation. Heat exchanger performance evaluation is explained, and general safety guidelines and common repairs are also covered.



Heat Rate and Plant Efficiency

Course #POS-014

Heat rate is a measure of the combined performance of the gas turbine cycle, steam turbine cycle, and any other associated auxiliaries. This three-day course covers the fundamentals of heat rate and the impact of changing heat rate on operating costs. The course includes an overview of heat rate concepts, controllable and non-controllable losses, and the effects of component performance on operating costs.

Heat Rate and Plant Efficiency (Combined Cycle)

Course #POS-015

This 2½-day course covers the fundamentals of heat rate and the impact of changing heat rate on operating costs. The course includes an overview of heat rate concepts, controllable and non-controllable losses, and the effects of component performance on operating costs.

Heat Rate and Plant Efficiency (Fossil)

Course #POS-016

Heat rate is the common measure of system efficiency in a power plant. The heat rate is a measure of the combined performance of the gas turbine cycle, steam turbine cycle, and any other associated auxiliaries. This 2½-day course introduces the basic characteristics of heat rate, provides instruction on how to calculate heat rate, describes the fundamentals of heat rate, and the impact of changing heat rate on operating costs.

Heat Rate and Plant Efficiency (Gas Turbine Simple Cycle)

Course #POS-017

Heat rate is a measure of the combined performance of the gas turbine cycle, steam turbine cycle, and any other associated auxiliaries. This one-day course covers the fundamentals of heat rate and the impact of changing heat rate on operating cost. The course includes an overview of heat rate concepts, controllable and non-controllable losses, and the effects of component performance on operating cost.



Heat Recovery Steam Generator

Course #POS-018

A heat recovery steam generator's (HRSG) basic function is to remove useful energy in waste heat from a gas turbine, or from some other combustion process, and transform it into steam energy, which is a critical factor in achieving high thermal efficiencies in a combined cycle plant. This steam energy can then be used to drive a steam turbine, produce electricity, or supply steam for a host of other purposes. This three-day course provides an overview of the HRSG function and describes the components and operation of the HRSG, including the operation and maintenance.

Heat Transfer and Thermodynamics

Course #POS-019

This three-day course begins with a fundamental review of Thermodynamic properties, measurements, and conversions. Next, we review the *First* and *Second Laws of Thermodynamics* followed by a review of heat transfer methods, heat cycles, and heat exchanger operation. The final portion of the course reviews reactor heat generation and fuel heat transfer. This course is of great benefit to plant turbine operators.

Process Chemistry

Course #POS-020

This two-day course introduces basic process chemistry principles. This course focuses on a number of areas related to basic chemistry, including the characteristics of matter, chemical bonding, chemical equations, and a review of process chemical compounds. We also review hydrocarbons, Hydrogen Sulfide, and the process of chemical conversion of “sour” gas to “sweet” gas. The final portion reviews the problem of corrosion and the prevention of galvanic corrosion.

Two-Phase and Three-Phase Separators

Course #POS-021

In the oil production business, there are many processes and components. Poor separation of oil from water, excess heat-causing foam, or not enough gas flashed off are all problems that impact production. This one-day course reviews the purpose, operation, and components of two- and three-phase separators.



Water Treatment System

Course #POS-022

This five-day course is designed to provide participants with a thorough background of the plant water treatment system. Topics include the water treatment system, service water system, demineralized water system, and waste water system. The final portion explains a chemistry control program, including corrosion, boiler water quality, water chemistry specifications, blowdown system, abnormal chemistry and action levels.

Turbine and Controls Series

The *Turbine and Controls* series of courses cover various power plant machinery components, systems, and equipment.

Alstom Steam Turbine

Course #TUR-001

This three-day course begins by reviewing Thermodynamics, heat transfer, and fluid flow. The course then goes into basic steam turbine design and then dives into the Alstom steam turbine. We discuss the various sections of the steam turbine and the valves that supply steam to those sections. Auxiliary systems are discussed including Seal Steam, Gland Exhaust, Lube Oil, Hydraulic Oil, and Seal Oil.

Combined Cycle Plant Fundamentals

Course #TUR-002

This four-day fundamentals course provides an introduction to the systems and components of the combined cycle plant. Major components covered include gas turbine, steam turbine and heat recovery steam generator (HRSG). Additionally, Thermodynamics, plant water chemistry, and heat rate basics are taught.

Combined Cycle Plant Maintenance and Operations

Course #TUR-003

This five-day course begins with a review of gas turbine theory. Next, we describe the main turbine systems, including air inlet and filtration, compressor, combustion system, turbine section, bearings, support systems, protection systems, HRSG, duct burner, and the SCR system. Water chemistry, as it relates to turbine operations, is also discussed. Plant operations and turbine control processes are also described. The final portion of the course describes combined cycle plant maintenance and inspections.

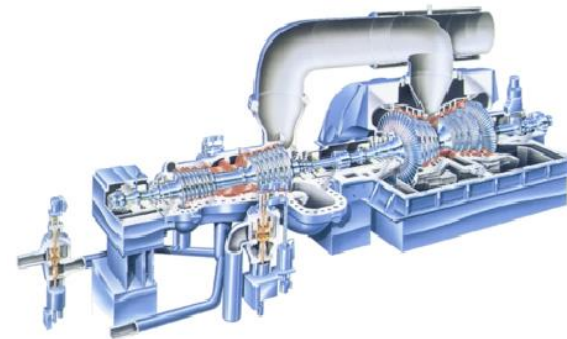
Combustion Fundamentals

Course #TUR-004

This three-day course is designed to provide participants with a working knowledge of the combustion process used in modern power plant applications. Different fuels, the equipment used to burn these fuels, and the monitoring of emissions are covered in detail. Emission monitoring and the requirements of the *Clean Air Act* are also discussed in detail.

GE D11 Steam Turbine

Course #TUR-005



This four-day course begins by reviewing Thermodynamics, heat transfer, and fluid flow. The course then goes into basic steam turbine design and then dives into the D11 steam turbine. We discuss the various sections of the steam turbine and the valves that supply steam to those sections. Auxiliary systems are also discussed including Seal Steam, Gland Exhaust, Lube Oil, Hydraulic Oil, and Seal Oil. Steam turbine operations are explained, including start-up and the stresses associated with this evolution.

GE EX2000 Digital Exciter

Course #TUR-006

This five-day course begins with a review of the fundamentals of AC power followed by a review of semiconductor fundamentals. AC generator types and operations are also discussed. Major generator components are explained, followed by a description of the governor control system. In the final portion, the EX2000 digital exciter is explained, including exciter operation, software and hardware structures, how to operate the program, keyboard functions, operating modes, and running diagnostic tests.

GE EX2100 Digital Exciter

Course #TUR-007

This five-day course begins with an overview of the EX2100 digital exciter system. Next, both the analog and digital exciter operations are described, including the software and hardware structures. The final portion of the course describes how to operate the program, including keyboard functions, operating modes, and running diagnostic tests.

GE Frame 6B Combustion Turbine

Course #TUR-008

This five-day course begins with a review of gas turbine theory. Next, the major components of the GE Frame 6B turbine are described before reviewing the air inlet/filtration system, compressor, combustion system, turbine section, support systems, and protection system. Finally, we discuss common turbine failures and how to troubleshoot various turbine problems.

GE Frame 7EA Gas Turbine

Course #TUR-009

This five-day course begins with a review of gas turbine theory. Next, the major components of the GE Frame 7EA turbine are reviewed, including the air inlet/filtration system, compressor, combustion system, turbine section, support systems, and protection system. Finally, we discuss common turbine failures, how to troubleshoot various turbine problems, and gas turbine maintenance.



GE Frame 7FA Gas Turbine

Course #TUR-010

This five-day course begins with a review of gas turbine theory. Next, the major components of the GE Frame 7FA turbine are described before reviewing the air inlet/filtration system, compressor, combustion system, turbine section, support systems, operations and controls, operator commands, control system, and protection system. Finally, we review common turbine failures and how to troubleshoot various turbine problems.

GE LM 2500 Gas Turbine

Course #TUR-011

This five-day course begins with a review of gas turbine theory. Next, the major components of the GE LM 2500 turbine are described before reviewing the air inlet/filtration system, compressor, combustion system, turbine section, support systems, and protection system. Finally, we discuss common turbine failures and how to troubleshoot various turbine problems.

GE LM 6000 Combustion Turbine Operation

Course #TUR-012

This five-day course begins with a review of gas turbine theory. Next, the major components and operation of the GE LM6000 turbine are described before reviewing the fuel systems, air intake system, and turbine auxiliaries. Additionally, this course gives technicians the maintenance knowledge to properly analyze problems and take the required corrective actions to properly maintain the unit.



GE LM 6000 Combustion Turbine Maintenance

Course #TUR-013

This five-day course is for technicians involved in the daily operation and maintenance of an LM 6000 combustion turbine. The purpose of this training is to provide technicians with the necessary knowledge and skills for consistent and trouble-free turbine operation. This course also gives technicians the knowledge of preventive maintenance procedures to properly analyze problems and take the necessary corrective actions to properly maintain the unit in a serviceable manner.

GE SPEEDTRONIC™ MK V Turbine

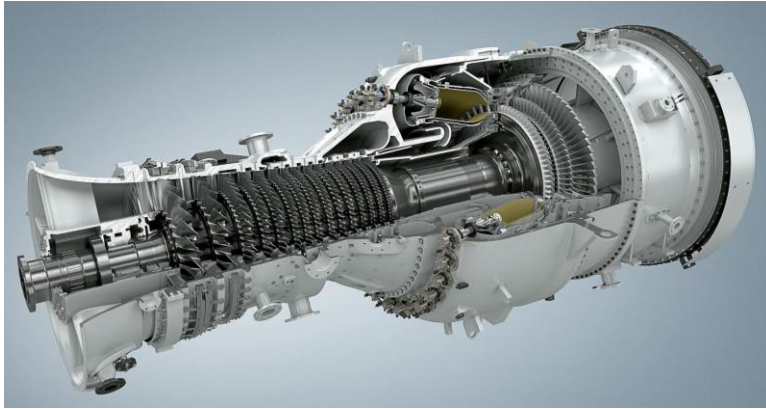
Course #TUR-014

This three-day course begins with a system overview, covering the “big picture” of the GE SPEEDTRONIC™. Next, the hydraulic controls and components are explained. Other topics include the system software, master trip circuit, control configuration, and miscellaneous circuits.

GE SPEEDTRONIC™ MK VI Turbine

Course #TUR-015

This four-day course describes the GE MK VI SPEEDTRONIC™ control system that supports the plant turbine operation. This is a technician-level course for both operating and maintenance personnel, providing the knowledge base necessary to begin working on equipment.



Siemens SGT 800 Gas Turbine

Course #TUR-016

This five-day course begins with a review of gas turbine theory. Next, the major components of the Siemens SGT 800 turbine are described before reviewing the air inlet/filtration system, compressor, combustion system, turbine section, support systems, and protection system. Finally, we discuss common turbine failures and how to troubleshoot various turbine problems.

Siemens/Westinghouse/Mitsubishi 501 Series Gas Turbine

Course #TUR-017

This five-day course begins with a review of gas turbine theory. Next, the major components of the 501 series gas turbine are described before reviewing the air inlet/filtration system, compressor, combustion system, turbine section, support systems, operations and controls, operator commands, control system, and protection system. Finally, we review common turbine failures and how to troubleshoot various turbine problems.

Solar Gas Turbine

Course #TUR-018

This four-day course begins with a review of gas turbine theory. Next, the major components of the Solar gas turbine are described, how energy is transformed, and fluid flow. Next, we introduce feedback theory by reviewing a closed loop system and how it operates. We also discuss turbo-compressor theory, the turbine controller, its hardware, the turbine fuel control interconnections, and finally, the man-machine interface (MMI).

Steam Plant Fundamentals

Course #TUR-019

This ten-day course begins with a review of a simple power plant and the basic energy processes and equipment for converting chemical energy to heat energy, equipment for transferring heat energy to steam energy, and equipment for converting steam energy to mechanical energy, and converting mechanical energy into electrical energy. Then, we describe the boiler feedwater cycle as it applies to a steam power plant. The combustion process is fully described followed by the steam-water cycle in boilers, how turbines are classified, constructed, and operate, the steam-water cycle in turbines, the condenser steam cycle, and the function and components of the condensate and boiler feed system. The next topic describes the water treatment process, including sources of water, reasons for purification of water, and the methods of water treatment. We review the mechanical equipment and processes associated with a steam generating plant, and describe the oils and lubrication requirements for plant equipment. Valves, traps, and associated system piping are described, and the pumps and air compressors used in a steam plant are reviewed. Instrumentation and control systems that comprise the steam plant operating systems and a description of steam plant operating procedures using checklists and typical operating procedures are provided. The final section describes the job of the plant operator.

Toshiba Steam Turbine

Course #TUR-020

This three-day course begins by reviewing Thermodynamics, heat transfer, and fluid flow. The course then goes into basic steam turbine design and then dives into the Toshiba steam turbine. We discuss the various sections of the steam turbine and the valves that supply steam to those sections. Auxiliary systems are discussed including Seal Steam, Gland Exhaust, Lube Oil, Hydraulic Oil, and Seal Oil. Steam turbine operations are explained, including start-up and the stresses associated with this evolution.

Westinghouse AEH Turbine Control System

Course #TUR-021

This five-day course covers the operation of the Westinghouse AEH turbine control system. The main focus of this course is to present the principles of each part of the AEH system. The electronic system is covered down to the circuit card level. This approach provides students with an understanding of the turbine control system, enhancing maintenance and troubleshooting.



Westinghouse Digital EHC System

Course #TUR-022

This five-day course gives students a working knowledge of Digital Electro-Hydraulic Control (EHC) systems. The course allows students to become comfortable with the system operation by analyzing the system on both a block diagram and circuit card level. The course emphasizes a “nuts and bolts” approach to the DEH system that will greatly enhance the abilities of maintenance and supervisory personnel who operate and maintain the system.

Instructional Training Series

The *Instructional* series of courses cover various “soft skills” including training, leadership, and project management.

Fundamentals of Classroom Instruction

Course #IS-001

This five-day course gives participants the knowledge and skills needed to effectively conduct classroom training. This course contains in-depth discussions about the learning process of adult learners, as well as many group-oriented, role playing, and brainstorming sessions designed to prepare the trainer for the work area training environment.

Leadership Behaviors and Communication

Course #IS-002

This one-day course involves two areas of behaviors: Action and Communication. The first section involves identifying behaviors common to effective leaders. The second section introduces you to the art of communication.

Observer Training

Course #IS-003

This four-hour workshop teaches participants how to achieve acceptable reliability and validity when performing observer ratings. We stress the use of a behavior-based system, highlighting its benefits over more subjective methods. We then provide experiential practice with identifying and overcoming potential biasing factors that can reduce a rater’s skill and effectiveness.

Presentation Skills for Supervisors

Course #IS-004

This two-day seminar is designed to give supervisors the skills needed to provide on-the-job training (OJT) to their co-workers. This seminar

contains in-depth discussions around the thinking process of the adult learner, as well as many group-oriented, role playing, and brainstorming sessions designed to prepare the supervisor for the work area training environment.

Project Management

Course #IS-005

This two-day course introduces the process of project management, including the Tools, Planning, and Implementation phases. Case studies and examples enhance the lecture by providing real-world examples.



Train the Trainer

Course #IS-006

The *Train the Trainer Workshop* is a two-day seminar designed to teach workers the skills needed to provide on-the-job training (OJT) to their co-workers. This seminar contains in-depth discussions around the thinking process of the adult learner, as well as many group-oriented, role playing, and brainstorming sessions designed to prepare the trainer for the work area training environment.

If you cannot find a course herein that matches your training needs, please contact us directly. Our training development specialists can put together your specific training needs. We are more than happy to prepare exactly what your organization is looking for! Some of our current and past clients are shown below.

