Milwaukee School of Engineering
Applied Technology Center

Department of Professional Education and Research Development

Fluid Power

On Campus – On Customer site - International

- Mechanical Systems
- Mechanical Maintenance
- Process Engineering
- Electrical Systems
- Industrial Safety

Professional Training
=
Professional Work Force!

Table of Contents

Why MSOE?

- **MSOE is a leader in fluid power research and education for more than 50 years.**
- **MSOE provides training on campus, at customer sites and internationally.**
- **MSOE certifies all courses and eligible to grant Continuing Education Credit Units (CEU) for the participants of the professional education programs.**
- **MSOE is one of the most recognized institutions nationwide in terms of fluid power practical-oriented education.**
- **MSOE provides long term technical skills development solutions for industry.**

Milwaukee School of Engineering:

MSOE is a private, non-profit university with about 2,600 students that was founded in 1903. MSOE offers bachelor's and master's degrees in engineering, business, mathematics and nursing, as well as professional education courses and certifications in fluid power. The university has a national academic reputation; longstanding ties to business and industry; and dedicated professors with real-world experience.

Welcome, The Applied Technology Center™ (ATC) is the research arm of MSOE. It serves as a technology transfer catalyst among academia, business, industry and governmental agencies. The close association between MSOE and the business and industrial community has long been one of its strengths. The ATC is well known for its success in the transfer of technology from the laboratory to the marketplace.

One of the largest centers of excellence in the ATC is MSOE's Fluid Power Institute™ (FPI). The FPI conducts very active applied research for a variety of companies and industries. Advanced fluid power research in the United States is being conducted through the National Science Foundation and the industry-sponsored Engineering Research Center for Compact and Efficient Fluid Power (CCEFP), led by a consortium of universities including MSOE.

Tom Bray
Dean of Applied Research

Other major centers of excellence and cooperative ventures within the ATC include:

- Professional Education and Research Development (PERD).
- Rapid Prototyping Center (additive manufacturing).
- Center for Bio-Molecular Modeling (CBM).
- Clinical and Translational Science Institute (CTSI).
- Construction Science and Engineering Center.
- Engineering Research Center for Compact and Efficient Fluid Power (CCEFP).
- Mid-West Energy Research Consortium (M-WERC).
- Nano-Engineering Laboratory.
- Photonics and Applied Optics Center.
- Wisconsin Center for Commercialization Resources (WCCR).
- Wisconsin Space Grant Consortium.

MSOE seminars offer participants the opportunity to explore technological developments and current applications and techniques. The programs are designed to keep practicing engineers abreast of new developments and applications, and also to provide a basic understanding of the technology to new entrants into the field.

MSOE seminars:

- Are based on applied research conducted by scholars.
- Use state-of-the-art laboratories with industrial-grade training equipment.
- Use a hands-on approach to reinforce the concepts presented in class.
- Applications-oriented and often customized to the industry or companies of seminar participants.
- Are offered on the basis of strong long-term partnerships with set objectives and outcomes.

On-site seminars:

MSOE seminars are available for an on-site presentation at your company. The curriculum may be presented in its original format or be modified to meet your specific needs. Confidentiality protected!

MSOE's seminars are unique in the industry because:

- Seminar instructors are experts in their fields, including certified fluid power specialists, Professional Engineers and Ph.D.s.
- Attendees are exposed to the latest fluid power research and industry projects developed at the Fluid Power Institute.
- Professional education seminars use the latest software versions of MATLAB®/Simulink® and Automation Studio in the advanced courses.
- Attendees can network and build professional relationships while benefitting from training, research and industrial projects.

Dr. Medhat Bahr Khalil
Director of Professional Education & Research Development (PERD)
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Cell: (414) 940-2232
Fax: (414) 277-7470
khalil@msoe.edu
1025 N. Broadway,
Milwaukee, WI, 53202-3109, USA

For more than 50 years, MSOE's Fluid Power Institute has been a leader in fluid power research and education. As a part of MSOE's practical, applications-oriented education philosophy, FPI staff and students conduct research and analysis for agriculture, construction, mining off-highway and industrial fluid power applications. Its client list includes global companies such as Caterpillar, CNH, Exxon-Mobil, Husco International, John Deere, Parker Hannifin and Sun Hydraulics.

Premier companies choose the Fluid Power Institute as a partner because of its expertise in evaluating a wide range of hydraulic components and machinery. FPI engineers design and build specialized power supplies and instrumentation systems for pump, motor and fluid efficiency testing. The range of power FPI has available to conduct high-pressure endurance testing of hoses, valves, tubes, plugs and seals is also unique; cylinders as short as a pencil, and as long as a semi-trailer can be evaluated.

The FPI has two facilities that enable it to evaluate a remarkable range of equipment:

On Campus FPI Laboratory
2,400 square foot, Eight test-cells, endurance, fatigue, performance and efficiency tests.

Off-campus FPI Laboratory
12,000 square-feet, high-bay ceiling, drive-in access, reconfigurable workspace and major hydraulic power capabilities.

Thomas Wanke
Director of Fluid Power Institute
www.msoe.edu/fpi

FPI's newly established off-campus laboratory is located in the Chase Commerce Center on the south side of Milwaukee. This facility is especially suited for evaluating large components, systems and vehicles. A reconfigurable work space enables FPI engineers to customize power and test conditions using a variety of methods.

FPI has the ability to design test plans that meet the unique requirements of its clients. Our engineers and students work closely with clients to determine their exact needs. Systems are designed, built and instrumented to test equipment under the appropriate duty cycle. Tests can be conducted according to customer specifications, ASTM, ISO, NFPA or SAE standards.

Engineering Services

The key to developing a reliable, available and maintainable fluid power system is to make it an integral part of the engineering process, and to eliminate failures and failure modes through identification, classification, analysis and removal or mitigation. When developing fluid power systems, it is imperative to select the right activities and to conduct those activities at the right time. The engineering faculty and staff at FPI are experts in fluid power application from a simple design to an efficient and reliable hydraulic or pneumatic system.

Tribology Services

The FPI has been a leader in contamination analysis and filtration technology for decades. In the 1980's, FPI pioneered the use of automatic particle counters in hydraulic fluid analysis. In the 1990's, FPI pioneered the development of surgically clean fluids for initial-fill applications. In the 2000's FPI was the very first to use Atomic Force Microscopy in wear particle analysis. FPI's role as a practitioner and educator in these areas has truly advanced the fluid power industry. Our current research thrust incorporates the study and formulation of energy-efficient hydraulic fluids-an endeavor funded by a grant from the National Science Foundation and industry partners.

Many of the world's largest equipment manufacturers use FPI to test new hoses, tubes, cylinders, coolers, reservoirs, pumps, bearings and valve assemblies to determine the type and size of manufacturing contamination, left in the component as received by the customer. Through the use of advanced diagnostic methods such as ferrography, atomic force microscopy, stereomicroscopy and laser particle imaging, early detection and root-cause analysis are possible.

Meet Fluid Power Experts

Dr. Medhat Khalil, **Director of Professional Education & Research Development at MSOE.** Medhat has constantly been working on his academic development through the years, starting from Bachelor and Masters Degree in Mechanical Engineering in Cairo, Egypt proceeding with his PH.D. in Mechanical Engineering and his Post-Doctoral Industrial Research Fellowship at Concordia University in Montreal, Quebec, Canada. He has been certified and is a member of many renowned institutions such as: Certified Hydraulic Specialist by the International Fluid Power Society IFPS; Certified Accredited Fluid Power Instructor by IFPS; Member of Center for Compact and Efficient Fluid Power Engineering Research Center (CCEFP); Listed Fluid Power Consultant by the National Fluid Power Association (NFPA); Member of the Board at the International Fluid Power Society (IFPS); President and Technical Director of CompuDraulic; Member of American Society of Mechanical Engineers (ASME). Medhat has vast working experience in the field of Mechanical engineering and more specifically hydraulics, he has developed and taught fluid power system training courses for industry professionals, familiar with the technological developments in the field of fluid power and designed several hydraulic systems for industrial applications. In addition, Medhat developed several analytical and educational software systems. Medhat was the conceptual designer of the state-of-the-art Universal Fluid Power Trainer. He was a recipient of the Otto J. Maha Pioneers in Fluid Power Award in 2012.

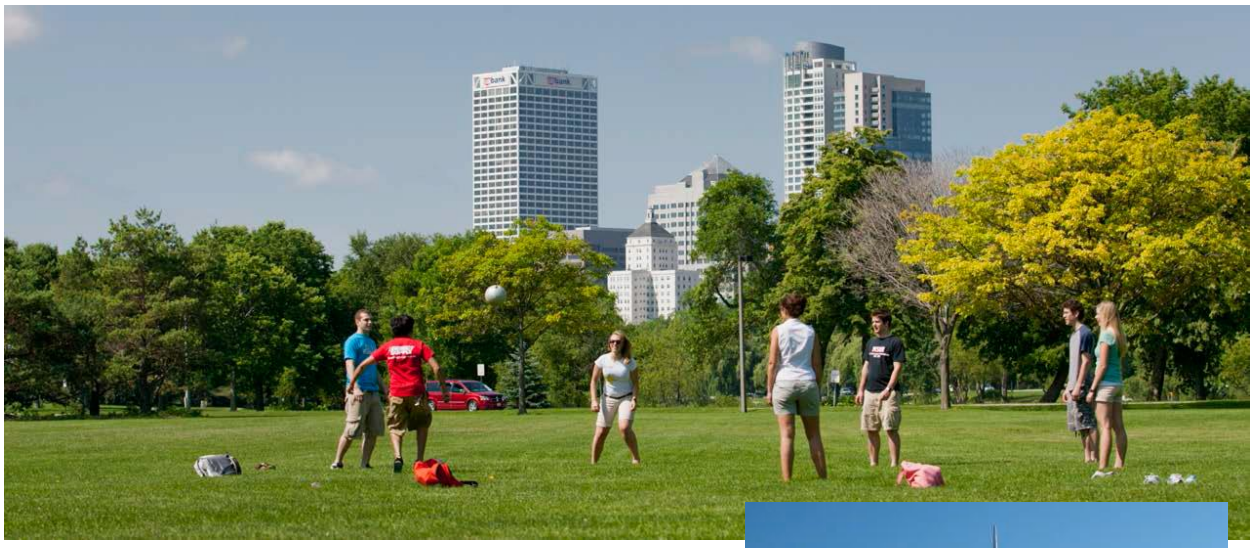
Dr. Daniel Williams

is an associate professor in MSOE's Mechanical Engineering department. He earned his bachelor's degree in mechanical engineering from the University of Wisconsin-Platteville and his master's degree and Ph.D. in mechanical engineering from the University of Wisconsin-Madison. Williams has more than 20 years of industry engineering experience. He worked for two years as a design engineer at Snap-On Tools Corporation in Kenosha, Wis. Following graduate studies, Williams worked for 18 years in John Deere's Construction & Forestry Division in Dubuque, Iowa, where he specialized in machine systems simulation—hydraulics, drive train, rigid body dynamics and controls—and control design. Dan has also been a member of the full-time faculty at Loras College in Dubuque, where he taught courses in the electromechanical engineering program for five years.

Thomas Wanke ’78,’96, C.F.P.E., is the director of MSOE’s Fluid Power Institute, America’s leader in fluid power technology research and education. He has more than 45 years of experience in fluid power technology, 40 of which have been at MSOE. Wanke has a bachelor’s degree in mechanical engineering technology and a master’s degree in engineering with a fluid power specialty option, both from MSOE. He has worked on projects in the following areas: component and system design; development and evaluation; field troubleshooting and failure analysis; and fluids, filtration and contamination control. Wanke is a member of SAE and FPS. He is chairman of the NFPA Technical Board and is Educational Program Co-chairman for IFPE 2014. Tom was a recipient of the MSOE Fluid Power Institute Fluid Power Achievement Award in 2012. He was a recipient of the Otto J. Maha Pioneers in Fluid Power Award in 2011.

Paul Michael, C.L.S., is a research chemist in MSOE’s Fluid Power Institute. He earned his B.S. in chemistry at the University of Wisconsin, Milwaukee and graduated with distinction from Keller Graduate School of Management. He has more than 30 years of experience in the formulation and testing of hydraulic fluids and lubricants. Paul is an STLE certified Lubrication Specialist and chairs the NFPA Fluids Committee. In addition to his research in contamination analysis, he is currently investigating energy efficient hydraulic fluids in the NSF funded multi-university Center for Compact and Efficient Fluid Power. Michael was a recipient of the Otto J. Maha Pioneers in Fluid Power Award in 2012.

City of Milwaukee



Milwaukee is known for its clean and friendly community and its rich ethnic heritage. Milwaukee is located in the southeastern corner of the state of Wisconsin, and is about 90 miles north of Chicago, Ill. It is the center of business and culture in the metropolitan area. MSOE is in a vibrant downtown neighborhood called East Town. There are countless activities within walking distance of campus including shopping, theaters, restaurants, professional sporting venues and more. Lake Michigan is only a few blocks away.

Milwaukee has four distinct seasons. Lake Michigan influences the climate considerably, cooling the city in the warm months and moderating cold temperatures in the winter. The average high temperature in July is 81° F. January is the coldest month, with an average high temperature of 28° F. The city averages about 37 inches of snow throughout the winter months, and plenty of sunshine and warmth during the summer!

Milwaukee: A fluid power industrial hub

The following fluid power related component manufacturers, machine builder, service providers, associations and organization are samples of Milwaukee-based or at least have a subsidiary in the city of Milwaukee:

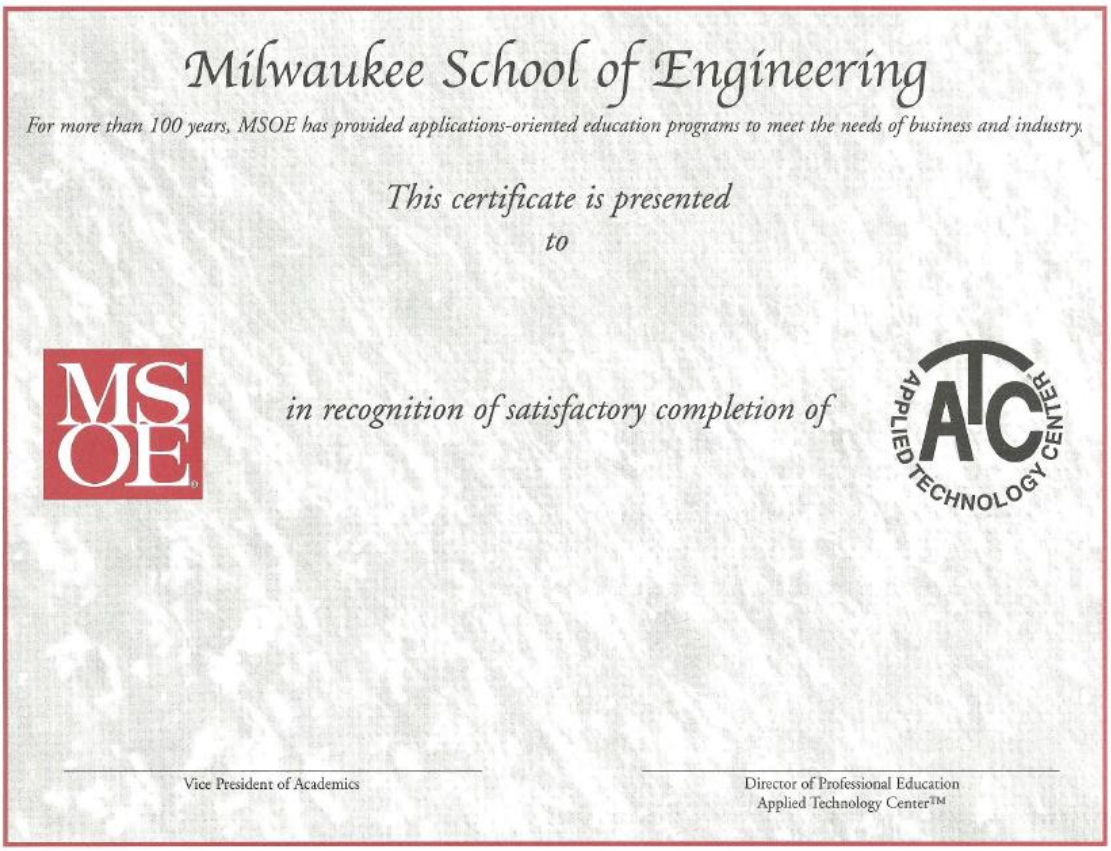
- **Actuant.**
- **Caterpillar Mining.**
- **CASE.**
- **Eaton R&D.**
- **Fluid System Components.**
- **Grimstad.**
- **GS- Hydraulics.**
- **Husco International.**
- **Milwaukee Cylinders.**
- **Milwaukee School of Engineering.**
- **Motion Industries.**
- **Milwaukee Hydraulics.**
- **National Fluid Power Association (NFPA).**
- **Norman Equipment.**
- **Oilgear.**
- **Poclain Hydraulics.**
- **P & H Mining.**
- **PUTZMEISTER America.**
- **Racine Federated.**

Certification and Continuing Education Credit Units:

The Professional Education Department authorizes Continuing Education Credit Unis (CEUs) for seminar participants. For every 1 contact hour, 0.1 CEU is granted. For example, 10 Hours seminar participant deserve 1 CEU.

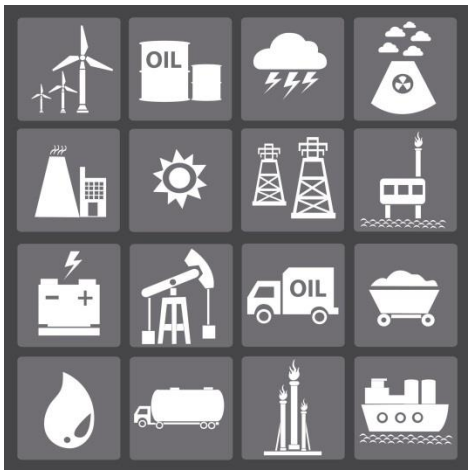
For an institution to be eligible to grant CEU, it must meet certain criteria:

- It should be a recognized institution.
- Courses must be with learning objectives.
- Presenter must be qualified instructor.
- Records of participants must be kept and maintained.
- Participants must be certified either by a certification exam or hands-on practice.



Targeted Clients:

We provide quality training for professionals from
Industrial and Mobile Applications.

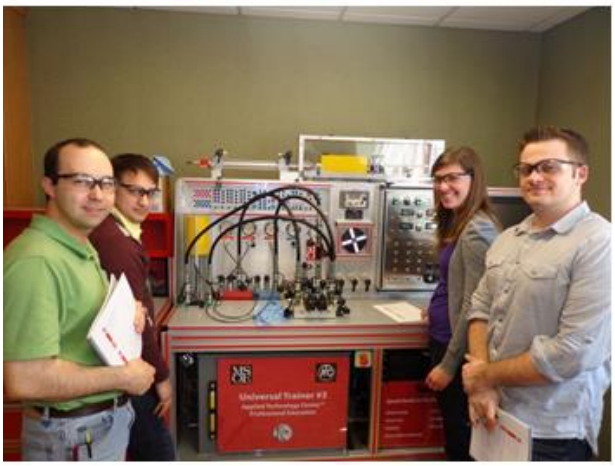


- Steelworks and Metal Forming.
- Molding and Die Casting Industries.
- Forging and Extrusion Works.
- Machine Tools.
- General Manufacturing.
- Industrial Automation.
- Process Engineering.
- Wood, Paper and Glass Industries.
- Pharmaceutical Industries.
- Chemical and Petrochemicals.
- Food Industries.
- Power Plants.
- Renewable Energy.
- Material Handling.

- Earth Moving Machines.
- Construction Machines.
- Lifting Equipment.
- Agricultural Machines.
- Oil & Gas Industries.
- Offshore Equipment.
- Mining Equipment.
- Marines & Shipbuilding.
- Defense Systems.
- Aerospace Industries and
- Airport Service Machines.
- Rail-way Vehicles.
- City service Vehicles.
- Automotive engineering.

Training Equipment:

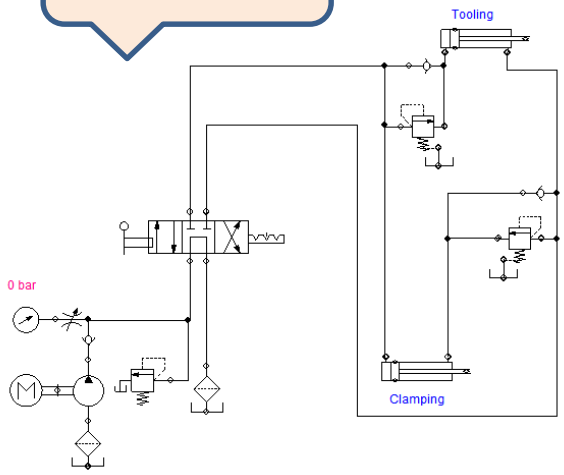
1. Circuit Design and Component Selection
2. Functional Animation
3. Mathematical Modeling
4. Performance Simulation
5. Prototyping with Hardware-in-the-Loop
6. Performance Analysis and Data Acquisition



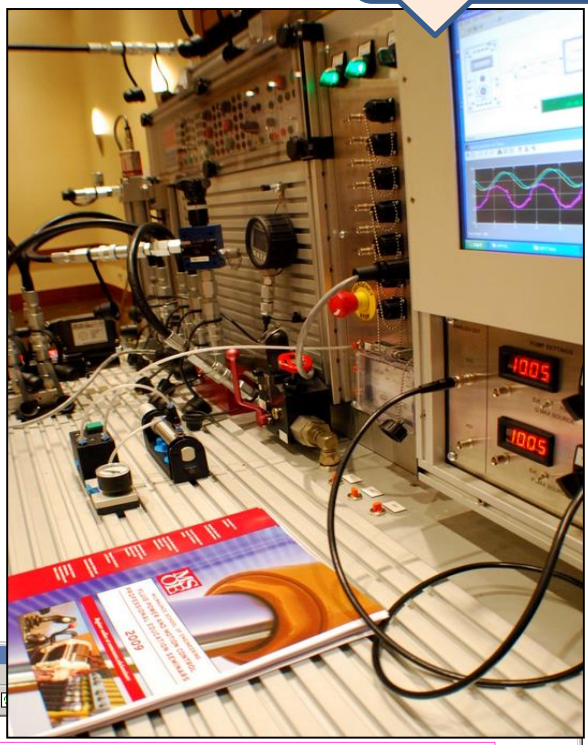
The state-of-the-art Universal Fluid Power Trainer (UFPT) has been designed by Dr. Khalil. Four fully functional units have been added to the department of Professional Education to be used by seminar participants to practice designing, animating, simulating and building hydraulic circuits. The machines are universal, transportable and compact so that it can be shipped to the customer's site.

To learn more about the Universal Fluid Power Trainers:
http://www.msoe.edu/seminars

Animate it



Practice it



Simulate it

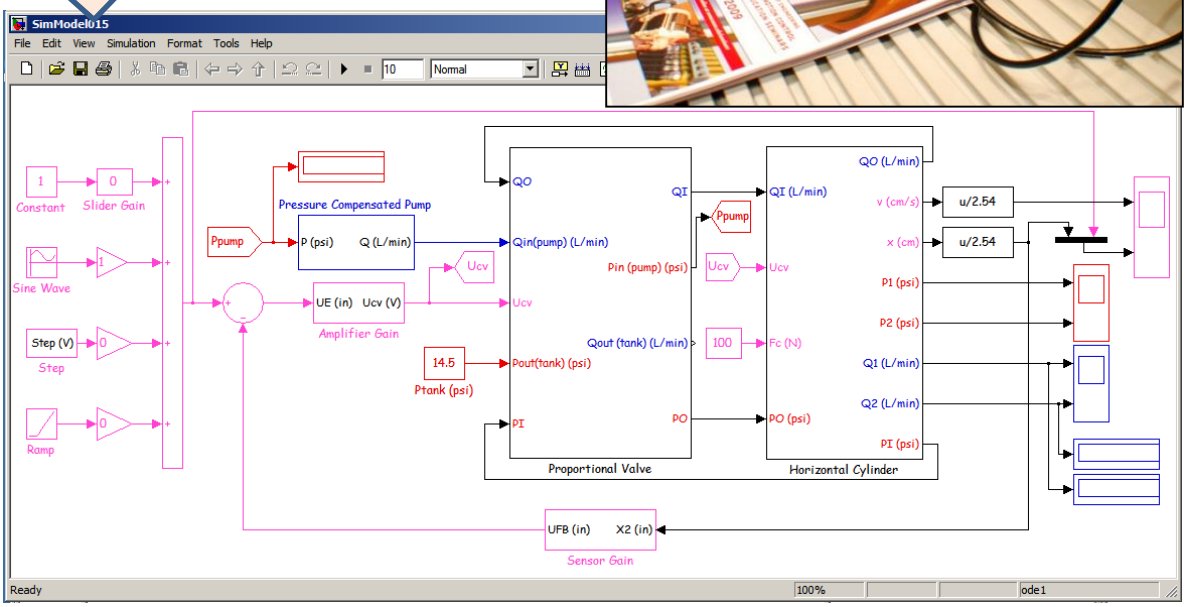
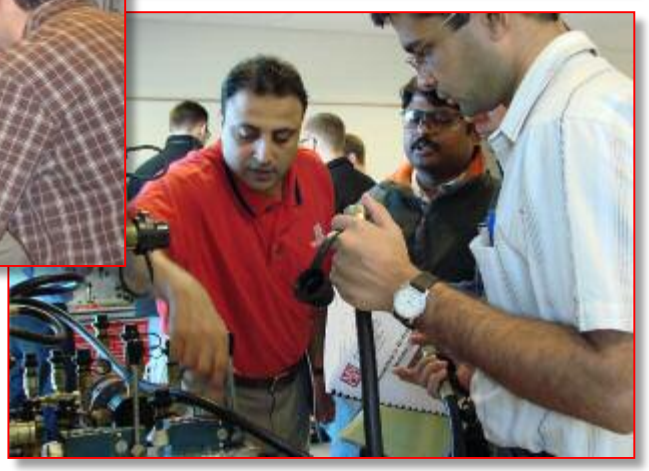


Photo Gallery:



Logistics:

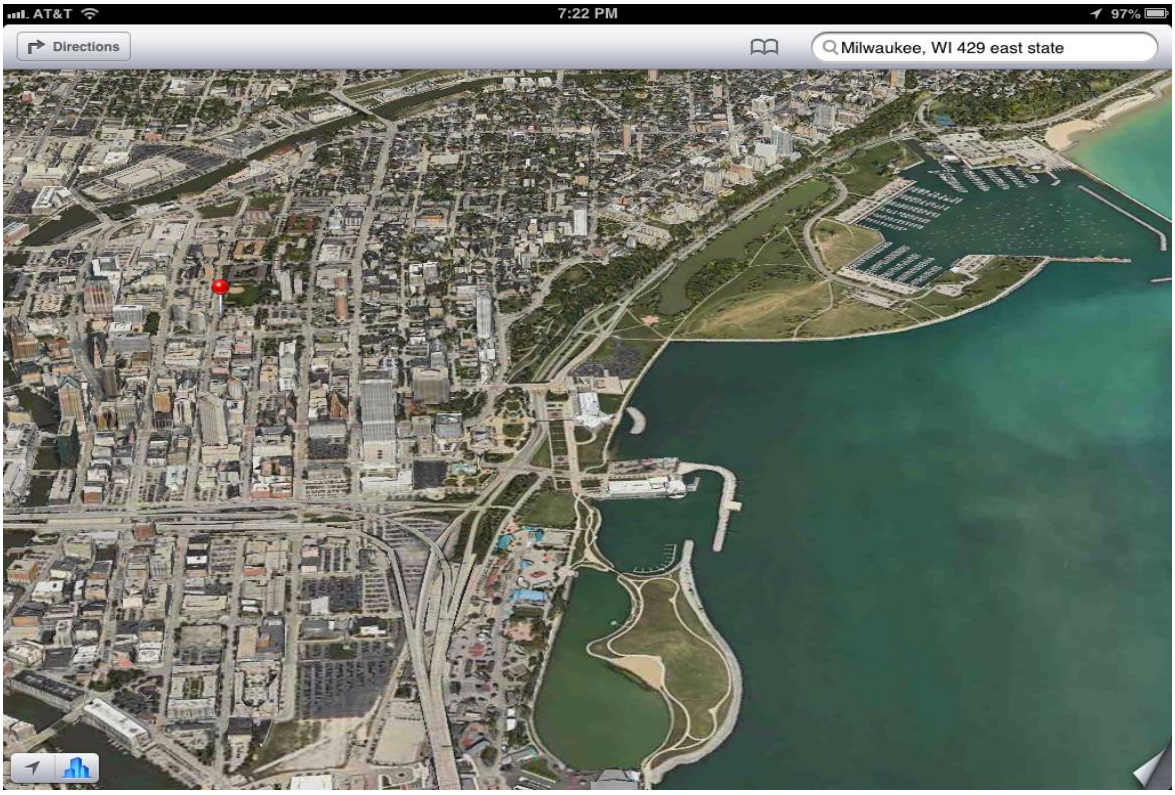
Air Travel to Milwaukee:
Book your flight to Mitchell International Airport (Airport Code: MKE), it is a 15-minute taxi ride to downtown Milwaukee.

Driving Directions to MSOE, From the north:
Down town Milwaukee can be reached from I-43 South, from the South through I-94 west/I-43 north and from the west through I-94 East. Please review google map for updated maps.

Where to Stay:
The following hotels are within a ten minute walking distance to the seminar location. Mention MSOE when making reservations to receive a reduced rate. The hotels are served by airport shuttles .

Hyatt Regency Milwaukee
1234-276 (414)
1234-233 (800)
333 W. Kilbourn Ave.
$119 plus tax per night
www.hyatt.com

The Astor Hotel
4220-271 (414)
924 E. Juneau Ave.
$69 per week night plus tax
www.thehotelastor.com

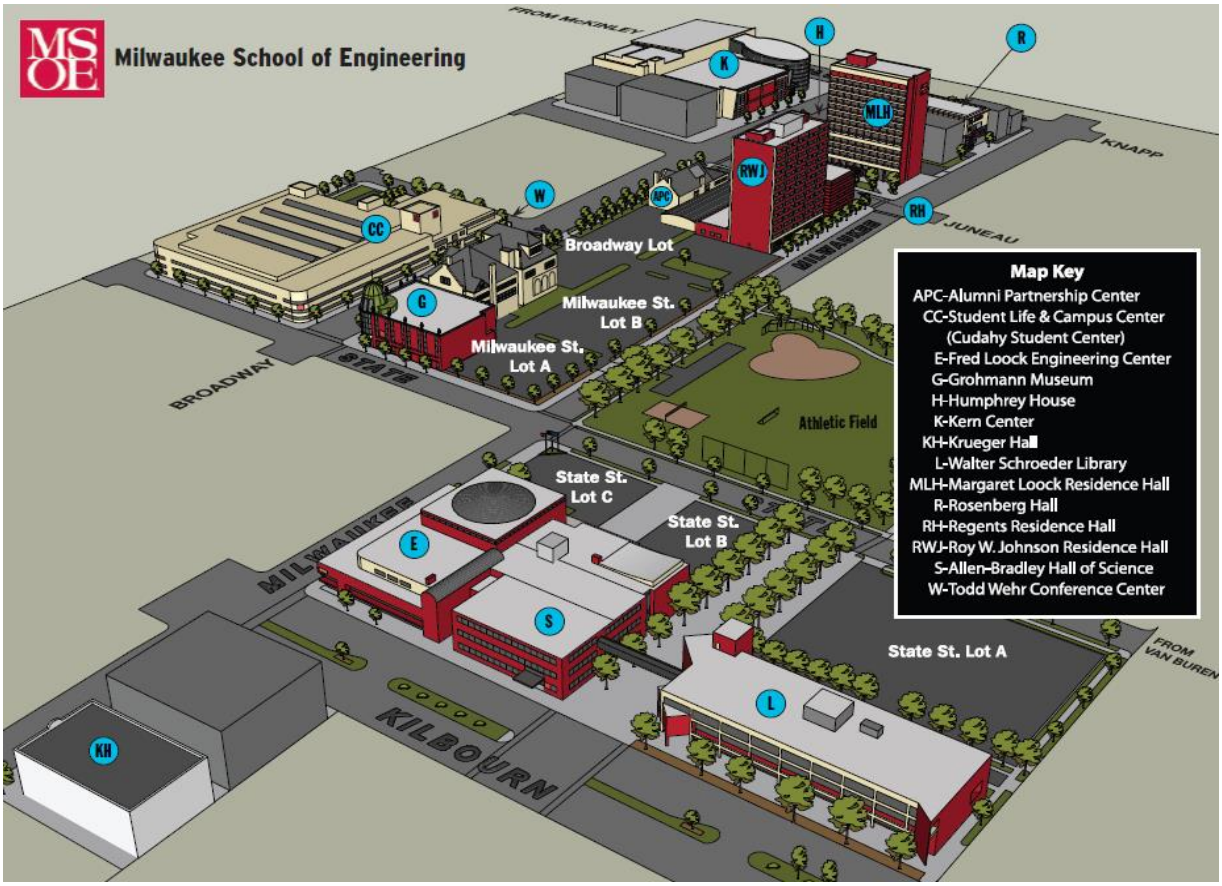


Address:

- 429 East State Street Milwaukee, WI, 53202.
- Seminars are held at the Science Building (E), Room S-100.

Parking:
Seminar participants receive free parking at the university campus. Parking lot TBD on the parking permit.

Dressing:
Dress casual and comfortable. Look up Milwaukee weather forecast to plan your trip.
www.weather.com, zip code.53202



Registration:

Fax to: +1-414-277-7470

Mail to:
Applied Technology Center
Milwaukee School of Engineering.
1025 N. Broadway, Milwaukee, WI, 53202-3129

Call: +1-414-277-7195 **OR:** +1-414-277-7269

www.msoe.edu/seminars

khalil@msoe.edu

Cancellation Policy:

- MSOE reserves the right to cancel a seminar if minimum enrollment is not met.
- Cancellation from the client side subject to the following conditions:
  - Three weeks before the seminar date are subject to a $200 cancellation fee with a refund of the remainder.
  - Cancellations two weeks before the seminar date are subject to a $400 cancellation fee with a refund of the remainder.
  - Cancellations one week before the seminar date are subject to a $600 cancellation fee and the remaining funds will be used as a credit towards any future seminar, subject to availability.

Seminar Registration Form

Please enroll the individual (s) listed below in:

Seminar #	Seminar Name	Seminar Date

Name: ----------

Title: ----------

Tel: ----------

Email: ----------

Company: ----------

Address: ----------

Payment Method:

☐ Company Purchase Order: PO# ----------

☐ Charge Seminar Fee (s) to ☐MasterCard ☐VISA ☐Discover ☐American Express

Account Number ---------- Expiration Date:

Name on the Card Signature

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Address: ----------

Payment Method:

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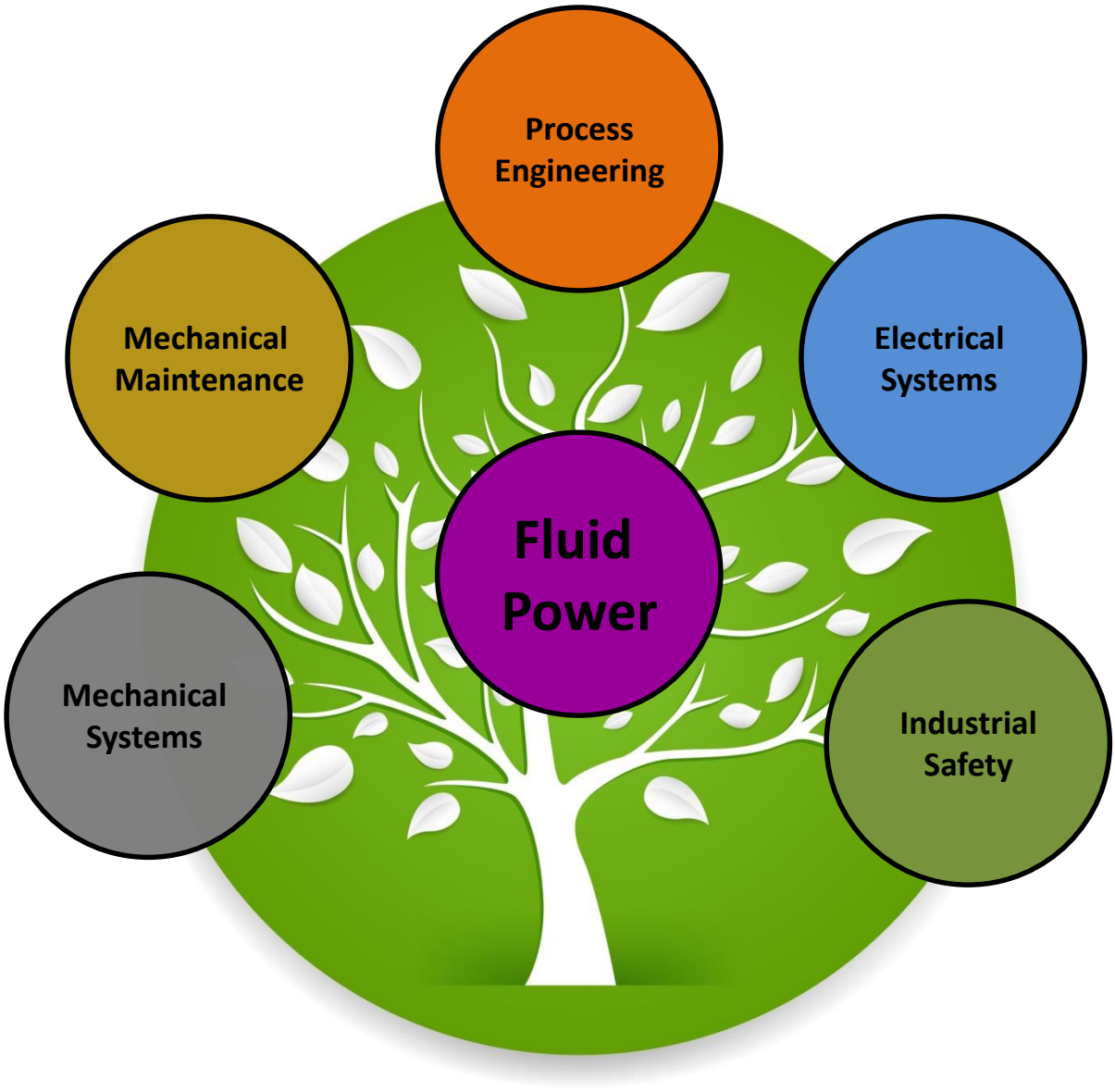
☐ Charge Seminar Fee (s) to ☐MasterCard ☐VISA ☐Discover ☐American Express

Account Number ---------- Expiration Date:

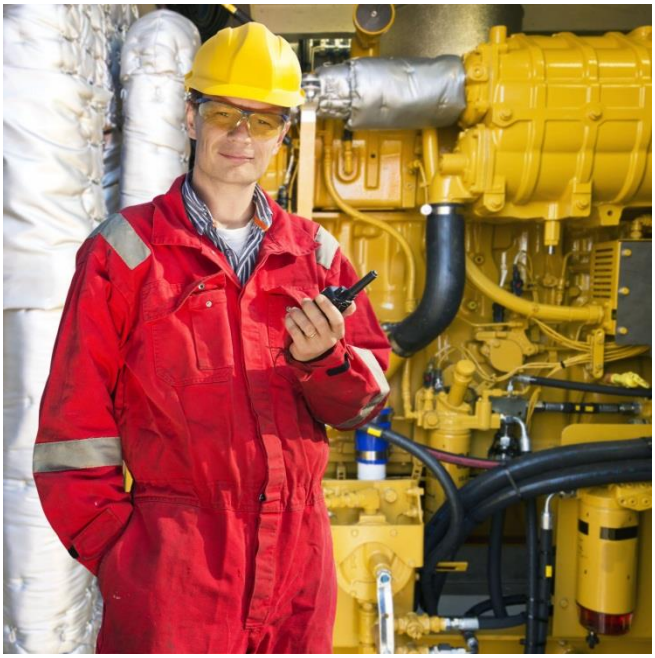
Name on the Card Signature

MSOE-PERD www.msoe.edu/seminars khalil@msoe.edu Cell: +1-414-940-2232

Seminar Tree:



Fluid Power Training



We serve both industrial and mobile applications!

We are the sole provider of fluid power training to largest construction companies worldwide!

We are member of:

CENTER FOR COMPACT AND EFFICIENT FLUID POWER
NSF A National Science Foundation Engineering Research Center

Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under development.

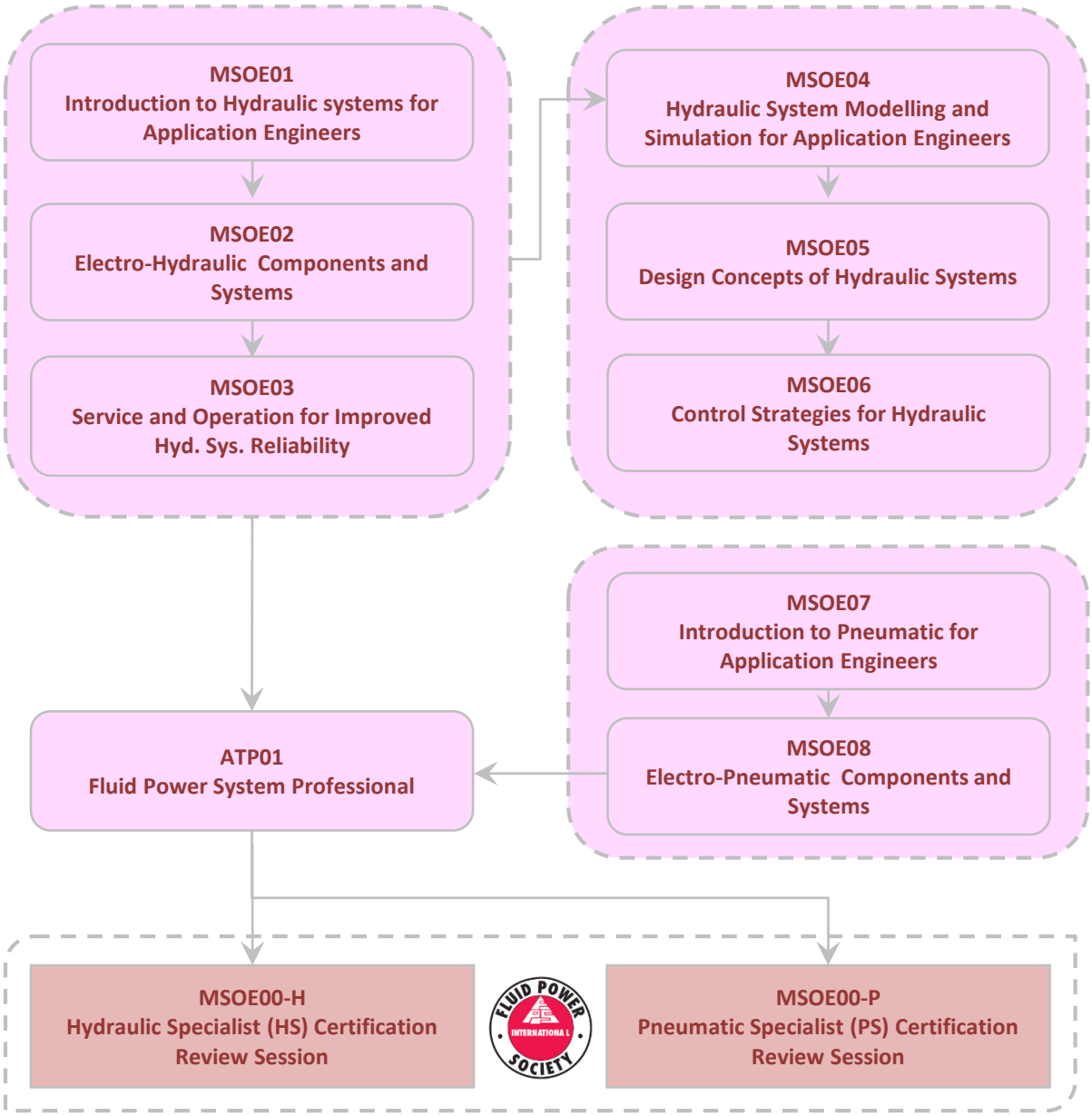
Customize Your Own Industrial Training.
Courses can be mobilized to your facility.
For dates and locations of courses scheduled in current calendar year visit:
www.msoe.edu/semiars

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE00-H	Hydraulic Specialist Certification Review Session (IFPS Certification)	1.8	18	3	NO	YES	YES	$1440
MSOE00-P	Pneumatic Specialist Certification Review Session (IFPS Certification)	1.8	18	3	NO	YES	NO	$1440
MSOE01	Introduction to Hydraulic Systems for Application Engineers	2.7	27	5	YES	NO	YES	$2,160
MSOE02	Electro-Hydraulic Components and System	2.7	27	5	YES	NO	YES	$2,160
MSOE03	Service and Operation for Improved Hydraulic System Reliability	2.7	27	5	NO	NO	YES	$2,160
MSOE04	Hydraulic System Modelling and Simulation for Application Engineers	2.7	27	5	YES	NO	YES	$2,160
MSOE05	Design Concepts of Hydraulic Systems	2.7	27	5	YES	NO	UD	$2,160
MSOE06	Control Strategies for Hydraulic Systems	2.7	27	5	YES	NO	UD	$2,160
MSOE07	Introduction to Pneumatic Systems for Application Engineers	1.8	18	3	YES	NO	UD	$1,440
MSOE08	Electro-Pneumatic Components and Systems	1.8	18	3	YES	NO	UD	$1,440
ATP01	Fluid Power System Professional	2.7	27	5	NO	YES	NO	$2,160
TPC 307	Basic Hydraulics	1.0	10	2	NO	YES	NO	$800
TPC 308	Hydraulic Troubleshooting	1.0	10	2	NO	YES	NO	$800
TPC 309	Basic Pneumatic	1.0	10	2	NO	YES	NO	$800
TPC 310	Pneumatic Troubleshooting	1.0	10	2	NO	YES	NO	$800
WMK01	Overview of Fluid Power Systems	0.6	6	1	NO	NO	NO	$480
WMK02	Fluid Power Applications	1.2	12	2	NO	NO	NO	$960
WMK03	Hydraulic Motors Construction and Application	1.2	12	2	NO	NO	NO	$960
WMK04	Electrical Control of Fluid Power	1.2	12	2	NO	NO	UD	$960

Fluid Power Training

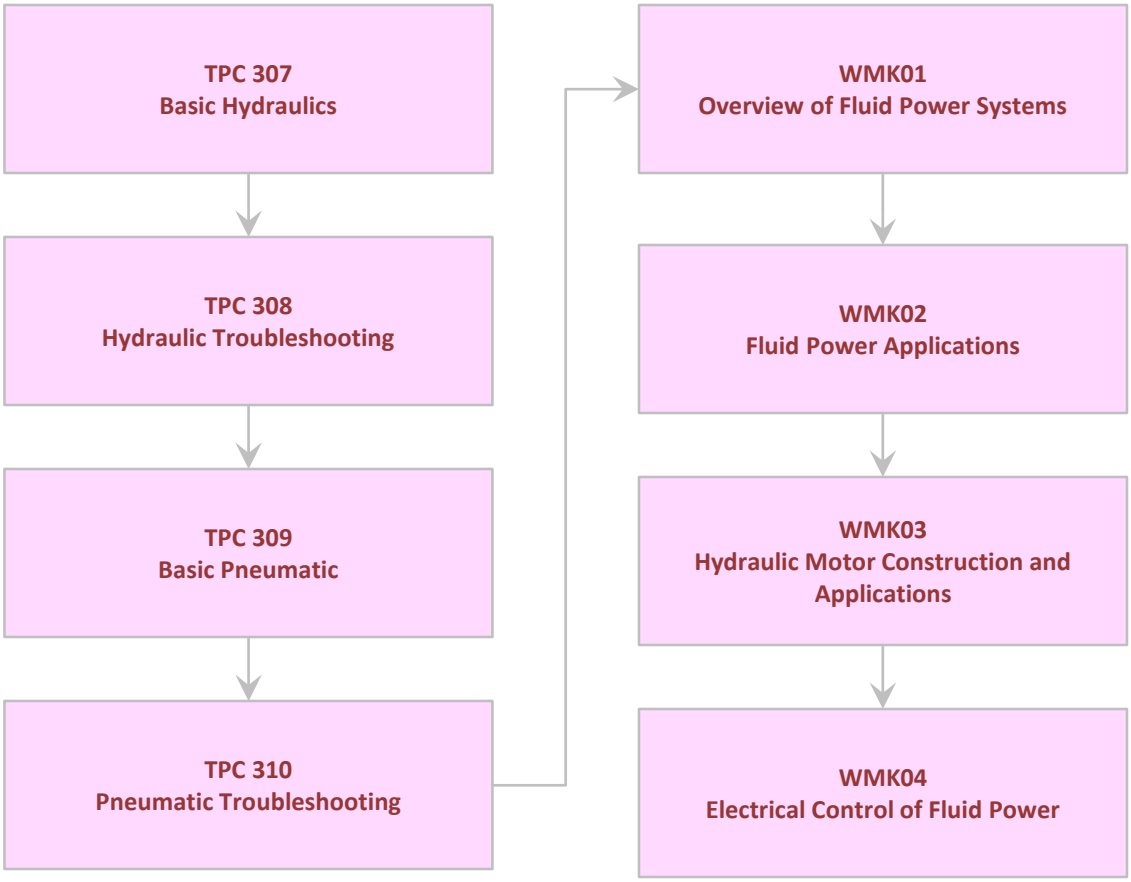
Recommended Training Path

For the field of Fluid Power for Engineers and Associate Degree Holders.



Once an individual completes HS and PS certification levels, they are considered a Fluid Power Specialist; no additional written test is require

Recommended Training Path
For the field of Fluid Power for Participants with Limited Math Background.



Hydraulic Specialist Certification Review Session

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE00-H	Hydraulic Specialist Certification Review Session (IFPS Certification)	1.8	18	3	NO	YES	YES	$1440

Course Description:

This 18-hours 3-days review session is conducted at MSOE followed by the certification exam on the fourth day. The objective of the course is to walk the participants through the study manual provided by IFPS in order to maximize the chance of passing the certification exam.

What is the IFPS?

The International Fluid Power Society is the only organization that provides comprehensive technical certification offerings for all professionals in the fluid power and motion control industry.

What is the Process of Certification?

After 3-days review session provided by MSOE, participants will take the certification exam on fourth day. Exam will be provided and proctored by IFPS. The test is 3-hours 50-questions multiple-choice type of test. You need to get 35 correct answers out of 50 questions. If you fail you can re-schedule taking the exam at a later time. If you pass, you will be issued a "Hydraulic Specialist" certificate. The certificate is good for five years, after five years you do not need to retake the exam, you need only to report to IFPS indicating that you are still working in the field.

Why Get Certified?

- The “Hydraulic Specialist” certification is an internationally recognized certification.
- The certificate is portable - it goes with the individual wherever they work.
- Certifications help an individual to advance his career and introduce himself to the global job market.
- Certification sets an individual apart as a leader in their chosen field of work.
- Certification will help a vendor provide over-the-top quality and acquire ISO certification easily.
- Certified personnel help make the work environment safe and improve the safety, reliability and efficiency of a machine operation.

Course Agenda:

	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.5
	Job Responsibility 1: Apply Hydraulic Circuits to Perform Desired Tasks	2.5
PM	**Job Responsibility 2:** Analyze Loads and Motion	1
	Job Responsibility 3: Select Components for Hydraulic Applications	2
	Day 2	**Hr**
AM	**Job Responsibility 3:** Contd.	1.5
	Job Responsibility 4: Prepare Bills of Material and Schematics	0.5
	Job Responsibility 5: Recommend Fluid , Fluid Conductors and Fluid Filtration	1
PM	**Job Responsibility 6:** Analyze and Troubleshoot Hydraulic Systems	0.5
	Job Responsibility 7: Interface Hydraulic Instrumentation and Control Systems	1
	Day 3	
AM	**Pretest 1 and 2**	3.0
PM	**Pretest 3 and 4**	3.0
	Total	**18**
	Day 4	
AM	**Certification Exam**	3

Pneumatic Specialist Certification Review Session

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE00-P	Hydraulic Specialist Certification Review Session (IFPS Certification)	1.8	18	3	NO	YES	NO	$1440

Course Description:

This 18-hours 3-days review session is conducted at MSOE followed by the certification exam on the fourth day. The objective of the course is to walk the participants through the study manual provided by IFPS in order to maximize the chance of passing the certification exam.

What is the IFPS?

The International Fluid Power Society is the only organization that provides comprehensive technical certification offerings for all professionals in the fluid power and motion control industry.

What is the Process of Certification?

After 3-days review session provided by MSOE, participants will take the certification exam on forth day. Exam will be provided and proctored by IFPS. The test is 3-hours 50-questions multiple-choice type of test. You need to get 35 correct answers out of 50 questions. If you fail you can re-schedule taking the exam at a later time. If you pass, you will be issued a “Pneumatic Specialist" certificate. The certificate is good for five years, after five years you do not need to retake the exam, you need only to report to IFPS indicating that you are still working in the field.

Why Get Certified?

- The “Pneumatic Specialist” certification is an internationally recognized certification.
- The certificate is portable - it goes with the individual wherever they work.
- Certifications help an individual to advance his career and introduce himself to the global job market.
- Certification sets an individual apart as a leader in their chosen field of work.
- Certification will help a vendor provide over-the-top quality and acquire ISO certification easily.
- Certified personnel help make the work environment safe and improve the safety, reliability and efficiency of a machine operation.

Course Agenda:

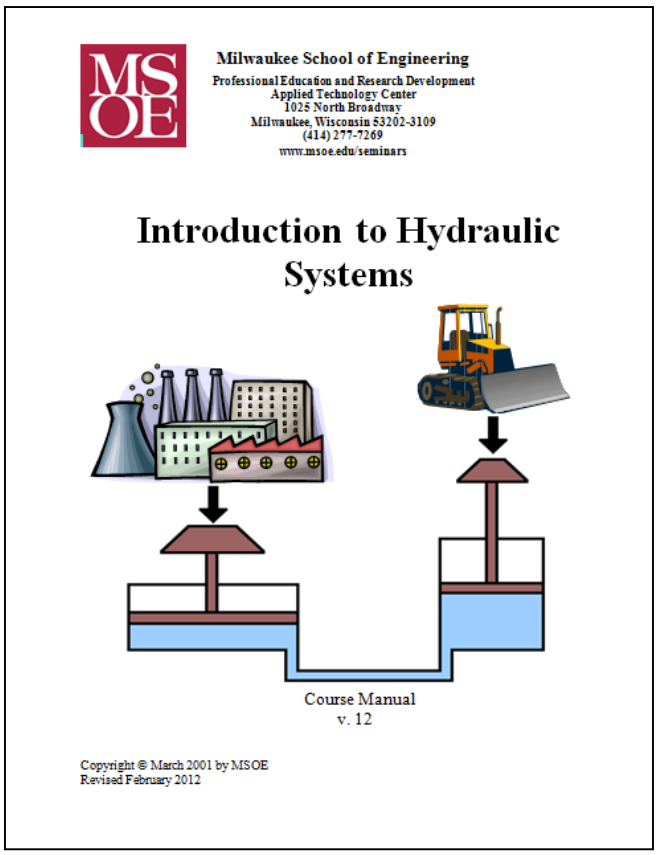
	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.5
	Job Responsibility 1: Load and Motion Analysis	2.5
PM	**Job Responsibility 2:** System Analysis and Troubleshooting	1.5
	Job Responsibility 3: System Design	1.5
	Day 2	**Hr**
AM	**Job Responsibility 3:** Contd.	1.0
	Job Responsibility 4: Component Application	2.0
PM	**Job Responsibility 5:** Air Compress ion and Preparation	1.5
	Job Responsibility 6: Control Components and Systems	1.5
	Day 3	
AM	**Pretest 1 and 2**	3.0
PM	**Pretest 3 and 4**	3.0
	Total	**18**
	Day 4	
AM	**Certification Exam**	3

Introduction to Hydraulic Systems for Application Engineers

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE01	Introduction to Hydraulic Systems for Application Engineers	2.7	27	5	YES	NO	YES	$2160

Course Description:

This 27-hour 5-day seminar is designed to acquaint individuals with the fluid power field and provide a practical working knowledge of this important and growing industry. This program features laboratory sessions where participants will gain practical experience working with actual fluid power components and systems. Specifically, laboratory sessions will treat the disassembly, inspection and assembly of individual components, as well as system design examples. This class explores not only how hydraulic components work, but why it works this way.



Course Agenda:

	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.5
	CH01: Hydraulic Systems Overview	1.5
	CH02: Basic Concepts Review	1
PM	**CH02:** Contd.	1.5
	Lab 1: Energy Losses in Hydraulic Conductors	1
	CH03: Hydraulic Component Sizing Calculations	0.5
	Day 2	**Hr**
AM	**CH04:** Hydraulic Pumps and Motors	3
PM	**Lab 2:** Power Distribution in a Hydraulic System	1
	CH04: Contd.	1.5
	Inspect Pumps and Motors	0.5
	Day 3	**Hr**
AM	**CH05:** Hydraulic Valves Overview	3
PM	**Lab 3:** Valve Coefficient Development.	0.5
	CH05: Contd.	0.5
	CH06: Hydraulic Linear and Rotary Actuators.	1.5
	Lab 4: Motion Control of Hydraulic Cylinder.	0.5
	Day 4	**Hr**
AM	**CH07:** Hydraulic Accumulators.	0.5
	Inspect Valves, Actuators and Accessories.	0.5
	CH08: Hydraulic Circuits for Basic Applications.	2
PM	**CH08**: Contd.	0.5
	Lab 5: Control of Overrunning Loads.	1
	CH08: Contd.	0.5
	Lab 6: Speed Control of Hydraulic Actuator.	1
	Day 5	**Hr**
AM	**CH08:** Contd.	1
	Lab 7: Boosting Speed of Hydraulic Cylinder.	1
	CH08: Contd.	0.5
	Lab 8: Sequence Operation of Hydraulic Cylinder.	0.5
	Machine shutdown Procedure.	
	Total	**27**

Electro-Hydraulic Components and Systems

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE02	Electro-Hydraulic Components and System	2.7	27	5	YES	NO	YES	$2,160

Course Description:

This 27-hour 5-day seminar is designed to cover the knowledge of electrohydraulic components and systems. The seminar also covers the technicalities of in-field tuning of open-loop and closed-loop electro-hydraulic systems. The state-of-the-art Universal Fluid Power Trainers are used to demonstrate the theory presented. Upon the completion of the seminar, participants should be able to recognize the difference in construction, principle of operation and characteristics between ON/OFF valves, proportional valves and servo valves. The seminar covers how to apply real-time control techniques for EH systems and perform infield tuning to adjust the system performance. Additionally the seminar covers EH valve selection criteria and control systems.

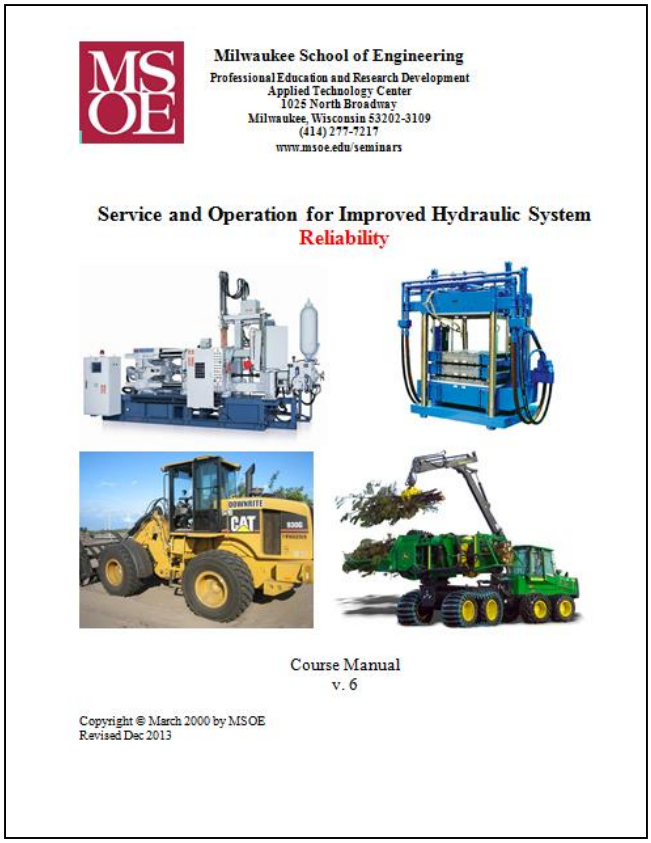
Course Agenda:

	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.25
	CH01: Hydro-Mechanical vs. Electro-Hydraulic Solutions	2.25
	CH02: Electro-hydraulic System Application	0.5
PM	**CH03:** Switching (ON/OFF) Valves-Construction and Operation	2
	Lab Manual - UFPT	0.5
	Lab20: Cylinder extension upon pressing a push-button	0.5
	Day 2	**Hr**
AM	**CH04:** Switching (ON/OFF) Valves-Circuits for Basic Functions	1.5
	Lab21: Signal storage by electrical self-locking	0.25
	Lab22: Electrical locking by means of contactors contact	0.5
	Lab23: Position-dependent cylinder deceleration	0.5
	Lab24: Pressure-Dependent cylinder reversal	0.25
PM	**Lab25:** Event-Dependent warning circuit	0.25
	CH04: Contd. (Practice building circuits without instructor's orientation).	1.25
	CH05: Proportional Valves	1.5
	Day 3	**Hr**
AM	**CH05:** Contd.	2
	Lab26: Cylinder Motion Control Performance using Switching Valve vs. Prop.Valve	0.5
	CH06: Servo Valves	0.5
PM	**CH06:** Contd.	2.5
	Lab27: Cylinder Motion Control Performance using Servo Valve vs. Proportional Valve	0.5
	Day 4	**Hr**
AM	**CH07:** Electro-hydraulic System Design Considerations	1
	Lab28: Digital Control of EH Variable Displacement Pumps	0.5
	CH08: Control Electronics for Electro-Hydraulic Systems	1.5
PM	**CH08:** Contd.	1
	Lab29: Digital Control of Electro-Hydraulic Cylinder Position + Machine Shutdown Procedure	1
	CH09: Valve Selection for an Electro-Hydraulic Controlled Actuator	1
	Day 5	**Hr**
AM	**CH09:** Contd.	2
	CH10: Electro-hydraulic Valves Commissioning and Maintenance	1
	Total	**27**

Service and Operation for Improved Hydraulic System Reliability

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE03	Service and Operation for Improved Hydraulic System Reliability	2.7	27	5	NO	NO	YES	$2,160

Course Description:
This 27-hour 5-day seminar focuses on the topics that must be considered to maximize hydraulic system reliability. The introduced topics can be broadly classified as service-related and operations related. In the service topics, maintenance, troubleshooting and failure analysis techniques of fluid power systems will be discussed. In the operational-related topics, hydraulic fluids, contamination control and filtration technology will be discussed.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Service and Operation for Improved Hydraulic System Reliability

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Course Agenda:

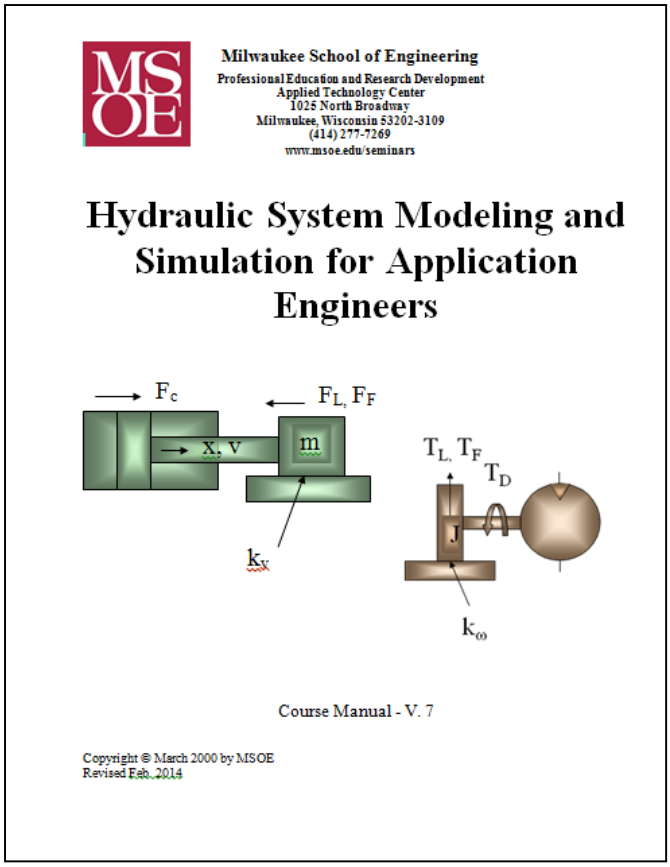
	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.5
	CH01: Hydraulic System Safety	2.5
PM	**CH02:** Hydraulic Fluids	1.5
	CH03: Hydraulic Fluid Seals	1.5
	Day 2	**Hr**
AM	**CH04:** Filtration Technology and Contamination Control	3
	CH05: Filtration Technology and Contamination Control	0.5
	CH06: Hydraulic Conductors	2.5
	Day 3	**Hr**
AM	**CH07:** Hydraulic Reservoirs	1
	CH08: Hydraulic Heat Exchangers	1
	CH09: Hydraulic Measuring Instrument	1
PM	**CH10:** Maintenance of Hydraulic Cylinders	1
	CH11: Maintenance of Hydraulic Pumps and Motors	2
	Day 4	**Hr**
AM	**CH12:** Maintenance of Hydraulic Valves	1.5
	CH13: Maintenance of Hydraulic Accumulators	0.5
	CH14: Hydraulic Components Failure Analysis	1
PM	**CH14:** Contd.	1
	CH15: Hydraulic System Troubleshooting	2
	Day 5	**Hr**
AM	**CH15:** Contd.	3
	Total	**27**

Hydraulic System Modelling and Simulation for Application Engineers

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE04	Hydraulic System Modelling and Simulation for Application Engineers	2.7	27	5	YES	NO	YES	$2,160

Course Description:

This 27-hour 5-day seminar focuses on the technique of building mathematical models with the least amount of design parameters. This technique is designed to help application engineers who are involved in modelling systems at large. The adopted modelling process of a component is based on existing data published by the component's manufacturer. If the data is missing, the class discusses how to identify the dynamics experimentally.



Course Agenda:

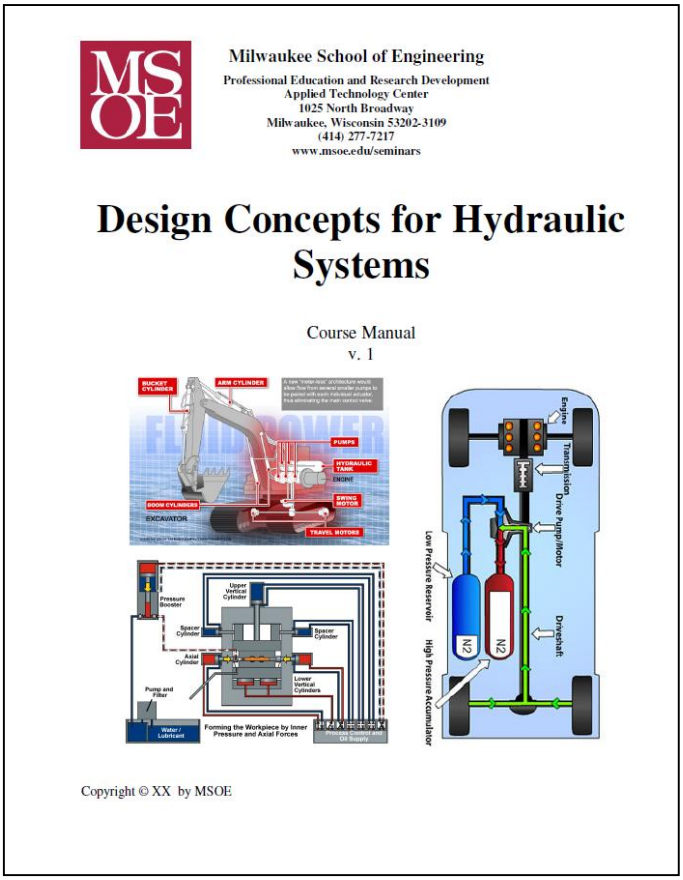
	Course Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)	
	Day 1	**Hr**
AM	Registration and Orientation Session	0.25
	CH01: Introduction to Physical System Modelling and Simulation	0.75
	CH02: Dynamic Systems Modelling, Simulation and Analysis Review	2
PM	**CH02:** Contd.	1.5
	CH03: Hydraulic Components and Systems Modelling Approaches	1.5
	Day 2	**Hr**
AM	**CH04:** Fluid Properties Modelling	1.5
	CH05: Hydraulic Conductors Modelling	1,5
PM	**CH06:** Hydraulic Pumps Modelling for Application Engineers	2
	Lab09: Pump Static Characteristic Measuring	0.5
	Lab10: Pump Step Response Measuring	0.5
	Day 3	**Hr**
AM	**CH07:** Hydraulic Motors Modelling for Application Engineers	2
	Lab11: Hydraulic Motor U-n Static Characteristics	0.5
	Lab12: Identify Hydraulic Motor Dynamics	0.5
PM	**CH08:** Hydraulic Cylinders Modelling for Application Engineers	1.5
	Lab13: Identify Horizontal Cylinder Dynamics	0.5
	CH09: Hydraulic Valves Modelling for Application Engineers	1
	Day 4	**Hr**
AM	**CH09:** Contind.	1
	Lab14: Proportional Valve Flow Gain Measuring	1
	Lab15: Servo Valve Flow Gain Measuring	1
PM	**CH10:** EH Cylinder Position Control System Modelling	0.5
	Lab16: EH Position Controlled Hydraulic Cylinder Step Response	0.5
	Lab17: EH Position Controlled Hydraulic Cylinder Frequency Response	0.5
	CH11: EH Motor Speed Control System Modelling	0.5
	Lab18: EH Speed Controlled Hydraulic Motor Step Response	0.5
	Lab19: EH Speed Controlled Hydraulic Motor Frequency Response	0.5
	Day 5	**Hr**
AM	**CH12:** Practice Hydraulic System Simulation using Hardware-in-the-Loop Technique	1.5
	CH13: Practice Hydraulic System Simulation using Automation Studio	1.5
	Total	**27**

Design Concepts of Hydraulic Systems

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE05	Design Concepts of Hydraulic Systems	2.7	27	5	YES	NO	UD	$2,160

Course Description:
This 27-hour 5-day seminar focuses on the control strategies as applied to hydraulic systems including reviewing basic control theory. The seminar covers various methods of controlling hydraulic systems using open versus closed loop, using PC-Based Control versus PLC-based control. The seminar also covers sensors calibration and the step-by-step calculation for sizing electro-hydraulic systems to meet certain dynamics.

Course Agenda:
Under-development.



Control Strategies for Hydraulic Systems

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE06	Control Strategies for Hydraulic Systems	2.7	27	5	YES	NO	UD	$2,160

Course Description:
This 27-hour 5-day seminar focuses on the design concepts of hydraulic systems including understanding component design and sizing calculations. The seminar covers lots of system design technicalities including fail safe design, noise reduction, energy saving strategies and other basic system requirements. The seminar contains valuable information for hydraulic components designers as well as the application engineers.

Course Agenda:
Under-development.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Control Strategies for Hydraulic Systems

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Introduction to Pneumatic Systems for Application Engineers

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE07	Introduction to Pneumatic Systems for Application Engineers	1.8	18	3	YES	NO	UD	$1,440

Course Description:
This 18-hour 3-day seminar is designed to cover pneumatic systems in-depth, including design concepts and calculations. The seminar covers sizing calculations, read schematics, mechanical valves, actuators, compressors and air treatment.

Course Agenda:
Under-development.

Electro-Pneumatic Components and Systems

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
MSOE08	Electro-Pneumatic Components and Systems	1.8	18	3	YES	NO	UD	$1,440

Course Description:
This 18-hour 3-day seminar is designed to cover in-depth electro-pneumatics including components and systems. The seminar covers solenoid and proportional valves, pneumatic accessories used in industrial automation and how to use pneumatic devices to build open and closed loop control systems.

Course Agenda:
Under-development.


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Electro-Pneumatic Components and Systems

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Fluid Power Systems Professional

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP01	Fluid Power System Professional	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-hour 5-day seminar covers topics relating to the design, application, and maintenance of fluid power (hydraulic and pneumatic) systems. This program is redesigned and includes expanded contents on hydraulic pumps, fluid power systems, components, and devices specific to industrial, commercial, and mobile power equipment applications. To assure high level of contribution of the participants, each chapter ends with a self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on first one. A CD-ROM is included and contains information to supplement the textbook.

Course Agenda:

Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	2	0
	CH01: Fluid Power Systems in Industry	1	12
PM	**CH02:** Fluid Power Systems Principles	1	22
	CH03: Hydraulic System Fundamentals	1	22
	CH04: Fluid Conductors and Connectors	1	22
	Day 2	**Hr**	
AM	**CH05:** Hydraulic Pumps	1.5	30
	CH06: Directional Control	1.5	30
PM	**CH07:** Flow Control	1.5	21
	CH08: Hydraulic Actuators	1.5	27
	Day 3	**Hr**	
AM	**CH09:** Pressure Control	1.5	17
	CH10: Hydraulic Fluid Maintenance	1.5	21
PM	**CH11:** Pneumatic System Fundamentals	1	14
	CH12: Pneumatic System Compression and Control	2	29
	Day 4	**Hr**	
AM	**CH13:** Pneumatic System Conditioning	1	16
	CH14: Fluid Power System Electrical Control	2	25
PM	**CH15:** Fluid Power System Maintenance and Trouble Shooting	1	15
	Review and conclusion	2	
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

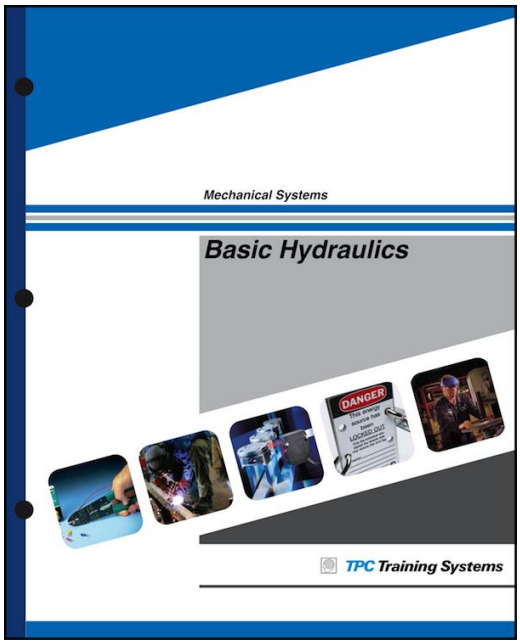
Basic Hydraulics

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 307	Basic Hydraulics	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers hydraulic principles in a reduced form more suitable for technicians. Topics covered are types of hydraulic fluids and their characteristics. The class describes components of the hydraulic system and their functions, including filters and strainers, reservoirs and accumulators, pumps, piping, tubing and hoses, control valves, relief valves, actuating devices and a variety of cylinders and hydraulic motors.

To assure high level of contribution of the participants, each chapter concludes with a self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on the first one.



Course Agenda:

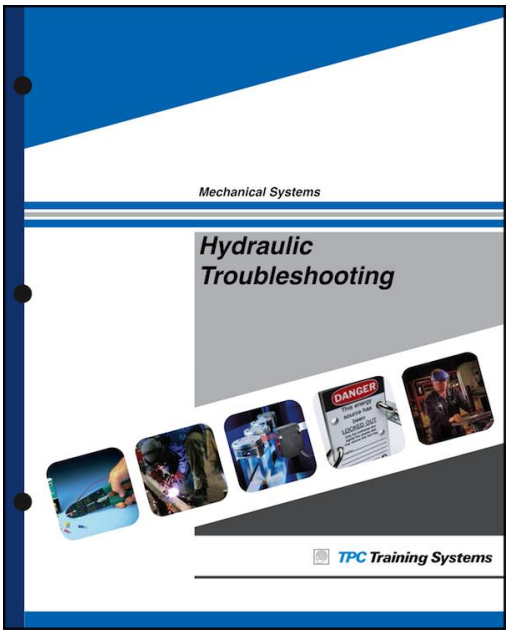
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Hydraulics	1	14
	CH02: Hydraulic Fluids	1	8
	CH03: Strainers and Filters	1	12
PM	**CH04:** Reservoirs and Accumulators	1	17
	CH05: Hydraulic Pumps	1	15
	CH06: Piping, Tubing, and Fittings	1	13
	Day 2	Hr	
AM	**CH07:** Directional Control Valves	1	18
	CH08: Pressure-Control Valves	1	17
	CH09: Cylinders	1	14
PM	**CH10:** Hydraulic Motors	1	13
	Total Contact Hours	10	
	Certification Exam	2	

Hydraulic Troubleshooting

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 308	Hydraulic Troubleshooting	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers understanding the systems, using schematic diagrams, installation procedures, cleanliness and safety. Includes tubing cutting, bending, and flaring, identification and selection of proper fluids, and charging the system. Discusses planned maintenance, specific repair/replacement recommendations, system diagnosis, and troubleshooting. To assure high level of contribution of the participants, each chapter concludes with a self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on first one.



Course Agenda:

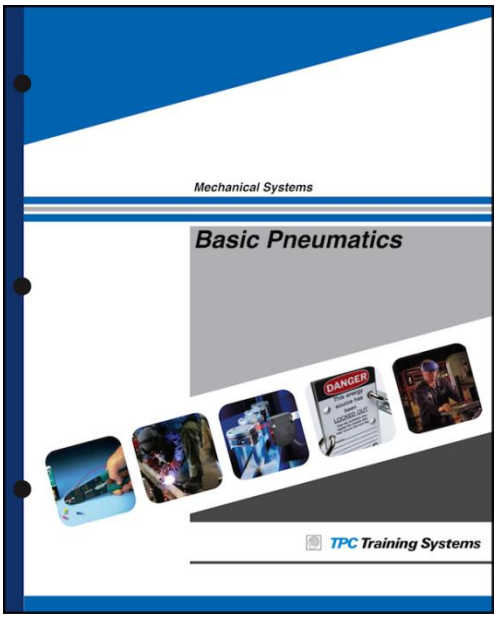
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Hydraulic Systems	1	12
	CH02: Hydraulic Schematic Diagrams	1	8
	CH03: Installing Hydraulic Components	1	10
PM	**CH04:** Installing Pipes and Tubes	1	12
	CH05: Selecting Hydraulic Fluids	1	7
	CH06: Planning System Maintenance	1	9
	Day 2	Hr	
AM	**CH07:** Troubleshooting Systems	1	4
	CH08: Troubleshooting Valves	1	8
	CH09: Troubleshooting Cylinders	1	9
PM	**CH10:** Troubleshooting Pumps and Motors	1	7
	Total Contact Hours	10	
	Certification Exam	2	

Basic Pneumatic

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 309	Basic Pneumatic	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers hydraulic principles in a reduced form more suitable for technicians. Topics covered are how work, force, and energy are applied to principles of pneumatics. Shows operating principles of reciprocating, positive displacement, rotary, and dynamic air compressors. Covers primary and secondary air treatment. Includes valves, logic devices, cylinders, and air motors. To assure high level of contribution of the participants, each chapter concludes with a self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on first one.



Course Agenda:

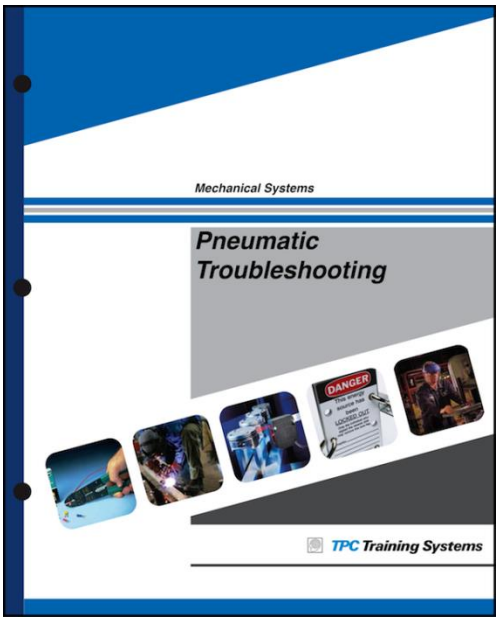
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Pneumatic Principles	1	19
	CH02: Reciprocating Compressors	1	11
	CH03: Rotary Compressors	1	13
PM	**CH04:** Primary Air Treatment	1	14
	CH05: Secondary Air Treatment	1	10
	CH06: Piping, Hoses, and Fittings	1	16
	Day 2	Hr	
AM	**CH07:** Directional Control Valves	1	14
	CH08: Pressure Control Valves	1	9
	CH09: Pneumatic Cylinders	1	12
PM	**CH10:** Pneumatic Motors and Rotary Actuators	1	14
	Total Contact Hours	10	
	Certification Exam	2	

Pneumatic Troubleshooting

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 310	Pneumatic Troubleshooting	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers pneumatic systems, schematic symbols and diagrams, installing system components, planned maintenance, system diagnosis, and troubleshooting. Includes maintenance of air compressors, control valves, air motors, electrical components, and hybrid systems. To assure high level of contribution of the participants, each chapter concludes with a self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on the first one.



Course Agenda:

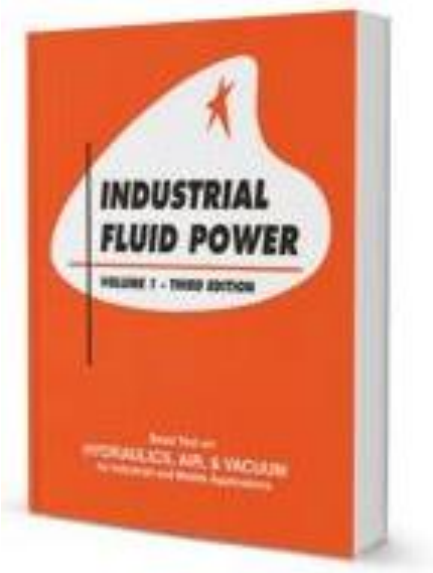
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Pneumatic Systems	1	7
	CH02: Pneumatic Schematic Diagrams	1	13
	CH03: Installation of System Components	1	12
PM	**CH04:** System Maintenance	1	8
	CH05: Determining System Failures	1	6
	CH06: Troubleshooting Air Compressors	1	8
	Day 2	Hr	
AM	**CH07:** Troubleshooting Control Valves	1	8
	CH08: Troubleshooting Cylinders	1	12
	CH09: Troubleshooting Air Motors	1	14
PM	**CH10:** Pneumatic/Hydraulic Systems	1	11
	Total Contact Hours	10	
	Certification Exam	2	

Overview of Fluid Power Systems

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
WMK01	Overview of Fluid Power Systems	0.6	6	1	NO	NO	NO	$480

Course Description:

This 6-hour one-day course is an introductory overview of fluid power (hydraulic and pneumatic) technology. It is not a scientific study, instead it focuses on hydraulics practiced in the field. In this course, we overview basic principles and components along with simple circuitry. Text book will given to students. You will find many charts of design data at the back of the text book. When you have completed this study, and if you are a serious student, you will want to continue your study with the more advanced courses.



Course Agenda:

Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 – 4)

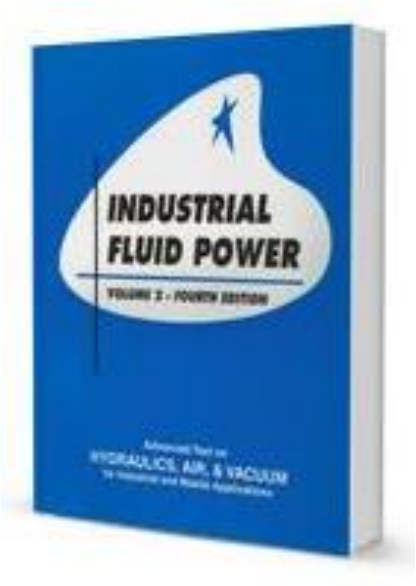
	Day 1	Hr	# of Slides
AM	**CH01:** Fluid Power Principles	1	46
	CH02: Fluid Power Cylinders	1	78
	CH03: Fluid Power Valves I	1	64
PM	**CH04:** Fluid Power Valves II	1	46
	CH05: Fluid Power Pumps	1	47
	CH06: Fluid Power Accessories	1	40
	Total Contact Hours	6	

Fluid Power Applications

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
WMK02	Fluid Power Applications	1.2	12	2	NO	NO	NO	$960

Course Description:

This 12-hour 2-day course covers fluid power (hydraulic and pneumatic) application. Topics include circuits to perform, pressure control, speed control and general actuator motion actuator (hydraulic and pneumatic). Text book will be given to students. When you have completed this study, and if you are a serious student, you will want to continue your study with more advanced courses.



Course Agenda:

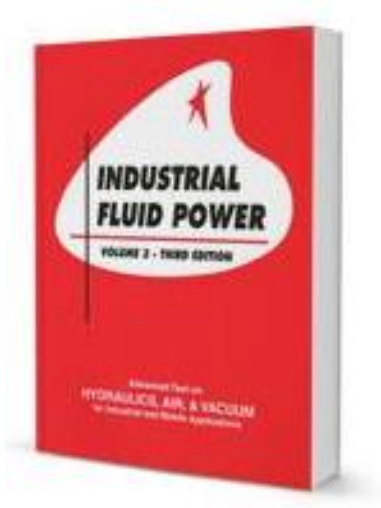
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Fluid Power Cylinders	1	27
	CH02: Introduction To Air Circuitry	1	32
	CH03: Several Cylinders On One Machine	1	26
PM	**CH04:** Automatic Reciprocation	1	13
	CH05: Miscellaneous Air Circuits	1	14
	CH06: Hydraulic Circuitry	1	9
	Day 2	Hr	# of Slides
AM	**CH07:** Directional Control	1.5	65
	CH08: Pressure Control	1.5	48
PM	**CH09:** Speed Control	0.75	15
	CH10: Hydraulic Circuit	0.75	14
	CH11: Pressure Intensification	0.75	18
	CH12: Air Over Oil Applications	0.75	12
	Total Contact Hours	12	

Hydraulic Motors Construction and Operation

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
WMK03	Hydraulic Motors Construction and Application	1.2	12	2	NO	NO	NO	$960

Course Description:

This 12-hour 2-day course covers fluid power rotational actuators (hydraulic and pneumatic) construction and application technology. It is not a scientific study, instead it covers practices used in the field. In this course, we overview various constructions of air and hydraulic motors and samples of circuits and applications using rotational motion. Text book will given to students. You will find many charts of design data at the back of the text book. When you have completed this study, and if you are a serious student, you will want to continue your study with more advanced courses.



Course Agenda:

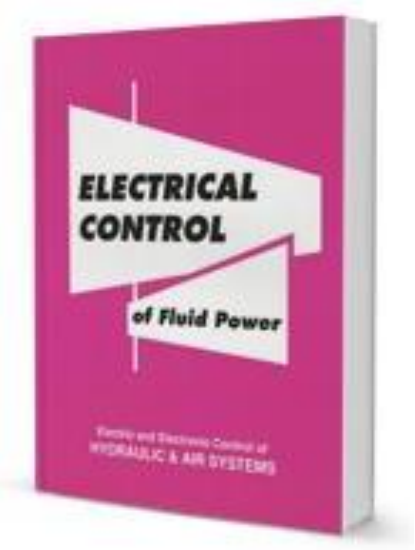
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Hydraulic Motors Compared To Hydraulic Pumps	1	16
	CH02: A Review Of Force	1	19
	CH03: Torque Determination	1	13
PM	**CH04: Hydraulic and Electric Motors Compared**	0.5	7
	CH05: Motor Circuits For One Direction of Rotation	1.5	30
	CH06: Basic Methods Of Motor Speed Control	1	27
	Day 2	**Hr**	**# of Slides**
AM	**CH07: Side Loading On Motor Shaft**	1	10
	CH08: The Closed Loop For Transmitting Power	1	23
	CH09: Air Motor Types	1	10
PM	**CH10:** Rotary Actuators	1	12
	CH11: Rotary-Type Flow Dividers	1	22
	CH12: Types Of Steering Linkage	0.5	5
	CH13: Tension Stressing	0.5	13
	Total Contact Hours	**12**	

Electrical Control of Fluid Power

Fluid Power Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
WMK04	Electrical Control of Fluid Power	1.2	12	2	NO	NO	UD	$960

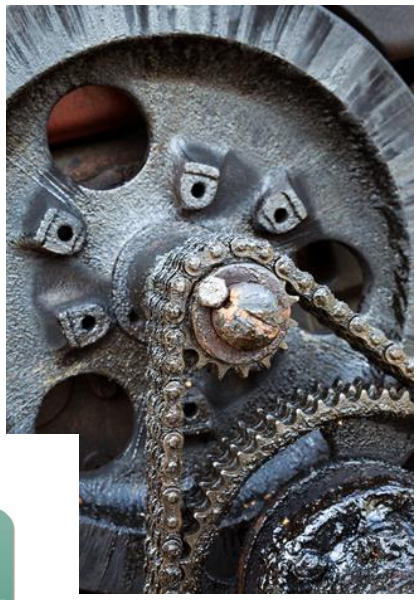
Course Description:

This 12-hour 2-day course covers concepts in one way or another related to electrical circuits for controlling air and hydraulic fluid power machines. Starting with a simple explanation of some of the common components, it ends with a study of servo valves, proportional solenoid valves, and electronic programmable controllers. No attempt is made to cover theory or laws of electricity. All material is on a practical basis, with laws, theory, and mathematics avoided as much as possible. Text book will given to students. You will find many charts of design data at the back of the text book. When you have completed this study, and if you are a serious student, you will want to continue your study with more advanced courses.



Course Agenda:

Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	Hr	# of Slides
AM	**CH01:** Popular Fluid and Electrical Components	1	28
	CH02: How to Draw and Read Electrical Diagrams	1	5
	CH03: Directional Control; Reciprocation of Cylinders	1	28
PM	**CH04:** Directional Control; Sequencing of Cylinders	1	25
	CH05: Pressure Control by Electrical Means	1	13
	CH06: Solving Design Problems in Electrical Circuitry	1	16
	Day 2	Hr	# of Slides
AM	**CH07:** Miscellaneous Applications	1	28
	CH08: Safety Circuits	1	20
	CH09: Electric Motors and Motor Starters	1	10
PM	**CH10:** Programmable Controllers	1	14
	CH11: Servo Valves and Systems	1	16
	CH12: Proportional Solenoid Valves	1	18
	Total Contact Hours	12	



Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under-development.

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Courses can be mobilized to your facility.
Courses in this sectors are non-scheduled courses offered only in customer-site.
If there is an interest, please contact Dr. Medhat Khalil directly.

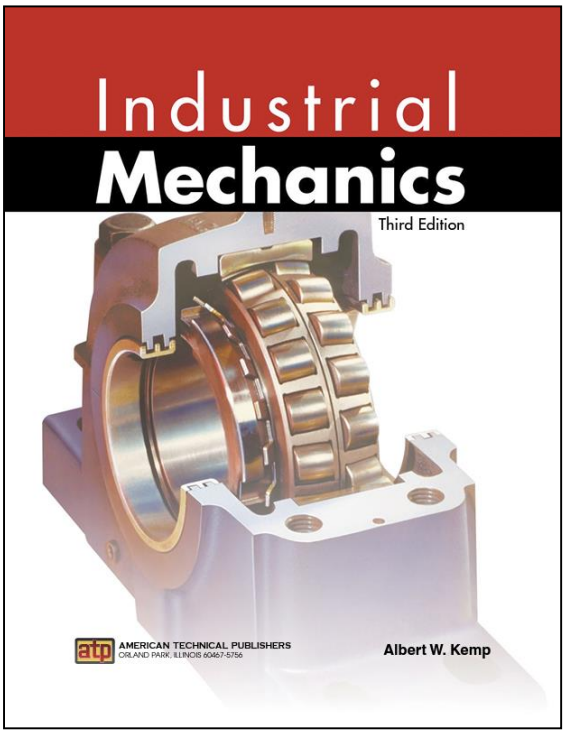
Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP02	Industrial Mechanics	2.7	27	5	NO	YES	NO	$2,160
ATP03	Small Engines	2.1	21	4	NO	YES	NO	$1,680
ATP04	Low Pressure Boilers	1.8	18	3	NO	YES	NO	$1,440
ATP05	High Pressure Boilers	1.8	18	3	NO	YES	NO	$1,440
TPC102	Reading Schematics and Symbols	1.0	10	2	NO	YES	NO	$800
TPC103	Mathematics in the Plant	1.0	10	2	NO	YES	NO	$800
TPC104	Making Measurement	1.0	10	2	NO	YES	NO	$800
TPC 301	Basic Mechanics	1.0	10	2	NO	YES	NO	$800
TPC 302	Lubricants and Lubrication	1.0	10	2	NO	YES	NO	$800
TPC 303.1	Power Transmission Equipment	0.8	8	2	NO	YES	NO	$640
TPC 304	Bearings	1.0	10	2	NO	YES	NO	$800
TPC 305	Pumps	1.0	10	2	NO	YES	NO	$800
TPC 306	Piping Systems	1.0	10	2	NO	YES	NO	$800

Industrial Mechanics

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP02	Industrial Mechanics	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-hour 5-day seminar presents an overview of the principles of industrial mechanical systems and the equipment in these systems. This seminar presents the latest information on all aspects of mechanical systems, including rigging, lifting, ladders and scaffolds, hydraulic systems, pneumatic systems, lubrication, bearings, belts and pulleys, mechanical drives, vibration, alignment, and electricity. Industrial Mechanics is designed for postsecondary, industrial, and apprenticeship training programs. To assure high level of contribution of the participants, each chapter concludes with self assessment test. Certification will be granted only for people who pass the final Certification Exam. Post test will be retaken by people who failed on first one. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

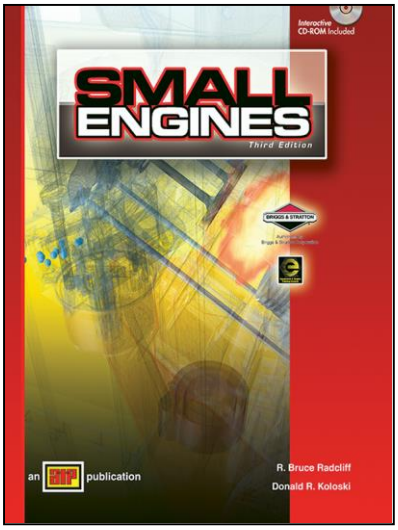
Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)			
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	2	0
	CH01: Industrial Safety	1	28
PM	**CH02:** Precision Measurement	1.5	44
	CH03: Print reading	1.5	46
	Day 2	**Hr**	
AM	**CH04:** Tools (self Study)	0	28
	CH05: Calculations	1	21
	CH06: Rigging (self Study)	0	64
	CH07: Lifting	1	36
	CH08: Ladders and Scaffolds (Self Study)	0	29
	CH09: Hydraulic Principles	1	30
PM	**CH10:** Hydraulic Applications	3	60
	Day 3	**Hr**	
AM	**CH11:** Pneumatic Principles	1	21
	CH12: Pneumatic Applications	1	35
	CH13: Lubrication	1	16
PM	**CH14:** Bearings	1	22
	CH15: Flexible Belt Drives	1	22
	CH16: Mechanical Drives	1	18
	Day 4	**Hr**	
AM	**CH17:** Vibration	1	24
	CH18: Alignment	1	30
	CH19: Electricity	1.5	33
	CH20: Preventive Maintenance Programs	1.5	24
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Small Engines

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP03	Small Engines	2.1	21	4	NO	YES	NO	$1,680

Course Description:

This 21-hour 4-day seminar presents Small Engines in a comprehensive textbook that presents small engine operation and service principles using concise text, detailed illustrations, and practical applications. The content is based on technician requirements put forth by Briggs & Stratton. The seminar explains the why of engine design and the how of operation as well as basic repair. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

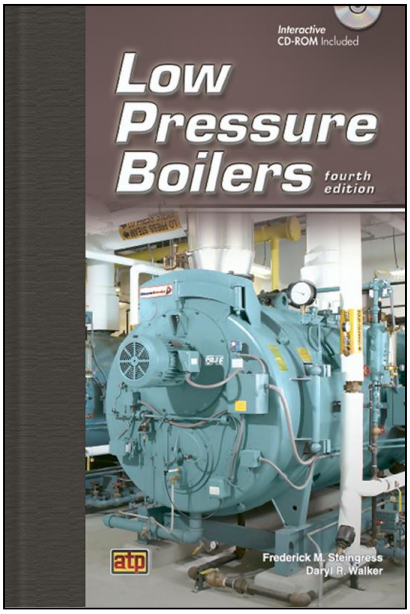
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	2	0
	CH01: Internal Combustion Engine	1	25
PM	**CH02:** Safety & Tools	1.5	25
	CH03: Engine Operation	1.5	28
	Day 2	**Hr**	
AM	**CH04:** Compression System	1.5	36
	CH05: Fuel System	1.5	39
PM	**CH06:** Governor System	1	26
	CH07: Electrical System	2	41
	Day 3	**Hr**	
AM	**CH08:** Cooling and Lubrication System	1	29
	CH09: Multiple Cylinder Engines	1	18
	CH10: Troubleshooting	1	32
PM	**CH11:** Failure Analysis	1	24
	CH12: Engine Application and Selection	2	49
	Day 4	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**21**	

Low Pressure Boilers

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP04	Low Pressure Boilers	1.8	18	3	NO	YES	NO	$1,440

Course Description:

This 18-hour 3-day seminar presents information on the safe and efficient operation of low pressure steam boilers and related equipment, hot water boilers, and cooling systems. The provided textbook covers the new ASME symbol stamps, integrated boiler controls, code requirements for bottom blow down, feed water regulators, emissions regulations and New Source Performance Standards, variable-speed drives, diaphragm draft gauges, water treatment programs and solubilizing water treatments. Energy efficiency and environmental issues are emphasized throughout. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

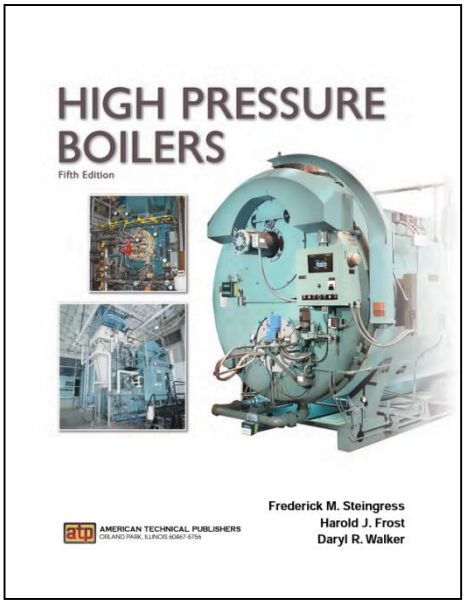
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	2	0
	CH01: Boiler Operation Principles	1	26
PM	**CH02:** Boiler Fittings	1	24
	CH03: Feed water Systems	1	20
	CH04: Steam System Accessories	1	14
	Day 2	**Hr**	
AM	**CH05:** Fuel Systems	1	32
	CH06: Draft System	1	9
	CH07: Boiler Water Treatment	1	21
PM	**CH08:** Boiler Operation Procedures	1	22
	CH09: Hot Water Heating Systems	1	26
	CH10: Cooling Systems	1	28
	Day 3	**Hr**	
AM	**CH11:** Boiler Operation Safety	1.5	20
	CH12: Boiler Operator Licensing	1.5	29
PM	**Review and conclusion**	1	0
	Certification Exam	2	0
	Total	**18**	

High Pressure Boilers

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP05	High Pressure Boilers	1.8	18	3	NO	YES	NO	$1,440

Course Description:

This 18-hour 3-day seminar presents provides a comprehensive overview of the safe and efficient operation of high pressure boilers and related equipment. The latest combustion control technology, as well as EPA regulations and their implications, are included in this seminar. This edition has been reorganized to provide a systems view of boiler operation. All aspects of high pressure boilers are discussed and illustrated. The provided text book contains comprehensive glossary and appendix provide helpful reference material. This textbook is designed for both learners preparing to obtain a boiler operator's license and for boiler operators intending to upgrade their skills. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

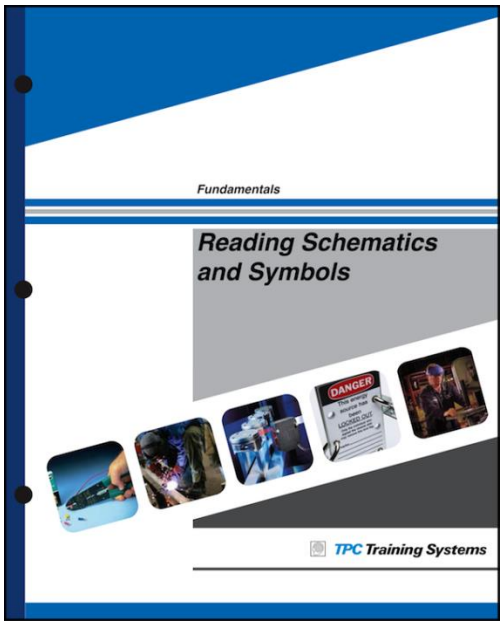
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	1.5	0
	CH01: Steam Boilers	1.5	35
PM	**CH02:** Boiler Systems	1	14
	CH03: Steam System Fittings	1	21
	CH04: Steam System Accessories	1	25
	Day 2	**Hr**	
AM	**CH05: Feed-Water Systems**	1	24
	CH06: Water Treatment	1	28
	CH07: Combustion Equipment	1	27
PM	**CH08:** Fuels and Combustion	1	11
	CH09: Combustion and Boiler Controls	1	23
	CH10: Draft Systems	1	17
	Day 3	**Hr**	
AM	**CH11:** Instrumentation and Control Systems	1.5	38
	CH12: Steam Boiler Operation	1.5	43
PM	**Review and conclusion**	1	0
	Certification Exam	2	0
	Total	**18**	

Reading Schematics and Symbols

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC102	Reading Schematics and Symbols	1.0	10	2	NO	YES	NO	$800

Course Description:

This 12-hour 2-day seminar covers all types of schematics and symbols used in commercial and industrial settings. Examines symbols on schematics, electrical symbols and diagrams, piping symbols and diagrams, hydraulic and pneumatic diagrams and symbols. Discusses air conditioning and refrigeration systems, including explanations of electrical/electronic control schematics. Covers welding and joining symbols.



Course Agenda:

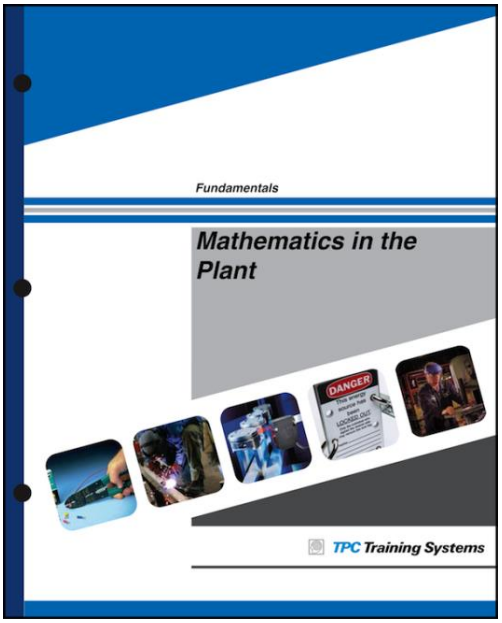
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Introduction to Schematics and Symbols	1	
	CH02: Symbols on Schematics	1	
	CH03: Electrical Symbols	1	
PM	**CH04:** Electrical Diagrams	1	
	CH05: Piping Symbols	1	
	CH06: Piping Diagrams	1	
	Day 2	**Hr**	
AM	**CH07:** Hydraulic and Pneumatic Symbols	1	
	CH08: Hydraulic and Pneumatic Diagrams	1	
	CH09: Air Conditioning and Refrigeration Systems	1	
PM	**CH10:** Welding and Joining Symbols	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Mathematics in the Plant

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC103	Mathematics in the Plant	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hours 2-day seminar begins by introducing mathematical basics-numbers and numerals, subtraction, addition, multiplication, and division. Examines common fractions and decimal fractions, ratios and proportions, powers and roots. Discusses the calculator: usage, basic and special functions, internal logic, and special purpose calculators. Moves on to cover geometry, algebra, and formulas for problem solving. Concludes by explaining properties of triangles and trig and inverse trig functions.



Course Agenda:

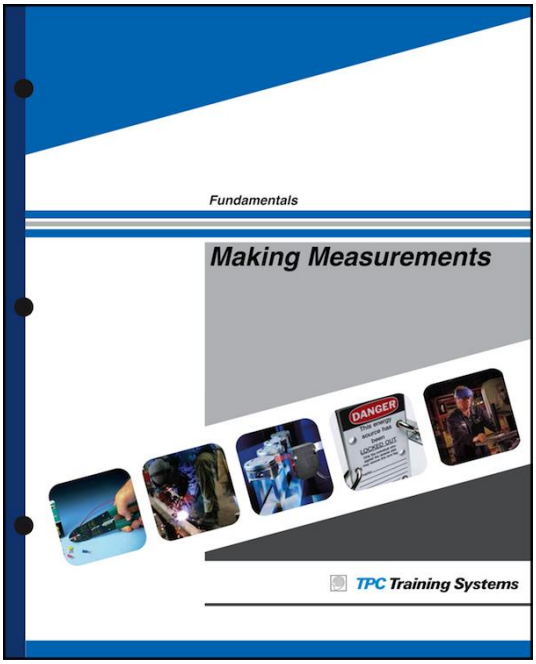
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Whole Numbers	1	
	CH02: Common Fractions	1	
	CH03: Decimal Fractions	1	
PM	**CH04:** Ratios and Proportions	1	
	CH05: Powers and Roots	1	
	CH06: Calculators	1	
	Day 2	**Hr**	
AM	**CH07:** Geometry	1	
	CH08: Algebra	1	
	CH09: Using Formulas	1	
PM	**CH10:** Trigonometry	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Making Measurement

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC104	Making Measurement	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers units of measurement used in commercial and industrial applications. Examines all aspects of basic measurement concepts and procedures, including accuracy and tolerance. Discusses techniques and devices for comparison measurements (dial indicators and gauge blocks). Shows common methods for measuring volume, motion, force, temperature, fluid flow, and electricity. Explains how to use scales and rules, combination calipers, and micrometers.



Course Agenda:

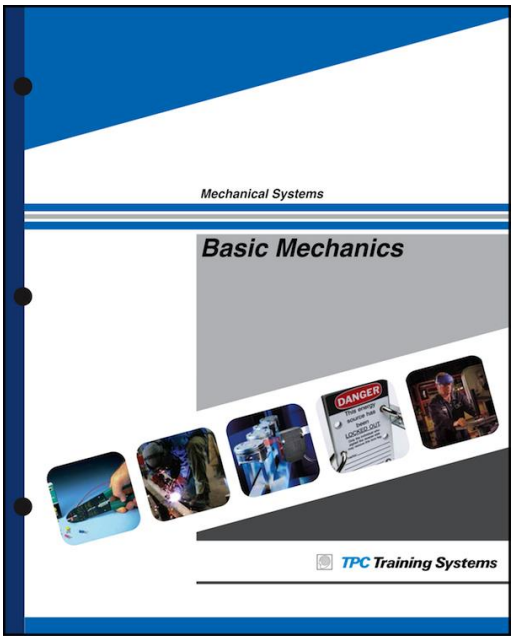
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Units of Measurement	1	
	CH02: Metric Measurement	1	
	CH03: Linear Measurement	1	
PM	**CH04:** Comparison and Surface Measurement	1	
	CH05: Measuring Bulk Materials	1	
	CH06: Measuring Motion	1	
	Day 2	**Hr**	
AM	**CH07:** Measuring Forces	1	
	CH08: Measuring Temperature	1	
	CH09: Measuring Fluids	1	
PM	**CH10:** Measuring Electricity	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Basic Mechanics

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 301	Basic Mechanics	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers force and motion, work and energy, and fluid mechanics as applied in industrial maintenance. Explains principles of operation for simple machines, such as the lever, inclined plane, wheel and axle, pulley, and screw. Explains the basic elements of industrial machines, as well as common measurement tools used to monitor and adjust equipment. Covers hand tools, power tools and fasteners, ending with a discussion of ways to reduce friction and wear.



Course Agenda:

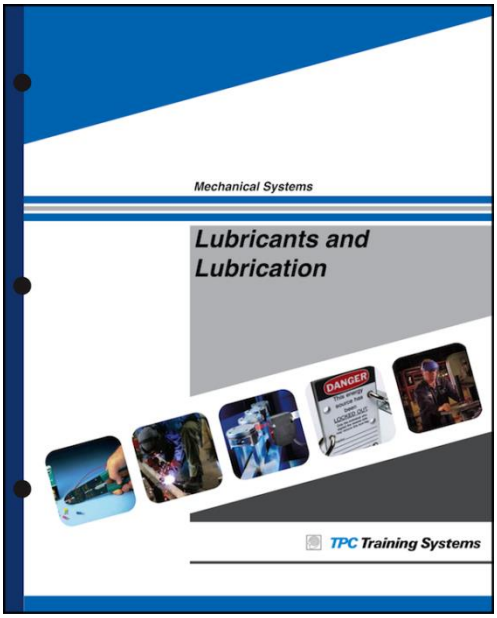
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Forces and Motion	1	
	CH02: Work, Energy, and Power	1	
	CH03: Fluid Mechanics	1	
PM	**CH04:** Simple Machines	1	
	CH05: Machine Elements	1	
	CH06: Measurement Tools and Instruments	1	
	Day 2	**Hr**	
AM	**CH07:** The Safe Use of Hand Tools	1	
	CH08: The Safe Use of Portable Power Tools	1	
	CH09: Fasteners	1	
PM	**CH10:** Friction and Wear	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Lubricants and Lubrication

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 302	Lubricants and Lubrication	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers a complete lubrication training program, including functions and characteristics of lubricants, factors in selection of lubricants, and effects of additives. Oils, greases, and other compounds used for lubrication are described, as well as their applications. Lubrication methods and recommended storage and handling procedures are included.



Course Agenda:

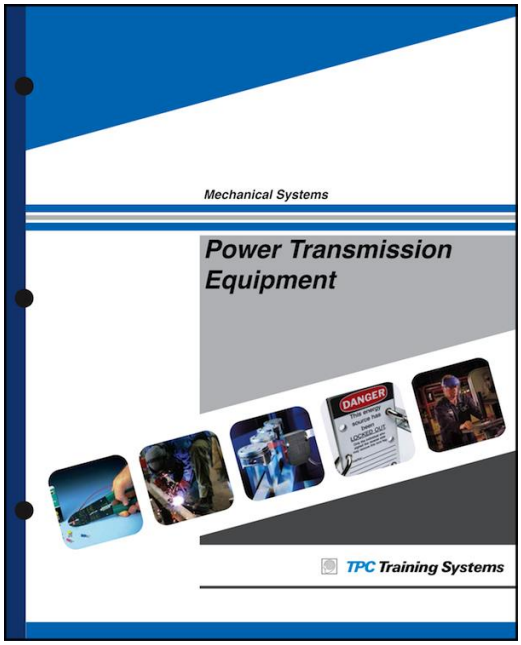
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Principles of Lubrication	1	
	CH02: Lubricant Characteristics	1	
	CH03: Additives, Lub. Action, & Bearing Lub.	1	
PM	**CH04:** Oils and Their Applications	1	
	CH05: General-Purpose Greases	1	
	CH06: Special-Purpose Greases and Dry-Film Lubricants	1	
	Day 2	**Hr**	
AM	**CH07:** Lubrication Systems and Methods	1	
	CH08: Automatic Lubrication Methods	1	
	CH09: Lubricant Storage and Handling	1	
PM	**CH10:** Lubrication Management	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Power Transmission Equipment

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 303.1	Power Transmission Equipment	0.8	8	2	NO	YES	NO	$640

Course Description:

This 10-hour 2-day seminar covers belt drives, chain drives, gears and gear drives, adjustable-speed drives, shaft alignment, shaft coupling devices, and clutches and brakes.



Course Agenda:

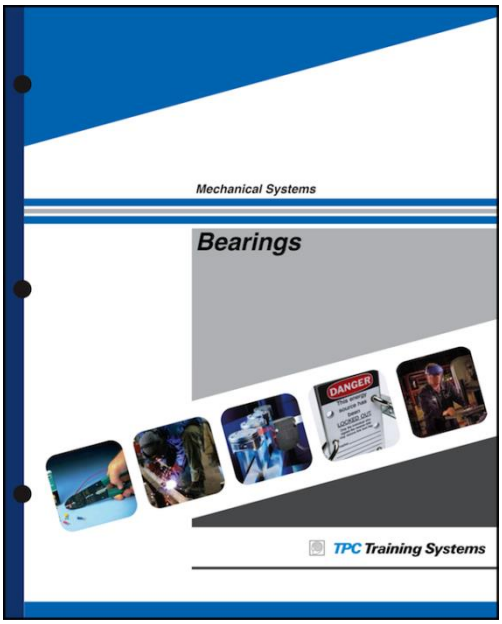
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Belt Drives	1	
	CH02: Chain Drives	1	
	CH03: Gears	1	
PM	**CH04:** Gear Drives	1	
	CH05: Adjustable-Speed Drives	1	
	CH06: Shaft Alignment	1	
	Day 2	**Hr**	
AM	**CH07:** Shaft Coupling Devices	1	
	CH08: Clutches and Brakes	1	
	Total Contact Hours	**8**	
	Certification Exam	**2**	

Bearings

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 304	Bearings	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers principles and applications of various types of bearings, including plain journal, ball, and roller bearings. Explains installation, inspection and repair of bearings. Deals with specialized bearings, including powdered-metal, nonmetallic, and hydrostatic bearings. Covers bearing seals, lubrication, and maintenance practices.



Course Agenda:

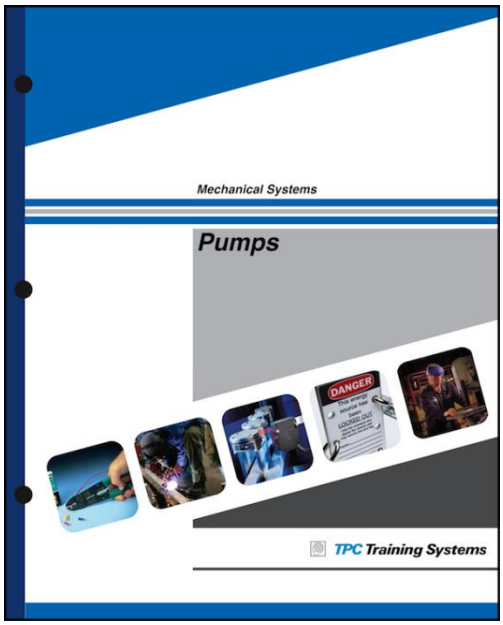
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Bearings and Shafts	1	
	CH02: Plain Journal Bearings I	1	
	CH03: Plain Journal Bearings II	1	
PM	**CH04:** Antifriction Bearings I	1	
	CH05: Antifriction Bearings II	1	
	CH06: Ball and Roller Bearings	1	
	Day 2	**Hr**	
AM	**CH07:** Specialized Bearings	1	
	CH08: Bearing Seals	1	
	CH09: Lubrication	1	
PM	**CH10:** Bearing Maintenance	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Pumps

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 305	Pumps	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers typical applications of various types of pumps. Describes factors affecting pump selection. Explains operating principles of centrifugal, propeller, and turbine, rotary, reciprocating, and metering pumps. Includes special-purpose pumps, diaphragm pumps, and others designed to handle corrosive and abrasive substances. Covers pump maintenance, packing gland, seal, and bearing replacement.



Course Agenda:

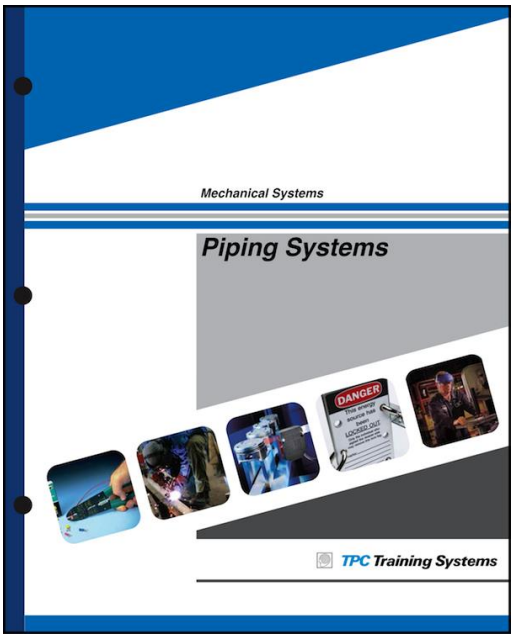
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Pump Development and Application	1	
	CH02: Basic Pump Hydraulics	1	
	CH03: End-Suction Centrifugal Pumps	1	
PM	**CH04:** Propeller and Turbine Pumps	1	
	CH05: Rotary Pumps	1	
	CH06: Reciprocating Pumps	1	
	Day 2	**Hr**	
AM	**CH07:** Metering Pumps	1	
	CH08: Special-Purpose Pumps	1	
	CH09: Packings and Seals	1	
PM	**CH10:** Pump Maintenance	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Piping Systems

Mechanical Systems Training								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 306	Piping Systems	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers piping and tubing systems used for fluid transport in the plant: hydraulic fluids, steam, liquefied product, refrigerant, and water. Shows typical metallic and nonmetallic piping systems, pipe-joining methods, and how tubing and hoses differ from piping. Covers valves, pipe fittings, hangers, supports, and insulation, and shows how tubing is sized, fitted, bent, and joined. Explains uses of traps, filters, and strainers.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Introduction to Piping Systems	1	
	CH02: Metal Piping	1	
	CH03: Nonmetallic Piping	1	
PM	**CH04:** Tubing	1	
	CH05: Hoses	1	
	CH06: Fittings	1	
	Day 2	**Hr**	
AM	**CH07:** Common Valves	1	
	CH08: Special Valves	1	
	CH09: Strainers, Filters, and Traps	1	
PM	**CH10:** Accessories	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	


SERVICE

Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under-development.

Customize Your Own Industrial Training.
Courses can be mobilized to your facility.
Courses in this sectors are non-scheduled courses offered only in customer-site.
If there is an interest, please contact Dr. Medhat Khalil directly.

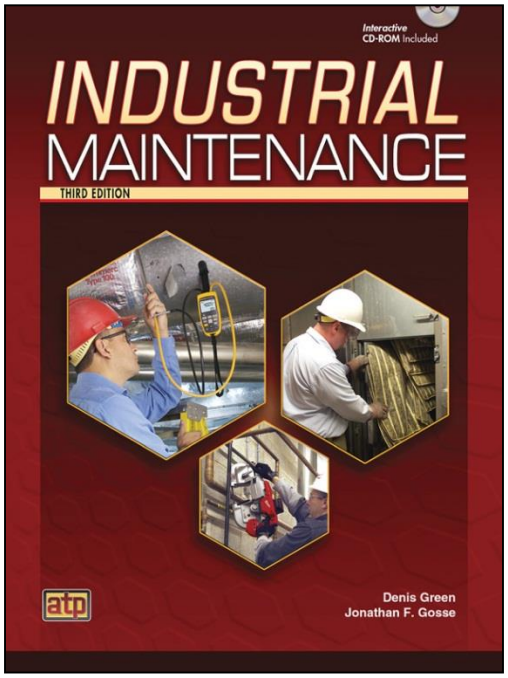
Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP06	Industrial Maintenance	2.1	21	4	NO	YES	NO	$1,680
TPC 341	Mechanical Drive Maintenance	0.5	5	1	NO	YES	NO	$400
TPC 342	Mechanical and Fluid Drive Systems	0.5	5	1	NO	YES	NO	$400
TPC 343	Bearing and Shaft Seal Maintenance	0.5	5	1	NO	YES	NO	$400
TPC 344	Pump Installation and Maintenance	0.5	5	1	NO	YES	NO	$400
TPC 345	Maintenance Pipefitting	0.5	5	1	NO	YES	NO	$400
TPC 346	Tubing and Hose System Maintenance	0.5	5	1	NO	YES	NO	$400
TPC 347	Valve Maintenance and Piping System Protection	0.5	5	1	NO	YES	NO	$400
TPC 501	Introduction to Robotics	0.7	7	2	NO	YES	NO	$560
TPC901	Maintenance Organization	0.7	7	2	NO	YES	NO	$560
TPC902	Implementing Preventive Maintenance	0.5	5	1	NO	YES	NO	$400
TPC903	Controlling Maintenance Resources	0.5	5	1	NO	YES	NO	$400
TPC904	Improving Performance in Maintenance	0.5	5	1	NO	YES	NO	$400

Industrial Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP06	Industrial Maintenance	2.1	21	4	NO	YES	NO	$1,680

Course Description:

This 21-hour 4-day emphasizes on maintenance personnel versatility. Industrial Maintenance is a comprehensive source of fundamental system operation, maintenance, and troubleshooting information. This edition builds on industry-proven content and offers expanded coverage in the areas of energy efficiency and auditing, waste reduction, safety standards, advanced multimeter functions and procedures, building automation systems, and indoor air quality. Real-world maintenance problems and solutions are depicted throughout the textbook, along with equipment operating principles, maintenance management procedures, and troubleshooting scenarios for common systems. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

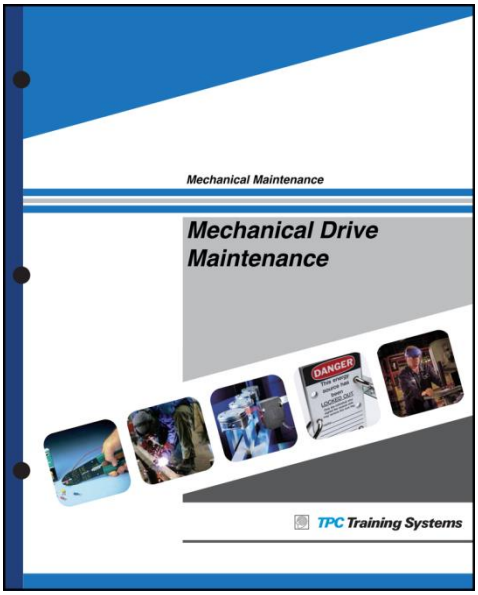
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Section 1: Introduction to Instrumentation**		
	CH01: Instrumentation Overview	1	7
	CH02: Fundamentals of Process Control	1	12
	CH03: Piping and Instrumentation Diagram	1	5
PM	**Section 2: Temperature Measurement**		
	CH04: Temperature Heat and Energy	0.75	9
	CH05: Thermal Expansion Thermometer	0.75	10
	CH06: Electrical Thermometers	1.5	24
	Day 2	**Hr**	
AM	**CH07:** Infrared Red Radiation Thermometer	1	15
	CH08: Practical Temperature Measurement and Calibration	2	21
PM	**Section 3: Pressure Measurement**		
	CH09: Electrical Pressure Elements	0.75	9
	CH10: Practical Pressure Measurement and Calibration	0.75	11
	CH11: Mechanical Level Instruments	0.75	9
	CH12: Electrical Level Instruments	0.75	13
	Day 3	**Hr**	
AM	**Section 4: Level Measurement**		
	CH13: Mechanical Level Instruments	0.75	17
	CH14: Electrical Level Instruments	0.75	12
PM	**CH15:** Ultrasonic Radar and Laser Level Instruments	1	8
	CH16: Nuclear level Instruments and Weigh Systems	1	6
	CH17: Practical Level Measurement and Calibration	1	11
	Day 4	**Hr**	
AM	**Section 5: Flow Measurement**		
	CH18: Fluid Flow	1	7
	CH19: Differential Pressure Flow meter	1	8
	CH20: Mechanical Flow meter	1	11
PM	**CH21:** Magnetic Ultrasonic and Mass Flow meter	0.75	8
	CH22: Practical Flow Measurement	0.75	6
	Section 6: Analyzers		
	CH23: Gas Analyzer	0.75	12
	CH24: Humidity and Solid Moisture Analyzer	0.75	11
	Day 5	**Hr**	
AM	**CH25:** Liquid Analysers	0.75	13
	CH26: Electromechanically and Composition Analyzer	0.75	17
	Section 7: Position Measurement		
	CH27: Mechanical and Proximity Switch	0.75	13
	CH28: Practical Position Measurement	0.75	10
	Total	**27**	

Mechanical Drive Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 341	Mechanical Drive Maintenance	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers alignment, particularly coupling alignment. Includes installation and maintenance of mechanical drives, from chain drives to enclosed gear drives.



Course Agenda:

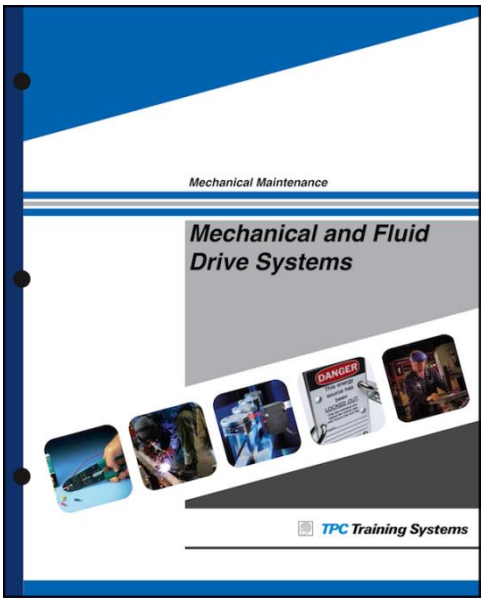
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Chain Drives	1	
	CH02: Belt Drives	1	
	CH03: Open Gear Devices	1	
PM	**CH04:** Enclosed Gear Drives	1	
	CH05: Drive Couplings	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Mechanical and Fluid Drive Systems

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 342	Mechanical and Fluid Drive Systems	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers further details of drive maintenance, including brakes, clutches, and adjustable-speed drives. Also covers maintenance and troubleshooting of fluid drives and package drive systems.



Course Agenda:

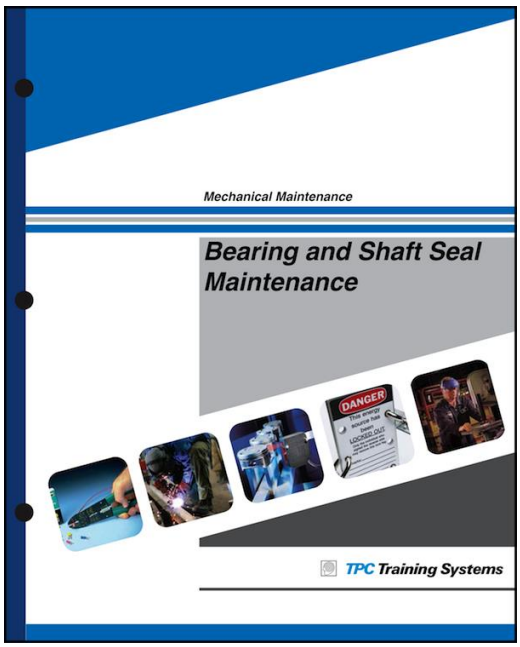
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Mechanical Brakes and Clutches	1	
	CH02: Electric Brakes and Clutches	1	
	CH03: Adjustable-Speed Drives	1	
PM	**CH04:** Fluid Drives	1	
	CH05: Complete Drive Systems	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Bearing and Shaft Seal Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 343	Bearing and Shaft Seal Maintenance	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers plain bearings, their parts, dimensions, functions, and relining techniques. Continues with installation and replacement of antifriction bearings. Also covers linear motion bearings and shaft seals.



Course Agenda:

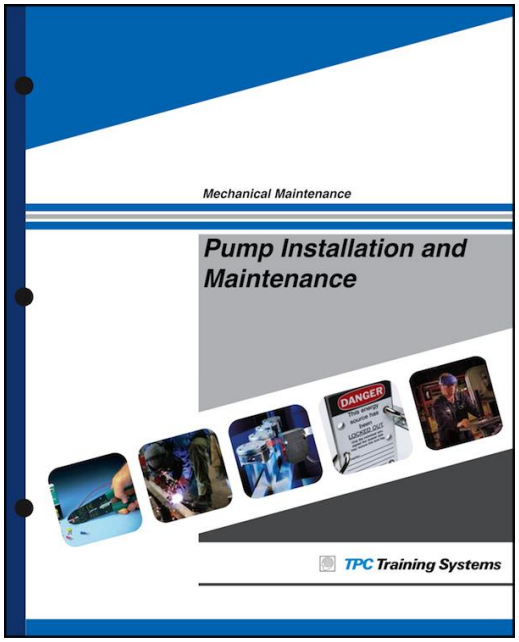
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Plain Bearings	1	
	CH02: Installing Antifriction Bearings	1	
	CH03: Removing and Replacing Antifriction Bearings	1	
PM	**CH04:** Mounted Antifriction Bearings	1	
	CH05: Linear Motion Bearings and Shaft Seals	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Pump Installation and Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 344	Pump Installation and Maintenance	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers basic pumping concepts. Describes required maintenance of packing and seals. Covers maintenance and overhaul of centrifugal pumps. Concludes with maintenance of rotary pumps.



Course Agenda:

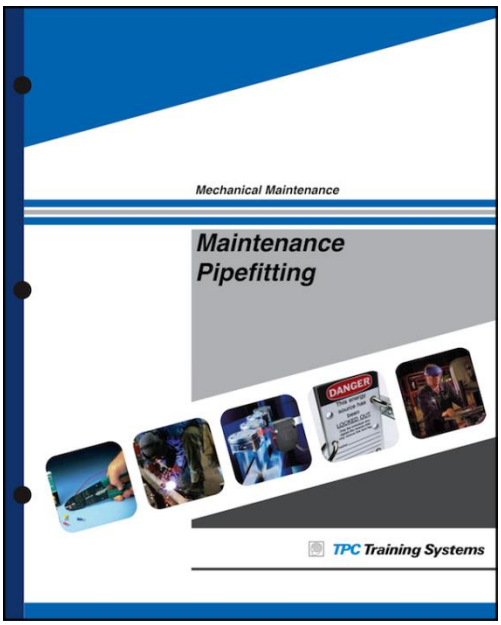
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Basic Pumping Concepts	1	
	CH02: Maintaining Packing and Seals	1	
	CH03: Maintaining Centrifugal Pumps	1	
PM	**CH04:** Overhauling Centrifugal Pumps	1	
	CH05: Maintaining Rotary Pumps	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Maintenance Pipefitting

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 345	Maintenance Pipefitting	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers basic pumping concepts. Describes required maintenance of packing and seals. Covers maintenance and overhaul of centrifugal pumps. Concludes with maintenance of rotary pumps.



Course Agenda:

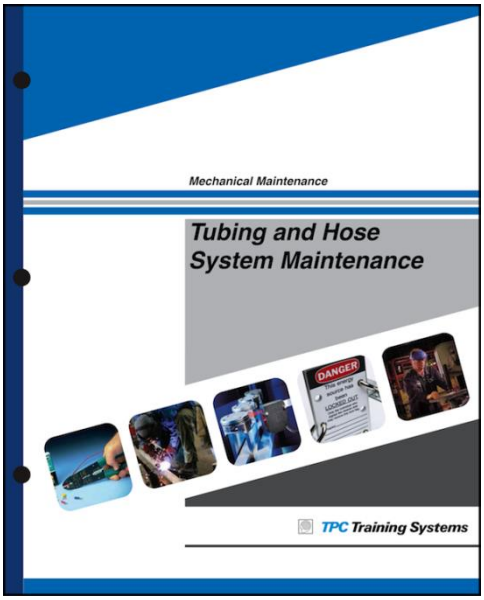
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Piping Dimensions and Terminology	1	
	CH02: Threaded Piping Systems	1	
	CH03: Welded Piping Systems	1	
PM	**CH04:** Plastic Piping Systems	1	
	CH05: Pipefitting Accessories	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Tubing and Hose System Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 346	Tubing and Hose System Maintenance	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers tubing specifications, materials, and fittings. Explains procedures used for handling, bending, cutting, and installing tubing. Gives basics of tubing in a hydraulic system. Describes hose systems and their functions. Concludes with gaskets, sealants, and adhesives.



Course Agenda:

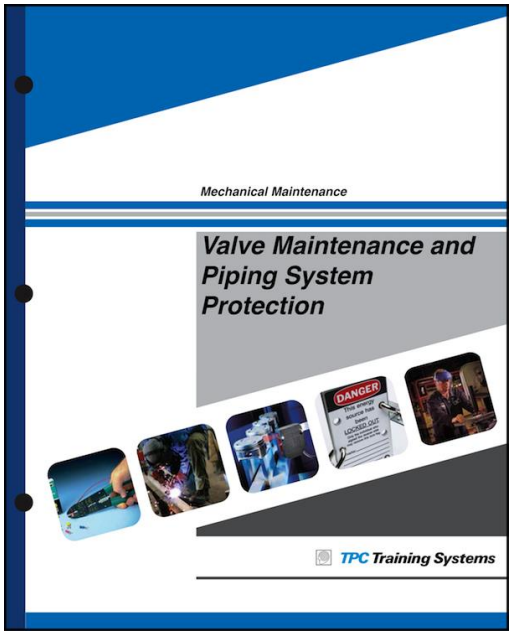
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Tubing Fundamentals	1	
	CH02: Installing Tubing	1	
	CH03: Hydraulic Tubing Systems	1	
PM	**CH04:** Hose Systems	1	
	CH05: Gaskets, Sealants, and Adhesives	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Valve Maintenance and Piping System Protection

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 347	Valve Maintenance and Piping System Protection	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers maintenance and operation of gate, globe, ball, plug, check, and special-purpose valves. Details actuators and various accessories. Explains valve selection based on application. Describes methods of protecting piping systems.



Course Agenda:

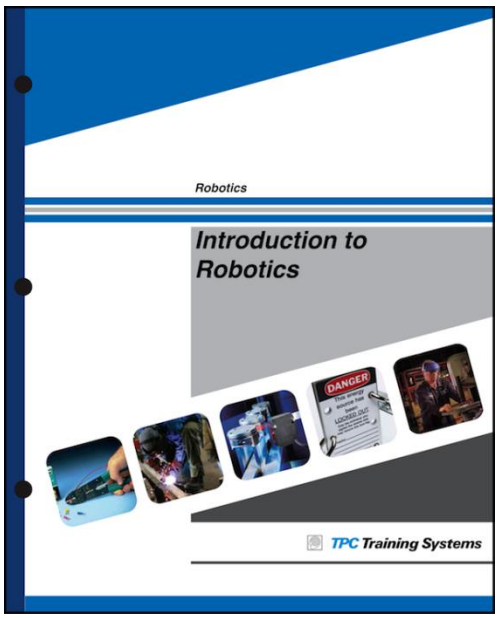
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Valve Maintenance	1	
	CH02: Special Valves	1	
	CH03: Actuators and Accessories	1	
PM	**CH04:** Valve Selection	1	
	CH05: Piping System Protection	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Introduction to Robotics

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 501	Introduction to Robotics	0.7	7	2	NO	YES	NO	$560

Course Description:

This 7-hour 2-day seminar covers the background for a detailed study of robot maintenance. Introduces the trainee to the basics of robotics, using clear, easy-to-follow language to take the mystery out of this growing technology.



Course Agenda:

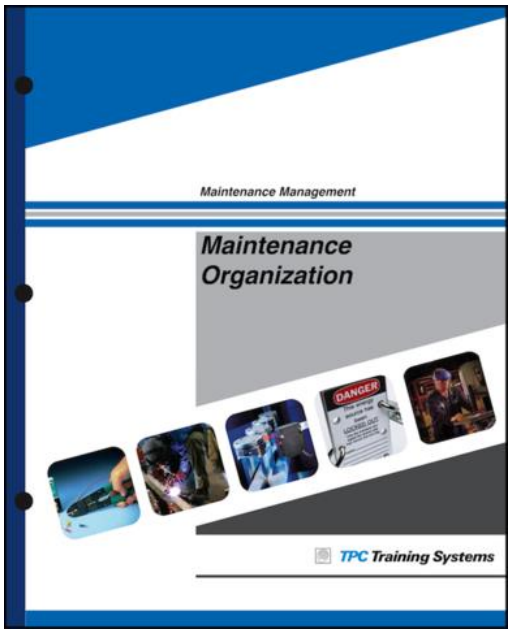
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Robotics in Automated Manufacture	1	
	CH02: The Basic Robot System	1	
	CH03: Robot Classification I	1	
PM	**CH04:** Robot Classification II	1	
	CH05: Work-Cell Sensors	1	
	CH06: End-of-Arm Tooling	1	
	Day 2	**Hr**	
AM	**CH07:** Robot Teaching and Programming	1	
	Total Contact Hours	**7**	
	Certification Exam	**2**	

Maintenance Organization

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC901	Maintenance Organization	0.7	7	2	NO	YES	NO	$560

Course Description:

This 7-hour 2-day seminar covers the basic types of maintenance organizations. Discusses cost-saving concepts of using work order systems. Explains how to develop and use information sources to implement maintenance management. Shows how to apply work standards and planning procedures to simplify a supervisor's job. Introduces the use of computers for first-line supervisors.



Course Agenda:

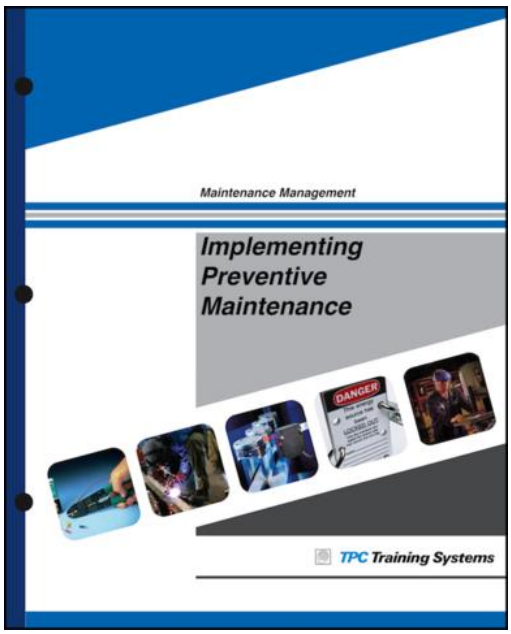
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Types of Maintenance Organization	1	
	CH02: Maintenance Planning and Operations	1	
	CH03: Work Order Systems	1	
PM	**CH04:** Using Information Sources	1	
	CH05: Controlling Backlog through Planning	1	
	CH06: Applying Work Standards	1	
	Day 2	**Hr**	
AM	**CH07:** Managing Maintenance by Computer	1	
	Total Contact Hours	**7**	
	Certification Exam	**2**	

Implementing Preventive Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC902	Implementing Preventive Maintenance	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers methods of using maintenance resources for greatest efficiency, and tells how to implement the techniques effectively. Explains what workload is and how to measure it. Provides a thorough investigation into the control of labor, parts, and materials—both in the field and in the shop. Examines the budget process and how to control costs through budgeting



Course Agenda:

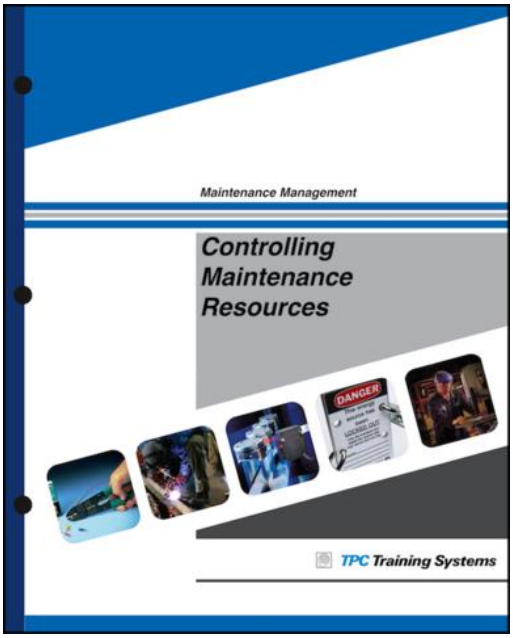
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** The Need for PM	1	
	CH02: Setting Up a PM Program	1	
	CH03: Scheduling PM	1	
PM	**CH04:** Controlling Work	1	
	CH05: Quality Control	1	
	Total Contact Hours	5	
	Certification Exam	2	

Controlling Maintenance Resources

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC903	Controlling Maintenance Resources	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers the background for a detailed study of robot maintenance. Introduces the trainee to the basics of robotics, using clear, easy-to-follow language to take the mystery out of this growing technology.



Course Agenda:

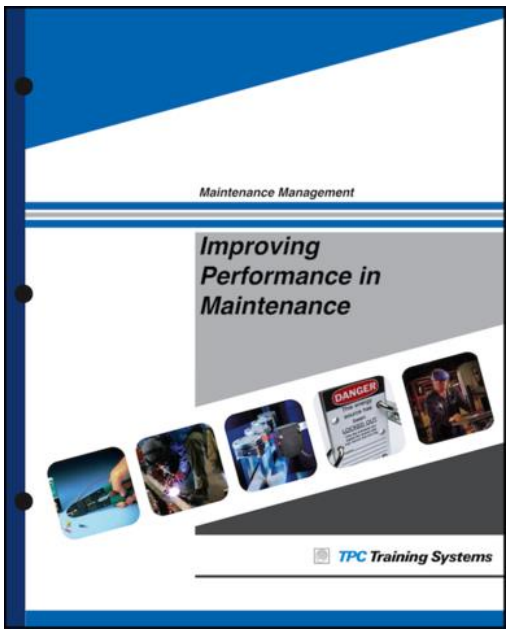
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Measuring Workload	1	
	CH02: Controlling Labor	1	
	CH03: Controlling Parts and Materials	1	
PM	**CH04:** Managing Shop Operations	1	
	CH05: Controlling Costs through Budgeting	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Improving Performance in Maintenance

Mechanical Maintenance								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC903	Controlling Maintenance Resources	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers instructions to first-line supervisor in the strategies involved in improving performances, and presents proven methods for increasing maintenance productivity. Develops ways of evaluating training effectiveness and the management of time. Describes the information necessary to stimulate improvement in all facets of the maintenance program.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	CH01: Evaluating Performance	1	
	CH02: Increasing Productivity	1	
	CH03: Effects of Training	1	
PM	CH04: Managing Time	1	
	CH05: Stimulating Improvement	1	
	Total Contact Hours	5	
	Certification Exam	2	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Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under-development.

Customize Your Own Industrial Training.
Courses can be mobilized to your facility.
Courses in this sectors are non-scheduled courses offered only in customer-site.
If there is an interest, please contact Dr. Medhat Khalil directly.

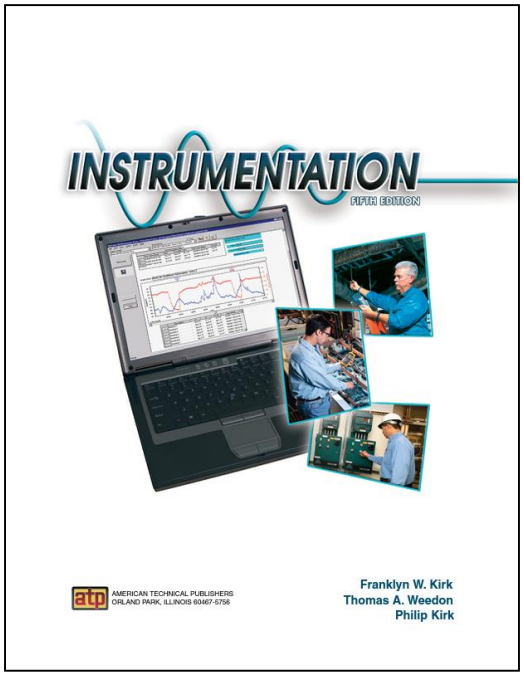
Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP07A	Instrumentation I	2.7	27	5	NO	NO	NO	$2,160
ATP07B	Instrumentation II	2.7	27	5	NO	YES	NO	$2,160
WMK05	Fundamentals of Industrial Control and Automation	1.2	12	2	NO	NO	UD	$960
TPC 271	Introduction to Process Control	0.6	6	1	NO	YES	NO	$480
TPC 272	Foundations of Measurement Instrumentation	0.5	5	1	NO	YES	NO	$400
TPC 273	Pressure Measurement	0.5	5	1	NO	YES	NO	$400
TPC 274	Force, Weight, and Motion Measurement	0.5	5	1	NO	YES	NO	$400
TPC 275	Flow Measurement	1.0	10	2	NO	YES	NO	$800
TPC 276	Level Measurement	0.5	5	1	NO	YES	NO	$400
TPC 277	Temperature Measurement	0.5	5	1	NO	YES	NO	$400
TPC 278	Analytical Instrumentation	0.5	5	1	NO	YES	NO	$400
TPC 279	Final Control Elements	0.5	5	1	NO	YES	NO	$400
TPC 281	Working with Controllers	0.5	5	1	NO	YES	NO	$400
TPC 282	How Control Loops Operate	0.5	5	1	NO	YES	NO	$400
TPC 283	Data Transmission	0.5	5	1	NO	YES	NO	$400
TPC 284	Computers in Process Control	0.5	5	1	NO	YES	NO	$400
TPC 111	How Power Plants Work	0.5	5	1	NO	YES	NO	$400
TPC 112	Generating Steam in the Power Plant	0.5	5	1	NO	YES	NO	$400

Instrumentation I

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP07A	Instrumentation I	2.7	27	5	NO	NO	NO	$2,160

Course Description:

This 27-Hours 5-Day seminar is PART 1 of a comprehensive review that provides a technician-level approach to instrumentation used in process control. With an emphasis on common industrial applications, this textbook covers the four fundamental instrumentation measurements of temperature, pressure, level, and flow, in addition to position, humidity, moisture, and typical liquid and gas measuring instruments. Fundamental scientific principles, detailed illustrations, descriptive photographs, and concise text are used to present the following instrumentation topics. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

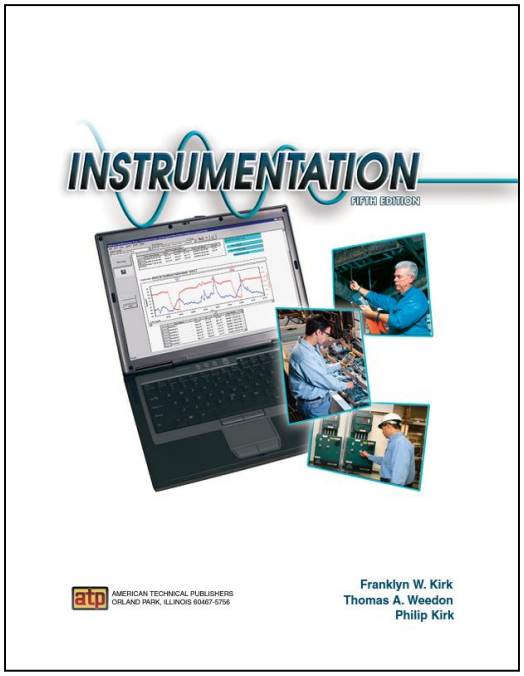
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Section 1: Introduction to Instrumentation**		
	CH01: Instrumentation Overview	1	7
	CH02: Fundamentals of Process Control	1	12
	CH03: Piping and Instrumentation Diagram	1	5
PM	**Section 2: Temperature Measurement**		
	CH04: Temperature Heat and Energy	0.75	9
	CH05: Thermal Expansion Thermometer	0.75	10
	CH06: Electrical Thermometers	1.5	24
	Day 2	**Hr**	
AM	**CH07:** Infrared Red Radiation Thermometer	1	15
	CH08: Practical Temperature Measurement and Calibration	2	21
PM	**Section 3: Pressure Measurement**		
	CH09: Electrical Pressure Elements	0.75	9
	CH10: Practical Pressure Measurement and Calibration	0.75	11
	CH11: Mechanical Level Instruments	0.75	9
	CH12: Electrical Level Instruments	0.75	13
	Day 3	**Hr**	
AM	**Section 4: Level Measurement**		
	CH13: Mechanical Level Instruments	0.75	17
	CH14: Electrical Level Instruments	0.75	12
PM	**CH15:** Ultrasonic Radar and Laser Level Instruments	1	8
	CH16: Nuclear level Instruments and Weigh Systems	1	6
	CH17: Practical Level Measurement and Calibration	1	11
	Day 4	**Hr**	
AM	**Section 5: Flow Measurement**		
	CH18: Fluid Flow	1	7
	CH19: Differential Pressure Flow meter	1	8
	CH20: Mechanical Flow meter	1	11
PM	**CH21:** Magnetic Ultrasonic and Mass Flow meter	0.75	8
	CH22: Practical Flow Measurement	0.75	6
	Section 6: Analysers		
	CH23: Gas Analyzer	0.75	12
	CH24: Humidity and Solid Moisture Analyzer	0.75	11
	Day 5	**Hr**	
AM	**CH25:** Liquid Analysers	0.75	13
	CH26: Electromechanically and Composition Analyzer	0.75	17
	Section 7: Position Measurement		
	CH27: Mechanical and Proximity Switch	0.75	13
	CH28: Practical Position Measurement	0.75	10
	Total	**27**	

Instrumentation II

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP07B	Instrumentation II	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-Hours 5-Day seminar is PART 2 of a comprehensive review that provides a technician-level approach to instrumentation used in process control. With an emphasis on common industrial applications, this textbook covers the four fundamental instrumentation measurements of temperature, pressure, level, and flow, in addition to position, humidity, moisture, and typical liquid and gas measuring instruments. Fundamental scientific principles, detailed illustrations, descriptive photographs, and concise text are used to present the following instrumentation topics. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

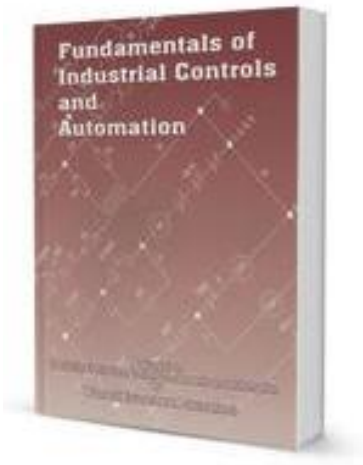
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Section 8: Transmission and Communication**		
	CH29: Transmission Signal	1	7
	CH30: Digital Numbering System and Codes	1	9
	CH31: Digital Communications	1	14
	CH32: Industrial Networks	1	16
	CH33: Wireless Systems	1	12
	CH34: Practical Transmission and Communication	1	8
	Day 2	**Hr**	
AM	**Section 9: Automatic Control**		
	CH35: Automatic Control and Process Dynamics	1	19
	CH36: Control Strategies	2	20
PM	**CH37:** Control Tuning	0.75	10
	CH38: Digital and Electric Controllers	0.75	15
	Section 10: Final Elements		
	CH39: Control Valves	1.5	21
	Day 3	**Hr**	
AM	**CH40:** Regulators and Dampers	0.75	10
	CH41: Actuators and Positioners	1.5	20
	CH42: Variable Speed Drives and Electric Power Controllers	0.75	9
PM	**Section 11: Safety Systems**		
	CH43: Safety Devices and Equipment	1.5	21
	CH44: Electrical Safety Standards	0.75	8
	CH45: Safety Instrumented Systems	0.75	5
	Day 4	**Hr**	
AM	**Section 12: Instrumentation and Control Applications**		
	CH46: General Control Techniques	2	19
	CH47: Temperature Control	1	8
PM	**CH48:** Pressure and Level Control	1	6
	CH49: Flow Control	1	12
	CH50: Analysis and Multi-Variable Control	1	6
	Day 5	**Hr**	
AM	**Review and Conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Fundamentals of Industrial Control and Automation

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
WOMK05	Fundamentals of Industrial Control and Automation	1.2	12	2	NO	NO	UD	$960

Course Description:

This 12-hour 2-day course is an introduction to the Fundamentals of Industrial Controls and Automation. The seminar focuses on a beginner's study of electricity, electronics, control components and automation as related to industrial controls. Modern manufacturing techniques are only possible because of dependable electrical control systems. The provided textbook explores the proper use of electrical controls to maximize productivity, minimize downtime, simplify maintenance, improve safety and provide information to effectively manage operations. Topics covered in the seven chapters include: Electrical Fundamentals, Input Devices - Sensors and Switches, Logic Devices - Timers and Counters, Output Devices, Schematic Diagrams and Logic, Programmable Logic Controllers and Accessories, and Temperature Control Systems.



Course Agenda:

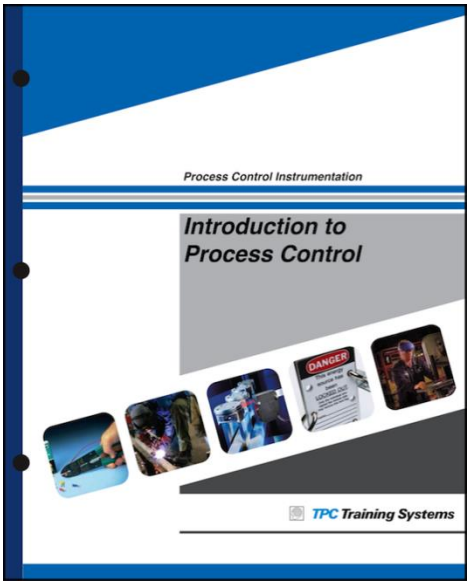
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Popular Fluid and Electrical Components	1.5	15
	CH02: How to Draw and Read Electrical Diagrams	1.5	41
PM	**CH03:** Directional Control; Reciprocation of Cylinders	1	19
	CH04: Directional Control; Sequencing of Cylinders	2	40
	Day 2	**Hr**	**# of Slides**
AM + PM	**CH05:** Pressure Control by Electrical Means	1.5	33
	CH06: Solving Design Problems in Electrical Circuitry	3	50
	CH07: Miscellaneous Applications	1.5	21
	Total	**12**	

Introduction to Process Control

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 271	Introduction to Process Control	0.6	6	1	NO	YES	NO	$480

Course Description:

This 6-hours 2-day seminar covers the function of basic devices for measuring and controlling different kinds of variables in process control. Introduces closed-loop control and PID functions. Introduces analog and digital devices and programmable logic controllers (PLCs). ISA and SAMA instrumentation symbols and interpretation and use of process diagrams are covered.



Course Agenda:

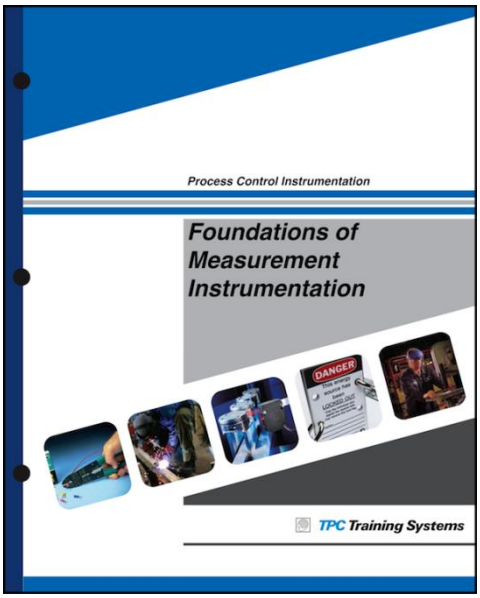
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** The Nature of Process Control	1	
	CH02: Elements of Process Control	1	
	CH03: Process Control Signals	1	
PM	**CH04:** Process Control Diagrams	1	
	CH05: Using Symbols and Diagrams in Process Control	1	
	CH06: Process Control Loop Operations	1	
	Total Contact Hours	6	
	Certification Exam	2	

Foundations of Measurement Instrumentation

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 272	Foundations of Measurement Instrumentation	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hours 1-day course covers the basic principles of measurement and defines process control terms. Describes several kinds of signals and displays and traces the path of a signal through the system. Explains the operation of transducers, transmitters, signal conditioners, converters, and recorders. Discusses specification details, conversion between English and SI units, calibration methods, and the maintenance of records.



Course Agenda:

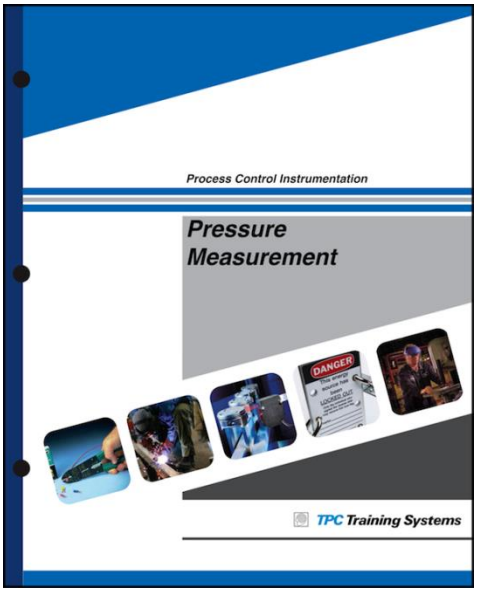
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Introduction to Process Measurement	1	
	CH02: Principles of Transducer Operation	1	
	CH03: Basic Process Measurement Systems	1	
PM	**CH04:** Systems Standards and Instrument Calibration	1	
	CH05: Maintaining System Quality	1	
	Total Contact Hours	5	
	Certification Exam	2	

Pressure Measurement

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 273	Pressure Measurement	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers units of pressure and discusses Boyle's and Charles' laws to explain relationships among pressure, volume, and temperature. Describes sensor operation of manometers, bourdon tubes, diaphragms, and bellows. Explains the operation of potentiometric, capacitive, reluctive, servo, strain-gauge, and piezoelectric transducers. Describes devices used in low-pressure control. Discusses proper and safe methods for installing and servicing pressure instruments.



Course Agenda:

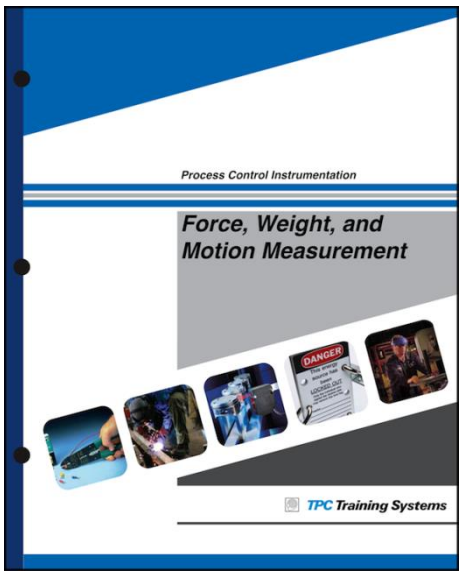
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Pressure in Liquids and Gases	1	
	CH02: Pressure Sensors	1	
	CH03: Pressure Transducers	1	
PM	**CH04:** Low-Pressure Measurement	1	
	CH05: Installation and Service	1	
	Total Contact Hours	5	
	Certification Exam	2	

Force, Weight, and Motion Measurement

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 274	Force, Weight, and Motion Measurement	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers force, stress, and strain and explains the operation of strain-gauge systems. Relates weight to mass and scales to balances. Explains the operation of load-cell scales. Describes belt-scale, nuclear-scale, and weigh feeder operation. Covers position measurements by means of proximity detection, air gauging, LVDT gauges, synchros, code disks, and other devices. Explains machine tool control and accelerometer operation. Describes the measurement of angular velocity and acceleration, vibration detection, and machinery balancing.



Course Agenda:

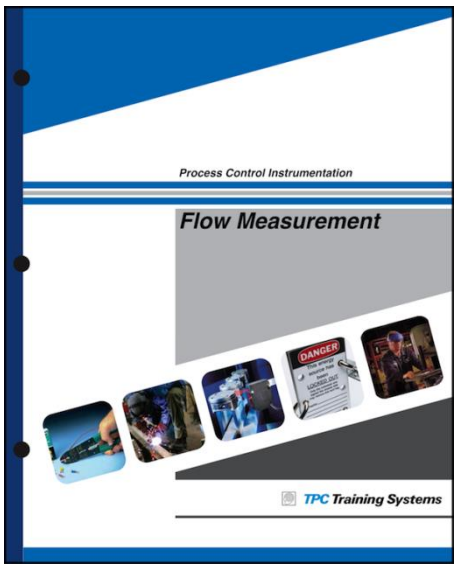
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Force, Stress, and Strain	1	
	CH02: Weight and Mass Measurement	1	
	CH03: Weighing Materials in Motion	1	
PM	**CH04:** Position Measurements	1	
	CH05: Acceleration, Vibration, and Shock	1	
	Total Contact Hours	5	
	Certification Exam	2	

Flow Measurement

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 275	Flow Measurement	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers principles of fluid flow and how primary devices affect fluid flow. Describes flow measurement using several kinds of secondary devices. Discusses rotameters and other variable-area instruments. Explains how weirs, flumes, and other arrangements measure open-channel flow. Compares many kinds of positive-displacement meters and explains the operation of several kinds of turbine and magnetic flow meters. Describes less-common flow meters (including vortex-precession, mass flow, and ultrasonic devices) and instruments that meter the flow of solids. Provides guidelines for safe installation and maintenance of flow devices.



Course Agenda:

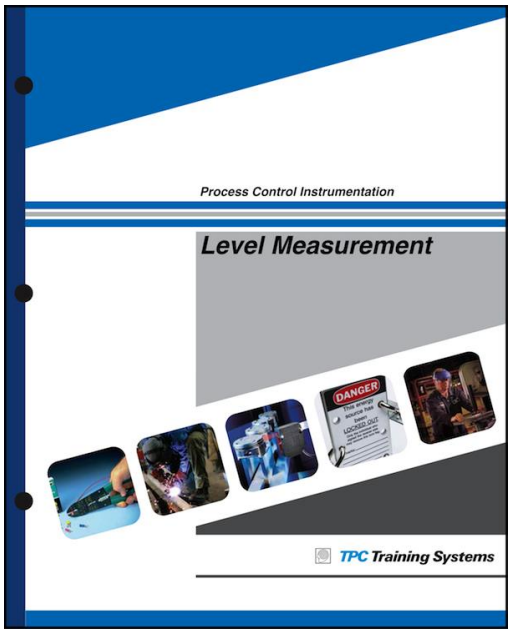
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Properties of Fluid Flow	1	
	CH02: Primary Measuring Devices	1	
	CH03: Secondary Measuring Devices	1	
PM	**CH04:** Variable-Area Instruments	1	
	CH05: Open-Channel Flow Devices	1	
	CH06: Positive-Displacement Meters	1	
	Day 2	**Hr**	
AM	**CH07:** Turbine and Magnetic Flow meters	1	
	CH08: Specialized Flow meters	1	
	CH09: Metering the Flow of Solid Particles	1	
PM	**CH10:** Installation and Maintenance of Flow Instruments	1	
	Total Contact Hours	**10**	
	Certification Exam	**2**	

Level Measurement

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 276	Level Measurement	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers principles governing various methods of measuring level. Explains operation of conductive, capacitive, resistive, ultrasonic, and photoelectric devices. Compares the operation of several kinds of pressure-head instruments. Explains the measurement of solids by ultrasonic, microwave, radiation, and other methods. Discusses several special-application devices for both continuous and point level measurement.



Course Agenda:

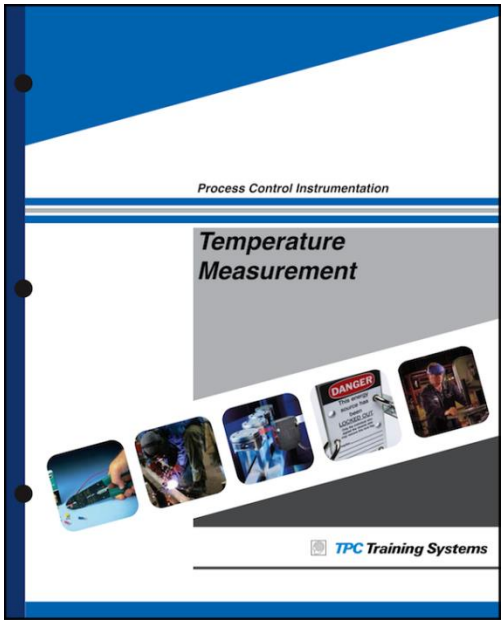
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Level Measurement	1	
	CH02: Electrical Instruments	1	
	CH03: Pressure Head Instruments	1	
PM	**CH04:** Solid Level Measurement	1	
	CH05: Other Level Measurement Instruments	1	
	Total Contact Hours	5	
	Certification Exam	2	

Temperature Measurement

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 277	Temperature Measurement	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers units in thermal measurement and operation of RTDs (and Wheatstone bridges), thermistors, and thermocouples and thermometers. Includes principles of pyrometry and operation of narrowband, broadband, and band pass pyrometers. Discusses calibration standards, typical calibrating methods, and instrument testing.



Course Agenda:

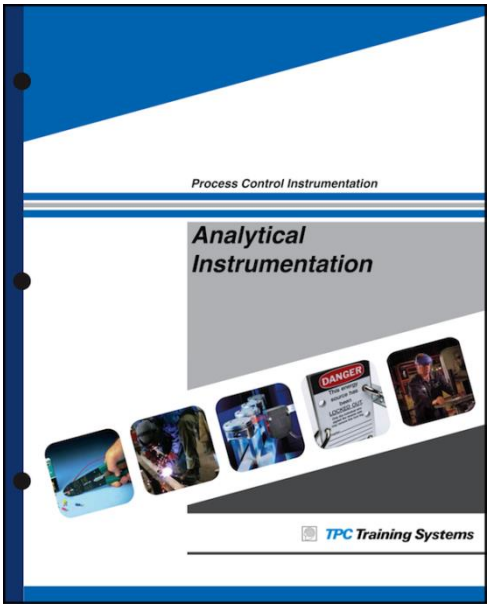
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Temperature Measurement Principles and Indicators	1	
	CH02: Bimetallic & Fluid-Filled Temp. Instruments	1	
	CH03: Electrical Instruments	1	
PM	**CH04:** Pyrometry	1	
	CH05: Temp. Instrument Maint. & Calibration	1	
	Total Contact Hours	5	
	Certification Exam	2	

Analytical Instrumentation

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 278	Analytical Instrumentation	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers principles, installation, calibration, and maintenance of conductivity probes, and methods of stack gas monitoring. Includes how to install, calibrate, and maintain pH and ORP measurement instruments and operation, installation, calibration, and maintenance of several optical analyzers. Discusses principles and safe practices governing sensors used in measuring oxygen, carbon monoxide, carbon dioxide, and other products of combustion. Concludes with operation, calibration, and system components in liquid and gas chromatography.



Course Agenda:

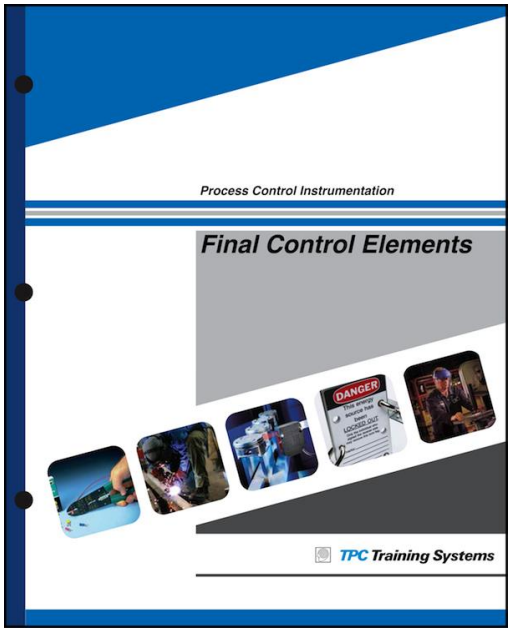
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Measuring Conductivity	1	
	CH02: Measuring pH and ORP	1	
	CH03: Optical Measurements	1	
PM	**CH04:** Measuring Products of Combustion	1	
	CH05: Chromatography	1	
	Total Contact Hours	5	
	Certification Exam	2	

Final Control Elements

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 279	Final Control Elements	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers how elements in a closed-loop system affect final control element. Describes components in final control subsystems. Discusses operations of solenoids, motors, relay systems, and PLCs. Explains pneumatic actuators and positioners. Describes mechanical advantage in several hydraulic control systems. Compares construction, characteristics, and applications of eight control valves. Traces operation of each element in typical feedwater, turbine, and robotic control systems.



Course Agenda:

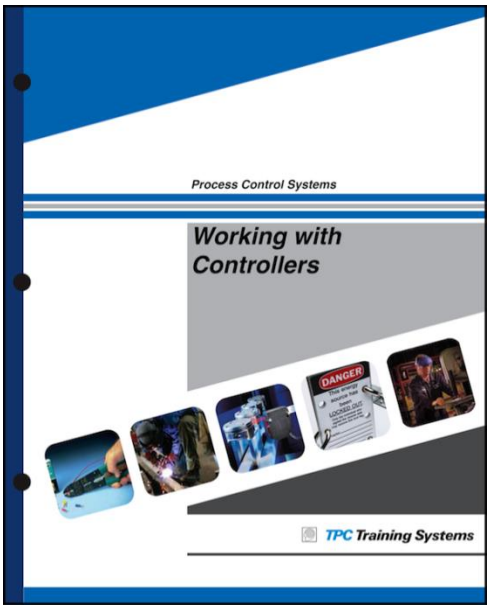
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Final Control Elements in Process Loops	1	
	CH02: Electric Actuators	1	
	CH03: Pneumatic and Hydraulic Actuators	1	
PM	**CH04:** Control Valves	1	
	CH05: Final Control Element Applications	1	
	Total Contact Hours	5	
	Certification Exam	2	

Working with Controllers

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 281	Working with Controllers	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers the purposes and kinds of controllers and their relationship to other components in process control systems. Explains the concepts of current-, position-, and time-proportioning control. Compares the operation of several kinds of controllers. Describes the operation of proportional, integral, and derivative modes, and discusses tuning procedures for each. Discusses cascade, feedforward, ratio, and auctioneering control systems as well as other operations. Describes ways to eliminate or reduce controller problems.



Course Agenda:

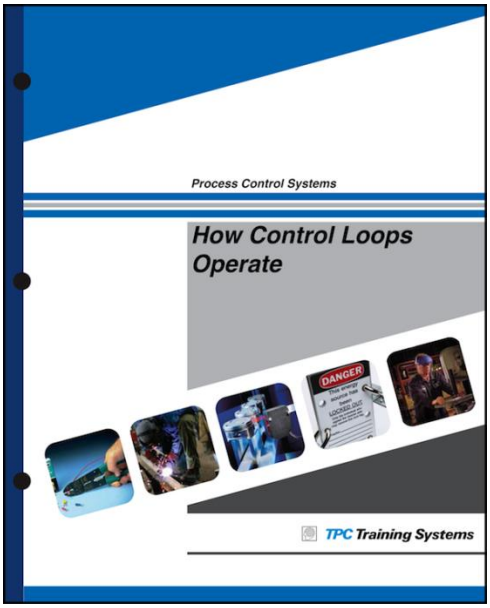
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Introduction to Controls	1	
	CH02: Controller Operations	1	
	CH03: Controller Modes and Tuning	1	
PM	**CH04:** Special Controller Applications and Options	1	
	CH05: Maintaining Controller Systems	1	
	Total Contact Hours	5	
	Certification Exam	2	

How Control Loops Operate

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 282	How Control Loops Operate	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers definition of control loop terms and characteristics. Includes specific examples of operation of control loops of many kinds. Discusses proportional, integral, and derivative modes in detail. Describes advanced control methods by means of four strategies with specific examples. Examines the effects of loop dynamics on system stability.



Course Agenda:

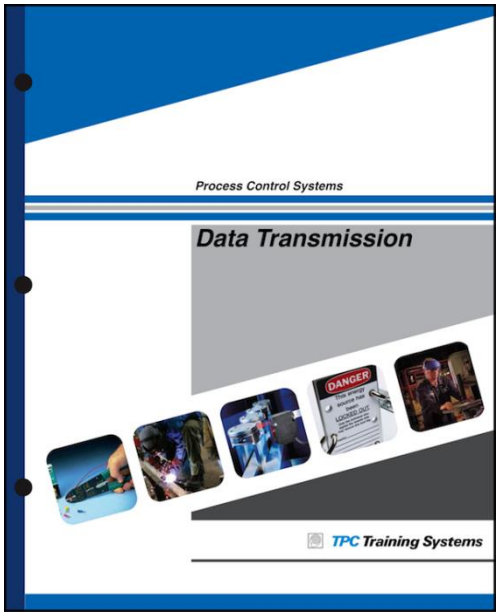
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Fundamentals of Control Loops	1	
	CH02: Control Loop Characteristics	1	
	CH03: Advanced Control Methods	1	
PM	**CH04:** Loop Dynamics	1	
	CH05: Loop Protection	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Data Transmission

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 283	Data Transmission	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers mechanical, hydraulic, pneumatic, and telemetric data transmission methods. Discusses indicators, other devices, and methods used for electrical/electronic data transmission in detail. Compares methods and standards for parallel and serial digital data transmission. Describes optical isolation and the operation of optical data transmission systems in detail. Provides specific methods for preventing common kinds of data transmission interference.



Course Agenda:

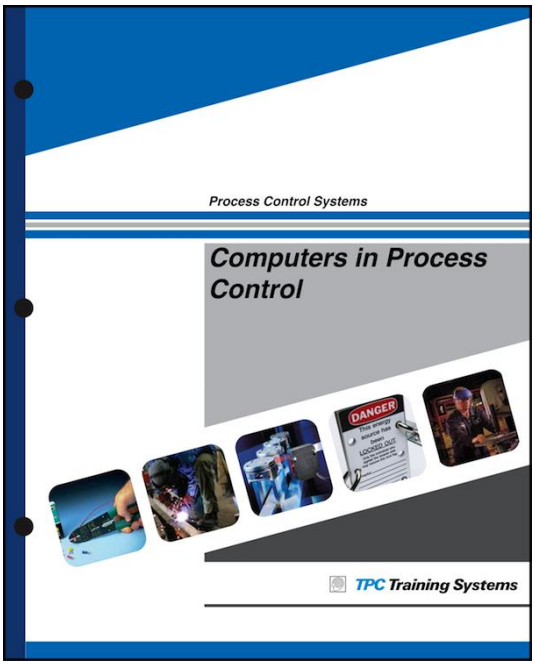
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Process Data Transmission Methods	1	
	CH02: Electrical Data Transmission	1	
	CH03: Digital Data Transmission	1	
PM	**CH04:** Optical Data Transmission	1	
	CH05: Data Transmission Interference	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Computers in Process Control

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 284	Computers in Process Control	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers the evolution of today's process control computer systems. Compares smart components to older conventional system devices. Covers the architecture (hardware and software), configuration, and operation of distributed control systems in depth (two entire lessons) by using as an example a typical DCS controlling an ice cream plant. Defines common terms used in today's integrated plant and discusses the integration of discrete and continuous processes with plant business functions.



Course Agenda:

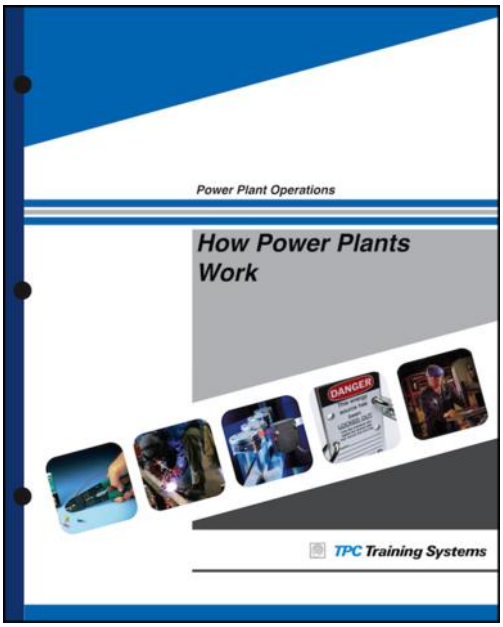
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** History and Overview	1	
	CH02: Small Computers in Process Control	1	
	CH03: DCS Architecture	1	
PM	**CH04:** DCS Configuration and Operation	1	
	CH05: Systems and Application Integration	1	
	Total Contact Hours	5	
	Certification Exam	2	

How Power Plants Work

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 111	How Power Plants Work	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day seminar covers the basic steam generation system, how thermal energy is converted into electrical energy, components of the system, and design features for gaining thermal efficiency. Includes handling of water, fuel, and wastes, and the operating features of a power plant.



Course Agenda:

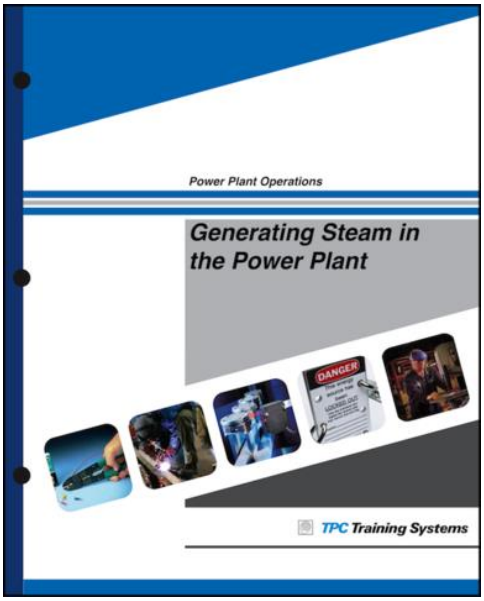
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Steam-The Primary Force	1	
	CH02: How Heat is Converted to Power	1	
	CH03: Power Plant Efficiency	1	
PM	**CH04:** Handling Water, Fuel, and Wastes	1	
	CH05: Power Plant Operation and Control	1	
	Total Contact Hours	5	
	Certification Exam	2	

Generating Steam in the Power Plant

Process Engineering								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 112	Generating Steam in the Power Plant	0.5	5	1	NO	YES	NO	$400

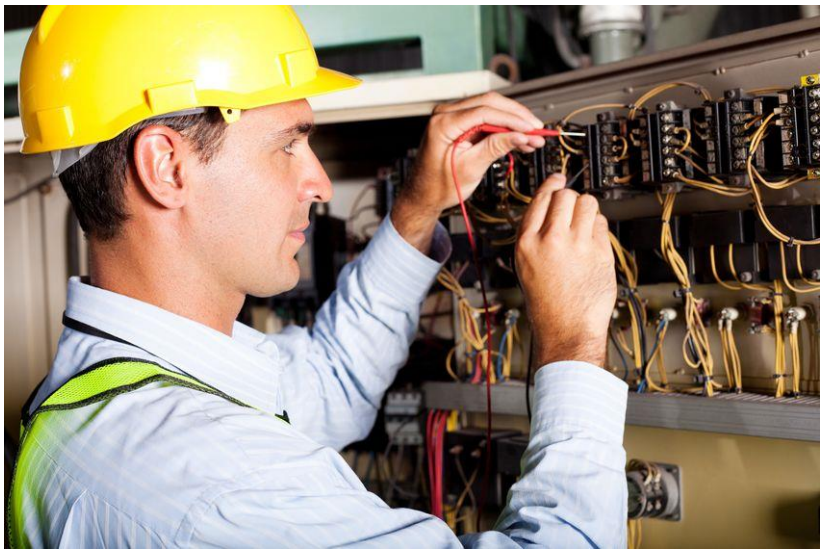
Course Description:

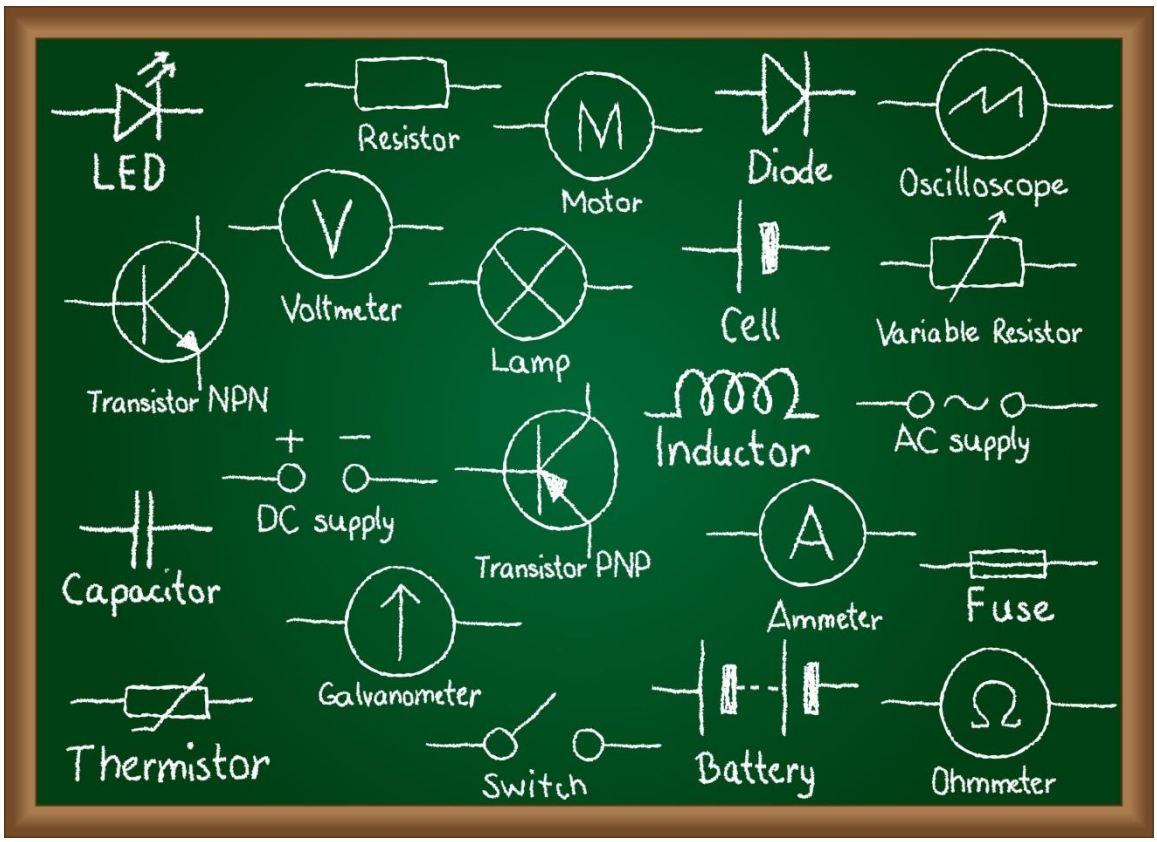
This 5-hours 1-day seminar covers energy principles and boiler maintenance. Explains coal, oil, and natural gas combustion, and how to conserve energy through improved combustion control.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Transforming Energy into Work	1	
	CH02: Boiler Operation	1	
	CH03: Boiler Maintenance	1	
PM	**CH04:** Combustion and How It Works	1	
	CH05: Combustion and How It Works	1	
	Total Contact Hours	5	
	Certification Exam	2	




LED
Resistor
Motor
Diode
Oscilloscope
Voltmeter
Lamp
Cell
Variable Resistor
Transistor NPN
Inductor
AC supply
DC supply
Transistor PNP
Capacitor
Ammeter
Fuse
Galvanometer
Thermistor
Switch
Battery
Ohmmeter

Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under-development.

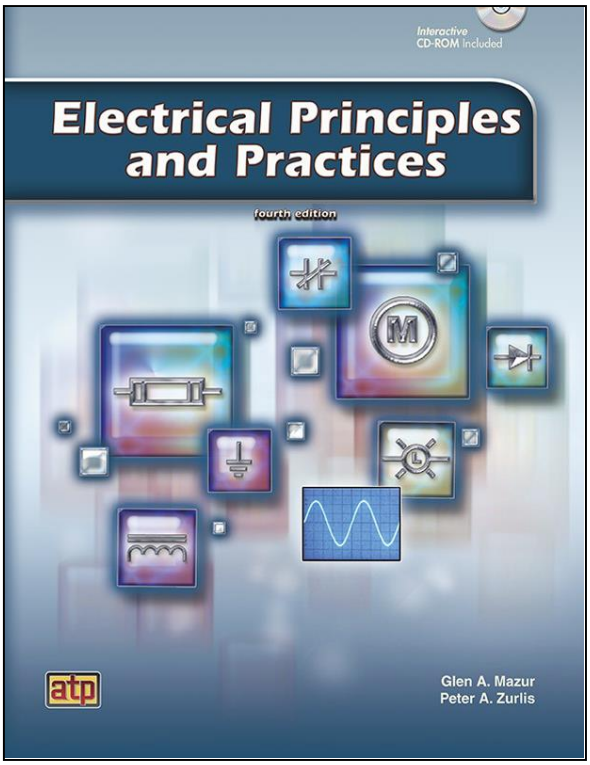
Customize Your Own Industrial Training.
Courses can be mobilized to your facility.
Courses in this sectors are non-scheduled courses offered only in customer-site.
If there is an interest, please contact Dr. Medhat Khalil directly.

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP08A	Electrical Principles and Practices I	2.1	21	4	NO	NO	NO	$1,680
ATP08B	Electrical Principles and Practices II	2.7	27	5	NO	YES	NO	$2,160
ATP09	AC/DC Principles	2.7	27	5	NO	YES	NO	$2,160
ATP10	Introduction to Programmable Logic Controls	2.7	27	5	NO	YES	NO	$2,160
ATP11	Motors	2.7	27	5	NO	YES	NO	$2,160
ATP12A	Electrical Motor Controls for Integrated Systems I	2.4	24	4	NO	NO	NO	$2,160
ATP12B	Electrical Motor Controls for Integrated Systems II	2.4	24	4	NO	YES	NO	$1,920
ATP13	Solid State Devices and Systems	2.7	27	5	NO	YES	NO	$2,160
TPC201	Basic Electricity and Electronics	1.0	10	2	NO	YES	NO	$800
TPC202	Batteries and DC Circuits	1.0	10	2	NO	YES	NO	$800
TPC203	Transformers and AC Circuits	1.0	10	2	NO	YES	NO	$800
TPC204	Electrical Measuring Instruments	0.5	5	1	NO	YES	NO	$400
TPC205	Electrical Safety & Protection	0.7	7	2	NO	YES	NO	$560
TPC206	DC Equipment and Control	1.0	10	2	NO	YES	NO	$800
TPC207	Single Phase Motor	1.0	10	2	NO	YES	NO	$800
TPC208	Three Phase Systems	1.0	10	2	NO	YES	NO	$800
TPC209	AC Control Equipment	1.0	10	2	NO	YES	NO	$800
TPC 298	Programmable Logic Controllers Fundamentals	0.7	7	2	NO	YES	NO	$560

Electrical Principles and Practices I

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP08A	Electrical Principles and Practices I	2.1	21	4	NO	NO	NO	$1,680

Course Description:
This 21-Hour 4-Days seminar is PART 1 of an introduction to electrical and electronic principles and practices and their uses in residential, commercial, and industrial applications. Chapters have been expanded to include greater coverage of personal protection and safety. A CD-ROM is included and contains information to supplement the textbook.



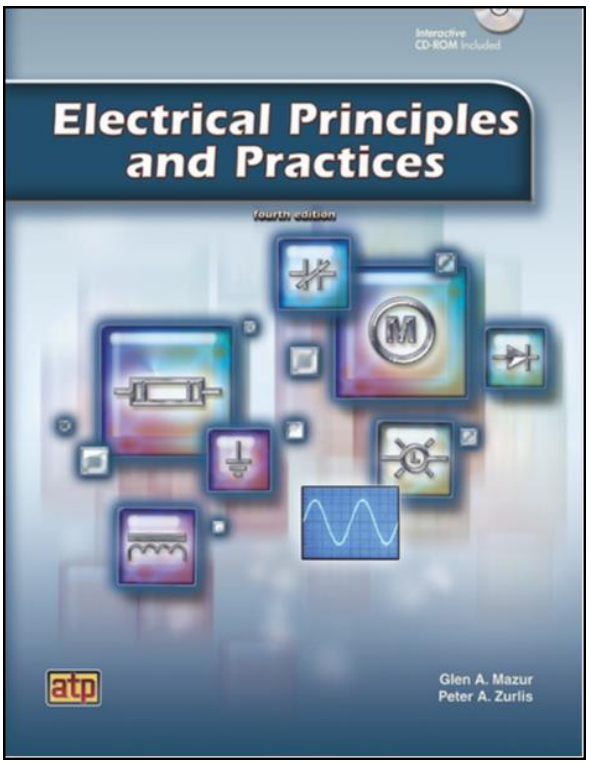
Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Electricity Principles	1	19
	CH02: Basic Quantities	2	31
PM	**CH03:** Ohm's Law and the Power Formula	1.5	20
	CH04: Safety	1.5	26
	Day 2	**Hr**	
	CH05: Math Principles	3	46
PM	**CH06:** Math Applications	1.5	22
	CH07: Numbering Systems and Codes	1.5	23
	Day 3	**Hr**	
AM	**CH08:** Meter Abbreviations and Displays	1	14
	CH09: Taking Standard Measurements	2	34
PM	**CH10:** Symbols and Pintreading	1.5	36
	CH11: Circuit Conductors Connections and Protection	1.5	38
	Day 4	**Hr**	
AM	**CH12:** Series Circuits	1	15
	CH13: Parallel Circuits	1	14
	CH14: Series Parallel Circuits	1	14
	Total	**21**	

Electrical Principles and Practices II

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP08B	Electrical Principles and Practices II	2.7	27	5	NO	YES	NO	$2,160

Course Description:
This 27-Hour 5-Day seminar is PART 2 of an introduction to electrical and electronic principles and practices and their uses in residential, commercial, and industrial applications. Chapters have been expanded to include greater coverage of personal protection and safety. A CD-ROM is included and contains information to supplement the textbook. X



Course Agenda:

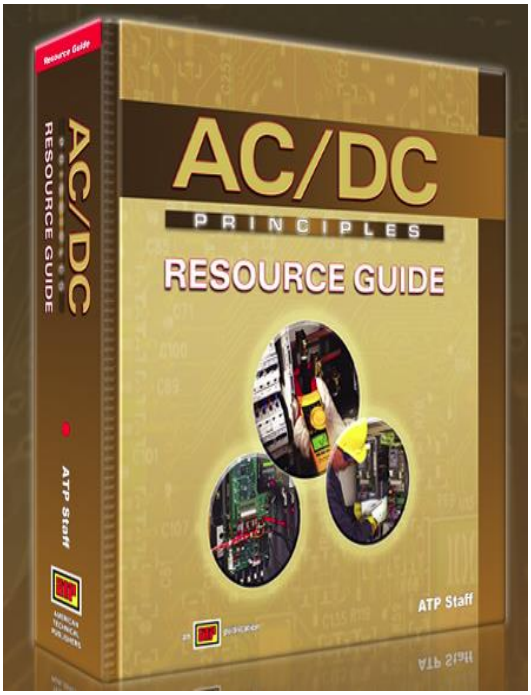
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH15:** Transformers and Smart Grid Technology	3	38
PM	**CH16:** Electric Motors	1.5	27
	CH17: Resistance, Inductances and Capacitance	1.5	25
	Day 2	**Hr**	
AM	**CH18:** Circuit Requirements	3	40
PM	**CH19:** Residential Circuits	3	32
	Day 3	**Hr**	
AM	**CH20:** Commercial Circuits	3	47
PM	**CH21:** Industrial Circuits	3	41
	Day 4	**Hr**	
AM	**CH22:** Fluid Power Circuits	1.5	29
	CH23: Audio Systems	1.5	32
PM	**CH24:** Electrical Control Devices	1.5	29
	CH25: Digital Electrical Circuit	1.5	25
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

AC/DC Principles

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP09	AC/DC Principles	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-Hour 5-Days seminar shows learners how to apply basic laws and analysis techniques to introductory circuits as well as actual AC and DC circuit applications. Ohm's law, Kirchhoff's law, theories applied to basic circuits. Algebra and trigonometry are applied to aid in building fundamental mathematical skills. Step-by-step example problems follow all mathematical formulas. The seminar also includes an introduction to concepts of electricity, network analysis techniques, and vector diagrams and phase relationships, and concludes with chapters on resonance, three-phase AC, transformers, and AC motors. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

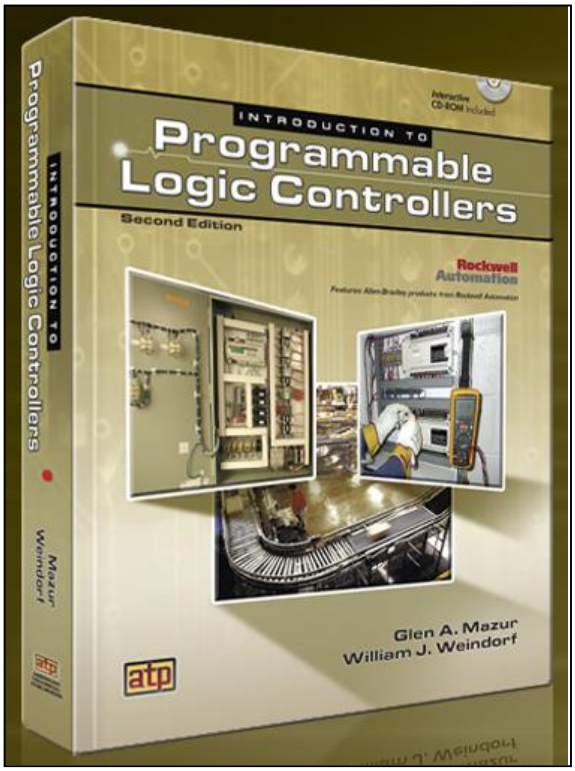
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Basic Concepts of Electricity	1.5	41
	CH02: Resistance	1.5	37
PM	**CH03:** Voltage Sources	1.5	42
	CH04: The Simple Circuit and Ohm's Law	1.5	31
	Day 2	**Hr**	
AM	**CH05:** DC Series Circuits	1	13
	CH06: DC Parallel Circuits	1	15
	CH07: DC Series/Parallel Circuits	1	12
PM	**CH08:** Complex Network Analysis Techniques	1	13
	CH09: Electromagnetism	1	24
	CH10: DC Circuit Inductance	1	18
	Day 3	**Hr**	
AM	**CH11:** DC Circuit Capacitance	1	19
	CH12: AC Fundamentals	1	16
	CH13: Vectors and Phase Relationships	1	17
PM	**CH14:** Resistive AC Circuits	1	13
	CH15: Inductive AC Circuits	1	20
	CH16: Capacitive AC Circuits	1	20
	Day 4	**Hr**	
AM	**CH17:** Inductive-Resistive-Capacitive Circuits	1	11
	CH18: Resonance	1	22
	CH19: Three-Phase AC	1	22
PM	**CH20:** Transformers	2	23
	CH21: AC Motors	1	15
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Introduction to Programmable Logic Controls

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP10	Introduction to Programmable Logic Controls	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-Hour 5-Days seminar covers the fundamentals of installing, programming, and troubleshooting digital and analog PLCs. Introduction to Programmable Logic Controllers is a text/workbook that provides a solid foundation in PLC theory, installation, programming, operation, and troubleshooting. Many large, detailed drawings of commercial and industrial PLC systems are used to support the information in the textbook. Electrical Principles and Practices is an introduction to electrical and electronic principles and practices and their uses in residential, commercial, and industrial applications. Chapters have been expanded to include greater coverage of personal protection and safety. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

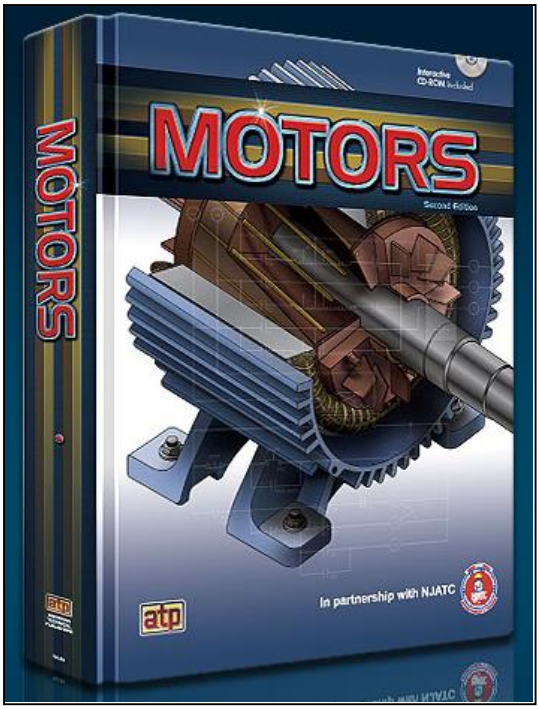
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Pre-Test**	1.5	0
	CH01: PLC and Electrical Safety	1.5	41
PM	**CH02:** Electrical Principles and PLC's	1.5	28
	CH03: Electrical Circuits and PLC's	1.5	27
	Day 2	**Hr**	
	CH04: PLC Hardware	1	19
AM	**CH05:** PLC Programming Instructions	1	18
	CH06: Programming PLC Timers and Controllers	1	17
PM	**CH07:** PLC and System Interfacing	1.5	31
	CH08: PLC Installations and Start Up	1.5	26
	Day 3	**Hr**	
AM	**CH09:** PLC and System Maintenance	1	13
	CH10: Troubleshooting Principles and Test Instruments	2	32
PM	**CH11:** Troubleshooting PLC Hardware	1.5	24
	CH12: Troubleshooting with PLC Software	1.5	16
	Day 4	**Hr**	
AM	**CH13:** Analog Principles	1	13
	CH14: Analog Device Installation and PLC Programming	2	23
	Application Studies	3	
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Motors

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP11	Motors	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-Hour 5-Days seminar provides a comprehensive overview of electrical theory and fundamental motor operating principles as they relate to installation and troubleshooting procedures. This full-color textbook includes the latest information on motor operating principles, starting, braking, and the mechanical aspects of installing and operating motors. Motors is designed to help the learner understand both fundamental and advanced concepts. Many different types of specialized motors are explained. Installation, maintenance, and troubleshooting are discussed in detail. Motors also presents correct safety procedures in compliance with the National Electrical Code® and NFPA 70E®. It can be used in a classroom learning situation, as a self-study textbook, or as a reference book on specialized motors applications. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

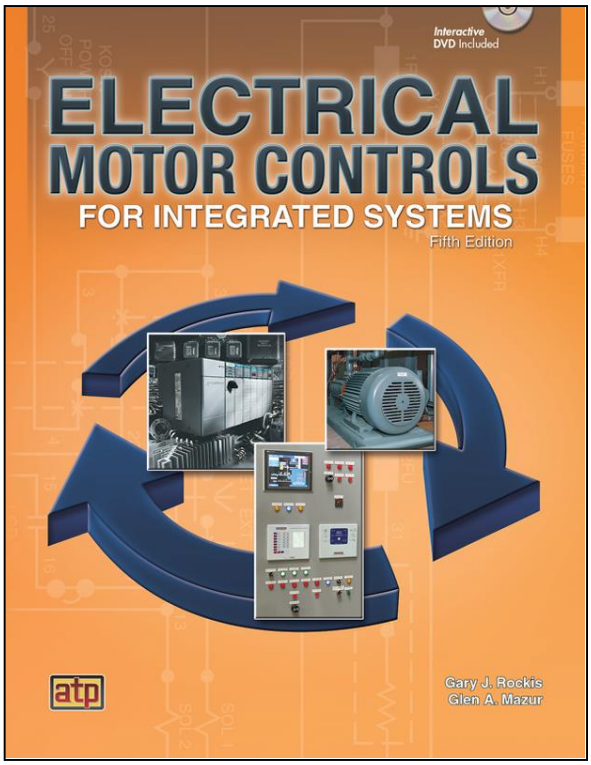
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Magnetism and Induction	0.75	17
	CH02: Motor Construction and Nameplates	1.5	28
	CH03: AC Alternators	0.75	13
PM	**CH04:** Three-Phase Motors	2	31
	CH05: Squirrel-Cage Motors	1	6
	Day 2	**Hr**	
AM	**CH06:** Wound-Rotor Motors	0.5	12
	CH07: Synchronous Motors	1.5	25
	CH08: Single-Phase Motors	1	20
PM	**CH09:** Motor Protection	1.5	23
	CH10: DC Motors and Generators	1.5	25
	Day 3	**Hr**	
AM	**CH11:** Starting	1.5	22
	CH12: Braking	1	13
	CH13: Multispeed Motors	0.5	9
PM	**CH14:** Adjustable-Speed Drives	1.5	20
	CH15: Bearings	1.5	24
	Day 4	**Hr**	
AM	**CH16:** Drive Systems and Clutches		20
	CH17: Motor Alignment		28
	CH18: Troubleshooting Motors	2	38
	CH19: Special-Application Motors	1	10
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Electrical Motor Controls for Integrated Systems I

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP12A	Electrical Motor Controls for Integrated Systems I	2.4	24	4	NO	NO	NO	$1,920

Course Description:

This 21-Hour 4-Day seminar is PART 1 of an introduction to electrical motor controls for integrated systems. The seminar covers electrical, motor, and mechanical devices and their use in industrial control circuits. This seminar provides the architecture and content for acquiring the knowledge and skills required in an advanced manufacturing environment. In this fast-changing manufacturing environment, technicians must be competent in various aspects of mechanical, electrical, and fluid power systems for productivity and success. The textbook also serves as a practical resource for maintenance technicians responsible for production equipment and HVAC equipment. The textbook begins with basic electrical and motor theory, builds on circuit fundamentals, and reinforces comprehension through examples of industrial applications. Special emphasis is placed on the development of troubleshooting skills throughout the text. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

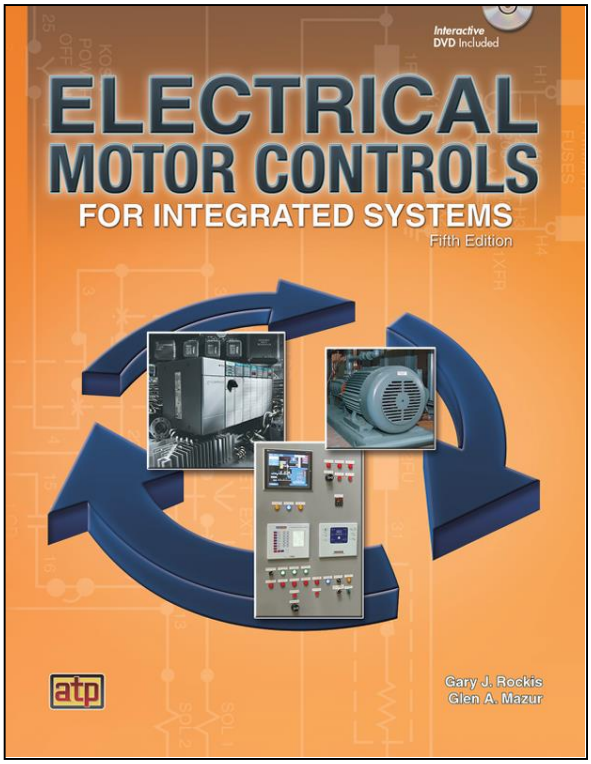
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Electrical Quantities and Basic Circuits	2	35
	CH02: Symbols and Diagrams	1	23
PM	**CH03:** Test Instruments	1.5	29
	CH04: Electrical Safety	1.5	21
	Day 2	**Hr**	
AM	**CH05:** Control Logic	1.5	35
	CH06: Mechanical Input Control Devices	1.5	36
PM	**CH07:** Solenoids	1.5	19
	CH08: Electromechanical Relays	1.5	15
	Day 3	**Hr**	
AM	**CH09:** DC Generators	1	7
	CH10: AC Generators	1	13
	CH11: Transformers	1	13
PM	**CH12:** Contactors and Magnetic Motor Starters	3	43
	Day 4	**Hr**	
AM	**CH13:** DC Motors	1.5	31
	CH13: AC Motors	1.5	32
	CH15: Reversing Motors	1.5	31
	CH16: Timing and Counting Functions	1.5	41
	Total	**24**	

Electrical Motor Controls for Integrated Systems II

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP12B	Electrical Motor Controls for Integrated Systems II	2.4	24	4	NO	YES	NO	$1,920

Course Description:

This 21-Hour 4-Days seminar is PART 2 of an introduction to electrical motor controls for integrated systems. The seminar covers electrical, motor, and mechanical devices and their use in industrial control circuits. This seminar provides the architecture and content for acquiring the knowledge and skills required in an advanced manufacturing environment. In this fast-changing manufacturing environment, technicians must be competent in various aspects of mechanical, electrical, and fluid power systems for productivity and success. The textbook also serves as a practical resource for maintenance technicians responsible for production equipment and HVAC equipment. The textbook begins with basic electrical and motor theory, builds on circuit fundamentals, and reinforces comprehension through examples of industrial applications. Special emphasis is placed on the development of troubleshooting skills throughout the text. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH17:** Motor Stopping Methods	1	12
	CH18: Motor Load, Torque, and Power Quality Requirements	1	17
	CH19: Reduced-Voltage Starting Circuits	1	19
PM	**CH20:** DC Power Sources	1.5	20
	CH21: Semiconductor Input Devices	1.5	33
	Day 2	**Hr**	
AM	**CH22:** Semiconductor Amplification and Switching	1.5	33
	CH23: Semiconductor Power Switching Devices	1.5	29
PM	**CH24:** Photoelectric Semiconductors, Fiber Optics, and Light-Based Applications	1.5	33
	CH25: Solid-State Relays and Starters	1.5	37
	Day 3	**Hr**	
AM + PM	**CH26:** Motor Drives	2	43
	CH27: Programmable Controllers	2	54
	CH28: Power Distribution and Smart Grid Systems	2	53
	Day 4	**Hr**	
AM	**CH29:** Preventive Maintenance Systems	2	31
	CH30: Predictive Maintenance	1	13
PM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**24**	

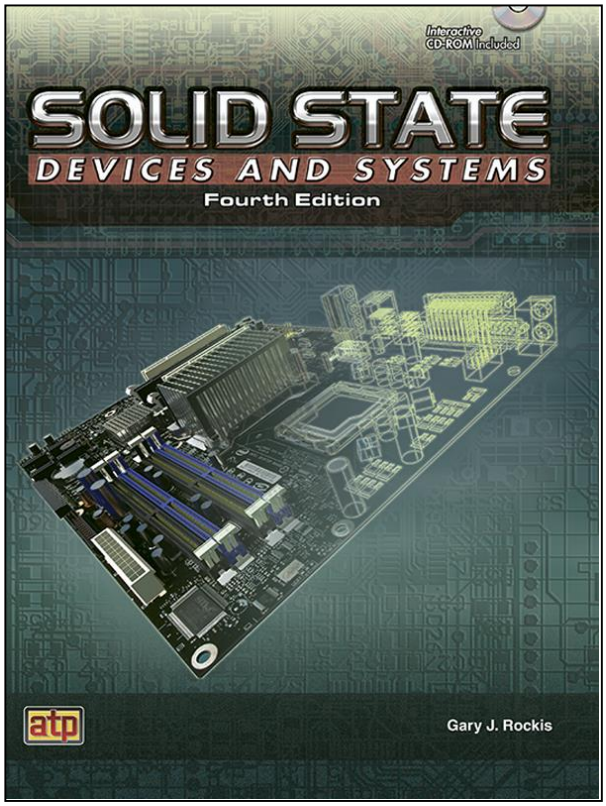
Solid State Devices and Systems

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP13	Solid State Devices and Systems	2.7	27	5	NO	YES	NO	$2,160

Course Description:

This 27-Hour 5-Day seminar presents a comprehensive overview of solid state devices and circuitry. This seminar is designed for electricians, students, and technicians who have a basic understanding of electricity. Component and circuit construction, operation, installation, and troubleshooting are emphasized and supported by detailed illustrations. Various practical applications are presented throughout the book as they relate to temperature, light, speed, and pressure control. Electron current flow is used throughout the book. Electron current flow is based on electron flow from negative to positive.

New and expanded topics include test instruments, printed circuit board construction, soldering and de-soldering, power sources and renewable energy, photonics, digital electronics, and solid state technology in programmable controllers. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

Course Agenda:

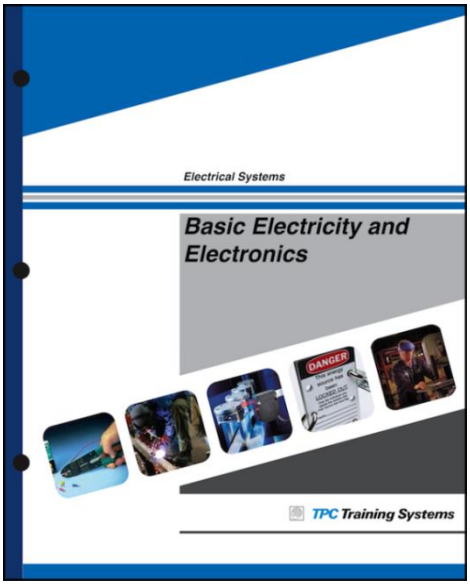
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Symbols, Circuits & Safety	1.5	26
	CH02: Test Instruments	1.5	33
PM	**CH03:** Printed Circuit Board Construction & Troubleshooting	1.5	32
	CH04: Soldering and De-soldering	1.5	36
	Day 2	**Hr**	
AM	**CH05:** Diode Application and Trouble Shooting	1.5	33
	CH06: DC Power Supply Operation & Troubleshooting	1.5	38
PM	**CH07:** Power Sources and Renewable Energy	1.5	38
	CH08: Transducer Application and Troubleshooting	1.5	36
	Day 3	**Hr**	
AM	**CH09:** Bi-Polar Junction Transistor	1.5	40
	CH10: Transistors & Amplifiers	1.5	33
	CH11: JFET's, MOSFET's & IGBT's (Self Study)	0	36
	CH12: Silicone Controlled Rectifiers (Self Study)	0	33
PM	**CH13:** Triacs, Diacs and Unijunction Transistors	1.5	31
	CH14: Operational Amplifiers and 555 Timers	1.5	37
	Day 4	**Hr**	
AM	**CH15:** Photonics (Self Study)	0	63
	CH16: Digital Electronics Fundamentals (Self Study)	1.5	29
	CH17: Solid State Relays	1.5	37
	CH18: Engine Application and Selection	1.5	49
	CH19: Solid State Technology & Programmable Controls	1.5	28
	Day 5	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

Basic Electricity and Electronics

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC201	Basic Electricity and Electronics	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers basic, nonmathematical approach to understanding principles of electricity. Introduces electron theory, static electricity, electrons in motion, and magnetism. Covers basic methods of measuring current, voltage, and resistance. Explains circuit components-conductors, insulators, resistors, capacitors-and simple Ohm's Law calculations for DC and AC circuits.



Course Agenda:

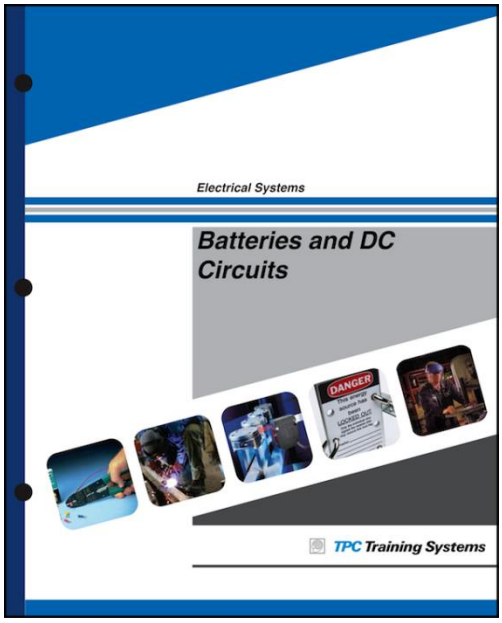
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Introduction to Electricity	1	
	CH02: Static Electricity	1	
	CH03: Current Electricity	1	
PM	**CH04:** Magnetism	1	
	CH05: Current, Resistance, and Potential Difference	1	
	CH06: Electrical Components	1	
	Day 2	Hr	
AM	**CH07:** Conductors	1	
	CH08: DC Circuits	1	
	CH09: AC Circuits	1	
PM	**CH10:** Electronics	1	
	Total Contact Hours	10	
	Certification Exam	2	

Batteries and DC Circuits

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC202	Batteries and DC Circuits	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers how electrochemical action is used. Covers batteries, electrolytic action, electroplating, Characteristics of storage batteries, application and maintenance of lead-acid, nickel-alkaline, and nickel-cadmium batteries, putting batteries into service, charging batteries, maintaining records, fundamentals of DC circuits, and using Ohm's Law to solve problems in DC series, parallel, and series-parallel circuits.



Course Agenda:

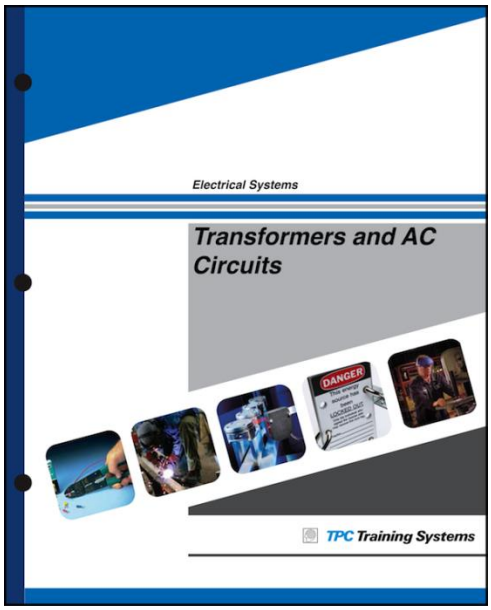
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Electrochemical Action	1	
	CH02: Battery Characteristics	1	
	CH03: Kinds of Batteries	1	
PM	**CH04:** Maintaining Lead-Acid Batteries	1	
	CH05: Charging Lead-Acid Batteries	1	
	CH06: Solving Problems in DC Circuits	1	
	Day 2	Hr	
AM	**CH07:** DC Series Circuits	1	
	CH08: Parallel Circuits	1	
	CH09: Series-Parallel Circuits	1	
PM	**CH10:** DC Circuits in Use	1	
	Total Contact Hours	10	
	Certification Exam	2	

Transformers and AC Circuits

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC203	Transformers and AC Circuits	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers differences between DC and AC circuits. Explains AC sine wave, using vectors to solve AC problems, calculating impedance in circuits having inductance, capacitance, and resistance, AC power relationships in single-phase and three-phase circuits, and principles of transformer maintenance.



Course Agenda:

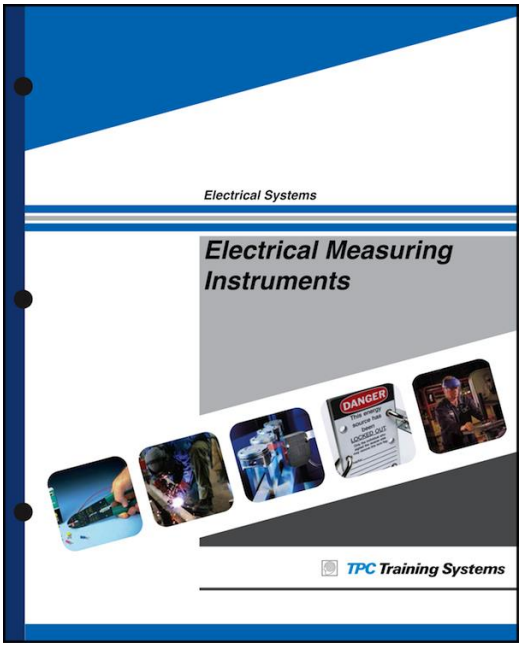
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Alternating Current	1	
	CH02: Mathematics in AC Circuits	1	
	CH03: Inductance and Inductive Reactance	1	
PM	**CH04:** Capacitance and Capacitive Reactance	1	
	CH05: Impedance	1	
	CH06: Power and Energy in AC Circuits	1	
	Day 2	Hr	
AM	**CH07:** Three-Phase Circuits	1	
	CH08: Principles of Transformers	1	
	CH09: Transformer Applications	1	
PM	**CH10:** Maintaining Transformers	1	
	Total Contact Hours	10	
	Certification Exam	2	

Electrical Measuring Instruments

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC204	Electrical Measuring Instruments	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 2-day seminar covers the principles on which electrical test instruments operate. Basic instruments covered include voltmeter, ammeter, wattmeter, ohmmeter, and megohmmeter. Covers AC metering, split-core ammeter, use of current and potential transformers. Includes detailed coverage of modern multimeters. Explains functions and uses of oscilloscopes.



Course Agenda:

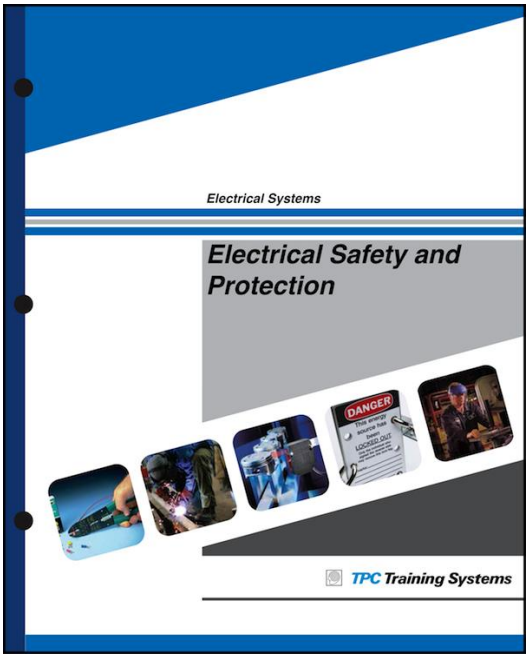
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Meter Operation	1	
	CH02: Ammeters, Voltmeters, and Wattmeters	1	
	CH03: Resistance Measurement	1	
PM	**CH04:** Multimeters	1	
	CH05: Oscilloscopes	1	
	Total Contact Hours	5	
	Certification Exam	2	

Electrical Safety & Protection

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC205	Electrical Safety & Protection	0.7	7	2	NO	YES	NO	$560

Course Description:

This 7-hour 2-day seminar covers electrical hazards and stresses the importance of electrical safety. Covers the equipment and procedures necessary to work safely with electricity, including PPE, lockout/tag out, and first aid. Explains the importance of grounding. Describes many kinds of fuses, circuit breakers, and motor protection devices and their uses.



Course Agenda:

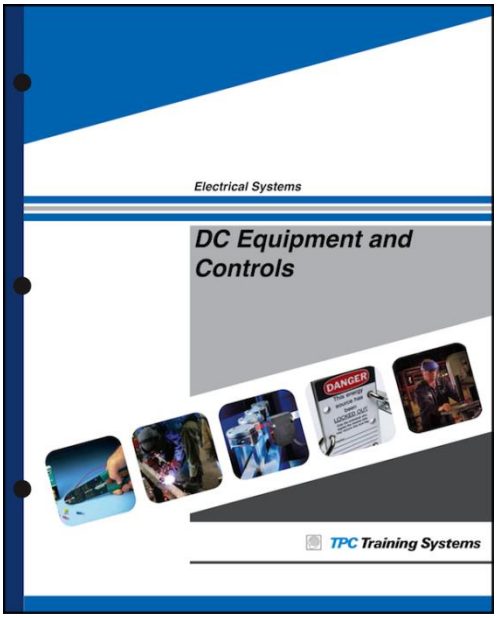
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Electrical Hazards	1	
	CH02: Electrical Safety Equipment	1	
	CH03: Electrical Safety Procedures	1	
PM	**CH04:** The National Electric Code	1	
	CH05: Grounding, Ground Faults, and Short Circuits	1	
	CH06: Fuses and Circuit Breakers	1	
	Day 2	Hr	
AM	**CH07:** Motor Protection	1	
	Total Contact Hours	7	
	Certification Exam	2	

DC Equipment and Control

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC206	DC Equipment and Control	1.0	10	2	NO	YES	NO	$800

Course Description:

This 7-hour 2-day seminar covers electrical hazards and stresses the importance of electrical safety. Covers the equipment and procedures necessary to work safely with electricity, including PPE, lockout/tag out, and first aid. Explains the importance of grounding. Describes many kinds of fuses, circuit breakers, and motor protection devices and their uses.



Course Agenda:

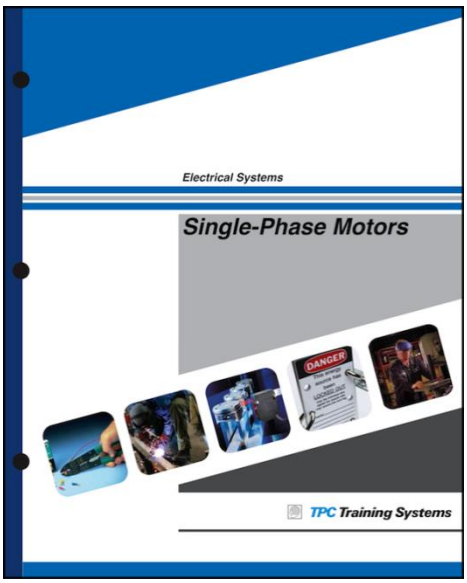
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** DC Power in Industry	1	
	CH02: DC Electromagnets	1	
	CH03: DC Generators	1	
PM	**CH04:** DC Motors	1	
	CH05: DC Armatures	1	
	CH06: DC Relays	1	
	Day 2	Hr	
AM	**CH07:** DC Controllers	1	
	CH08: DC Power Supplies	1	
	CH09: Silicon Controlled Rectifiers	1	
PM	**CH10:** Maintenance of DC Equipment	1	
	Total Contact Hours	10	
	Certification Exam	2	

Single Phase Motor

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC207	Single Phase Motor	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers the types and operating principles of common single-phase motors. Explains NEMA motor standards. Explains how to identify motor leads on split-phase, capacitor-start, capacitor-run, permanent split capacitor, and repulsion motors. Also covers universal motors, shaded-pole motors, and other special types, including synchro and servo systems. Gives general maintenance procedures on all single-phase motors.



Course Agenda:

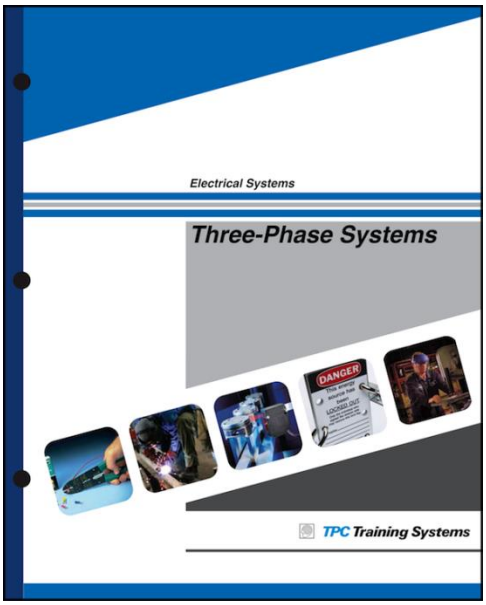
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Introduction to Single-Phase Motors	1	
	CH02: Split-Phase Motors	1	
	CH03: Capacitor Motors	1	
PM	**CH04:** Repulsion Motors	1	
	CH05: Universal Motors	1	
	CH06: Special Motors	1	
	Day 2	Hr	
AM	**CH07:** Synchros	1	
	CH08: Servos	1	
	CH09: Motor Installation	1	
PM	**CH10:** Motor Maintenance	1	
	Total Contact Hours	10	
	Certification Exam	2	

Three Phase Systems

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC208	Three Phase Systems	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers three-phase motor principles for induction, synchronous, and multi-speed dual-voltage motors. Gives recommended maintenance practices for large AC motors. Covers principles of three-phase motor starters, part winding, reversing, jogging, alternator principles and operation. Describes three-phase power distribution.



Course Agenda:

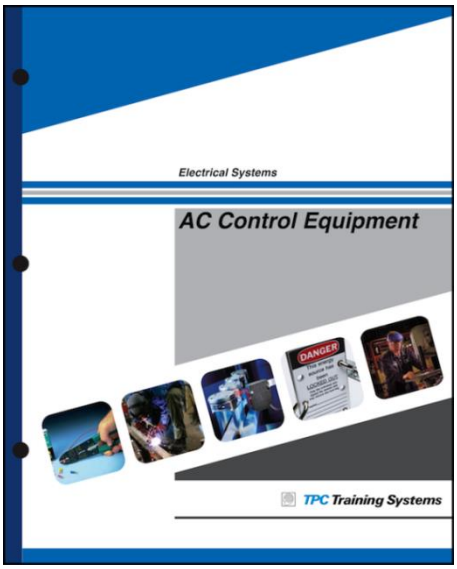
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Principles of Three-Phase Motors	1	
	CH02: Induction Motors	1	
	CH03: Synchronous Motors	1	
PM	**CH04:** Multispeed Motors	1	
	CH05: Maintaining Three-Phase Motors	1	
	CH06: Motor Starters	1	
	Day 2	Hr	
AM	**CH07:** Three-Phase Motor Controllers	1	
	CH08: Alternators	1	
	CH09: Auxiliary Generator Systems	1	
PM	**CH10:** Power Distribution Systems	1	
	Total Contact Hours	10	
	Certification Exam	2	

AC Control Equipment

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC209	AC Control Equipment	1.0	10	2	NO	YES	NO	$800

Course Description:

This 10-hour 2-day seminar covers the broad range of industrial motor starting and control equipment, including NEMA sizes and ratings. Includes pushbutton control stations, limit switches, mercury switches, mechanical and magnetic plugging, foot switches, and pressure, temperature, and float switches. Covers control panel wiring and special applications.



Course Agenda:

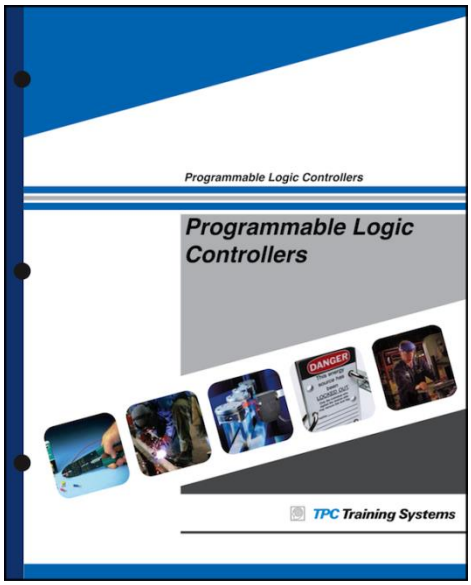
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Motor Starters	1	
	CH02: Switches and Controls	1	
	CH03: Limit Switches	1	
PM	**CH04:** Special Control Switches	1	
	CH05: Timers and Counters	1	
	CH06: Control Relays	1	
	Day 2	Hr	
AM	**CH07:** Equipment for Hazardous Locations	1	
	CH08: Special Motor Controls	1	
	CH09: Motor Control Centers	1	
PM	**CH10:** Control Panel Wiring	1	
	Total Contact Hours	10	
	Certification Exam	2	

Programmable Logic Controllers Fundamentals

Electrical Systems								
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 298	Programmable Logic Controllers Fundamentals	0.7	7	2	NO	YES	NO	$560

Course Description:

This 7-hour 2-day seminar covers prepares technicians to take full advantage of vendor training on specific equipment. Covers the basic operating principles of all PLCs, their inputs and outputs, programming, maintenance, and networking.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	Hr	# of Slides
AM	**CH01:** Introduction to Programmable Logic Controllers	1	
	CH02: Number Systems and Logic	1	
	CH03: Programming the System	1	
PM	**CH04:** Input/Output Devices and Modules	1	
	CH05: Developing a Programmable Logic Controller System	1	
	CH06: Maintenance and Troubleshooting	1	
	Day 2	Hr	
AM	**CH07:** System Expansion and Data Networks	1	
	Total Contact Hours	7	
	Certification Exam	2	


Work Safe
Be Safe

Designation Table:

Condition	Des.	Clarification
Exam:	YES	Course contains certification exam to get certified
	NO	No certification exam.
Hands-On:	YES	Course contains hands-on labs.
	NO	Course conducted on theoretical base.
Scheduled:	YES	Course scheduled and opened for public registration and will be conducted at MSOE
	NO	Course is offered upon request at the customer-site or for public when the minimum enrollment number is reached.
	UD	Course is under-development.

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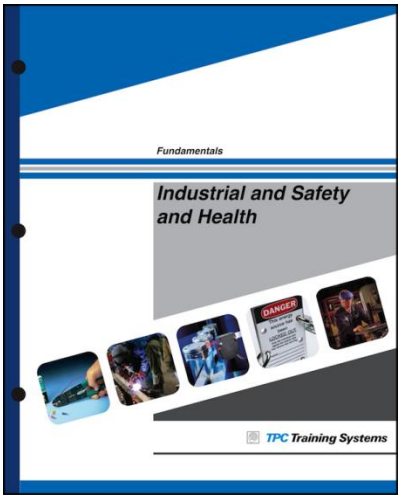
Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC109.1	Industrial Safety and Health	1.2	12	3	NO	YES	NO	$960
TPC 280	Safety, Calibration, and Testing Procedures	0.5	5	1	NO	YES	NO	$400
ATP14	Electrical Safety A Practical Guide to OSHA and NFPA 70E	1.5	15	3	NO	YES	NO	$1,200

Industrial Safety and Health

Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC109.1	Industrial Safety and Health	1.2	12	3	NO	YES	NO	$960

Course Description:

This 12-hour 3-days seminar explains a safe workplace, discusses safety in various situations, personal protective equipment and fire safety. Includes expanded coverage of many health hazards. Covers ergonomics, environmental responsibility and importance of maintaining a safe work environment.



Course Agenda:

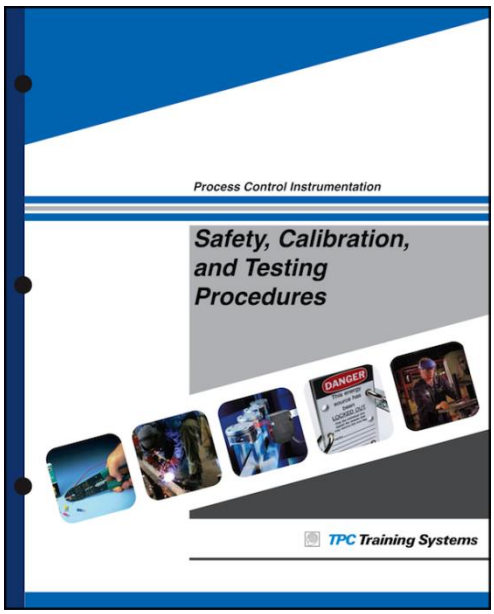
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Introduction to Safety and Health	1	
	CH02: Government Safety and Health Regulations	1	
	CH03: Personal Protective Equipment	1	
PM	**CH04:** Chemical Safety	1	
	CH05: Tool Safety	1	
	CH06: Material Handling	1	
	Day 2	**Hr**	**# of Slides**
AM	**CH07: Working Safely with Machinery**	1	
	CH08: Working Safely with Electricity	1	
	CH09: Electrical Equipment Safety	1	
PM	**CH010:** Fire Safety	1	
	CH011: Protecting Your Health 111	1	
	CH012: A Safe Work Environment	1	
	Total Contact Hours	**12**	
	Day 3	**Hr**	
AM	**Certification Exam**	**2**	

Safety, Calibration, and Testing Procedures

Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
TPC 280	Safety, Calibration, and Testing Procedures	0.5	5	1	NO	YES	NO	$400

Course Description:

This 5-hour 1-day course covers the responsibilities of employer, employee, and regulatory agencies in maintaining safety. Discusses ways of identifying and handling chemical, electrical, biological, radiation, and mechanical hazards. Discusses importance of maintenance (including calibration) and proper record keeping. Describes use of common electrical and electronic test instruments. Offers guidelines for handling heavy equipment, decontaminating and servicing pneumatic and hydraulic equipment, and troubleshooting.



Course Agenda:

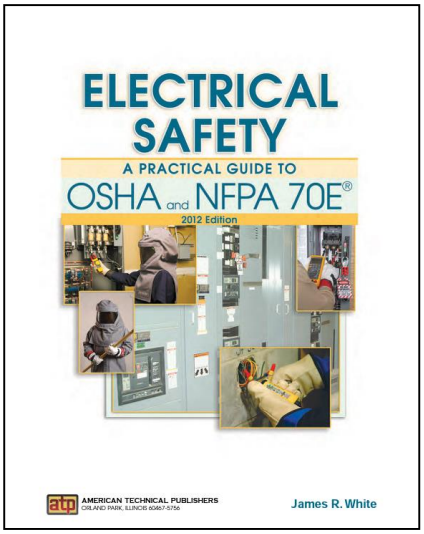
	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**CH01:** Safety Standards and Practices	1	
	CH02: Servicing Fundamentals	1	
	CH03: Pneumatic and Hydraulic Stations	1	
PM	**CH04:** Electrical and Electronic Stations	1	
	CH05: Troubleshooting	1	
	Total Contact Hours	**5**	
	Certification Exam	**2**	

Electrical Safety A Practical Guide to OSHA and NFPA 70E

Course #	Course Title	CEU	Hr	Days	Hands-On	Exam	Scheduled	$/Person
ATP14	Electrical Safety A Practical Guide to OSHA and NFPA 70E	1.5	15	3	NO	YES	NO	$1,200

Course Description:

This 15-Hour 3-Day seminar is a comprehensive overview of electrical safety in the workplace. The seminar presents a practical guide to electrical safety as per OSHA and NFPA 70E®. The textbook features chapters on approach boundaries, working on energized circuits, establishing an electrically safe work environment, and choosing and inspecting personal protective equipment. The information provided helps learners understand how to reduce risk and avoid electrical hazards in the workplace while still being productive, which makes this textbook a valuable training tool for trainers, contractors, and electricians in the field. A CD-ROM is included and contains information to supplement the textbook.



Course Agenda:

	Course Outline/Agenda: AM Session (9-Noon) Lunch Hour (Noon - 1 pm) PM Session (1 - 4)		
	Day 1	**Hr**	**# of Slides**
AM	**Pre-test**	1.5	
	CH01: Electrical Hazards and Basic Electrical Safety Concepts	1	12
	CH02: Multi-Employer Worksites and Electrical Safety Programs	0.5	7
PM	**CH03:** Training of Qualified and Unqualified Workers	0.75	8
	CH04: Approach Boundaries for Shock and Arc Flash Hazards	0.75	15
	CH05: Performing a Hazard/Risk Analysis	0.75	16
	CH06: Establishing an Electrically Safe Work Condition	0.75	15
	Day 2	**Hr**	
AM	**CH07:** Working on Energized Conductors and Circuit Parts	1.5	33
	CH08: Portable Electric Tools and Flexible Cords	1.5	20
PM	**CH09:** Choosing and Inspecting Personal Protective Equipment	1.5	27
	CH10: Guidelines for Common Electrical Tasks	1.5	24
	Day 3	**Hr**	
AM	**Review and conclusion**	1	
	Certification Exam	2	
	Total	**27**	

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