TECHNICAL
EDUCATION
ACADEMY

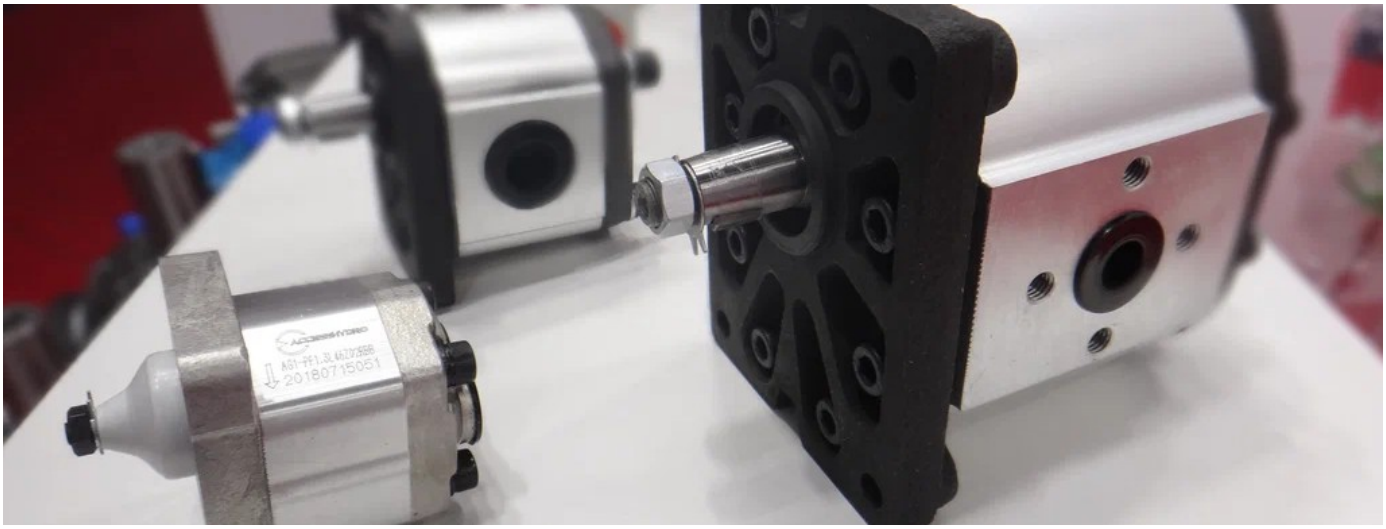
School of Engineering

COURSE PROGRAMME

000472

MECH063 - Industrial Hydraulics and Pneumatics

The Industrial Hydraulics and Pneumatics Training Program is a comprehensive course designed to provide delegates with a solid understanding of fluid power systems and their applications in various industries.



Learn from the Best in the Business!

Course overview

Intermediate level

Why take this course

The Industrial Hydraulics and Pneumatics Training Program is a comprehensive course designed to provide delegates with a solid understanding of fluid power systems and their applications in various industries. The course aims to equip participants with the theoretical knowledge and practical skills necessary to design, analyze, maintain, and troubleshoot hydraulic and pneumatic systems effectively.

The training program is divided into several modules, covering topics ranging from fundamental concepts, such as pressure and flow dynamics, to advanced system integration and real-world applications. The course begins by exploring the basic principles of hydraulics and pneumatics, including pressure measurement, fluid flow, and the relationships between pressure, force, and flow. This foundation is essential for understanding the behavior of fluid power systems and their components.

Next, the course delves into specific components of hydraulic and pneumatic systems, such as cylinders, valves, and actuators. Delegates will learn about the classifications, construction, and operation of these components, as well as how to select and size them for different applications. The course also covers various control methods and technologies, including electro-hydraulic and electro-pneumatic systems, which are critical for achieving precise and efficient control of fluid power systems.

In addition to component-level knowledge, the training program emphasizes the importance of system-level understanding. Delegates will learn how to design and analyze hydraulic and pneumatic circuits, as well as how to integrate these systems into industrial applications. The course also explores emerging trends and technologies in fluid power systems, preparing delegates for the future of the industry.

A strong focus is placed on practical skills and hands-on experience throughout the training program. Delegates will engage in project-based learning, designing and optimizing fluid power systems for specific applications. This hands-on approach allows participants to apply the theoretical knowledge they have gained and develop problem-solving skills that are essential in the field.

Maintenance and troubleshooting are vital competencies for professionals working with fluid power systems. The course covers best practices for maintaining hydraulic and pneumatic systems, implementing preventive maintenance strategies, and identifying and resolving common system faults. Safety and environmental considerations are also emphasized, ensuring delegates understand the importance of adhering to relevant regulations and minimizing the environmental impact of fluid power systems.

By the end of the Industrial Hydraulics and Pneumatics Training Program, delegates will have acquired a comprehensive understanding of fluid power systems and their applications. They will be equipped with the theoretical knowledge, technical skills, and practical experience necessary to excel in their careers and contribute to the efficient operation and maintenance of hydraulic and pneumatic systems in various industries.

Course overview — continued

Who it is for and how it helps

• Maintenance Engineers and Technicians: Professionals responsible for maintaining, troubleshooting, and repairing hydraulic and pneumatic systems in industrial settings.

• Mechanical Engineers: Engineers involved in the design, development, and optimization of fluid power systems for various industrial applications.

• Process Engineers: Individuals working with fluid power systems in manufacturing or production processes, seeking a deeper understanding of hydraulic and pneumatic principles.

• Instrumentation and Control Engineers: Professionals responsible for integrating and controlling hydraulic and pneumatic components in automated systems.

• Plant and Facility Managers: Individuals overseeing the operation and maintenance of industrial facilities that utilize hydraulic and pneumatic systems.

• Technical Sales Representatives: Professionals involved in selling hydraulic and pneumatic components, who require a deeper understanding of the technologies to better serve their customers.

• Vocational and Technical Students: Students pursuing careers in fields related to fluid power systems, who wish to gain a solid foundation in industrial hydraulics and pneumatics.

• Career Changers: Individuals considering a career in fluid power systems, looking for a comprehensive understanding of hydraulic and pneumatic principles and applications.

This course is suitable for both beginners and experienced professionals seeking to expand their knowledge and skills in the field of industrial hydraulics and pneumatics.

What you will learn

- Understand the fundamental principles and concepts of hydraulic and pneumatic systems, including pressure, flow, and fluid dynamics
- Identify and differentiate between various hydraulic and pneumatic components, such as cylinders, valves, actuators, and sensors
- Design, analyze, and optimize hydraulic and pneumatic circuits for various industrial applications, employing industry-standard symbols and nomenclature
- Implement and troubleshoot electro-hydraulic and electro-pneumatic systems, incorporating proportional and servo technologies
- Select appropriate hydraulic and pneumatic components based on system requirements, energy efficiency, and environmental considerations
- Apply best practices for the maintenance, troubleshooting, and repair of hydraulic and pneumatic systems to ensure optimal performance and minimize component failures
- Develop and implement preventive maintenance strategies and safety measures for fluid power systems in industrial settings
- Evaluate the energy efficiency of hydraulic and pneumatic systems and identify opportunities for improvement

Course overview — continued

- Understand the environmental impact of fluid power systems and adhere to regulations and standards for safety and environmental protection
- Integrate hydraulic, pneumatic, and electro-mechanical components in various real-world applications, considering emerging trends and technologies in fluid power systems
- Effectively communicate technical information related to hydraulic and pneumatic systems, both in written and oral formats, to peers, managers, and customers
- Gain hands-on experience in designing, assembling, testing, and optimizing a fluid power system for a specific project, demonstrating problem-solving skills and practical expertise in the field of industrial hydraulics and pneumatics

Curriculum

Modules 01–04

01 Fundamentals of Pressure and Flow

- Pressure: Definition, units, and measurement techniques
- Pascal's Law: Principles and real-world applications
- Understanding the pressure-force relationship
- Fluid flow dynamics and discharge calculations
- Differentiating between steady and unsteady flows
- Bernoulli's principle and its implications
- Laminar and turbulent flow characteristics
- Investigating the pressure-flow relationship

02 Exploring Hydraulic

- Cylinders Classifications: Single-acting vs. double-acting cylinders
- Cylinder construction, materials, and mounting methods
- Cylinder cushioning mechanisms and benefits
- Seals: types and selection criteria
- Hydraulic cylinder design checklist
- Diagnosing common hydraulic cylinder issues

03 Hydraulic Directional Control Valves

- Classifications, symbols, and types of valves
- Poppet, check, and spool valves: functionalities and applications
- Direct and indirect valve operation
- Valve actuation techniques
- 2-way, 3-way, and 4-way directional control valves
- Understanding positive and negative overlapping
- Center conditions and their significance

04 Hydraulic Pressure and Flow Control Valves

- Relief valve: function and importance
- Surge pressure management
- Sequence and counterbalance valves

Curriculum

Modules 04–08 · Module 04 — continued

- Pressure reducing and brake valves
- Unloading valves and their applications
- Flow control valves: function, types, and selection criteria

05 Hydraulic System Accessories and Fluids

- Overview: oil reservoirs, filters, heat exchangers, pipes, hoses
- Hydraulic fluid properties and performance characteristics
- Oil classifications, neutralization numbers, and selection
- Oil contamination, cleanliness standards, and storage practices
- Understanding oil additives and their benefits
- Common hydraulic oil-related problems and solutions

06 Introduction to Hydraulic Circuits and Applications

- Symbols and nomenclature of hydraulic components
- Fundamentals of hydraulic circuit design and analysis
- Types and illustrations of hydraulic circuits
- Design and practical applications of hydraulic circuits
- Advantages and limitations of hydraulic systems
- Simulation and analysis of hydraulic circuits using FLUIDSIM software

07 Electro-Hydraulic Systems

- Proportional solenoids: operation and applications
- Proportional valves: function and advantages
- Servo valves: operation and use cases
- Comparing proportional and servo technologies
- Utilizing transducers in hydraulic systems for improved performance

08 Maintenance and Troubleshooting in Hydraulic Systems

- Importance of safety and cleanliness in hydraulic systems
- Implementing preventive maintenance strategies
- Commissioning procedures and pre-commissioning checks

Curriculum

Modules 08–12 · Module 08 — continued

- Systematic troubleshooting of hydraulic system faults and failures
- Preventing premature hydraulic component failures

09 Pneumatic System Fundamentals

- Air characteristics and properties
- Generating, preparing, and distributing compressed air
- Key features of pneumatic systems
- Pneumatic symbols and component identification
- Essential components of pneumatic systems
- Pneumatic elements: control valves and actuators

10 Pneumatic Circuit Design, Maintenance, and Troubleshooting

- Designing pneumatic circuits for various applications
- Troubleshooting: flow chart analysis and diagnostic techniques for pneumatic circuits
- Best practices for maintaining pneumatic systems

11 Advanced Pneumatic Components and Applications

- Vacuum technology in pneumatic systems
- Pneumatic timers and counters
- Logic elements and memory circuits
- Flow control and quick exhaust valves
- Pneumatic sensors and switches
- Applications of advanced pneumatic components

12 Electro-Pneumatic Systems

- Electrical control of pneumatic systems
- PLCs in pneumatic control: principles and applications
- Electro-pneumatic circuit design
- Integrating sensors and actuators in electro-pneumatic systems
- Troubleshooting electro-pneumatic systems

Curriculum

Modules 13–15

13 Energy Efficiency in Hydraulic and Pneumatic Systems

- Evaluating energy consumption in fluid power systems
- Strategies for improving energy efficiency
- Proper component selection and sizing
- Optimizing system design for energy conservation
- Maintenance practices for enhanced energy efficiency

14 Safety and Environmental Considerations in Fluid Power Systems

- Identifying potential hazards in hydraulic and pneumatic systems
- Implementing safety measures and best practices
- Environmental impact of fluid power systems
- Proper disposal and recycling of fluids and components
- Regulations and standards for fluid power system safety and environmental protection

15 System Integration and Real-World Applications

- Integrating hydraulic, pneumatic, and electro-mechanical components
- Fluid power systems in mobile and industrial applications
- Case studies: successful implementations of fluid power systems
- Emerging trends and technologies in fluid power
- Future prospects and challenges in fluid power systems

Participation and contacts

Joining the programme

Contact the Academy and quote course code 000472 to confirm dates, delivery format, prices and enrolment terms.

Training for your team

Tell us your business goals, the roles and number of participants, and your preferred dates and location. This will help us discuss the right training option.

Preparing for the programme

The published programme does not specify any prerequisites. Contact us before enrolling to confirm how to prepare.

Discuss your training needs

mail@tecedu.org
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