Revised: Summer 2024

Virginia Western Community College
MEC 162
Applied Hydraulics and Pneumatics

Prerequisites
None

Corequisites
None

Course Description
Introduces hydraulic and pneumatic systems found in construction equipment, road vehicles, and farm equipment. Includes the basic theory, construction, maintenance, and repair of hydraulic and pneumatic power systems. This course covers the basics of pneumatic, electropneumatic and hydraulic control circuits in a complex mechatronic system. Students will learn the functions and properties of control elements based upon physical principles, and the roles they play within the system. Technical documentation such as data sheets, circuit diagrams, displacement step diagrams and function charts will also be covered. By understanding and performing measurements on the pneumatic and hydraulic control circuits, students will learn and apply troubleshooting strategies to identify, localize and (where possible) correct malfunctions. Preventive maintenance of (electro) pneumatic and hydraulic components as well as safety issues within the system will be discussed.

Semester Credits: 3 Lecture Hours: 2 Lab Hours: 2

Required Materials

Textbook:
Resources will provided by instructor

Software:
None

Other Required Materials:
Tooling University, online subscription, purchased through Tooling U bookstore(online) to receive student discount

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Course Outcomes

At the completion of this course, successful students will be able to

- Explain what a mechatronic system is, and the inter-relationships of components and modules within a complex mechatronic system with a focus on (electro) pneumatic and hydraulic control systems.
- Identify the role of (electro) pneumatic and hydraulic control systems in complex mechatronic systems and subsystems.
- Demonstrate troubleshooting and maintenance of (electro) pneumatic and hydraulic circuits within a mechatronic system.
- Explain the role of various (electro) pneumatic and hydraulic components within a given system or module.
- Analyze and describe the flow of energy in each mechatronic system or subsystem.
- Analyze the relationship between flow and pressure in both hydraulic and pneumatic systems.
- Identify common pneumatics and hydraulic symbols and use them to construct viable working circuits.
- Identify common circuits utilized in an industrial setting.
- Analyze circuit diagrams and describe their operation.
- Describe the basic physical properties of pneumatic and hydraulic components.
- Measure and adjust pneumatic and hydraulic components in a mechatronic system.
- Analyze technical documents such as data sheets, circuit diagrams, displacement step diagrams, timing diagrams and function charts for the pneumatic and hydraulic components within a mechatronic system.
- Identify and document causes of malfunctions in pneumatic and hydraulic circuits.
- Remedy malfunctions in pneumatic and hydraulic circuits.
- Recognize the safety hazards within a pneumatic and hydraulic system.

Topical Description

- Pneumatics and Electropneumatics
- Electropneumatic Control System
- Signal Processing Structure
- Function Diagram and Pneumatic Circuit Diagram
- Actuation of Pneumatic Cylinders
- Sequence Control Systems
- Electrically Actuated Directional Control Valves (DCVs)
- Displacement-Step Diagram

- Pneumatic Actuators
- Stroke Speed Regulation of Pneumatic Actuators
- Basic Electropneumatic Control Circuits
- Air Generation and Distribution
- Terminal Connections
- Electrical Control Devices
- Safety Regulations
- Hydraulics Overview
- Circuit Symbols
- Design of Circuit Symbols
- Physical Principles
- Transmission
- Pressure Transfer and Flow Rate
- Solenoid Activated Directional Control Valves
- Troubleshooting

Notes to Instructors

Beginning Fall 2020, VWCC will require students to have a computer or reliable access to a computer, capable of participation in an online format. Online courses at Virginia Western require a significant amount of interaction with Canvas, the Learning Management System, and many require real-time class sessions using the Zoom web-conferencing tool. To be successful in online classes, students must have substantial access to a computer with hi-speed internet connectivity. The expected requirements are listed on the college webpage.

This class covers the required topics for successful completion of NC3 certifications in Fundamentals of Pneumatics and Fundamentals of Hydraulics. Both certifications can be completed without additional content.