Hydraulics & Pneumatics
Subject Code: 010225
Course & Unit Descriptions

Course Description:
In the *Hydraulics and Pneumatics* course, students will learn physical principles of hydraulics. They will diagnose problems, test system components, properly maintain hydraulic circuits and diagnose and test problem areas in hydraulics systems of agricultural and industrial power equipment.

Unit: Safety

Students will demonstrate their knowledge of safety rules and regulations. Students will identify safety signs and signals. Students will describe health and safety practices along with demonstrating appropriate responses for major types of hazardous materials disasters.

Benchmark: 4.1 Safety Procedures
Level 2: Follow safety procedures in specific situations with specialized tools and equipment, evaluate situation and take corrective action

Indicators
4.1.01 Demonstrate knowledge of safety rules and regulations
4.1.02 Interpret safety signs and symbols
4.1.03 Model safe attitudes and behaviors (e.g., lifting, climbing)
4.1.04 Identify safety hazards and take corrective measures
4.1.05 Use safety equipment in accordance with established procedures
4.1.06 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary

Academic Standards
English Standards: Demonstrate comprehension of print and electronic text by responding to questions (e.g., literal, inferential, evaluative and synthesizing). (Reading Process B, 8-10; Reading Process B, 11-12)

Benchmark: 4.2 Stationary and Mobile Equipment Maintenance
Level 2: Inspect and maintain specialized machinery and equipment according to schedule

Indicators
4.2.01 Perform a machine condition inspection
4.2.03 Ensure presence and function of safety systems and hardware
4.2.08 Maintain machinery, equipment, instruments and facility cleanliness, appearance, and safety
4.2.09 Inspect and maintain fluid conveyance and storage components (e.g., hoses and lines, valves, nozzles)

Academic Standards
English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)
Math: Apply mathematical knowledge and skills routinely in other content areas and practical situations. (Mathematical Processes B, 8-10)

Benchmark: 5.13 Hazardous Materials Management
Level 2: Follow handling, storage, and recording procedures for hazardous materials

Indicators

5.13.01 Describe health and safety practices to reduce risks from hazardous materials (i.e., MSDS forms, employer notification forms, personal protective equipment)
5.13.02 Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical, fire and explosion, general safety hazards)
5.13.03 Demonstrate an ability to obtain and use information addressing hazardous substance discharge
5.13.04 Demonstrate safe management, handling, disposal and/or recycling procedures for hazardous and regulated materials and hazardous waste
5.13.05 Detect and identify hazardous materials
5.13.06 Perform site evaluation to determine presence and storage of hazardous materials
5.13.08 Prepare hazardous materials for transportation and storage in accordance with regulations
5.13.09 Maintain hazardous material handling documentation
5.13.10 Identify hazardous materials that can be recycled

Academic Standards

English: Apply reading comprehension strategies to understand grade-appropriate text. (Reading Process A, 8-10; Reading Process A, 11-12)
Math: Construct convincing arguments based on analysis of data and interpretation of graphs. (Data Analysis F, 8-10)
Science: Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources. (Earth and Space Sciences D, 9-10)

Benchmark: 5.4 Contaminants

Level 2: Assess affected area, determine the source and type of contaminant, and respond appropriately

Indicators

5.4.03 Identify, comply with and implement contaminant control, remediation and prevention practices (e.g., biological, radiological, sanitation, buffer strips for run-off)

Academic Standards

English: Use multiple resources to enhance comprehension of vocabulary. (Vocabulary F, 8-10; Vocabulary E, 11-12)
Math: Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision. (Measurement E, 8-10)
Science: Describe how human activities can impact the status of natural systems. (Life Sciences G, 9 -10)
Social Studies: Evaluate the consequences of geographic and environmental changes resulting from governmental policies and human modifications to the physical environment. (Geography B, 11-12)

Benchmark: 5.6 Emergency Response

Level 2: Assess affected area, determine the source and type of contaminant, and respond appropriately

Indicators

5.6.03 Identify and implement various emergency response plans

Academic Standards

English: Use appropriate self-monitoring strategies for comprehension. (Reading Process C, 8-10; Reading Process C, 11-12)

Unit: Principles of Hydraulics

Students are taught the physical and mechanical principles of hydraulic systems.

Benchmark: 4.6 Hydraulic Systems
Level 2: Diagnose, repair, and rebuild hydraulic components

Indicators
4.6.01 Describe physical and mechanical principles of hydraulics
4.6.02 Describe features, benefits and applications of types of hydraulic and hydrostatic systems

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Hydraulic Component Systems

Students learn the components and functions of hydraulic and pneumatic systems. Topics include pumps, control valves, control assemblies, actuators, maintenance procedures, switching and control devices.

Benchmark: 4.6 Hydraulic Systems
Level 2: Diagnose, repair and rebuild hydraulic components.

Indicators
4.6.04 Describe the application and operation of major components (e.g., pumps, motors, valves, cylinders, accumulators)
4.6.08 Evaluate system cleanliness
4.6.10 Remove, inspect and replace major components

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Hydraulic Symbols, Schematics and Circuits

Students will understand hydraulic schematics and circuits to diagnose, repair, and rebuild hydraulic components.

Benchmark: 4.6 Hydraulic Systems
Level 2: Diagnose, repair, and rebuild hydraulic components

Indicators
4.6.03 Interpret symbols and schematic drawings

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Analyze, Diagnose, Test and Troubleshoot

Students are taught hydraulic systems using schematic diagrams, installation procedures, cleanliness and safety. Students will demonstrate tubing cutting, bending, and flaring, identification and selection of proper fluid, and charging the system. Students will discuss planned maintenance, specific repair/replacement recommendations, system diagnosis, and troubleshooting.

Benchmark: 4.6 Hydraulic Systems

Level 2: Diagnose, repair and rebuild hydraulic components.

Indicators

4.6.05 Analyze, diagnose and test operating systems

4.6.06 Analyze, diagnose, test and repair/replace fluid conveyance components (e.g., hoses, lines, fittings)

4.6.07 Analyze, diagnose and test electronic control for hydraulic systems

4.6.08 Evaluate system cleanliness

4.6.11 Identify and measure flow rate, pressure and temperature

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Identify Hydraulic Fittings and Ports

Students will identify and explain the components of hydraulic cylinders including the fittings and ports.

Benchmark: 4.6 Hydraulic Systems

Level 2: Diagnose, repair and rebuild hydraulic components.

Indicators

4.6.01 Describe physical and mechanical principles of hydraulics

4.6.08 Evaluate system cleanliness

4.6.09 Identify hydraulic fittings and ports

Academic Standards

English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)

Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)

Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Preventative Maintenance

Students are taught the common hazards, safety measures, maintenance tasks, and inspection procedures for hydraulic equipment as it relates to preventative maintenance.

Benchmark: 4.6 Hydraulic Systems
Level 2: Diagnose, repair and rebuild hydraulic components

Indicators
4.6.06 Analyze, diagnose, test and repair/replace fluid conveyance components (e.g., hoses, lines, fittings)
4.6.08 Evaluate system cleanliness
4.6.12 Adhere to contamination control procedures

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)

Unit: Hydraulic Brakes

Students are taught hydraulic braking systems including system components and subsystems. Students will describe how these systems operate and troubleshoot and repair the various systems taught.

Benchmark: 4.6 Hydraulic Systems
Level 2: Diagnose, repair and rebuild hydraulic components

Indicators
4.6.04 Describe the application and operation of major components (e.g., pumps, motors, valves, cylinders, accumulators)
4.6.06 Analyze, diagnose, test and repair/replace fluid conveyance components (e.g., hoses, lines, fittings)
4.6.07 Analyze, diagnose and test electronic control for hydraulic systems
4.6.08 Evaluate system cleanliness
4.6.10 Remove, inspect and replace major components
4.6.12 Adhere to contamination control procedures

Academic Standards
English: Apply knowledge of roots, affixes and phrases to aid understanding of content area vocabulary. (Vocabulary D, 11-12)
Math: Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions. (Number G, 8-10)
Science: Explain the movement of objects by applying Newton's three laws of motion. (Physical Sciences D, 9-10)