**Hydraulics & Pneumatics**

Subject Code: 010225

Course & Unit Descriptions

**Course Description:**

Students will learn to diagnose, repair and rebuild hydraulic systems and their components. Students will learn the physical and mechanical principles of both hydraulic and hydrostatic operating units. Topics include testing system components and properly maintaining hydraulic and hydrostatic circuits. Students will demonstrate contamination control and system cleanliness in both hydraulic and hydrostatic operating systems. Throughout the course, site and personal safety procedures and business practices are reinforced.

**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.

Outcome 1.12

Site and Personal Safety Procedures: Follow site and personal safety procedures in specific situations with specialized tools and equipment, evaluate the situation and take corrective action.

Competency:

1.12.1 Use Occupational Safety and Health Administration (OSHA) defined procedures for identifying employer and employee responsibilities, working in confined spaces, managing worker safety programs, using ground fault circuit interrupters (GFCIs), maintaining clearance and boundaries and labeling.

1.12.2 Interpret safety signs and symbols.

1.12.3 Interpret personal safety rights according to the employee Right to Know plan.

1.12.4 Describe how working under the influence of drugs and alcohol increases the risk of accident, lowers productivity, raises insurance costs and reduces profits.

1.12.5 Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits.

1.12.6 Identify procedures for the handling, storage and disposal of hazardous materials.

1.12.7 Select, use, store, maintain and dispose of personal protective equipment (PPE), appropriate to job tasks, conditions and materials.

1.12.8 Identify safety hazards and take corrective measures.

1.12.9 Identify, inspect and use safety equipment appropriate for the task.

1.12.10 Follow established procedures for the administration of first aid and contact emergency medical personnel when necessary.

1.12.11 Set up for ergonomic workflow.

1.12.12 Apply inspection, rejection criteria, hitch configurations and load handling practices to slings and rigging hardware.

1.12.13 Demonstrate the proper use of American National Standards Institute (ANSI) hand signals.

1.12.15 Select and operate fire extinguishers based on the class of fire.

Outcome 4.1

Tool, Stationary and Mobile Equipment Maintenance: Inspect, clean, maintain and perform planned preventative maintenance on tools, machinery, implements and equipment.

Competency:

4.1.1 Identify the types of hand tools, power tools and stationary equipment and describe their functions.

4.1.2 Ensure the presence and functionality of safety systems and hardware.

4.1.3 Identify potential hazards and limitations related to the use of hand tools, power tools and stationary equipment.

4.1.4 Maintain machinery, equipment, instrument and facility cleanliness, appearance and safety.

4.1.6 Inspect for fluid leakage, fluid levels and the condition of fluids.

4.1.7 Clean, lubricate and adjust machinery and equipment.

4.1.8 Select fluids, maintain fluid levels and replace system filters.

4.1.9 Inspect and maintain fluid conveyance and storage components (e.g., hoses and lines, valves, nozzles).

4.1.11 Calibrate metering, monitoring and sensing equipment.

Outcome 4.2

Equipment Operations: Operate and maintain mechanical equipment and power systems.

Competency:

4.2.1 Follow manufacturer’s recommended operating procedures and adjustment specifications.

4.2.2 Differentiate among the functions, limitations and proper use of equipment, equipment controls and instrumentation.

4.2.3 Perform pre- and post-operation inspections and adjustments and report malfunctions.

4.2.4 Perform appropriate start-up, operating and shut-down procedures.

4.2.5 Select and operate the equipment and attachments needed to complete the task including levers, pedals or valves.

Outcome 6.8

Contaminants and Pollution Control: Assess an affected area, determine the source and type of contaminant and respond.

Competency:

6.8.7 Identify, comply with and implement contaminant control, remediation and prevention practices (e.g., biological, sanitation, buffer strips).

6.8.10 Develop and implement various emergency response plans.

Outcome 6.9

Hazardous Materials and Waste Management: Follow and apply handling, storage and recording procedures for hazardous materials and waste.

Competency:

6.9.2 Describe health and safety practices for reducing risks from hazardous materials (e.g., safety data sheet [SDS], employer notification forms, personal protective equipment [PPE]).

6.9.3 Demonstrate appropriate responses for major types of hazardous materials disasters (e.g., chemical releases, fires, explosions).

6.9.4 Obtain and use information addressing hazardous substance discharge.

6.9.5 Demonstrate safe management, handling, disposal and recycling procedures for hazardous materials and waste.

6.9.6 Perform site assessments to detect and identify the presence and storage of hazardous materials.

6.9.8 Prepare hazardous materials for transportation and storage in accordance with regulations.

6.9.9 Prepare and maintain hazardous material handling documentation.

6.9.10 Identify hazardous materials that can be recycled.

**Unit: Principles of Hydraulics**

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

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.2 Describe the physical and mechanical principles of hydraulics.

4.11.3 Explain the features, benefits and applications of the different types of hydraulic and hydrostatic systems.

**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.

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.4 Describe the application and operation of major components, including pumps, motors, valves and accumulators.

4.11.8 Evaluate system cleanliness to determine efficiency.

4.11.9 Locate hydraulic fittings and ports.

4.11.10 Remove, inspect and replace major components, including master cylinders and seals.

**Unit: Hydraulic Symbols, Schematics and Circuits**

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

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.1 Interpret symbols and schematic drawings related to hydraulic system design.

**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.

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.3 Explain the features, benefits and applications of the different types of hydraulic and hydrostatic systems.

4.11.4 Describe the application and operation of major components, including pumps, motors, valves and accumulators.

4.11.5 Test and diagnose operating systems.

4.11.6 Test, diagnose and repair or replace fluid conveyance components (e.g., hoses, lines, fittings).

4.11.7 Test and diagnose electronic controls for hydraulic systems.

4.11.8 Evaluate system cleanliness to determine efficiency.

4.11.11 Measure flow rate, pressure and temperature.

4.11.12 Prevent contamination of a hydraulic system.

**Unit: Identify Hydraulic Fittings and Ports**

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

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.2 Describe the physical and mechanical principles of hydraulics.

4.11.8 Evaluate system cleanliness to determine efficiency.

4.11.9 Locate hydraulic fittings and ports.

**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.

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.6 Test, diagnose and repair or replace fluid conveyance components (e.g., hoses, lines, fittings).

4.11.8 Evaluate system cleanliness to determine efficiency.

4.11.12 Prevent contamination of a hydraulic system.

**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.

Outcome 4.11

Hydraulic Systems: Diagnose, repair and rebuild hydraulic systems.

Competency:

4.11.4 Describe the application and operation of major components, including pumps, motors, valves and accumulators.

4.11.6 Test, diagnose and repair or replace fluid conveyance components (e.g., hoses, lines, fittings).

4.11.7 Test and diagnose electronic controls for hydraulic systems.

4.11.8 Evaluate system cleanliness to determine efficiency.

4.11.10 Remove, inspect and replace major components, including master cylinders and seals.

4.11.12 Prevent contamination of a hydraulic system.

Outcome 4.12

Brakes: Identify, inspect and replace components of braking systems.

Competency:

4.12.1 Identify and locate components of braking systems.

4.12.2 Identify pressure concerns in the brake system using hydraulic principles (Pascal’s Law).

**Unit: Business Operations**

Students will develop business goals and objectives using real-world examples of various organizational and business structures. Students will budget resources, evaluate outcomes, and forecast future budgetary needs according to standard business principles.

Outcome 1.10

Sales and Marketing: Manage pricing, place, promotion, packaging, positioning and public relations to improve quality customer service.

Competency:

1.10.1 Identify how the roles of sales, advertising and public relations contribute to a company’s brand.

1.10.2 Determine the customer's needs and identify solutions.

1.10.3 Communicate features, benefits and warranties of a product or service to the customer.

1.10.4 Identify the company policies and procedures for initiating product and service improvements.

1.10.5 Monitor customer expectations and determine product/service satisfaction by using measurement tools.

1.10.6 Discuss the importance of correct pricing to support a product’s or service’s positioning in the marketing mix.

Outcome 1.6

Business Literacy: Develop foundational skills and knowledge in entrepreneurship, financial literacy and business operations.

Competency:

1.6.1 Identify business opportunities.

1.6.5 Describe organizational structure, chain of command, the roles and responsibilities of the organizational departments and interdepartmental interactions.

1.6.6 Identify the target market served by the organization, the niche that the organization fills and an outlook of the industry.

1.6.7 Identify the effect of supply and demand on products and services.

1.6.8 Identify the features and benefits that make an organization’s product or service competitive.

1.6.9 Explain how the performance of an employee, a department and an organization is assessed.

Outcome 1.8

Operations Management: Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.

Competency:

1.8.5 Use inventory and control systems to purchase materials, supplies and equipment (e.g., Last In, First Out [LIFO]; First In, First Out [FIFO]; Just in Time [JIT]; LEAN).

1.8.6 Identify the advantages and disadvantages of carrying cost and Just-in-Time (JIT) production systems and the effects of maintaining inventory (e.g., perishable, shrinkage, insurance) on profitability.

1.8.8 Identify routine activities for maintaining business facilities and equipment.

**Unit: Communication & Information Management**

Students will research and conduct presentations using a variety of computer applications including Internet. Students will utilize personal information management to develop recordkeeping and communication skills. Students will organize information accurately and practice workplace communication techniques.

Outcome 1.4

Knowledge Management and Information Technology: Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.

Competency:

1.4.1 Use office equipment to communicate (e.g., phone, radio equipment, fax machine, scanner, public address systems).

1.4.2 Select and use software applications to locate, record, analyze and present information (e.g., word processing, e-mail, spreadsheet, databases, presentation, Internet search engines).

1.4.3 Verify compliance with security rules, regulations and codes (e.g., property, privacy, access, accuracy issues, client and patient record confidentiality) pertaining to technology specific to the industry pathway.

1.4.4 Use system hardware to support software applications.

1.4.5 Use information technology tools to maintain, secure and monitor business records.

1.4.6 Use an electronic database to access and create business and technical information.

1.4.7 Use personal information management and productivity applications to optimize assigned tasks (e.g., lists, calendars, address books).

1.4.8 Use electronic media to communicate and follow network etiquette guidelines.

Outcome 1.2

Leadership and Communications: Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competency:

1.2.1 Extract relevant, valid information from materials and cite sources of information.

1.2.2 Deliver formal and informal presentations.

1.2.3 Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.5 Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6 Use proper grammar and expression in all aspects of communication.

1.2.9 Identify advantages and disadvantages involving digital and/or electronic communications (e.g., common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity)

**Unit: Business Leadership, Employability & Interpersonal Skills**

Students will develop critical thinking and problem solving skills through the use of a variety of practical scenarios. Students will demonstrate leadership skills through participation with peer groups, support services, and professional organizations.

Outcome 1.1

Employability Skills: Develop career awareness and employability skills (e.g., face-to-face, online) needed for gaining and maintaining employment in diverse business settings.

Competency:

1.1.1 Identify the knowledge, skills and abilities necessary to succeed in careers.

1.1.2 Identify the scope of career opportunities and the requirements for education, training, certification, licensure and experience.

1.1.3 Develop a career plan that reflects career interests, pathways and secondary and postsecondary options.

1.1.4 Describe the role and function of professional organizations, industry associations and organized labor and use networking techniques to develop and maintain professional relationships.

1.1.5 Develop strategies for self-promotion in the hiring process (e.g., filling out job applications, resumé writing, interviewing skills, portfolio development).

1.1.6 Explain the importance of work ethic, accountability and responsibility and demonstrate associated behaviors in fulfilling personal, community and workplace roles.

1.1.7 Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions.

1.1.8 Identify the correlation between emotions, behavior and appearance and manage those to establish and maintain professionalism.

1.1.9 Give and receive constructive feedback to improve work habits.

1.1.10 Adapt personal coping skills to adjust to taxing workplace demands.

1.1.11 Recognize different cultural beliefs and practices in the workplace and demonstrate respect for them.

1.1.12 Identify healthy lifestyles that reduce the risk of chronic disease, unsafe habits and abusive behavior.

Outcome 1.2

Leadership and Communications: Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.

Competency:

1.2.3 Identify and use verbal, nonverbal and active listening skills to communicate effectively.

1.2.4 Use negotiation and conflict-resolution skills to reach solutions.

1.2.5 Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose.

1.2.6 Use proper grammar and expression in all aspects of communication.

1.2.7 Use problem-solving and consensus-building techniques to draw conclusions and determine next steps.

1.2.8 Identify the strengths, weaknesses and characteristics of leadership styles that influence internal and external workplace relationships.

1.2.9 Identify advantages and disadvantages involving digital and/or electronic communications (e.g.,

common content for large audience, control of tone, speed, cost, lack of non-verbal cues, potential for forwarding information, longevity).

1.2.10 Use interpersonal skills to provide group leadership, promote collaboration and work in a team.

1.2.11 Write professional correspondence, documents, job applications and resumés.

1.2.12 Use technical writing skills to complete forms and create reports.

1.2.14 Use motivational strategies to accomplish goals.

Outcome 1.3

Business Ethics and Law: Analyze how professional, ethical and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.

Competency:

1.3.1 Analyze how regulatory compliance (e.g., United States Department of Agriculture [USDA], Food and Drug Administration [FDA], United States Department of Interior [USDI], Ohio Livestock Care Standards, water quality standards, local water regulations, building codes) affects business operations and organizational performance.

1.3.2 Follow protocols and practices necessary to maintain a clean, safe and healthy work environment.

1.3.3 Use ethical character traits consistent with workplace standards (e.g., honesty, personal integrity, compassion, justice).

1.3.4 Identify how federal and state consumer protection laws affect products and services.

1.3.5 Access and implement safety compliance measures (e.g., quality assurance information, safety data sheets [SDSs], product safety data sheets [PSDSs], United States Environmental Protection Agency [EPA], United States Occupational Safety and Health Administration [OSHA]) that contribute to the continuous improvement of the organization.

1.3.6 Identify deceptive practices (e.g., bait and switch, identity theft, unlawful door-to-door sales, deceptive service estimates, fraudulent misrepresentations) and their overall impact on organizational performance.

1.3.7 Identify the labor laws that affect employment and the consequences of noncompliance for both employee and employer (e.g., harassment, labor, employment, employment interview, testing, minor labor laws, Americans with Disabilities Act, Fair Labor Standards Acts, Equal Employment Opportunity Commission [EEOC]).

1.3.8 Verify compliance with computer and intellectual property laws and regulations.

1.3.9 Identify potential conflicts of interest (e.g., personal gain, project bidding) between personal, organizational and professional ethical standards.