Ohio CTE

Fluid Mechanics (2025)

Business Operations/21st Century Skills: Learners apply principles of economics, business management, marketing and employability in an entrepreneur, manager and employee role to the leadership, planning, developing and analyzing of business enterprises related to the career field. 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.** 1.1

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

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

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

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

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

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

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

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

9 Give and receive constructive feedback to improve work habits. 1.1.9

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

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

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

3 **Business Ethics and Law: Analyze how professional, ethical, and legal behavior contributes to continuous improvement in organizational performance and regulatory compliance.** 1.3

1 Analyze how regulatory compliance affects business operations and organizational performance. 1.3.1

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

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

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

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). 1.3.7

8 Verify compliance with computer, copyright, and intellectual property laws and regulations. 1.3.8

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

Mechanical Systems: Learners apply principles of motors and power, hydraulics and pneumatics, mechanical drives, pumping systems, and cleanroom vacuum systems. They gain essential knowledge and skills in installing, maintaining, and troubleshooting various mechanical systems used in engineering and manufacturing. 3

1 **Motors and Power: Install motors, variable-frequency drives (VFD), and power wiring.** 3.1

1 Identify types and components of single phase and three phase motors. 3.1.1

2 Interpret motor nameplate information and motor specifications. 3.1.2

3 Calculate motor loads. 3.1.3

4 Determine motor rotation needed for the installed load and explain the process for reversing rotation (i.e., three phase and single phase). 3.1.4

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2 **Hydraulics and Pneumatics Systems: Install, maintain, and Hydraulic and Pneumatic systems** 3.2

1 Understand and explain the fundamental principles of hydraulics and pneumatics system (e.g., Pressure, Flow, and Force) 3.2.1

2 Identify the major components of hydraulics and pneumatics systems (e.g., pumps, cylinders, valves, and compressors) 3.2.2

3 Describe the properties of fluids used in hydraulics systems including viscosity, density, and compressibility. 3.2.3

4 Describe the properties of gases used in pneumatic systems including viscosity, density, and compressibility. 3.2.4

5 Interpret a basic schematic of a basic hydraulic or pneumatic system identifying the components of that system within the schematic 3.2.5

6 Calculate pressures, forces, and fluid flow rates in hydraulic and pneumatic systems 3.2.6

7 Explain the transfer of energy in hydraulic and pneumatic systems, including the concepts of work, power, and efficiency. 3.2.7

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Identify present applications of hydraulic and pneumatic systems in industry. 3.2.8

9 Troubleshoot common issues in hydraulic and pneumatic systems (e.g., leaks, pressure drops, and component failures) 3.2.9

10 Select a fluid power system based on project needs (e.g., pressure, flow, temperature, dissipation, filtration, fluid, maintenance). 3.2.10

11 Explain the forces exerted by fluids on plane and curved boundaries 3.2.11

12 Differentiate between laminar and turbulent flow based on flow characteristics, velocity profiles, and Reynolds number, and explain their impact on fluid systems 3.2.12

13 Interpret absolute and gauge pressure measurements and convert between them using standard reference pressures in practical applications 3.2.13

14 Apply Pascal's Law to show how pressure moves through a fluid and how it can be used to increase force in hydraulic systems 3.2.14

15 Use Bernoulli's Equation to evaluate pressure, velocity, and elevation relationships in flowing fluids and solve basic engineering problems 3.2.15

4 **Pumping Systems: Install, maintain, and troubleshoot pumps and pumping systems.** 3.4

1 Understand and explain the fundamental principles of pumps and pumping systems. 3.4.1

2 Identify the major components of pumps and pumping systems. 3.4.2

3 Interpret a basic schematic of a pumping system identifying the components of that system within the schematic 3.4.3

4 Interpret pump curves. 3.4.4

5 Calculate flow, head/pressure and efficiency. 3.4.5

6 Compare types of positive and non-positive displacement pumps and their respective functions. 3.4.6

7 Align precision and non-precision couplings. 3.4.7

8 Disassemble and assemble pumping stations. 3.4.8

9 Troubleshoot pump system failure conditions (e.g., cavitation). 3.4.9

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Design and Development: Learners apply principles of the engineering design process, using sketching and drawing, computer-aided drafting and modeling, production and process design, and print interpretation. They gain essential knowledge and skills in analyzing and solving design problems, creating and interpreting technical drawings and models, selecting appropriate materials, and planning and evaluating production processes. 5

8 **Schematic Interpretation: Read, interpret, and utilize schematics to produce accurate products.** 5.8

1 Identify and interpret standard symbols used in schematics. 5.8.1

2 Recognize and label key components and systems within a schematic 5.8.2

3 Trace the flow of systems of schematic diagrams. 5.8.3

4 Utilize reference notes and legends to clarify details and specifications of schematics. 5.8.4

5 Identify discrepancies or errors in a schematic. 5.8.5

7 Differentiate between different styles and standards in schematics (e.g., international, US) 5.8.7

Maintenance and Safety: Learners apply principles of protection, prevention and mitigation to create and maintain safe working conditions at manufacturing sites. Knowledge and skills may be applied in all aspects of personal and site safety, including handling materials, using tools and equipment, working with and around electricity and using personal protective equipment. 10

1 **Site Safety: Handle materials, prevent accidents and mitigate hazards.** 10.1

1 Knowledge of safety standards and regulations, including Hazard Communication (HAZCOM) and Occupational Safety and Health Administration (OSHA) requirements (e.g., Working at Heights, Confined Space) 10.1.1

2 Knowledge of risk identification, evaluation, and mitigation strategies 10.1.2

5 Identify source of electrical and mechanical hazards and use shut-down and established lock out/tag-out procedures. 10.1.5

7 Identify procedures for the handling, storage and disposal of hazardous materials. 10.1.7

8 Identify the location of emergency flush showers, eyewash fountains, Safety Data Sheets (SDSs), fire alarms and exits. 10.1.8

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2 **Personal Safety: Practice personal safety.** 10.2

3 Select, use, store, maintain and dispose of personal protective equipment (PPE) appropriate to job tasks, conditions and materials. 10.2.3

5 Identify, inspect and use safety equipment appropriate for a task. 10.2.5

6 Use safe practices when working with electrical, mechanical, or other equipment. 10.2.6

8 Safely operate manual, electrical-powered and pneumatic tools. 10.2.8

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3 **Industrial Maintenance Safety: Plan, develop and ensure industrial maintenance afety.** 10.3

Safely operate machinery and equipment. 10.3.1

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2 Follow equipment shutdown procedures. 10.3.2

3 Perform leak checks on equipment. 10.3.3

4 Report and document unsafe machinery conditions. 10.3.4

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4 **Industrial Maintenance Installation and Repair: Inspect, maintain and repair industrial equipment.** 10.4

1 Identify installation techniques using manuals, checklists, and regulations. 10.4.1

2 Identify equipment alarms. 10.4.2

4 Calibrate and adjust manufacturing equipment. 10.4.4

5 Inspect and correct machine malfunctions. 10.4.5

6 Perform roughing pump system maintenance using a complex set of equipment specific instructions. 10.4.6