Ohio CTE

Industrial Maintenance (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

Electrical/Electronics: Learners apply principles of electricity and electronics related to electronic theory, alternating and direct cu co

2 **Circuits: Construct and analyze alternating current (AC) and direct current (DC) circuits.** 2.2

7 Analyze wiring schematics and diagrams for accuracy, function, and performance characteristics (e.g., time constants, current flow, impedance, signal timing, etc.) 2.2.7

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skills, digital electronics and power supplies. Knowledge and skills may be applied to fundamentals of electricity, analyzing and evaluating circuits, assembling components into electrical circuits, creating circuits to perform tasks and operations, wiring components to construct a communications system and providing power to an electrical system. 2

15 Troubleshoot and diagnose faults in AC circuits, identifying common issues such as open circuits, short circuits, faulty components (e.g., capacitors, resistors), and wiring issues. 2.2.15

3 Electronic Components: Describe the functions and purposes of electronic components. 2.3

1 Identify resistor values from color codes or other marks. 2.3.1

3 Identify symbols for electronic components. 2.3.3

4 Electronic Connections: Connect individual components into an electrical circuit. 2.4

1 Define the purpose of a connection and the differences between a good and bad connection. 2.4.1

5 Combine components per wiring schematics, block diagrams, and flow charts. 2.4.5

8 Use diagnostic tools to troubleshoot circuits effectively (signal generator, oscilloscope, multimeter etc.) 2.4.8

6 Cabling and Wiring: Connect components to construct low-voltage, data and communication systems using coaxial or fiber optic cables and twisted pair or balanced wires. 2.6

3 Splice and terminate cables and wires. 2.6.3

4 Test cables and wires. 2.6.4

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

5 Interpret schematics and control diagrams for building a motor circuit. 3.1.5

8 Troubleshoot and repair motor starting systems to verify operation according to schematics and control diagrams. 3.1.8

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

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

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

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3 **Mechanical Drives Systems: Install, maintain, and monitor mechanical drives systems.** 3.3

1 Compare types of gears, couplings, belts and chains and describe their uses. 3.3.1

2 Perform shaft alignment on rotating equipment. 3.3.2

5 Install and align power transmissions systems. 3.3.5

6 Perform power transmissions systems maintenance. 3.3.6

7 Monitor power transmissions systems. 3.3.7

8 Troubleshoots for power transmission systems problems and inefficiencies. 3.3.8

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

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

Design and Development: Learners apply principles of design and development related to the design process, sketching and visualization, modeling, drafting, materials and production and process design. 5

7 **Blueprint Interpretation: Read, interpret, and utilize blueprints to produce accurate products.** 5.7

1 Identify and interpret standard symbols used in blueprints. 5.7.1

2 Demonstrate the ability to read and convert measurements from scaled drawings. 5.7.2

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

Computer Integrated Manufacturing: Learners apply the principles of computer integrated manufacturing related to, robotics, programmable logic controllers and automated systems. 7

1 **Robotic Fundamentals: Apply robotics fundamentals.** 7.1

1 Identify the components of a robot system and explain their roles in the robot's operation cycle. 7.1.1

2 Understand applications of robot components and controllers. (e.g sensors, motors, actuators, end effector etc.) 7.1.2

11 Analyze the performance and troubleshoot the operation of a robot. 7.1.11

5 **Automation: Conceptualize the use of automation in manufacturing and apply this echnique to a production process.** 7.5

Diagnose and troubleshoot errors within an automated system. 7.5.7

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Technical Math and Science: Learners develop a comprehensive understanding of the fundamental principles and applications of technical mathematics and scientific concepts. Learners will perform precise measurements, interpret technical drawings, and apply scientific principles to solve engineering and manufacturing problems. 9

4 **Measurement and Interpretation: Interpret drawings and documentation and perform measurements.** 9.4

- 3 Identify measuring systems and convert between systems. 9.4.3
- 4 Identify information and symbols provided in drawings and specifications. 9.4.4
- 5 Skill in taking accurate measurements of material properties, components, and finished products using appropriate measuring tools & equipment 9.4.5
- 7 Ability to utilize a variety of different measuring instruments 9.4.7

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
- 8 Identify the location of emergency equipment (eyewash fountains, Safety Data Sheets (SDSs), fire alarms, fire extinguishers, etc) and utilize them when necessary. 10.1.8
- 9 Respond effectively to manufacturing-related emergencies and adapt response plans. 10.1.9
- 10 Identify the components of a hazardous materials safety plan. 10.1.10
- 14 Explain the role of third party certification (UL, IE, OSHA, etc.) 10.1.14

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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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ndustrial Maintenance Safety: Plan, develop and ensure industrial maintenance afety. 10.3

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- 1 Safely operate machinery and equipment. 10.3.1

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

5 Safely operate platforms, man lifts and ladders. 10.3.5

6 Identify tools and equipment requiring safety certification. 10.3.6

7 Use environmental data systems. 10.3.7

8 Monitor equipment for unsafe conditions. 10.3.8

9 Identify the benefits of cross-training. 10.3.9

10 Deliver set-up and operational procedures. 10.3.10

11 Demonstrate cleanroom gowning (Lab) using Standard Operating Procedures (SOP). 10.3.11

12 Explain the safety processes and practices of high vacuum systems. 10.3.12

13 Describe cleanroom requirements, purpose and maintenance. 10.3.13

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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

3 Maintain inspection processes and records. 10.4.3

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

7 Describe costs and benefits of proactive versus reactive maintenance. 10.4.7

8 Describe predictive time based, and preventative maintenance schemas. 10.4.8

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5 Machine Maintenance: Maintain tools and equipment in working condition. 10.5

1 Identify equipment maintenance requirements in the equipment manufacturer's documentation. 10.5.1

2 Identify maintenance tasks required (e.g., inspecting, grinding, sharpening, dressing, lubricating, cleaning). 10.5.2

3 Calibrate instruments accurately, following calibration procedures, and documenting calibration records 10.5.3

4 Develop a preventive maintenance schedule. 10.5.4

5 Monitor equipment operation based off manufactures SOP 10.5.5

6 Repair or replace equipment and accessories as needed. 10.5.6