Ohio CTE

Engineering Logic (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
- 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
- 7 Apply problem-solving and critical-thinking skills to work-related issues when making decisions and formulating solutions. 1.1.7
- 9 Give and receive constructive feedback to improve work habits. 1.1.9

2 **Leadership and Communication: Process, maintain, evaluate and disseminate information in a business. Develop leadership and team building to promote collaboration.** 1.2

- 1 Extract relevant, valid information from materials and cite sources of information. 1.2.1
- 2 Deliver formal and informal presentations. 1.2.2
- 5 Communicate information (e.g., directions, ideas, vision, workplace expectations) for an intended audience and purpose. 1.2.5
- 7 Use problem-solving and consensus-building techniques to draw conclusions and determine next steps. 1.2.7
- 10 Use interpersonal skills to provide group leadership, promote collaboration and work in a team. 1.2.10
- 12 Use technical writing skills to complete forms and create reports. 1.2.12

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

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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

8 **Operations Management: Plan, organize and monitor an organization or department to maximize contribution to organizational goals and objectives.** 1.8

2 Select and organize resources to develop a product or a service. 1.8.2

3 Analyze the performance of organizational activities and reallocate resources to achieve established goals. 1.8.3

4 Identify alternative actions to take when goals are not met (e.g., changing goals, changing strategies, efficiencies). 1.8.4

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

1 **Electrical and Electronic Theory: Explain electrical and electronic principles and theory.** 2.1

1 Describe the structure of atoms and their relationship to electricity. 2.1.1

3 Explain methods of producing electrical current. 2.1.3

4 Compare alternating current (AC) and direct current (DC). 2.1.4

5 Define the units of measurement for voltage, current, power and resistance. 2.1.5

6 Describe the relationships between voltage, current, resistance and power in circuits. 2.1.6

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

3 Identify symbols for electronic components. 2.3.3

4 **Electronic Connections: Connect individual components into an electrical circuit. Define the purpose of a connection and the differences between a good and bad connection.** 2.4

2 Describe methods of electrical connections and the purpose for each method. 2.4.2

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and providing power to an electrical system. 2

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

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
- 8 Identify present applications of hydraulics and pneumatic systems in industry. 3.2.8

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

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

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

1 **The Design Process: Use the engineering design process and quality assurance principles to analyze and solve design problems.** 5.1

- 1 Define the goal of a design 5.1.1
- 2 Describe the role of research, development and experimentation in design problem solving. 5.1.2
- 3 Conduct an investigation to identify customer needs, constraints and criteria. 5.1.3
- 4 Develop multiple solutions and select an approach. 5.1.4

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roduction and Process Design: Identify and evaluate production and process lesign. 5.5

4 Use process planning and improvement tools (e.g., flowcharts, diagrams, design for manufacturability [DFM]). 5.5.4

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

4 Programmable Logic Controllers: Program, install, and monitor digital computers used for automation of electromechanical processes to perform tasks. 7.4

1 Describe the purpose and use of Programmable Logic Controllers (PLC) within an automated system. 7.4.1

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

1 Describe key concepts of automation and its importance in advanced manufacturing 7.5.1

2 Identify various automation tools and techniques and explain their functions (e.g., robots, sensors, controls etc) 7.5.2

3 Identify the PLC of an automated system and explain its importance to the cell 7.5.3

Technical Math and Science: Technical Math and Science: Learners develop a comprehensive understanding of the fundamental principles an tec

1 Physics of Engineering: Learn the fundamentals of physics as it relates to engineering. 9.1

1 Display and interpret numbers in scientific notation and logarithmic scales 9.1.1

2 Describe and convert SI and US system units of measurement. 9.1.2

3 Identify and use both metric and inch rules. 9.1.3

Express physical quantities with an appropriate number of significant digits, units and dimensions. 9.1.4

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and scientific concepts. Learners will perform precise measurements, interpret technical drawings, and apply scientific principles to solve engineering and manufacturing problems. 9

5 Perform operations on whole numbers, fractions and mixed numbers. 9.1.5

6 Analyze measurements and perform technical calculations. 9.1.6

7 Read and interpret charts and tables to analyze data and formulate outcomes. 9.1.7

8 Quantitatively describe the units used in pressure measurement, such as Torr, and convert between units. 9.1.8

9 Quantitatively describe the units used in temperature measurement and convert between units (e.g. Fahrenheit, Celsius, Kelvin) 9.1.9

10 Quantitatively describe the units used in density measurement and convert between units (e.g. g/mL, g/cm3, g/L, kg/L, kg/m3) 9.1.10

14 Identify/differentiate engineering drawings. 9.1.14

17 Compare and contrast weight vs mass 9.1.17

18 Explain Newton's three laws of motion and identify their relationship to a specified topic 9.1.18

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

6 **Quality: Ability to ensure product quality, implement quality control measures, and continuously improve product inspection processes to meet or exceed quality requirements** 10.6

1 Identify quality control systems (e.g., Statistical Process Control (SPC), Six Sigma, Total Quality Management (TQM), Lean Management, “Plan-Do-Check-Act” etc). 10.6.1

5 Explain the basic principles and purpose of Quality Control and Quality Systems 10.6.5

6 Describe the seven basic tools of quality control. 10.6.6

7 Describe data set characteristics. 10.6.7

8 Describe types of variation and control charts. 10.6.8