Ohio CTE

Automation Technologies (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

4 **Knowledge Management and Information Technology: Demonstrate current and emerging strategies and technologies used to collect, analyze, record and share information in business operations.** 1.4

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

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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. 1.4.3

4 Use system hardware to support software applications. 1.4.4

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

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

Electrical/Electronics: Learners apply principles of electricity and electronics. 2

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

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

6 Select and install terminal strip according to wiring diagram and/or schematics. 2.4.6

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5 Digital Electronics: Create circuits to perform tasks and operations. 2.5

1 Identify the numbering systems, codes, arithmetic operations, Boolean operations, and simplification methods used in digital electronics. 2.5.1

2 Convert number systems (e.g., binary coded decimal (BCD) to decimal, and decimal to BCD) and perform arithmetic operations. 2.5.2

3 Understand and apply DeMorgan's Theorem to simplify logic expressions and digital circuits using basic logic gates, demonstrating the ability to analyze and modify circuit designs 2.5.3

4 Describe the purpose and use of logic gates (e.g., discrete and medium scale integration [MSI] gates, latches, flip-flops) and demonstrate understanding through the use of truth tables. 2.5.4

10 Identify and explain the purpose of memory in control systems, including types like RAM, ROM, and EEPROM. 2.5.10

17 Utilize counters in circuits for operations like counting, timing, and data sequencing. 2.5.17

18 Troubleshoot and modify digital circuits based on schematics and circuit diagrams. 2.5.18

20 Utilize memory in a control system for storing and accessing data. 2.5.20

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6 Cabling in 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

1 Describe the types, purpose, and characteristics of cables and wires and their purpose 2.6.1

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Select methods for splicing and terminating cables and wires (e.g., terminal strips, and crimp connectors). 2.6.2

3 Splice and terminate cables and wires. 2.6.3

4 Test cables and wires. 2.6.4

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

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

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

1 Describe the use of Programmable Logic Controllers (PLC) in manufacturing automation. 7.4.1

2 Identify programmable logic controller (PLC) hardware components, including relays, relay ladder logic, input/output modules, and communication interfaces 7.4.2

3 Design a programmable logic controller (PLC) program incorporating timers, counters, sequencers, comparators, and block transfers. 7.4.3

4 Demonstrate an understanding of number systems used in Programmable Logic Controllers (PLCs) binary, octal, decimal, and hexadecimal systems). 7.4.4

5 Develop, apply and execute a ladder logic program. 7.4.5

6 Design a motor control program using manual and automatic modes. 7.4.6

7 Monitor and troubleshoot a network and hardwired system with a programmable logic controller (PLC). 7.4.7

8 Monitor and troubleshoot programmable logic controller (PLC) operation (e.g., I/O forcing) 7.4.8

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Install and maintain programmable logic controllers (PLCs). 7.4.9

10 Explain the operation and design of various control relays 7.4.10

11 Identify and explain the purpose of three sections found in a PLC 7.4.11

12 Identify different output devices for a PLC and how they are controlled (e.g., lights, motors, solenoids etc.) 7.4.12

13 Identify different input devices for a PLC and how they are controlled (e.g., photoelectric, proximity, switches, push buttons, etc.) 7.4.13

14 Demonstrate and execute data transfers in PLC networks. 7.4.14

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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

4 Collect data from an automated system to identify continuous improvement opportunities 7.5.4

5 Analyze data gathered from an automated system to identify continuous improvement opportunities 7.5.5

6 Apply continuous improvement techniques to enhance the manufacturing process 7.5.6

7 Diagnose and troubleshoot errors within an automated system 7.5.7

8 Identify processes in the production that can be automated 7.5.8

9 Explain the function of industrial network components and addressing methods (switches, IP address, etc.) 7.5.9

10 Configure industrial network settings (assign IP addresses, establish connectivity, interpret status indicators etc.) 7.5.10

11 Analyze industrial network communication faults using diagnostic information (link lights, error messages, connectivity tests etc.) 7.5.11

12 Describe industrial communication methods between automation devices (discrete signals, analog signals, serial communication etc.) 7.5.12

13 Interpret communication information to determine exchange status 7.5.13

14 Evaluate communication between automation components and correct communication issues 7.5.14

15 Explain the purpose and structure of ISA automation standards used in industrial systems (ISA-95 system hierarchy, ISA-88 batch control model, etc.). 7.5.15

Maintenance and Safety: Le pri pre

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

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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 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

15 Apply information in the National Electrical Code (NEC) and other applicable codes when working on a job 10.1.15

16 Identify safety devices and protective measures used in automated systems (emergency stops, interlocks, guards, etc.). 10.1.16

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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

9 Follow established safety procedures when working on automated equipment (apply lockout/tagout, PPE, verify energy state, etc.). 10.2.9