Ohio CTE

Robotics (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 [EEOC]). 1.3.7

8 Verify compliance with computer 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

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

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). 1.4.2

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

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

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

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

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

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

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

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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

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

- 5 Explain the uses of series, parallel and series-parallel circuits. 2.2.5
- 6 Construct and troubleshoot series, parallel and series-parallel circuits. 2.2.6
- 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

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
- 2 Describe methods of electrical connections and the purpose for each method. 2.4.2
- 3 Select the type of electrical connection for electrical components. 2.4.3
- 4 Protect circuit boards from electrostatic discharge (ESD). 2.4.4
- 5 Combine components per wiring schematics, block diagrams, and flow charts. 2.4.5

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

- 1 Describe the types, purpose, and characteristics of cables and wires and their purpose 2.6.1
- 2 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

7 Power Supplies: Provide power to electrical circuits. 2.7

- 1 Identify the differences between transformer-powered supplies and line-connected supplies. 2.7.1
- 3 Construct and install regulated power supplies. 2.7.3

Precision and Advanced Machining: Learners apply principles of subtractive and additive manufacturing, tooling, CNC machining, and sei ma gai...

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3 Tooling: Identify necessary and appropriate tooling to be used in production 6.3

- 1 Classify various types of end-of-arm tooling used in machining. (i.e.: Grippers, Vacuums etc.) 6.3.1
- 2 Identify various types of materials used to create end-of-arm tools 6.3.2
- 3 Describe the functionality and purpose of the end-of-arm tool 6.3.3
- Select an appropriate end-of-arm tool based off job specifications and material requirement 6.3.4

knowledge and skills in performing various manufacturing processes, selecting and configuring appropriate tools and equipment, and understanding advanced manufacturing production technologies. 6

6 Perform setup and integration of end-of-arm tool 6.3.6

7 Evaluate the effectiveness of end-of-arm tool 6.3.7

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 Use job specifications to create programs for robot operations, sensors and feeder systems. 7.1.4

5 Plan, program and test a robot using teach pendant and simulation software. 7.1.5

7 Use robot speed specifications to calculate estimated cycle times for sample tasks. 7.1.7

8 Direct robot to home position using absolute and incremental coordinates. 7.1.8

9 Compare robotic applications and processes (e.g., palletizing, vision, pick and place, welding). 7.1.9

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

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2 Robotic Operation: Plan and operate robotic production processes. 7.2

1 Perform controller startup and shutdown. 7.2.1

2 Operate a teach pendant and pendant menu. 7.2.2

3 Use coordinates or motion functions to execute robotic processes. 7.2.3

4 Analyze alarm and event data, investigate anomalies, and take appropriate action to resolve issues 7.2.4

5 Select, display, and run a robotic program. 7.2.5

6 Modify command positions (i.e., touching-up points). 7.2.6

7 Explain both motion and non-motion instructions (i.e., control instructions, arithmetic instructions, and input/output instructions). 7.2.7

8 Identify robotic applications and processes (e.g., pick and place, welding). 7.2.8

9 Describe common end of arm tooling. 7.2.9

0 Explain how payload requirements impact robot operation 7.2.10

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11 Describe Cartesian space, the Right-Hand rule and how locations are represented in three-dimensional space. 7.2.11

12 Determine home position using absolute and incremental coordinates (e.g., fixed and floating zero). 7.2.12

13 Analyze the information contained in positional data. 7.2.13

14 Perform robot I/O analysis and manipulation. 7.2.14

15 Determine application suitability using work envelop, reach and articulation. 7.2.15

16 Explain methods of establishing a Tool-Center Point (TCP) or Tool-Control Point (TCP) 7.2.16

17 Identify and explain the function of robotic hardware (switches, sensors, proximity sensors) 7.2.17

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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 purpose and use of Programmable Logic Controllers (PLC) within an automated system. 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

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

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

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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