Ohio CTE

Industrial 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

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

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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

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

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 effectors 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

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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

10 Explain how payload requirements impact robot operation 7.2.10

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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3 **Industrial Robotic Programming: Write, edit and test robotic programming.** 7.3

1 Create, modify, and test robotic programs (e.g., second home, toolpath, non-motion commands). 7.3.1

2 Program macro and micro instructions, conditional statements, and arithmetic variables and instructions. 7.3.2

3 Program, monitor and operate inputs and outputs. 7.3.3

4 Create and set up tool and user frames to define reference points for robot end effectors and coordinate systems 7.3.4

5 Create and manage payload schedules, configuring and optimizing robots to handle varying weights, materials, and conditions. 7.3.5

6 Create and configure global and local positions for robotic systems by defining and adjusting coordinates creating precise robotic movements. 7.3.6

7 Configure and integrate I/O systems in robotic applications by setting up devices like sensors and actuators to ensure communication with external automation systems (PLCs). 7.3.7

8 Calibrate and modify tool control point Tool Center Point (TCP). 7.3.8

9 Describe the use of subroutines. 7.3.9

10 Perform data manipulation (e.g., counters, data tables, data registers). 7.3.10

11 Describe the various file types used for import/export of data. 7.3.11

12 Upload and download data between robotic simulation and a real robot. 7.3.12

13 Compare the differences between programming in robotic simulation and programming a physical robot. 7.3.13

4 Perform a robotic simulation to verify reach, cycle time, interference and work cell layout. 7.3.14

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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) 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

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

6 **End-of-Arm Tooling:** 7.6

1 Classify various types of robotic tooling used in machining (e.g., end-of-arm tooling, grippers, vacuum systems, etc.). 7.6.1

2 Identify various types of materials used to create robotic tools and components. 7.6.2

3 Describe the functionality and purpose of robotic tooling in manufacturing processes. 7.6.3

4 Select appropriate robotic tool based on job specifications and material requirements. 7.6.4

5 Design custom robotic tools to meet operational and job requirements. 7.6.5

6 Perform setup and integration of robotic tools within manufacturing systems. 7.6.6

7 Evaluate the effectiveness of robotic tooling in achieving production goals. 7.6.7

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 as| sit| ha| handling materials,

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

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

6 Identify and eliminate worksite clutter in accordance with standards for cleanliness and safety. 10.1.6

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'ersonal Safety: Practice personal safety. 10.2

using tools and equipment, working with and around electricity and using personal protective equipment. 10

- 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 safety. 10.3

- 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
- 8 Monitor equipment for unsafe conditions. 10.3.8

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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

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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