

**EXAM INFORMATION****Items**

34

**Points**

39

**Prerequisites**

NONE

**Grade Level**

10-12

**Course Length**

ONE SEMESTER

**Career Cluster**

MANUFACTURING

SCIENCE, TECHNOLOGY,  
ENGINEERING, AND MATHEMATICS**Performance Standards**

INCLUDED

**Certificate Available**

YES

**DESCRIPTION**

The first in a sequence of courses that prepares individuals with a lab-based hands-on curriculum combining electrical, mechanical and engineering principals. Students will learn to design, build, program and control robotic devices. A rigorous study and application of electrical concepts will include: sources of energy, electrical safety, use and identification of basic electronic components, sensors and actuators. Engineering concepts will include: mechanical design, prototype development, design testing, programming and proper engineer documentation.

**EXAM BLUEPRINT**

STANDARD	PERCENTAGE OF EXAM
1- Safety Practices	8%
2- History of Technology	8%
3- Fundamental Programming of Robots	26%
4- Robotics Project	5%
5- Engineering Design Process	31%
6- Documenting the Design Process	18%
7- Work Ethic, Communication, & Leadership	4%

**STANDARD 1****STUDENTS WILL FOLLOW SAFETY PRACTICES**

- Objective 1** Identify potential safety hazards and follow general laboratory safety practices.
1. Assess workplace conditions with regard to safety and health.
  2. Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
  3. Locate and understand the use of shop safety equipment.
  4. Select appropriate personal protective equipment.
- Objective 2** Use safe work practices.
1. Use personal protective equipment according to manufacturer rules and regulations.
  2. Follow correct procedures when using any hand or power tools.
- Objective 3** Complete a basic safety test without errors (100%) before using any tools or shop equipment.

Standard 1 Performance Evaluation included below (Optional)

**STANDARD 2****STUDENTS WILL IDENTIFY THE HISTORY AND APPLICATION OF TECHNOLOGY AND ENGINEERING AS IT APPLIES TO ROBOTICS AND AUTOMATED SYSTEMS**

- Objective 1** Define and identify historical impacts of robotic and automated systems and their benefit to society.
1. Define “robot”.
  2. Sample definitions:
  3. A robot is any device that emulates human movement, capabilities, or appearance; from the Czech word “robata”.
  4. A robot is an automatically controlled, reprogrammable, multipurpose machine.
  5. Describe the history and early beginnings of automated manufacturing & robotics.
  6. Define automated manufacturing/systems.
- Objective 2** Explain how automation and robotic systems have improved the quality of life, increased production, precision, and safety a variety of applications.
- Objective 3** Identify four engineering fields that impact the robotic and automation industry.
1. Mechanical
  2. Electrical
  3. Manufacturing
  4. Computer Science

Standard 2 Performance Evaluation included below (Optional)

**STANDARD 3****STUDENTS WILL BE ABLE TO CREATE AND INTERPRET FUNDAMENTAL PROGRAMMING OF ROBOTS AND AUTOMATED SYSTEMS**

- Objective 1** Demonstrate the ability to use good programming style.
1. Understand specifications and requirements for computer programs.
  2. Decompose the problem into appropriate components.
  3. Design solutions using algorithms and other problem-solving techniques.
  4. Create a flow chart and write a program that utilizes input (controller) and output commands.
  5. Write the code for a program.
    1. Demonstrate how to use white space properly.
    2. Employ an appropriate naming convention.
  6. Test programs for errors and proper functionality.
  7. Provide internal and external documentation for a program during development.
  8. Redo all steps as needed.
- Objective 2** Identify the syntactical components of a program.
1. Identify keywords, identifiers, operators, operands, and literals.
  2. Identify the entry-point of a program.
  3. Identify statements and expressions in a program.
  4. Identify program components such as functions, methods, or procedures.
- Objective 3** Demonstrate the ability to use basic elements of a specific language.
1. Write programs formatted based on the conventions of the utilized language.
  2. Declare, initialize, and assign values to constants and variables.
  3. Demonstrate the ability to use input and output commands.

**STANDARD 4****STUDENTS WILL WORK TO DESIGN, BUILD, AND PRESENT A ROBOTICS PROJECT**

- Objective 1** Demonstrate the ability to develop a solution to a given problem using robotics.
- Objective 2** Demonstrate the ability to work as team to build and program a robot.
- Objective 3** Demonstrate the ability to document, evaluate, and report on the final design.
1. Summarize the design process used in the development of the robot.
  2. Defend the final robot design.
  3. Make a formal presentation to the class.

Standard 4 Performance Evaluation included below (Optional)

**STANDARD 5****STUDENTS WILL UNDERSTAND, APPLY, AND DOCUMENT THE ENGINEERING DESIGN PROCESS**

- Objective 1** Adopt an engineering design model that includes these elements.
1. A Conceptual Stage which defines the problem and brainstorms ideas.
    1. Formulate a problem statement
    2. Identify and analyze design constraints
    3. Brainstorm and choose best solution
  2. A Developmental Stage where ideas are explored, research done, and a prototype built.
    1. Build a model or prototype
  3. An Evaluation Stage where the idea is tested, refined, and a final report is made.
    1. Test, analyze, and optimize
- Objective 2** Demonstrate the ability to clearly formulate a problem statement.
1. Identify that a problem exists.
  2. State or write the problem clearly.
- Objective 3** Demonstrate the ability to identify and analyze design constraints.
1. Analyze typical constraints: time, energy, space or area, tools, people, materials, capital and information.
  2. Document constraints that have a positive or negative effect on the design problem.
- Objective 4** Demonstrate the ability to investigate and research information pertaining to the design brief and choose the best solution.
1. Brainstorm and research information that is currently available.
  2. Identify conditions or factors which may affect the solution such as appearance, durability, simplicity and safety.
  3. Use sketches and notes in the process of generating alternative design solutions.
  4. Select the best solution or design using a decision matrix.
- Objective 5** Implement the design by building a model or prototype.
1. Create a chart that shows the build schedule and the team work assignments.
  2. Students will use their parts list to obtain needed material.
  3. Using safety procedures construct the prototype.
  4. Students will demonstrate the use of simple machines and show how they are used in structural design of complex devices and machines.
- Objective 6** Demonstrate the ability to test, analyze and optimize their design.
1. Test the prototype, apply math calculations, and document the results.
  2. Re-design and improve the prototype.

Standard 5 Performance Evaluation included below (Optional)



## STANDARD 6

### STUDENTS WILL DOCUMENT THE DESIGN PROCESS IN AN ENGINEERING NOTEBOOK

**Objective 1** Make accurately proportioned sketches using correct drawing conventions.

1. Notes are neat and legible.
2. Objects should be drawn to correct proportions
3. Dimensions are used appropriately.
4. Views can be isometric, orthogonal, sections, or assemblies.

**Objective 2** Create and utilize an engineering notebook per established conventions.

1. Sequential and chronological.
2. Accurate and complete reflection of the progress being recorded.
3. Sketches or pictures are included where appropriate.
4. No loose entries or pages.
5. Each page is dated and witnessed.
6. Unused spaces are identified and lined out.
7. Errors are not erased or obliterated.
8. Test data and calculations are included.

**Objective 3** Write a reflection of the project.

1. What was the objective?
2. What worked?
3. What didn't work and why it didn't?
4. How did the design compare with the best and worst performers?
5. What you would do differently?
6. Was the objective accomplished?

Standard 6 Performance Evaluation included below (Optional)

## STANDARD 7

### STUDENTS WILL UNDERSTAND AND DEVELOP POSITIVE WORK ETHICS, COMMUNICATION SKILLS, AND LEADERSHIP SKILLS

**Objective 1** Employ the Technology Student Association (TSA) and/or SkillsUSA Career & Technical Student Organization (CTSO) as an integral element of the curriculum.

**Objective 2** Demonstrate positive work ethics and leadership skills

1. Responsibility
2. Delegation
3. Reliability
4. Cooperation
5. Dependability
6. Teamwork
7. Effective Communication



8. Integrity

Objective 3 Understand the importance of inter-disciplinary teams.

Objective 4 Take minutes of team meetings.

Standard 7 Performance Evaluation included below (Optional)



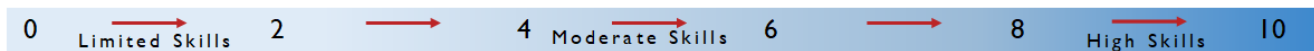
### Robotics I Performance Standards (Optional)

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of **8 or higher** on the rating scale. Students may be encouraged to repeat the objectives until they average **8 or higher**.

Students Name \_\_\_\_\_

Class \_\_\_\_\_

#### PERFORMANCE RATING SCALE



#### STANDARD 1 Safety Practices

Score:

- Follow safety practices

#### STANDARD 2 History of Technology

Score:

- Identify history and application of technology and engineering as it applies to robotics and automated systems

#### STANDARD 4 Robotics Project

Score:

- Work in a team to design, build, and present a robotics project

#### STANDARD 5 Engineering Design Process

Score:

- Understand and apply an Engineering Design Process

#### STANDARD 6 Documenting the Design the Process

Score:

- Document the design process in an engineering notebook

#### STANDARD 7 Work Ethic, Communication, and Leadership Skills

Score:

- Understand and develop positive work ethics, communication skills, and leadership skills

#### PERFORMANCE STANDARD AVERAGE SCORE: