

**EXAM INFORMATION****Items**

37

Points

49

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 second in a sequence of courses that prepares individuals with a lab-based, hands-on curriculum combining electrical, mechanical and engineering principles. 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 | 10% |
| 2- Ethical and Social Impacts of Robotics | 4% |
| 3- Education Pathways and Careers | 2% |
| 4- Work Ethic and Leadership Skills | 2% |
| 5- Program Code for Robots | 27% |
| 6- Fundamentals of Electricity | 24% |
| 7- Mechanical Advantage and Efficiency | 27% |
| 8- Team Project | 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 ETHICAL AND SOCIAL IMPACTS OF ROBOTICS AND AUTOMATION

- Objective 1 Contrast the social benefits and the negative consequences of robotics and automation.
- Objective 2 Describe the ethical impact of robotics and automation.
1. Discuss military and political use of robots; e.g. spy bugs and drones.
 2. Discuss who is responsible for a robot's intended use; e.g. a robot made to search a mine v/s the same technology used to invade someone's privacy.
 3. Discuss ethical and professional behavior in the development and use of technology.
- Objective 3 Students will explain the application of copyright and patent laws.
- Objective 4 Identify the uses of robotics in industry and how it impacts manufacturing and production.
1. Describe how robotics can improve manufacturing safety.
 2. Identify five or more industries that utilize robotic applications.
 3. Identify the advantages and disadvantages of automated assembly lines.

Standard 2 Performance Evaluation included below (Optional)

STANDARD 3

STUDENTS WILL BE ABLE TO IDENTIFY AND REPORT ON EDUCATIONAL PATHWAYS AND CAREER OPPORTUNITIES IN ROBOTICS AND AUTOMATION

- Objective 1 Identify occupations related to robotics.
- Objective 2 Identify different types of occupational training that would prepare them for a career in robotics.

Standard 3 Performance Evaluation included below (Optional)



STANDARD 4

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. reliability
 - 3. dependability
 - 4. effective communication
 - 5. delegation
 - 6. cooperation
 - 7. teamwork
 - 8. integrity
- Objective 3 Take minutes of team meetings.

Standard 4 Performance Evaluation included below (Optional)

STANDARD 5

STUDENTS WILL BE ABLE TO CREATE PROGRAM CODE FOR ROBOTS AND AUTOMATED SYSTEMS

- Objective 1 Define Closed-Loop and Open-Loop systems.
- Objective 2 Create and explain a program that utilizes input and output commands.
- Objective 3 Compile and utilize a personal library of commands.
- Objective 4 Apply sensors to obtain feedback.
- Objective 5 Apply switches and sensors to control robot movement.
- Objective 6 Apply digital logic to a problem-solving situation.
 - 1. Following a line.
 - 2. Avoiding an obstacle.
 - 3. Turning on an alarm.

Standard 5 Performance Evaluation included below (Optional)

STANDARD 6

STUDENTS WILL UNDERSTAND THE FUNDAMENTALS OF ELECTRICITY AS APPLIED TO ROBOTICS

- Objective 1 Calculate voltage, amperage, and resistance using Ohms Law.
- Objective 2 Use a multi-meter to measure voltage, amperage, and resistance.
- Objective 3 Define and identify series and parallel circuits.
- Objective 4 Compare and contrast energy sources and their ability to change to other forms of energy.



1. Describe and contrast energy sources.
2. Identify and contrast sources of electrical energy including AC & DC.
3. Describe energy ratings such as amp/hour and kilowatt/hour.

Objective 5 Use batteries, solar cells or generators to provide energy for the operation of small motors and other mechanical devices.

1. Identify batteries and describe their uses and hazards.
2. Properly connect and disconnect batteries and power supplies.
3. Define and calculate increase performance through series and parallel connections.

Standard 6 Performance Evaluation included below (Optional)

STANDARD 7

STUDENTS WILL BE ABLE TO IDENTIFY, UNDERSTAND, AND UTILIZE MECHANICAL ADVANTAGE AND EFFICIENCY TO PERFORM ROBOTIC TASKS

Objective 1 Identify the six simple machines and apply their use to a structural design.

The six simple machines defined by Renaissance scientists are:

1. Levers
2. Wheel and axle
3. Pulley
4. Inclined plane
5. Wedge
6. Screw

Objective 2 Analyze the effects of various forces on a mechanical device. (Every force is a vector and has two components, magnitude and direction.)

1. Discuss and demonstrate the following forces:
2. Gravitational forces
3. Normal force
4. Friction or Drag forces
5. Tension and Applied forces
6. Rotational forces (torque).

Objective 3 Calculate the mechanical advantage of gears, pulleys, and levers.

Objective 4 Discuss and calculate mechanical rates.

1. Discuss the difference between speed, velocity and acceleration.
2. Explore the concept of and calculate linear velocity.
3. Explore the concept of and calculate angular speed.
4. Explore the concept of and calculate linear acceleration.

Objective 5 Describe the effects of friction.

1. Discuss the advantages and disadvantages of friction.
2. Demonstrate rolling friction and explain why it reduces friction.

Objective 6 Describe the advantages and disadvantages of hydraulics and pneumatics.



1. Compare the advantages and disadvantages of hydraulics and pneumatics.
2. Discuss appropriate uses of both hydraulics and pneumatics.

Standard 7 Performance Evaluation included below (Optional)

STANDARD 8

STUDENTS WILL WORK IN TEAMS TO DESIGN, BUILD, AND PRESENT A FINAL 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 8 Performance Evaluation included below (Optional)



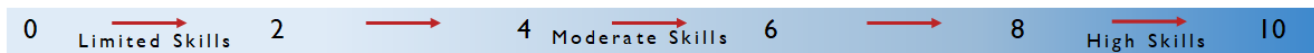
Robotics II Performance Standards (Optional)

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 Ethical and Social Impacts of Robotics

Score:

- Identify the ethical and social impacts of robotics and automation

STANDARD 3 Education Pathways and Careers

Score:

- Identify and report on educational pathways and career opportunities in robotics and automation

STANDARD 4 Work Ethic, Communication Skills, and Leadership Skills

Score:

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

STANDARD 5 Program Code for Robots

Score:

- Create program code for robots and automated systems

STANDARD 6 Fundamentals of Electricity

Score:

- Understand the fundamentals of electricity as applied to robotics

STANDARD 7 Mechanical Advantage and Efficiency

Score:

- Identify, understand, and utilize mechanical advantage and efficiency to perform robotic tasks

STANDARD 8 Mechanical Advantage and Efficiency

Score:

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

PERFORMANCE STANDARD AVERAGE SCORE: