

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.

Total Test Questions: 37

Levels: 10-12

Units of Credit: 0.50

Prerequisites: None

STANDARDS, OBJECTIVES, AND INDICATORS

STANDARD 1

10% of Exam Content

◆ STUDENTS WILL FOLLOW SAFETY PRACTICES.

- Objective 1: Identify potential safety hazards and follow general laboratory safety practices.
- Assess workplace conditions with regard to safety and health.
 - Identify potential safety issues and align with relevant safety standards to ensure a safe workplace/jobsite.
 - Locate and understand the use of shop safety equipment.
 - Select appropriate personal protective equipment.
- Objective 2: Use safe work practices.
- Use personal protective equipment according to manufacturer rules and regulations.
 - 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 2

4% of Exam Content

◆ 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.

Example discussion points:

- Discuss military and political use of robots; e.g. spy bugs and drones.
- 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.
- 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.

- Describe how robotics can improve manufacturing safety.
- Identify five or more industries that utilize robotic applications.
- Identify the advantages and disadvantages of automated assembly lines.

STANDARD 3

2% of Exam Content

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 4

2% of Exam Content

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

- | | |
|---------------------------|---------------|
| • responsibility | • delegation |
| • reliability | • cooperation |
| • dependability | • teamwork |
| • effective communication | • integrity |

Objective 3: Take minutes of team meetings.



STANDARD 5

27% of Exam Content

◆ 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.

Examples:

- Following a line.
- Avoiding an obstacle.
- Turning on an alarm.

STANDARD 6

24% of Exam Content

◆ 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.
- Describe and contrast energy sources.
 - Identify and contrast sources of electrical energy including AC & DC.
 - 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.
- Identify batteries and describe their uses and hazards.
 - Properly connect and disconnect batteries and power supplies.
 - Define and calculate increase performance through series and parallel connections.

STANDARD 7

27% of Exam Content

◆ 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:
- Levers
 - Wheel and axle
 - Pulley
 - Inclined plane
 - Wedge
 - 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.)
- Discuss and demonstrate the following forces:
 - Gravitational forces
 - Normal force
 - Friction or Drag forces
 - Tension and Applied forces
 - Rotational forces (torque).
- Objective 3: Calculate the mechanical advantage of gears, pulleys, and levers.
- Objective 4: Discuss and calculate mechanical rates.
- Discuss the difference between speed, velocity and acceleration.
 - Explore the concept of and calculate linear velocity.
 - Explore the concept of and calculate angular speed.
 - Explore the concept of and calculate linear acceleration.
- Objective 5: Describe the effects of friction.
- Discuss the advantages and disadvantages of friction.
 - Demonstrate rolling friction and explain why it reduces friction.
- Objective 6: Describe the advantages and disadvantages of hydraulics and pneumatics.
- Compare the advantages and disadvantages of hydraulics and pneumatics.
 - Discuss appropriate uses of both hydraulics and pneumatics.

STANDARD 8

4% of Exam Content

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.
- Summarize the design process used in the development of the robot.
 - Defend the final robot design.
 - Make a formal presentation to the class.

