

Denver Public Schools
Department of Curriculum and Instruction
2004/2005

COURSE SYLLABUS

I. General Course Information

Course Title(s): Automation and Robotics **Course Code:** 6883

Department: Career and Technology Education **Sub-Dept:** Industrial Technology

Grade Level(s): 7, 8 **Credits per Semester:** 2.5 **Credit Area:** Electives

Duration: 9 wks **Max Semesters:** One

Note: Science of Technology and Automation & Robotics should be taught in sequence during one semester.

Prerequisites: Design & Modeling and Magic of Electrons semester recommended.

Fees/Materials: Determined by Instructor

II. Course Description

In the fourth component in Gateway to Technology, students trace the history and development of automation and robotics. They learn about structures, energy transfer, machine automation, and computer control systems. Students acquire knowledge and skills in engineering problem solving and explore requirements for careers in engineering.

III. District Standards in CTE/Learning Objectives/DPS Standards

Safety Standard 5: The student will demonstrate the use of lifelong safety habits in the use of machines, tools, and processes in all endeavors.

In order to meet the standard, the student will be able to:

5.2 Demonstrate the practical application of safety practices that can be used in everyday life.

Engineering Standard 7: The student will understand and apply engineering principles.

In order to meet the standard, the student will be able to:

7.1 Demonstrate an understanding of the theory and application of electronics.

7.2 Apply concepts of engineering research, design, and problem solving.

7.3 Use modern technology and processes to explore complex engineering problems.

7.4 Explore a variety of career clusters and understand the evolving career opportunities within engineering.

DPS STANDARDS

READING AND WRITING

STANDARD 1: Students read and understand a variety of materials.

STANDARD 2: Students write and speak for a variety of purposes and audiences.

STANDARD 4: Students apply thinking skills to their reading, writing, speaking, listening, and viewing.

MATHEMATICS

STANDARD 5: Measurement – Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.

STANDARD 6: Computation: Students link concepts and procedures as they develop and use computational techniques, including estimating, mental arithmetic, paper-and-pencil, calculators, computers, and other manipulatives in problem-solving situations and communicate the reasoning used in solving these problems.

STANDARD 7: Technology: Students understand and use appropriate technologies to perform mathematical constructions and computations, simulate mathematical experiences, and to access, process, and communicate information related to the application of mathematics in problem-solving situations.

SCIENCE

STANDARD 2: Physical Science: Students know and understand common properties, forms, and changes in matter and energy.

STANDARD 5: Students know and understand interrelationships among science, technology, and human activity in the past, present, and future and how they can affect the world.

STANDARD 7: Students use appropriate technologies to facilitate understanding of scientific concepts, information, and to conduct scientific inquiry.

IV. Course Outline:

A. Introduction

1. What is Robotics?
2. History of Robotics
3. Future of Robotics

B. Structures

1. Comparisons
 - a. Natural
 - b. Man-made
2. Load Carrying Devices
 - a. Beams and Girders
 - b. Struts
 - c. Ties
3. Forces
 - a. Tension
 - b. Compression
4. Stability
 - a. Balance
 - b. Mass

C. Mechanics of Energy Transfer

1. Changing Direction and Force
 - a. Worm Gear
 - b. Universal Joint
 - c. Bevel Gear
2. Changing Type of Movement
 - a. Rack and Pinion
 - b. Crank and Slider
 - c. Cam and Follower
 - d. Lead Screw
3. Transmitting Rotary Movement
 - a. Belts and Pulleys
 - b. Chains and Sprockets
 - c. Gear Trains
4. Friction
 - a. Bearing Surfaces
 - b. Types of Bearings
 - c. Lubrication

D. Manufacturing Processes

1. Separating
 - a. Sawing
 - b. Drilling
 - c. Milling
 - d. Turning
 - e. Grinding
 - f. Electrical Discharge Machine
2. Forming
 - a. Forging
 - b. Casting
 - c. Bending

- d. Extruding
- e. Hydro forming
- f. Explosive Forming
- g. Stamping
- 3. Combining
 - a. Mechanical
 - b. Heat
 - c. Adhesive
 - d. Interlocking
- 4. Finishing
 - a. Coating
 - b. Anodizing
 - c. Plating
 - d. Laminating
- E. Control Systems and Programming
 - 1. Types of Control Systems
 - a. Open Loop
 - b. Closed Loop
 - 2. Sensors
 - a. Analog (Temperature, Light, Sound, Force)
 - b. Digital (Micro Switch, Reed Switch, Light, Force)
 - 3. Human to Machine Communications
 - a. Flow Charting (Task Evaluation, Logical Thinking)
 - b. Code Generation (Graphical Interface, Writing Code, Automated Code Generation)
 - 4. Machine to Machine Communications
 - a. Commands
 - b. Drivers Program
 - c. Interface Connections
 - d. Power Supplies
 - e. Diagnostic Program
- B. Social Implications and Career Opportunities in Automation
 - 1. Career Investigation
 - 2. Education paths to technical/engineering careers
 - Learn and follow rules of safety for the Industrial Technology classes. (5.2)
 - Pass with 100% the DPS Safety Test for specific area/equipment. (5.2)
 - Learn to accept responsibility for the personal safety of self and others. (5.2)
 - Maintain a clean and safe work environment. (5.2)
 - Demonstrate a positive personal attitude towards safety. (5.2)
 - Wear protective safety clothing as required. (5.2)
 - Use power tools correctly and safely. (5.2)
 - Locate emergency shutoff switch for all machinery/equipment. (5.2)
 - Report malfunctions to appropriate personnel. (5.2)
 - Identify fire exits and fire-fighting equipment. (5.2)
 - Define a safe work environment. (5.2)
 - Follow established safety procedures when using machine tools. (5.2)
 - Manipulate a robot to perform simple tasks. (7.1)

- Explore the uses of robotics. (7.1)
- Understand the fundamentals of robotics and the application of robotics in modern society. (7.1)
- List and explain the basic components of robots and their functions. (7.1)
- Identify the difference between an open and closed loop robotic system. (7.1)
- Explain the use of a digital sensor. (7.1)
- Perform stability and rigidity investigations. (7.1)
- Demonstrate methods of energy: manipulation and transfer, by constructing a system. (7.1)
- Demonstrate, in teams, the set-up of the Fischertechnik interface, computer, and power supply. (7.1)
- Relate basic computer language statements to design brief. (7.1)
- In teams solve a variety of problems using computer control design briefs. (7.1)
- Recognize the importance of troubleshooting by using a systematic approach. (7.1)
- Complete research assignment on careers related to robotics and automation. (7.1)

- Demonstrate consistently punctual arrival and regular attendance. (7.2)
- Demonstrate the process of team goal setting and organizing. (7.2)
- Define technology. (7.2)
- Identify a design problem, do product research, and present conclusions. (7.2)

- Introduce categories of jobs related to engineering. (7.4)
- Examine requirements of jobs. (7.4)