



**Technology Education
Grades 9 - 12
Robotics I
July 23, 2018
Robert Yost**

Dr. Mark Toback, Superintendent

This curriculum may be modified through varying techniques, strategies, and materials as per an individual student's Individualized Educational Plan (IEP)

**Wayne School District
Curriculum Format**

Content Area/ Grade Level/ Course:	Applied Technology Grades 9 - 12 Robotics 1
Unit Plan Title:	Unit 1: Sketching and Technical Posters
Time Frame	1-3 weeks

Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10

8.2 Design Thinking This standard, previously standard 8.2 Technology Education of the 2014 NJSL – Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The new framework design, detailed previously, includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

[Anchor Companion Standards \(Reading and Writing Grades 9-10\)](#)

[Anchor Companion Standards \(Reading and Writing Grades 11-12\)](#)

Unit Overview

1. Sketching and Technical Posters
 - a. Pencil types
 - b. Pencil control and line work
 - c. Crating: circles from squares
 - d. Layout of a technical poster
 - e. 2-dimensional sketching
 - f. 3-dimensional sketching
 - g. Ideation and Annotation

Standard Number(s)

8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.

8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.

8.2.12.ITH.1: Analyze a product to determine the impact that economic, political, social, and/or cultural factors have had on its design, including its design constraints

8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.

8.2.12.NT.2: Redesign an existing product to improve form or function.

9.2.12.CAP.3: Investigate how continuing education contributes to one's career and personal growth.

9.2.12.CAP.5: Assess and modify a personal plan to support current interests and postsecondary plans.

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving

Intended Outcomes - {Essential Questions}

- Explain how to communicate potential solution ideas using sketches
- The process of generating ideas is called ideation.
- Simple sketches usually are made to record and communicate ideas so they can be refined further.
- The notebook should serve as a written record of everything that happened with regard to a given project.
- Why use a pencil when a computer can be used for drawing?
- What types of pencils offer best results for sketching?
- Why is it important to be able to communicate with others?
- What is the value of the design and problem solving process?

Enduring Understandings

- Ideation techniques include brainstorming and researching.
- After brainstorming, engineers work on sketching and researching the potential design solutions.
- Engineers communicate their initial design solutions using rough sketches.
- Engineers begin sketching by visualizing the appearance and functionality of the object.
- A drafter is someone who draws documents for official purposes.
- Drafting began with prehistoric humans drawing images on the walls of their caves to communicate their ideas and representation of the world around them.

In this unit plan, the following 21st Century themes and skills are addressed.

Check all that apply. 21 st Century Themes		Indicate whether these skills are E -Encouraged, T -Taught, or A -Assessed in this unit by marking E , T , A on the line before the appropriate skill. 21 st Century Skills	
<input checked="" type="checkbox"/>	Global Awareness	<input checked="" type="checkbox"/>	Creativity and Innovation
<input type="checkbox"/>	Environmental Literacy	<input checked="" type="checkbox"/>	Critical Thinking and Problem Solving
<input type="checkbox"/>	Health Literacy	<input checked="" type="checkbox"/>	Communication
<input type="checkbox"/>	Civic Literacy	<input checked="" type="checkbox"/>	Collaboration
<input type="checkbox"/>	Financial, Economic, Business, and Entrepreneurial Literacy		

Student Learning Targets/Objectives (Students will know/Students will understand)	
<ul style="list-style-type: none"> ● Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities. ● Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles. 	
Assessments (Pre, Formative, Summative, Other) <i>Denote required common assessments with an *</i>	
<ul style="list-style-type: none"> ● Project assignments and group dynamics ● Documentation of ideas with notes in a defined poster format ● Class discussions and Critiques ● Rubrics 	
Teaching and Learning Activities	
<i>Activities</i>	<ul style="list-style-type: none"> ● Lecture and class discussion. ● Review past robotic in-class competitions including: Climb and deploy, robotic Lego machine challenge, engineering journals ● Review and rebuild of robotic arm ● “Go to the videotape” of projects
<i>Differentiation Strategies</i>	<ul style="list-style-type: none"> ● Individual and collaborative research, design and problem solving ● Student interest and skill level assessment (Learning Style Assessment results) ● Individual, small group, and large group instruction ● Media presentations and guest speakers ● Student presentations and Flipped Lessons
Resources	
<ul style="list-style-type: none"> ● http://www.state.nj.us/education/cccs/ ● http://curriculum.vexrobotics.com/curriculum/intro-to-engineering/introduction ● https://sites.google.com/site/manufacturingfordummies/home/the-3-primary-manufacturing-processes ● Engineering Fundamentals: Design, Principles, and Careers, Goodheart-Wilcox, copyright 2014 ● Pre-Engineering, McGraw Hill, copyright 2012 	

Content Area/ Grade Level/ Course:	Applied Technology Grades 9 - 12 Robotics 1
Unit Plan Title:	Unit 2: The 6-Simple Machines and Their Functions
Time Frame	1-5 weeks
Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10	
<p>8.2 Design Thinking This standard, previously standard 8.2 Technology Education of the 2014 NJSL – Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The new framework design, detailed previously, includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts</p> <p>9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.</p> <p>Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.</p> <p>Anchor Companion Standards (Reading and Writing Grades 9-10)</p> <p>Anchor Companion Standards (Reading and Writing Grades 11-12)</p>	
Unit Overview	
<p>Unit 2: Introduction To the 6-Simple Machines and Their Functions</p> <p>a. Wheel and Axle b. Pulley c. Lever d. Incline Plane e. Wedge f. Screw</p>	
Standard Number(s) * i.e: Math: 3.NBT.1 i.e.: RL 8.1	
<p>8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.</p> <p>8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modification to increase optimization based on feedback</p> <p>9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice</p> <p>9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving</p>	
Intended Outcomes - {Essential Questions}	

- What are the six simple machines
- What simple machine is adapted from another
- Name several devices used to transmit mechanical power
- Explain mechanical advantage

Enduring Understandings

- Simple machines are tools that make work easier
- Mechanical advantage is the number of times a machine or tool multiplies the input force to move a load
- All mechanical tools need an energy source to do work
- A mechanism is a system made by combining parts, such as simple machines
- The three most common types of power systems are mechanical, fluid, and electrical
- Mechanical energy is the energy of motion

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<input checked="" type="checkbox"/>	Global Awareness	<input checked="" type="checkbox"/>	Creativity and Innovation
<input type="checkbox"/>	Environmental Literacy	<input checked="" type="checkbox"/>	Critical Thinking and Problem Solving
<input type="checkbox"/>	Health Literacy	<input checked="" type="checkbox"/>	Communication
<input type="checkbox"/>	Civic Literacy	<input checked="" type="checkbox"/>	Collaboration
<input type="checkbox"/>	Financial, Economic, Business, and Entrepreneurial Literacy		

Student Learning Targets/Objectives (Students will know/Students will understand)

- Students will be able to apply their knowledge of simple machines to construct models to perform a given task
- Students will be able to develop an understanding that mechanical engineers combine simple machines to create more complex machines
- Develop methods for creating possible solutions, modeling and testing solutions, and modifying proposed design in the solution of a technological problem using hands-on activities.
- Create a technological product, system, or environment using given design specifications and constraints by applying design and engineering principles.

Assessments (Pre, Formative, Summative, Other)

*Denote required common assessments with an **

- Project assignments and group dynamics
- Documentation of ideas with notes in a defined poster format
- Class discussions and Critiques

Teaching and Learning Activities	
<i>Activities</i>	<ul style="list-style-type: none"> ● Lecture and class discussion. ● Review past robotic in-class competitions including: Climb and deploy, robotic Lego machine challenge, engineering journals ● Review and rebuild of robotic arm ● “Go to the videotape” of projects
<i>Differentiation Strategies</i>	<ul style="list-style-type: none"> ● Individual and collaborative research, design and problem solving ● Student interest and skill level assessment (Learning Style Assessment results) ● Individual, small group, and large group instruction ● Media presentations and guest speakers ● Student presentations and Flipped Lessons
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**Wayne School District
Curriculum Format**

Content Area/ Grade Level/ Course:	Applied Technology Grades 9 - 12 Robotics 1
Unit Plan Title:	Unit 3: Design and Problem Solving
Time Frame	5-10 weeks
Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10	

8.2 Design Thinking This standard, previously standard 8.2 Technology Education of the 2014 NJSL – Technology, outlines the technological design concepts and skills essential for technological and engineering literacy. The new framework design, detailed previously, includes Engineering Design, Ethics and Culture, and the Effects of Technology on the Natural world among the disciplinary concepts

9.2 Career Awareness, Exploration, Preparation and Training. This standard outlines the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements.

Standard 9.4 Life Literacies and Key Skills. This standard outline key literacies and technical skills such as critical thinking, global and cultural awareness, and technology literacy* that are critical for students to develop to live and work in an interconnected global economy.

[Anchor Companion Standards \(Reading and Writing Grades 9-10\)](#)

[Anchor Companion Standards \(Reading and Writing Grades 11-12\)](#)

Unit Overview

Unit 3:

Students will follow the develop an understanding and application of Informed Design Process to research, gather information, generate multiple ideations, discuss the best possible solution with group members and construct using best practices. Students will document work and create a technical poster per poster standards.

Standard Number(s) * i.e: **Math: 3.NBT.1** i.e.: **RL 8.1**

Intended Outcomes - {Essential Questions}

- Why follow the Informed Design Process for solving challenges?
- Can simple machine knowledge be applied to solve the design challenge?
- Why is technical documentation important in the engineering process?
- List the steps in the Informed Design Process

Enduring Understandings

- Designing solutions to a solve challenges require a methodical approach and the Informed Design Process model does just that
- Simple machines is the foundation of mechanical systems
- Documentation is a legal document that records the life cycle of the engineering concept/product
- A mechanism is a system made by combining parts, such as simple machines

In this unit plan, the following 21st Century themes and skills are addressed.

<i>Check all that apply.</i>		<i>Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.</i>	
21st Century Themes		21st Century Skills	
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Student Learning Targets/Objectives (Students will know/Students will understand)

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-

Assessments (Pre, Formative, Summative, Other)

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- Project assignments and group dynamics
- Documentation of ideas with notes in a defined poster format
- Class discussions and Critiques

Teaching and Learning Activities

<i>Activities</i>	<ul style="list-style-type: none"> ● Lecture and class discussion. ● Review past robotic in-class competitions including: Climb and deploy, robotic Lego machine challenge, engineering journals ● Review and rebuild of robotic arm ● “Go to the videotape” of projects
<i>Differentiation Strategies</i>	<ul style="list-style-type: none"> ● Individual and collaborative research, design and problem solving ● Student interest and skill level assessment (Learning Style Assessment results) ● Individual, small group, and large group instruction ● Media presentations and guest speakers ● Student presentations and Flipped Lessons

Resources

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Wayne School District Curriculum Format

Content Area/ Grade Level/ Course:	Applied Technology Grades 9 - 12 Robotics 1
Unit Plan Title:	Unit 4: Robotic Arm Construction
Time Frame	5-10 weeks

Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10

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[Anchor Companion Standards \(Reading and Writing Grades 9-10\)](#)

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Unit Overview

Unit 4:

Students will be able to identify parts of a basic robot and construct a working prototype with CAD and manufacture parts by way of outputting drawing to a laser cutting platform. Students will be able to use hydraulic cylinders and water to move different axis on the robot by way of a hand-held controller.

Standard Number(s)

- 8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
- 8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
- 8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
- 8.2.12.NT.2: Redesign an existing product to improve form or function.
- 9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas
- 9.4.12.IML.3: Analyze data using tools and models to make valid and reliable claims, or to determine optimal design solutions

Intended Outcomes - {Essential Questions}

- How many axis of movement does a fixed base robot need to be able to stack pallets?
- What is the work envelop of a robot??
- Why do robots need moveable joints?
- Explain what an actuator is?
- What is a program and how does it move a robot?

Enduring Understandings

- Actuators can be a system or device that moves a robotic part.
- A DPDT switch can be used wired to change the forward/reverse flow of electricity in a robotic arm circuit
- Electrical circuits are essential in the movement of robotic devices.
- Programmers write code that moves a robot in a defined motion.
- A robot is made to repeat the same steps over and over that would be tiring for a human worker.
- An axis is a moveable joint on a robotic system.
- Robots have a limited reach which is part of the work envelop.

In this unit plan, the following 21st Century themes and skills are addressed.

Check all that apply.
21st Century Themes

Indicate whether these skills are E-Encouraged, T-Taught, or A-Assessed in this unit by marking E, T, A on the line before the appropriate skill.

21st Century Skills

<input checked="" type="checkbox"/>	Global Awareness	<input checked="" type="checkbox"/>	Creativity and Innovation
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Assessments (Pre, Formative, Summative, Other)

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- Project assignments and group dynamics
- Documentation of ideas with notes in a defined poster format
- Class discussions and Critiques

Teaching and Learning Activities

<i>Activities</i>	<ul style="list-style-type: none"> ● Lecture and class discussion. ● Review past robotic in-class competitions including: Climb and deploy, robotic Lego machine challenge, engineering journals ● Review and rebuild of robotic arm ● “Go to the videotape” of projects
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**Wayne School District
Curriculum Format**

Content Area/ Grade Level/ Course:	Applied Technology Grades 9 - 12 Robotics 1
Unit Plan Title:	Unit 5: Electrical Circuits
Time Frame	5-10 weeks
Anchor Standards/Domain* *i.e: ELA: reading, writing i.e.: Math: Number and Operations in Base 10	
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Unit Overview	
<p>Unit 4:</p> <p>Students will be introduced to the foundation of circuits as it applies to the study of electrified systems and robotics. Students will be able to use a multimeter to measure voltage and other conditions of circuit analysis. Students will develop an understanding of electrical vocabulary and the application. Students will be able to construct circuits with traditional means as well as experiment with Arduino and breadboarding. Ohm’s Law and the calculation of resistor values will be used when constructing circuits with LEDs and other semiconductors.</p>	
Standard Number(s)	

- 8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
- 8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
- 8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved
- 8.2.12.ED.1: Use research to design and create a product or system that addresses a problem and make modifications based on input from potential consumers.
- 8.2.12.ED.2: Create scaled engineering drawings for a new product or system and make modifications to increase optimization based on feedback.
- 8.2.12.ITH.2: Propose an innovation to meet future demands supported by an analysis of the potential costs, benefits, trade-offs, and risks related to the use of the innovation.

Intended Outcomes - {Essential Questions}

- Can you explain the flow of electricity and open/closed circuits to a grade school child?
- What type of energy do batteries store?
- List the components required to construct an LED flashlight.
- How is electricity generated?
- What is continuity?
- What is an electro-magnet?

Enduring Understandings

- Normally open switch breaks the flow of electricity in a circuit much like the way an open drawbridge stops the flow of motor vehicles
- A DPDT switch can be used wired to change the forward/reverse flow of electricity in a robotic arm circuit
- LEDs, resistors, switch, and conductors are found in a modern dc flashlight
- Electro-magnets can be made with magnet wire, a nail, and a dc battery

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Assessments (Pre, Formative, Summative, Other)

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- Project assignments and group dynamics
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- Class discussions and Critiques

Teaching and Learning Activities

<i>Activities</i>	<ul style="list-style-type: none"> ● Lecture and class discussion. ● Review past robotic in-class competitions including: Climb and deploy, robotic Lego machine challenge, engineering journals ● Review and rebuild of robotic arm ● “Go to the videotape” of projects
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