

Robotics/Principles of Technology Grades 10-12

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Approved by the Midland Park Board of Education on
June 21, 2022

Robotics/Principles of Technology

Course Description:

Robotics/Principles of Technology is aligned with the NGSS standards and was developed based upon the interest of students. Through the use of technology, engineering and robotics, the course stresses problem-solving skills in a real world setting. Students will be given tasks and will need to design and construct various projects. Students will work independently as well as in pairs, small groups and large groups. Both verbal and written communication of ideas will be emphasized. The course is designed to motivate the student of all ability levels to participate in real-world scenarios utilizing engineering and robotic concepts to problem solve through hand on activities. Robotics/Principles of Technology encompass STEM principles in a variety of in-class and out-of-class learning activities designed to teach the student about careers in technology, engineering, robotics and science.

Course Sequence:

* Units overlap throughout the semester

Unit One: History of Robotics (1 week)

Unit Two: Careers in STEM (1 week)

Unit Three: Getting Started in Robotics (9-10 weeks)

Unit Four: Design in Engineering & Technology (2-3 weeks)

Unit Five: Applications of Robotics (3-4 weeks)

Unit Six: Designing & Building Robots (7-8 weeks)

Pre-requisite:

none

Unit 1
Overview
Content Area: Robotics/Principles of Technology

Unit Title: History of Robotics	
Grade Level: 10-12	
Core Ideas: This unit will cover the development of robotics over time. Students will research how robotics has evolved over time.	
Standards (Content and Technology)	
CPI#:	Statement:
Performance Expectations (NJSLs)	
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.
Career Readiness, Life Literacies, and Key Skills	
9.1.12.EG.3 9.1.12.FP.3	Explain how individuals and businesses influence government policies. Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing and building wealth over time.
9.4.12.CT.1 Identify problem-solving strategies used in the development of an innovative product or practice. 9.2.12.CAP.3 Investigate how continuing education contributes to one's career and personal growth. Computer Science and Design Thinking 8.1.12.IC.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. 8.1.12.IC.2 Test and refine computational artifacts to reduce bias and equity deficits. 8.1.12.IC.3 Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources. 8.1.12.CS.2 Model interactions between application software, system software, and hardware 8.1.12.CS.3 Compare the functions of application software, system software, and hardware	
Interdisciplinary Connection	
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
Companion Standards ELA/L	
NJLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem

RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RI.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Cross-cultural Statements/Mandates (Amistad, Holocaust, LGBT, etc...)	
Reflect on the influence that Hispanic Americans; Blind, Deaf & Hard of Hearing Americans; members of the AAPI, the LGBTQ and handicapped community has had on the development of robots throughout history	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.
7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.
Unit Essential Question(s): <ul style="list-style-type: none"> • How did robots evolve? • What are current & future uses of robots? 	
Unit Enduring Understandings: <ul style="list-style-type: none"> • Important events in the history & future of robotics • Understand the history of robotics. 	

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<ul style="list-style-type: none"> • Analyze the advancement of engineering. • Identify how robots have advanced over time. 		
Evidence of Learning		
Formative Assessments: Teacher observations, Homework assignments, outline worksheets, conference with students. Summative/Benchmark Assessment(s): History of Robotics Project. Alternative Assessments: extended time, verbal report		
Resources/Materials: Computer/Internet articles/Websites/Books		
Key Vocabulary: Artificial Intelligence Three Laws of Robotics Robot		
Suggested Pacing Guide		
Lesson Name/Topic	Student Learning Objective(s) Suggested Tasks/Activities:	Day(s) to Complete
History of Engineering & Technology	Recognize how engineering & technology has evolved over time. Pre-Quiz History of Robotic Scavenger Hunt	3 days
History of Robotics	Identify how robotics has evolved over Pre-Quiz	2 days

	time.	History of Robotic Scavenger Hunt Timeline	
Advancement of Robots	Explain recent advances in robotics. Current Event Articles and Videos		5 days throughout course
Uses of Robots in Industry	Understand fields where robots are utilized	What is a Robot? Class activity	5 days throughout course

Teacher Notes: Unit occurs throughout the course

Additional Resources: NEWSELA, News websites, google slides

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students Students at Risk	504 Students
<ul style="list-style-type: none"> Consult student IEP Allow errors <ul style="list-style-type: none"> Rephrase questions, directions, and explanations Allow extended time to answer questions, and permit drawing, as an explanation 	<ul style="list-style-type: none"> Consult ELL student Plan Assign a buddy, same language or English speaking Allow errors in speaking <ul style="list-style-type: none"> Rephrase questions, directions, and explanations Allow extended time to answer questions 	<ul style="list-style-type: none"> Consult G and T teacher Provide extension activities Build on students' intrinsic motivations Higher Level mathematical computations 	<ul style="list-style-type: none"> Consult 504 Plan Allow errors <ul style="list-style-type: none"> Rephrase questions, directions, and explanations Allow extended time to answer questions, and permit drawing, as an explanation

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Unit 2

Overview

Content Area: Robotics/Principles of Technology

Unit Title: Careers in STEM

Grade Level: 10-12

Core Ideas: Explore careers in technology and robotics. Research the education and paths to STEM careers. Evaluate personal interest in STEM careers. Understand effects of STEM careers and applications in everyday life

Standards (Content and Technology)

CPI#:	Statement:
Performance Expectations (NJSL)	
HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants
HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.
Career Readiness, Life Literacies, and Key Skills	
9.1.12.EG.3	Explain how individuals and businesses influence government policies.
9.1.12.FP.3 9.2.12.CAP.3	Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing and building wealth over time. Investigate how continuing education contributes to one's career and personal growth.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice.
Computer Science and Design Thinking	
8.1.12.IC.1	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
8.1.12.IC.2 8.1.12.IC.3 8.1.12.CS.2	Test and refine computational artifacts to reduce bias and equity deficits. Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources. Model interactions between application software, system software, and hardware
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
Interdisciplinary Connection MP.2 Reason abstractly and quantitatively	
MP.4	Model with mathematics
Companion Standards ELA/L	
NJLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem
RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RI.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Cross-cultural Statements/Mandates (Amistad, Holocaust, LGBT, etc...)	

Reflect on various Hispanic Americans; Blind, Deaf & Hard of Hearing Americans; members of the AAPI, the LGBTQ and handicapped community have careers in robotics

Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)

Develop, implement and model effective problem solving and critical thinking skills (CASEL)

7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.
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7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.
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Unit Essential Question(s):

- What careers exist in Engineering & Robotics?
- What institutions (college, schooling, certificates) are available and needed to pursue a STEM career?

Unit Enduring Understandings:

- STEM careers are attainable
- STEM careers require specific skills and education

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- Am I interested in pursuing a STEM career/education?
- What do I personally use that is an application of someone else's STEM career?
- STEM careers have important applications

Evidence of Learning

Formative Assessments: Teacher observations, Homework assignments, outline worksheets, conference with students. **Summative/Benchmark Assessment(s):** Rubric Project on Careers in Robotics
Alternative Assessments: modified requirements

Resources/Materials: internet resources, teacher created outline and project

Key Vocabulary:

STEM
Engineering

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s) Suggested Tasks/Activities:	Day(s) to Complete
Journal Questions	Identify education options for STEM careers Robotics as a College/Grad School Focus	2 days
Research Project	Research careers Class Project	2-3 days
Current Happening	Learn about newest STEM careers Teacher guided readings	2-3 days

Teacher Notes:

Additional Resources: NEWSELA. College Websites, Journals

Differentiation/Modification Strategies

Students with

English Language

Gifted and Talented

Students at Risk 505Students

Disabilities

Learners

Students

- Consult student IEP

- Consult ELL student

- Consult G and T

- Consult with IR&S

- Consult 504 Plan

Plan

teacher

as needed

- Allow errors

- Assign a buddy,

- Provide extension

- Provide extended

- Allow errors

- Rephrase questions,

same language or

activities

time to complete

- Rephrase questions,

directions, and

English speaking

tasks

directions, and

explanations

- Build on students'

explanations

- Allow errors in

intrinsic motivations

- Consult with

- Allow extended

- Allow extended

speaking

Guidance

time to answer

time to answer

questions, and

- Higher Level

mathematical

questions, and

permit drawing, as

- Rephrase questions,

directions, and

computations

permit drawing, as

an explanation

explanations

an explanation

- Allow extended time to answer questions

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Unit 3

Overview

Content Area: Robotics/Principles of Technology

Unit Title: Getting started in robotics: Building, Programming & Sensors

Grade Level: 10-12

Core Ideas: Students will identify what the parts are in the robotic kits and how the EV3 brick (memory brick) works. Students will install the EV3 program software and analyze the programming process. Identify the output ports, input ports, cables and the remote control. Students will learn how to create a basic program, by understanding modes, settings, loops and sequencing for robotics. Students will compare how numeric values (math blocks) are converted to logic values. Students will understand how sensors work and create programs and robots for utilization of different sensors.

Standards (Content and Technology)

CPI#:

Statement:

Performance Expectations (NJSLs)

HS-PS3-3

Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.

HS-PS2-3

Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.

HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.

HS-ETS1-4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills

9.1.12.EG.3

Explain how individuals and businesses influence government policies.

9.1.12.FP.3

Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing and building wealth over time.

9.2.12.CAP.3 Investigate how continuing education contributes to one's career and personal growth. 9.4.12.CT.1

Identify problem-solving strategies used in the development of an innovative product or practice. **Computer Science and Design Thinking**

8.1.12.IC.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.

8.1.12.IC.2

Test and refine computational artifacts to reduce bias and equity deficits.

8.1.12.IC.3	Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
Interdisciplinary Connection	
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
Companion Standards ELA/L	
NJSLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJSLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
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RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RI.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Cross-cultural Statements/Mandates (Amistad, Holocaust, LGBT, etc...)	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.
7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.

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<p>Unit Essential Question(s):</p> <ul style="list-style-type: none"> • What parts are available to build a robot? • How are robots programmed? • What types of sensors exist on robots and how do the sensors control the robot? 	<p>Unit Enduring Understandings:</p> <ul style="list-style-type: none"> • How the robot kit will enable students to build a robot. • Ability to program the EV3 robots. • How different sensors control the actions of robots.
Evidence of Learning	

Formative Assessments: Teacher observations, identify aspects of the brick, Google assignments, Group problem solving, worksheets, quiz, conference with students.

Summative/Benchmark Assessment(s): Textbook Discovery Assignments

Alternative Assessments: modified work

Resources/Materials: “The LEGO MINDSTORMS EV3

Discovery Book: A Beginner's Guide to Building and

Programming Robots” (No Starch Press; 1st edition (June 14, 2014)), Core Kits, LEGO Mindstorm App

Key Vocabulary:

Sensors Loops

Ports Pseudocode

Motors Gears

Programming

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s) Suggested Tasks/Activities:	Day(s) to Complete
Inventory	Inventory Learn the parts in the EV3 Mindstorms robotics kit.	1-2 days
Explore App	Getting to Started CH 2 Identify the features of coding robots using the mindstorm app	1-2 days
CH 3 and \$	Identify parts and blocks with the EV3 Getting Started CH 3 and CH4 Action Blocks	3-4 days
Loops	Understand loops and sequencing in programming. Programming EV3 with Mindstorm App	3-4 days
Sensors	CH 5-6 Discovery Tasks Differentiate between the different types of sensors and how they work in robots:	3-4 days
Build	<u>Touch, color, infrared and rotation</u> Construct robots using different sensors. CH 5-6 Discovery Tasks	1 week
Program	Program, test and redesign robots. Completing complex Discovery Tasks	2 weeks

Teacher Notes: Pacing will depend on students’ previous experience with coding

Additional Resources: Edpuzzles on app

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	506Students
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<ul style="list-style-type: none"> ● Consult student IEP ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation 	<ul style="list-style-type: none"> ● Consult ELL student Plan ● Assign a buddy, same language or English speaking ● Allow errors in speaking <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions 	<ul style="list-style-type: none"> ● Consult G and T teacher ● Provide extension activities ● Build on students' intrinsic motivations ● Higher Level mathematical computations 	<ul style="list-style-type: none"> ● Consult with IR&S as needed ● Provide extended time to complete tasks ● Consult with Guidance 	<ul style="list-style-type: none"> ● Consult 504 Plan ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation
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Unit 4

Overview

Content Area: Robotics/Principles of Technology

Unit Title: Design in Engineering & Technology

Grade Level: 10-12

Core Ideas: Students will study how problem solving involves investigation & research leading to a design. Discussion on choosing and justifying the perfect design. Analyze how the building, testing, evaluating, redesign and modifications lead to an optimal product.

Standards (Content and Technology)

CPI#:

Statement:

Performance Expectations (NJSLS)

HS-PS4-5

Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.

HS-ETS1-4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills

9.1.12.EG.3

Explain how individuals and businesses influence government policies.

9.1.12.FP.3

Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing

	and building wealth over time.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice.
Computer Science and Design Thinking	
8.1.12.IC.1	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.
8.1.12.IC.2	Test and refine computational artifacts to reduce bias and equity deficits.
8.1.12.IC.3	Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
Interdisciplinary Connection	
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
Companion Standards ELA/L	
NJSLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJSLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem
RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RI.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Cross-cultural Statements/Mandates (Amistad, Holocaust, LGBT, etc...)	
Reflect on the influence that robotics has had on accessibility for handicapped and Blind, Deaf & Hard of Hearing people.	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.

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7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.
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Unit Essential Question(s):

- How do the principles and processes of engineering lead to a product?

Unit Enduring Understandings:

- How engineers and scientists work together to clarify a problem, research and investigate, and then design a prototype.

Evidence of Learning

Formative Assessments: Teacher observations, Homework assignments, Group problem solving, worksheets, conference with students.

Summative/Benchmark Assessment(s): Communication of the solution report, rubric for project
Alternative Assessments: Preset plans when needed

Resources/Materials:

“The LEGO MINDSTORMS EV3 Discovery Book: A Beginner's Guide to Building and Programming Robots” (No Starch Press; 1st edition (June 14, 2014)), Core Kits, LEGO Mindstorm App, website sources and additional [Expansion kits](#)

Key Vocabulary:

Sensors Loops
 Ports Pseudocode
 Motors Gears
 Programming

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s) Suggested Tasks/Activities:	Day(s) to Complete
Robot Research & Planning Preparing for Build and Design Design and Build	Investigate application of design skills Tasks: Planning necessary parts and coding for Cross the gap, Drop In the <u>Box</u> Identify the necessary parts and build Organize parts for: Cross the gap, Drop In the Box Design their building plans Complete Robot build and Coding for: Cross the gap, Drop In the Box Test and evaluate	1 day 1-2 days 1-2 days
Evaluate Personal Abilities	Apply Design and Building skills Free Choice	2 weeks

Teacher Notes: this unit may be repeated throughout the course as more skills are gained

Additional Resources: Textbook, LEGO website and Kits

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	507Students
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<ul style="list-style-type: none"> ● Consult student IEP ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation 	<ul style="list-style-type: none"> ● Consult ELL student Plan ● Assign a buddy, same language or English speaking ● Allow errors in speaking <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions 	<ul style="list-style-type: none"> ● Consult G and T teacher ● Provide extension activities ● Build on students' intrinsic motivations ● Higher Level mathematical computations 	<ul style="list-style-type: none"> ● Consult with IR&S as needed ● Provide extended time to complete tasks ● Consult with Guidance 	<ul style="list-style-type: none"> ● Consult 504 Plan ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation
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Unit 5

Overview

Content Area: Robotics/Principles of Technology

Unit Title: Applications of Robotics

Grade Level: 10-12

Core Ideas: Students will explore how robots are widely used in manufacturing, assembly, packing and packaging, mining, transport, earth and space exploration, surgery, weaponry, laboratory research, safety, and the mass production of consumer and industrial goods. Students will evaluate the ethics and priorities of robotic applications.

Standards (Content and Technology)

CPI#:

Statement:

Performance Expectations (NJSLs)

HS-ETS1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

HS-PS4-5

Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.

HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.

HS-ETS1-4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills

9.1.12.EG.3

Explain how individuals and businesses influence government policies.

9.1.12.FP.3	Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing and building wealth over time.
9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
9.4.12.CT.1 Identify problem-solving strategies used in the development of an innovative product or practice. Computer Science and Design Thinking	
8.1.12.IC.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	
8.1.12.IC.2	Test and refine computational artifacts to reduce bias and equity deficits.
8.1.12.IC.3	Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
Interdisciplinary Connection	
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
Companion Standards ELA/L	
NJSLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJSLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem
RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
RI.11-12.9	Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
Cross-cultural Statements/Mandates (Amistad, Holocaust, LGBT, etc...)	
Reflect on the influence that robotics has had on accessibility for handicapped and Blind, Deaf & Hard of Hearing people.	
Recognize the importance of self-confidence in handling daily tasks and challenges (CASEL)	
Develop, implement and model effective problem solving and critical thinking skills (CASEL)	
7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.

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7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.
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Unit Essential Question(s):

- How do engineers and scientists work to solve problems?
- What are the most important uses of robots?

Unit Enduring Understandings:

- There are important uses of robots
- Robots can complete tasks that humans cannot safely do
- Form follows function in robot design

Evidence of Learning

Formative Assessments: Teacher observations, identify aspects of sensors, Homework assignments, Group problem solving, worksheets, quiz, conference with students.

Summative/Benchmark Assessment(s): Completion of all research, challenge projects and analysis with correct results (rubric) within allotted time.

Alternative Assessments:

Resources/Materials: books, website sources, teacher

prepared presentation, newsela

Key Vocabulary:

Nanorobots
Domestic robots
Food Service
Toxic Cleanup
Heavy Machinery
Military robots

Suggested Pacing Guide**Lesson****Student Learning Objective(s) Suggested Tasks/Activities: Day(s) to Complete Name/Topic**

Priorities	Evaluate importance of various robot functions Robot Priorities Research Project	5 days
Journal Model	<u>Critically think about Robot uses</u> Understand robots follow the concept Create Visual	1 day 3-4 days
Current event	that “Form Follow Function” in <u>particular applications</u> reflect on current applications of robots teacher assigned articles, videos and news	3-4 days

Teacher Notes: can be completed throughout course as events occur

Additional Resources: NEWSELA, Edpuzzle

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students Students at Risk	508 Students
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<ul style="list-style-type: none"> ● Consult student IEP ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation 	<ul style="list-style-type: none"> ● Consult ELL student Plan ● Assign a buddy, same language or English speaking ● Allow errors in speaking <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions 	<ul style="list-style-type: none"> ● Consult G and T teacher ● Provide extension activities ● Build on students' intrinsic motivations ● Higher Level mathematical computations 	<ul style="list-style-type: none"> ● Consult with IR&S as needed ● Provide extended time to complete tasks ● Consult with Guidance 	<ul style="list-style-type: none"> ● Consult 504 Plan ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation
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Unit 6

Overview

Content Area: Robotics/Principles of Technology

Unit Title: Designing & Building Robots

Grade Level: 10-12

Core Ideas: Students will utilize knowledge of STEM to design, sketch and build a robot. Students will apply skills to have their robot complete assigned tasks as well as individual choice in their projects. Problem solving and collaboration will be emphasized in the lessons.

Standards (Content and Technology)

CPI#:

Statement:

Performance Expectations (NJSLS)

HS-ETS1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including costs, safety, reliability, and aesthetics, as well as possible social, cultural and environmental impacts.

HS-ETS1-4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Career Readiness, Life Literacies, and Key Skills

9.1.12.EG.3
9.1.12.FP.3

Explain how individuals and businesses influence government policies.
Relate the concept of delayed gratification (i.e., psychological distance) to meeting financial goals, investing and building wealth over time.

9.2.12.CAP.3	Investigate how continuing education contributes to one's career and personal growth.
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 Computer Science and Design Thinking	
8.1.12.IC.1 Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	
8.1.12.IC.2	Test and refine computational artifacts to reduce bias and equity deficits.
8.1.12.IC.3	Predict the potential impacts and implications of emerging technologies on larger social, economic, and political structures, using evidence from credible sources.
8.1.12.CS.2	Model interactions between application software, system software, and hardware
8.1.12.CS.3	Compare the functions of application software, system software, and hardware
Interdisciplinary Connection	
MP.2	Reason abstractly and quantitatively
MP.4	Model with mathematics
Companion Standards ELA/L	
NJSLSA.R1.	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
NJSLSA.R23	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
NJSLSA.R24	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RI.11-12.7	Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem
RI.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.
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7.1.AL.IPRET.1	Identify main ideas and significant details in a range of oral, viewed, and written texts.
7.1.AL.IPRET.9	Differentiate facts from opinions by accurately answering most questions that require inferring implied meanings.

Unit Essential Question(s):

- Using STEM concepts, can a robot be designed & built to complete specific tasks?
- What design aspects are most important when working with robots?

Unit Enduring Understandings:

- Problem solving by designing and building a robot to cover the task required.
- Collaborative work

Evidence of Learning

Formative Assessments: Teacher observations, Group problem solving, worksheets, conference with students
Summative/Benchmark Assessment(s): Completion of project (design, build & program) with rubric within allotted time.

Alternative Assessments:
 modified final assignments

Resources/Materials:

The Lego Mindstorms EV3

Discovery Book: a beginner's guide to building
 & programming robots

The Art of Lego Mindstorm EV3 Programming
 The Lego Mindstorms EV Idea Book
 STEM by Design, Teaching with LEGO Mindstorms EV3
 Classroom Activities for the Busy Teach: EV3
 The Lego Mindstorms EV3 Laboratory: build, program
 and experiment with five wicked cool robots!

Key Vocabulary:

Sensors Loops
 Ports Pseudocode
 Motors Gears

Programming

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s) Suggested Tasks/Activities:	Day(s) to Complete
Investigation	Investigate how to solve problems stated Pick a challenge and discuss how to <u>solve the problem</u>	1 day
on	Calculate movements needed Sketch a drawing of a robot design Write a description of the robots	2 days
Calculations	<u>function</u> Design and Program robot to complete task	4 days
Build time	Build the robot	
Observations	Observe how the designed program works Test the robot and make adjustments and make adjustments	1-2 days

Testing	Utilize STEM skills to build, test and Test the robot and make adjustments correct their models		1-2 days
Teacher Notes: extra time as needed			
Additional Resources: internet searches for ideas			
Differentiation/Modification Strategies			
Students with Disabilities	English Language Learners	Gifted and Talented Students Students at Risk	509Students
<ul style="list-style-type: none"> ● Consult student IEP ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation 	<ul style="list-style-type: none"> ● Consult ELL student Plan ● Assign a buddy, same language or English speaking ● Allow errors in speaking <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions 	<ul style="list-style-type: none"> ● Consult G and T teacher ● Provide extension activities ● Build on students' intrinsic motivations ● Higher Level mathematical computations 	<ul style="list-style-type: none"> ● Consult 504 Plan ● Allow errors <ul style="list-style-type: none"> ● Rephrase questions, directions, and explanations ● Allow extended time to answer questions, and permit drawing, as an explanation