

CTE Standards Unpacking Robotics

Course: Robotics

Course Description: This robotics course emphasizes the design, building, operation, application, and documentation of robotic systems. Students follow the engineering design process, apply basic programming skills, and explore how robots and automated systems are used in industry.

Students will have an understanding of the historical and current uses of robots and automated systems; programmable circuits, interfacing both inputs and outputs; proficient ethical standards for engineering and technology professions; and testing of robots.

Career Cluster: STEM

Prerequisites: None

Program of Study Application: This is a STEM Pathway Course for the Robotics Pathway, preceded by a Foundational Course(s) and a Cluster Course(s).

INDICATOR #RBT 1: Identify components of a robotic system.		
SUB-INDICATOR 1.1 (Webb Level: 1 Recall): Describe the parts necessary to make a robot.		
SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept): Examine the relationships among the subsystems.		
Knowledge (Factual) Learn the concepts of robotic technology and how robots work.	Understand (Conceptual): Understand how the software, hardware, and mechanical components of robots are design and integrated. Understand how these components work together.	Skills (Application): Write a research report indicating historical and current Robotic systems

Benchmarks

Students will be assessed on their *ability* to:

- Design a robotic plan.
- Create a robot to perform simple tasks.
- Create a report explaining the interaction between Microprocessor, Sensors, Intelligent Controls, and Motors.

Academic Connections

**ELA Literacy and/or Math Standard
(if applicable, Science and/or Social
Studies Standard):**

RBT 5.1 Explore career opportunities in the robotics field
 Examples: Robotic surgeries, Police and fire and rescue robotics. The uses of robotics in business and industry. Learn about ethical and social impact of using robots.

68ETS12. Evaluate competing design solutions using a systematic process to determine how well they

**Sample Performance Task
Aligned to the Academic
Standard(s):**

Research available resources to find how robots may be useful in helping disabled people.

INDICATOR #RBT 2: Understand safety procedures and ethical issues inherent to robotics.

SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Demonstrate proper safety procedures

SUB-INDICATOR 2.2 (Webb Level: 2 Skill/Concept): Determine how to apply OSHA Compliant Lockout – Tag-out procedures

SUB-INDICATOR 2.3 (Webb Level: 2 Skill/Concept): Examine current ethical issues.

<p>Knowledge (Factual): Learn the basic concepts and building blocks of a robot such as design, engineering, and software components..</p>	<p>Understand (Conceptual): Understand how a robot works. Identify human careers replaced by robotics. Research and report on a specific career of interest in the robotics field. Write a biography about a historic person in the field of robotics</p>	<p>Skills (Application): Build a simple robot using available components. When given a product, research the types of robotic fields, necessary for the product to have been created. Compare and contrast career opportunities related to different fields of robotics.</p>
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Benchmarks

Students will be assessed on their *ability* to:

- Describe how the robotics field may influence the job market.
- Identify the uses of robots.
- Demonstrate understanding of basic components of a robot.
- Design and/or program a robot to follow a set of commands.

<i>Academic Connections</i>	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>RBT 5.1 Explore career opportunities in the robotics field. Examples: Robotic surgeries, Police and fire and rescue robotics. The uses of robotics in business and industry. Learn about ethical and social impact of using robots.</p> <p>68ETS12. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Research available resources to find how robots may be useful in helping disabled people.</p>

INDICATOR #RBT 3: Construct, analyze and troubleshoot circuits.

SUB-INDICATOR 3.1 (Webb Level: 3 Strategic Thinking): Build circuit according to schematic diagram

<i>SUB-INDICATOR 3.2 (Webb Level: 3 Strategic Thinking):</i> Calculate circuit parameters		
<i>SUB-INDICATOR 3.3 (Webb Level: 3 Strategic Thinking):</i> Measure circuits parameters		
<i>SUB-INDICATOR 3.4 (Webb Level: 3 Strategic Thinking):</i> Compare calculated and measured solutions to analyze circuit operation		
<p>Knowledge (Factual): Choose proper electronic components to construct a circuit</p>	<p>Understand (Conceptual): Compare parameters to determine if they are within circuit parameters</p> <p>Understand the basic calculations and measurement parameters used in building a robot</p> <p>Understanding of the basic electrical and electronic circuitry.</p>	<p>Skills (Application): Assemble circuit in accordance with schematic diagram Employ correct formula or law to solve for unknown parameters</p> <p>Record calculated parameters using proper measurement parameters</p> <p>Select and use proper test equipment to measure required parameters</p> <p>Graph calculated and measured parameters</p> <p>Inspect circuit operation</p>
<p>Benchmarks Students will be assessed on their <i>ability</i> to:</p> <ul style="list-style-type: none"> • Document a Robotic project's Circuit Diagrams, Block Diagrams and Flowcharts as well as the Robotic project's design and implementation procedures. • Present the final project as a team. 		

<i>Academic Connections</i>	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>9-12-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.</p> <p>9-12-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 cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts.</p> <p><u>CCSS.MATH.CONTENT.HSN.Q.A.1</u></p> <p>Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Prepare and present a plan containing design schemas.</p>

<p>INDICATOR #RBT 4: Design, build and analyze a robotic system.</p>		
<p>SUB-INDICATOR 4.1 (Webb Level: 3 Strategic Thinking): Build and program a robot to perform a specified task.</p>		
<p>SUB-INDICATOR 4.2 (Webb Level: 3 Strategic Thinking): Test the robot for any flaws in hardware or bugs in software components.</p>		
<p>SUB-INDICATOR 4.3 (Webb Level: 3 Strategic Thinking): Write a technical report evaluating the system performance.</p>		
<p>Knowledge (Factual): Robotic components: hardware, software, and electrical components of a robot</p>	<p>Understand (Conceptual): Test individual subsystems and the system as an entire unit The development of the work envelope for the robotic movements</p>	<p>Skills (Application): Use mechanical tools, such as motors, gears, and gear trains in the construction of a robotic system and program Use VEX, NXT, or other kits to create robotic system Students also may join other schools to participate in the BEST Robotics They may also participate in the Engineering camps or contest, which host competitions will be held.</p>
<p>Benchmarks Students will be assessed on their <i>ability</i> to:</p> <ul style="list-style-type: none"> • Students will create various engineering models to assemble a robot. 		

<i>Academic Connections</i>	
<p>ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):</p> <p>6-8ETS14. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.</p> <p>CCSS.MATH.CONTENT.HSS.ID.A.3</p> <p>Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).</p>	<p>Sample Performance Task Aligned to the Academic Standard(s):</p> <p>Students will create various engineering models using LEGOS.</p> <p>Engineering camps which host competitions will be held.</p> <p>Student will develop a work envelope for robotic systems.</p>

INDICATOR #RBT 5: Research career opportunities and industry applications		
SUB-INDICATOR 5.1 (Webb Level: 1 Recall): Explore career opportunities in the robotics field		
SUB-INDICATOR 5.2 (Webb Level: 3 Strategic Thinking): Investigate commercial application of robotic systems		
Knowledge (Factual): Learn how to create a complete report to include background research, explanation of components, the physical and electrical, as well as the software used Identify human careers replaced by robotics.	Understand (Conceptual): Understand the importance of documentations and instructional manuals	Skills (Application): Build your robot, debug any errors, and test it to make sure meets the operational standards. Present your project to your classmates, community, BEST Robotics, etc
Benchmarks Students will be assessed on their <i>ability</i> to: <ul style="list-style-type: none"> Build and show your completed operational robot 		
Academic Connections		
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	Sample Performance Task Aligned to the Academic Standard(s):	

<p>11-12.W.2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.</p>	<p>When assembling a robot, students will create a manual that contains the information related to the robotic components, the way it was assembled, and it's operations.</p>
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Additional Resources

Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.

BEST Robotics: <http://www.bestinc.org/> Vex

Robotics <http://vexrobotics.com>

FIRST Tech Challenge: <http://www.usfirst.org/roboticsprograms/ftc> STEM

Robotics 101: <http://stemrobotics.cs.pdx.edu/node/190?root=291>

Career Research: www.sdmylife.com and <http://www.onetonline.org>