Seymour Public Schools Curriculum

Grade Seven Science, Technology, Engineering & Math (STEM) Curriculum

The purpose of this class is to use hands-on experiences and real-world applications to expand upon the learning students experienced during the sixth grade year of STEM.

Unit 1 – Ideas & Innovations

Students will explore the relationships among science, technology, and engineering. They will be exposed to problem-solving strategies and will use critical-thinking skills to find solutions. They will also explore the Universal Systems Model and how it relates to technology and innovation. Introductory activities will center on using the TETRIX Building System to solve simple design problems. The activities will culminate with the students designing a vehicle to compete against other classmates in a design challenge focusing on endurance, speed, or torque.

Unit 2 – Robots

Students will learn about the role that robots play in our lives. Students will learn how to operate, program, and use robots in different environments. Initially, each student will learn to manipulate the robot and program it to conduct repeatable tasks. Students will learn about each of the sensors and how to program them to control a self-directed robot. Ultimately, they will program a robot to operate by using the sensors as inputs to solve a challenge.

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UNIT 1- Ideas & Innovations

Subject: **Grade:** **Time Frame:**	**STEM** **7** **August-November (9 Weeks)**
CCSS **Overarching Standards**	**Literacy Standards:** CCSS.ELA-LITERACY.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. CCSS.ELA-LITERACY.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently. **Math Standards:** CCSS.MATH.CONTENT.7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.
Enduring Understanding	Science, technology, and engineering are inter-related and cause each other to make new advancements. The Universal Systems Model applies to all types of systems. Invention involves the creation of something new, while innovation involves improving something that already exists.
Essential Questions	How are science, technology, and engineering related? Why is the Universal Systems Model important for engineering and technology? What is the difference between an invention and innovation?
Priority Standards	**Connecticut Technology Education Standards** EKS.05 Employ critical thinking skills independently and in teams to solve problems and make decisions (e.g., analyze, synthesize and evaluate). ➢ EKS.05.02 Analyze elements of a problem to develop creative solutions. ➢ EKS.05.04 Create ideas, proposals, and solutions to problems. ➢ EKS.05.05 Evaluate ideas, proposals, and solutions to problems. ➢ EKS.05.07 Generate new and creative ideas to solve problems by brainstorming possible solutions. NT.01 Recognize the nature, characteristics, and scope of technology. ➢ NT.01.02 Explain that technology is closely aligned to creativity, which has resulted in innovation. NT.02 Demonstrate and understanding of the core concept of technology. ➢ NT.02.01 Explain a technical system by identifying its parts (inputs, processes, output and feedback). NT.03 Define and explain the relationships among technologies and the connections between technology and other fields of study. ➢ NT.03.01 Illustrate how technology systems often interact with each other. DD.02 Explore the engineering design.

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	Common Core State Standards CCSS.MATH.CONTENT.7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies.
Performance Expectations **(Student outcomes)**	➢ Distinguish the difference between an invention and innovation. ➢ Use the *Ideas & Innovations* problem-solving model. ➢ Investigate techniques for ideation. ➢ Explore the relationships among science, technology, and engineering. ➢ Experiment with engineering trade-offs. ➢ Investigate the concepts of systems, subsystems, and systems thinking. ➢ Explore the Universal Systems Model of technology. ➢ Compete in a vehicle design challenge. **Common Core State Standards** CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). **Connecticut Technology Education Standards** NT.01.08 Recognize and explain that technology involves inventing new things and modifying the old ones to make them more efficient. NT.02.03 Show evidence of how parts relate to each other through systems thinking. NT.02.06 Explain that a trade-off is a decision process recognizing the need for careful compromises among competing factors.

Strategies/Modes	**Materials/Resources**	**Assessments**
➢ Modeling ➢ Guided practice ➢ Class/Small-group Discussions ➢ Student-determined pacing ➢ Hands-on learning	➢ Synergy ITC presentations ➢ Online dictionary ➢ Teacher-created supplemental materials ➢ Graphic Organizers ➢ Calculators ➢ TETRIX Building System	<u>Summative Assessment</u> ➢ End of unit questions from Synergy ITC, and performance task in which students complete an endurance, speed, or torque challenge with their vehicles. A rubric will be provided. <u>Formative Assessments</u> ➢ Pre-test ➢ Research, Challenge & Application (RCA): quizzes throughout the unit ➢ Performance assessments ➢ Problem-solving questions

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UNIT 2- Robots

Subject: **Grade:** **Time Frame:**	**STEM** **7** **November-January (9 Weeks)**
CCSS **Overarching Standards**	**Literacy Standards:** CCSS.ELA-LITERACY.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. CCSS.ELA-LITERACY.RST.6-8.10 By the end of grade 8, read and comprehend science/technical texts in the grades 6-8 text complexity band independently and proficiently. **Math Standards:** CCSS.MATH.CONTENT.6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form x + p = q and px = q for cases in which p, q and x are all nonnegative rational numbers. CCSS.MATH.CONTENT.7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers.
Enduring Understanding	Robots function by receiving input from a computer, similar to how humans function by receiving input from the brain. Robots serve many purposes, including performing hazardous or repetitive tasks. Robots can be controlled by remote control or by if-then-else programming.
Essential Questions	How is the process of completing a task similar between robots and humans? Why are robots useful for performing hazardous and/or repetitive tasks? How does an if-then-else program work? Why would an if-then-else program be used instead of a remote control?
Priority Standards	**Common Core State Standards** CCSS.ELA-LITERACY.RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. CCSS.MATH.CONTENT.7.RP.A.1 Compute unit rates associated with ratios of fractions, including ratios of lengths, areas and other quantities measured in like or different units. For example, if a person walks 1/2 mile in each 1/4 hour, compute the unit rate as the complex fraction 1/2/1/4 miles per hour, equivalently 2 miles per hour. CCSS.MATH.CONTENT.7.G.B.4 Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle. CCSS.MATH.CONTENT.8.G.B.7

	Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **Connecticut Technology Education Standards** NT.01.01 Explain that all new products and systems can be developed to solve problems or to help do things that could not be done without the help of technology. NT.02.01 Explain a technological system by identifying its parts (inputs, processes, output and feedback). NT.02.02 Differentiate between the systems found in nature vs. human made technological systems. NT.02.05 Explain the benefits and consequences of technical innovation. NT.02.08 Define the processes used to complete a system. IT.01.01 Design and use instruments to gather data. IT.02.01 Assess the impact of technology as it affects humans.
Performance Expectations **(Student outcomes)**	➢ Explore the history of robotics by using a software program. ➢ Experience the fundamentals of industrial robots by viewing a video segment. ➢ Use a computer to program and operate a robotic arm. ➢ Recognize the importance of robotics in the development of manufacturing. ➢ Use software to manipulate a robotic arm to perform selected activities. ➢ Identify the advantages and disadvantages of robots. ➢ Learn how a touch sensor, an ultrasonic sensor, a sound sensor, and a light sensor function. ➢ Create a program to complete a task using multiple sensors and the NXT Brick. **Common Core State Standards** CCSS.ELA-LITERACY.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). CCSS.MATH.CONTENT.6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation d = 65t to represent the relationship between distance and time. CCSS.MATH.CONTENT.8.G.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system **Connecticut Technology Education Standards** EKS.04.02 Apply scientific methods in qualitative and quantitative analysis, data gathering, direct and indirect observation, predictions, and problem identification. NT.01.013 Explain that technology creates new economic opportunities and social benefits and, at the same time, produces new social problems. NT.02.04 Differentiate between an open and closed system.

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	IT.02.06 Cite instances where technology has caused cultural, social, economic, and political changes.

Strategies/Modes	Materials/Resources	Assessments
➢ Modeling ➢ Guided practice ➢ Class/Small-group Discussions ➢ Student-determined pacing ➢ Hands-on learning	➢ Synergy ITC presentations ➢ Online dictionary ➢ Teacher-created supplemental materials ➢ Graphic Organizers ➢ Calculators ➢ SAM robotic arm and software ➢ LEGO NTX software and corresponding equipment	<u>Summative Assessment</u> ➢ End of unit questions from Synergy ITC and performance assessment in which students create a program that controls their robot by using multiple sensors at once. <u>Formative Assessments</u> ➢ Pre-test ➢ Research, Challenge & Application (RCA): quizzes throughout the unit ➢ Performance assessments ➢ Exit slips