STEM CTL
STEM Center for Teaching and Learning

PreK–12th Grade STEM Curriculum by Design Course Descriptions

Elementary School

6- to 8-Week Units

Preschool - Our Living World: Engages preschool students will be introduced to the life cycles of plants, butterflies, and frogs. They will use a multisensory approach as they plant and observe seed growth, experience hands-on lessons, enjoy literature, and share with teachers and students the circle of life.

Kindergarten - A Home for All Seasons: Engages kindergarten students in hands-on inquiry and design as they explore animal homes. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they design and build a birdhouse.

1st Grade - Can You Hear Me?: Engages Grade 1 grade students in hands-on inquiry and design as they explore one of the greatest challenges of the 21st century: how we are able to hear and process sounds. Following guided inquiry activities, a design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they design and create something that makes a sound and also helps them detect sounds.

2nd Grade - From Nature to Me: Engages Grade 2 students in hands-on inquiry and design as they explore biomimicry and learn how to obtain from nature the tools needed for scientific discovery. Following guided inquiry activities, a design challenge lets students to create a device that will travel on land or air to disperse seeds.

3rd Grade - Natural Hazards: Engages Grade 3 students in hands-on inquiry and design as they explore natural hazards that occur on the Earth. The final design challenge provides an opportunity for students to apply knowledge and skills in a meaningful way as they develop a design for a snowshoe to help people travel during a blizzard.

4th Grade - The Power of Solar: Develops students' understanding of energy systems and related technologies, temperature, electricity, and sustainable sources of energy. By utilizing an experiential approach, students collaboratively investigate solar energy as a global issue and learn that stewardship and innovation can make a difference in solving the world's problems.

5th Grade - Our Water, Our World: Engages learners in hands-on inquiry and design as they explore one of the greatest challenges of the 21st

century: universal access to clean water. Utilizing an experiential approach, students collaboratively investigate global water issues and learn how stewardship and innovation can help to solve the world's problems.

6th Grade - Our World and Me: Serves as a capstone experience for sixth-grade learners using hands-on inquiry and design as they explore robotics through the engineering field of mechatronics.

Kindergarten to 5th Grade - Computing byDesign: These 2-day supplemental lessons are designed to introduce students to computing and coding at early levels to develop early understanding with hands on learning, problem solving skills, methodologies, and design challenges. Each grade level lesson ties into the Elementary School byDesign units, and these lessons are meant to accentuate lessons with new ideas and perspectives.

Middle School

18-week courses

6th Grade - Exploring Technology: Prepares Grade 6 students by equipping them with an understanding of technology and engineering using hands-on activities that promote both Technological and Engineering Literacy. Students will have opportunities to apply the engineering design process in real-world problem-solving lessons.

7th Grade - Invention & Innovation: Grade 7 students study the history of inventions and innovations, including their impacts on society. They learn about the core concepts of technology and about the various approaches to solving problems, including engineering design and experimentation. Students apply their creativity in the invention and innovation of new products, processes, or systems.

8th Grade - Technological Systems: Teaches Grade 8 students how systems work together to solve problems and capture opportunities. A system can be as small as two components working together or can contain millions of interacting devices. We often break down the macro systems into less complicated microsystems to understand the entire system better.

Engineering for All (EfA) Extension Units

Ideal for 7th to 9th grade students

4- to 7-week courses

Vertical Farms: Fresh Food for Cities: In order to address the Grand Challenge of producing food for a growing world population, students become “experts” in designing and constructing hydroponic systems. Once their hydroponic systems are up and running and plants are growing, the students receive a message that their firm has been asked to design a hydroponic system for the wall of an existing apartment building.

Water: The World in Crisis: To address the grand challenge of improving water availability and safety, students will explore issues of water scarcity, including the effects of unsafe water, water contaminants, and water filtration methods. The unit begins as students are told they have been accepted to be part of a team of engineering students working with the local chapter of Engineers across Borders. Students learn about the world water crisis and water scarcity and become “experts” in “traditional” design and construction of water filtration systems.

High School

36-week course unless otherwise noted

9th to 12th Grade

9th Grade Foundations of Technology and Engineering: Prepares 9th grade students to understand and apply technological concepts and processes that are the cornerstone for the high school technology and engineering program. Group and individual activities engage students in creating ideas, developing innovations, and engineering practical solutions. Technology and Engineering content, resources, and laboratory/classroom activities apply student applications of science, mathematics, and other school subjects in authentic situations.

9th to 12th Grade Onshape Certification byDesign: This course is broken down into three units that all have five learning cycles, a preliminary challenge, and primary challenge. Students will complete modeling, assembly, and engineering drawing challenges and will have the opportunity to work collaboratively while designing their own parts and assemblies. These challenges provide students with practice and in some challenges, emulate the Onshape Associate Certification Exam. **(18-week course)**

9th to 12th Grade AP Computer Science Principles byDesign: This course is organized using the College Board AP Computer Science Big Ideas and Computational Thinking Practices. In this course, high school students program using the Snap programming language, learn some of the most powerful ideas of computer science, demonstrate creativity, and discuss the social implications of computing, thinking deeply about how they can be personally active in promoting and reducing the possible harms.

10th to 12th Grade

10th to 12th Grade Technological Design: Students in engineering teams apply STEM concepts and skills to solve engineering design problems and innovate designs. Students research, develop, test, and analyze engineering designs using criteria such as design effectiveness, public safety, human factors, and ethics.

11th to 12th Grade

11th to 12th Grade Advanced Design Applications: Student will focus on the three dimensions of technological literacy “knowledge, ways of thinking and acting, and capabilities” with the goal of students developing the characteristics of technologically literate citizens. This course employs teaching/learning strategies that enable students to explore and deepen their understanding of "big ideas" regarding technology and makes use of a variety of assessment instruments to reveal the extent of understanding.

11th to 12th Grade Advanced Technological Applications: Students will study five components of the Designed world: Engineering Design Graphics and Spatial Skills, Cybersecurity, Biotechnology, Information Technology, and Robotics.

12th Grade Engineering Design (Capstone): This course focuses on how engineers apply their creativity, resourcefulness, mathematical, scientific, and technical knowledge and skills in the creation or refinement of technological products/systems. A key approach will be the employment of a sophisticated, sequential, and iterative design and development process to solve authentic engineering tasks/problems.