ENGINEERING byDesign™
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PreK–12th Grade Engineering byDesign Course Descriptions

Elementary School

6- to 8-Week Units

Preschool - Our Living World: In this interactive unit, preschool students will explore the life cycles of plants, butterflies, and frogs. Through a multisensory approach, they will plant seeds and observe their growth, participate in hands-on activities, enjoy stories related to nature, and share their discoveries with classmates and teachers.

Kindergarten - A Home for All Seasons: Engages 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 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 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 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.

Middle School

18-week courses

6th Grade - Exploring Technology: Prepares 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: 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 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

Hydroponics: Food for All: Students will explore the principles of hydroponics, plant biology, sustainable design, and microelectronics through hands-on activities and projects. They will learn about different hydroponic systems, the needs of plants, and how to create efficient designs using upcycled materials. Students will build and refine hydroponic structures, program microcontrollers to automate their systems, and collect and analyze data to optimize plant growth. The curriculum culminates in a grand challenge where students apply their knowledge to design and build an optimized hydroponic system for a new plant, using sensors and data-driven decision-making to ensure success.

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

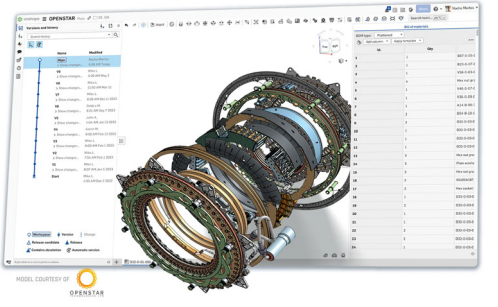
36-week course unless otherwise noted

9th to 12th Grade

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.

Pre-Engineering & Robotics Certfication byDesign: This comprehensive course prepares students to earn the REC Foundation's Pre-Engineering and Robotics industry certifications. Students will gain a deep understanding of engineering principles and robotics applications through hands-on activities, fostering critical thinking, teamwork, and problem-solving skills. The curriculum is designed to ignite a passion for innovation while building a solid foundation for future success in STEM fields. **(18-week course)**

Onshape Certification byDesign: This course is broken down into three units that all have five lessons, 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)**



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

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

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.

Advanced Technological Applications: Students study five components of the Designed World: Engineering Design Graphics and Spatial Skills, Cybersecurity, Biotechnology, Information Technology, and Robotics. The Engineering Design Graphics and Spatial Skills unit introduces students to the language of technical graphics, the engineering design process, and the importance of sketching to convey design ideas quickly. The Cybersecurity unit is intended to help students become well informed about protecting their personal information online and maintaining a safe Internet presence. The Biotechnology unit explores the ways in which plants, animals, and microorganisms impact various industries. In the Information Technology unit, students learn to utilize data analysis and visualization/3D modeling tools to solve problems and communicate their ideas to diverse audiences. The Robotics unit engages students in context-rich applications such as home automation, agricultural crop harvest, prosthetics, and self-driving cars.

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.