



Science Department Curriculum Guide

Engineering 1 through 4 – CP & H

Course Descriptions	
484 Engineering 1: Technical Drawing And Design – CP This course involves an introductory experience in technical drawing as a tool of technical communication. Primary emphases are on development of basic drafting skills, visualization, and solving graphical problems. Students will explore architectural concepts as well as mechanical drawings. This course will also introduce students to the engineering design process, and explore multiple topics in the world of engineering, including electronics, manufacturing, and physical computing. This course is open to all students.	2.5 credits
485 Engineering 2: Design And Fabrication – CP Through problems that engage and challenge, students explore a broad range of engineering topics, including mechanisms, the strength of structures and materials, and automation. Students develop skills in problem-solving, research, and design while learning strategies for design process documentation, collaboration, and presentation. Students will also develop fabrication skills including woodworking, electronics, welding, CNC machining, and additive manufacturing. This course is open to all students.	2.5 credits
486: Engineering 3: 3d Modeling And Prototyping – CP Through the use of Autodesk Inventor students will get an in-depth study of three-dimensional modeling and component creation. Students will be expected to solve problems through the modeling and production of proof-of-concept prototypes. Additional topics include CNC programming, 3D printing, and advanced fabrication. This course is open to students in grades 11 and 12.	5.0 credits
489 Engineering 4: Engineering Capstone – H This course is designed for students to create independent projects to further develop skills and experience in particular areas of interest. All project proposals must be approved by the instructor. Student proposals may be from any field of- 25 -previous study in engineering and reflect an appropriate complexity and level of difficulty. This capstone course is open to students in grades 11 and 12 who have completed at least 2 courses in engineering.	5.0 credits

Engineering Standards Overview
The high school technology/engineering standards place particular emphasis on science and engineering practices of developing and using models; analyzing and interpreting data; using mathematics; designing solutions; and obtaining, evaluating, and communicating information. Relevant examples give students a valuable context to learn about and model a technological system, use a model to explain differences in systems or illustrate how a system works. This leads to a more detailed understanding of the role that engineering design, materials, tools, and manufacturing have in the natural and designed world. The standards expect students to research and analyze specific design solutions that give them an opportunity to determine optimal conditions for performance of materials, influences of cost, constraints, criteria, and possible environmental impacts. Use of mathematics is a key skill in designing prototypes to scale, using prototypes or simulations that model multiple interactions in a complex problem and calculating change to a system that includes a number of variables. Students communicate and evaluate solutions to real-world problems, propose or refine solutions, and examine the social and cultural impacts a product, material, manufacturing process, or technology could have in our world. The application of these practices across the core ideas gives students a rich grounding in technology/engineering.



Engineering Four Core Standards

The high school technology/engineering standards are built from middle school and allow grade 9 or 10 students to explain major technological systems used in society and to engage in more sophisticated design problems. The standards expect students to apply a variety of science and engineering practices to four core ideas of technology/engineering:

- Engineering design standards support students' understanding of how engineering design is applied to complex societal challenges as well as developing their skills in defining design problems and developing solutions.
- A focus on materials, tools, and manufacturing supports students in understanding how manufacturing makes use of and can change material properties to create useful products. They consider different manufacturing processes, including where computer-aided systems can be useful, and how those processes can affect material properties.
- Standards about technological systems help students to learn how complex design systems work, particularly those they use every day. Such systems include communications systems, structural systems, and transportation systems. Through the study of these critical infrastructure systems, students understand how the components they interact with every day depend on the design and functioning of the larger system. They also can abstract the concept of a system, identifying inputs and outputs of subsystems and their interrelationships.
- Energy and power technologies standards support students in understanding how humans manipulate and use energy to accomplish physical tasks that would otherwise be impossible or difficult. These technologies include open and closed pneumatic and hydraulic systems.

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Subjects: Engineering 1: Technical Drawing and Design, Engineering 2: Design and Fabrication

Units	Essential Questions / Topics	Activities May Include
Engineering Design	- What is the best practice for representing 3 dimensional objects in 2d views? - Fundamentals of mechanical drawing - Orthographic projection - Multi- view drawings - Isometric view - Principles of dimensioning - Training in multiple software platforms	- Multiple duplication of drawings that present particular challenges in graphic representation. This may include hand sketching or CAD software as available. - Creation of original drawings that present solutions to various engineering problems as presented.
Technological Systems	- What are the fundamental theories and principals to convey electricity? - AC/DC - Basic circuit construction. - Soldering - Wiring - Resistance and continuity - The pneumatic module uses a system of components that store, control and regulate air pressure.	- Use a model to explain how information transmitted via digital and analog signals travels through the following media: electrical wire, optical fiber, air, and space. Analyze a communication problem and determine the best mode of delivery for the communication - Model a technological system in which the output of one subsystem becomes the input to other subsystems.
Fabrication	An introduction to practices and techniques used with common hand and power tools used in industry. These may include topics in woodworking machining, metals, and electronics. Emphasis is placed on safety and skill building.	The use of all tools and shop equipments varies as needed.