Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 6 PLTW - Design & Modeling	**Department:** Engineering & Technology
Grade Level: 6	**Duration:** 6 weeks

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Introduction to Technology:** This unit introduces students to the components of STEAM (Science Technology Engineering Art Math). They will learn that the STEAM curriculum is the intersection of several branches of knowledge and deepen their understanding of how humans use STEAM to develop new products and services. By the end of the unit students should be capable of making good ethical decisions concerning the positive and negative unintended consequences of using technology.	**4 days**
2. **Design Process:** This unit focuses on the design process. The steps involved in the process as well as the design elements will be fully explored by the students. They will learn that there is no perfect design, and for a design solution to be successful it must satisfy the criteria and constraints found in the design brief. Through the study of measurement students will apply the language of numbers to justify their ideas.	**4 days**
3. **Sketching and Views:** This unit will explore the art of visual communication. Isometric, perspective, and thumbnail freehand sketching will be practiced with an emphasis on accurate depiction of different design solutions. Students will learn about multi-view drawings and the part they play in the representation of design solutions.	**4 days**
4. **3D Computer Modeling:** In this unit the students' knowledge gained from the previous units will make the transition to the computer application using a 3D modeling software much easier. Exposure and use of both the metric and American measurement system will expand their understanding of measurement. Their knowledge of geometry will be increased as well as the new applications they will learn as they begin to build their designs using geometric shapes. Coordinate geometry is also studied and applied with an emphasis on the X-, Y-, and Z-axes. File creation and management will be stressed as they create, save, edit, and assemble their parts.	**12 days**
5. **Prototype Fabrication:** In this unit students will apply what they learned in unit 4's 3D Computer Modeling. They will be able to design, assemble, and create fabrication drawings of several design projects assigned. Students will be also be expected to utilize fabrications tools such as 3d printing services including traditional power and hand tools in the manufacture of a capstone project.	**12 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 7 PLTW - Energy & the Environment	**Department:** Engineering & Technology
Grade Level: 7	**Duration:** All year

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Investigating Energy:** Students investigate and learn to define the laws of thermodynamics. Students learn the six types of energy. To deepen students' understanding students will use algebraic equations to calculate work and power distribution.	**15 days**
2. **Sustainable Energy:** As energy demands become more profuse students will have to reflect on their own attitudes and examine alternative energy sources that are not based on crude oil. Students will also examine the pros and cons of using various alternative energy sources and their effect on the environment. Thorough examination of current political and economic issues as it relates to energy production, use and consumption will also be studied.	**16 days**
3. **Making an Impact:** Environmental engineering focuses on developing a sustainable future, preventing pollution, and assessing the environmental impact of integrated waste management systems. The seven steps of integrated waste management include reduce, reuse, recycle, compost, incineration that creates usable energy, landfills, and incineration with no usable energy created. Engineers must consider a product's life cycle when designing because every product has an impact on the environment. Every individual impacts the environment through the choices they make in energy consumption and garbage disposal. Using energy efficiently will minimize unnecessary heat transfer and draw less electricity from the fossil fuel burning power plants, thereby contributing less to climate change.	**14 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 7 PLTW - Magic of Electrons	**Department:** Engineering & Technology
Grade Level: 7	**Duration:** All year

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Science of Electricity:** Students will learn that electricity (energy) comes in different forms. Collected, compared, and classified technical data provide useful information. Different materials have different properties that affect how electricity is produced and used.	**7 days**
2. **Electromotive Force:** Students will learn that electricity has the capacity to do work. Various products and systems use electricity to do work. Collected, compared, and classified technical data provide useful information. Troubleshooting is a problem-solving technique used to find out why something does not work and aid in correcting it. The selection and safe use of tools aid in the completion of a specific task. Motors generate electromotive force through the use of electricity in order to do work. Components of motors are arranged in various configurations.	**5 days**
3. **Circuit Design and Fabrication:** Students will study that different electrical system components perform different functions. Models (bread boarding) are used to test designs and processes. The use of symbols and schematics promotes clear communication. The selection and safe use of tools aids in designing circuitry. Collected, compared, and classified technical data provide useful information. A series circuit provides one path for electrical current to follow and a parallel circuit provides multiple paths.	**22 days**
4. **Digital Electronics:** Students will learn that digital electronics provides a means to transfer messages between people and machines. Communication systems include a source, encoder, transmitter, receiver, decoder, and destination. Electronic systems can be broken down into open or closed loop systems. Controls provide a means to change electronic systems.	**10 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 7 PLTW - Science of Technology	**Department:** Engineering & Technology
Grade Level: 7	**Duration:** 1 Semester

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Applied Chemistry:** Students will learn the ins and outs of being a chemical engineer. Students will understand that chemical engineering is involved with design, construction and operation of machines that perform chemical reactions, separations, or mixes, and fluid flow to solve problems and make useful products. Students will study how chemical engineers solve real life problems and work in industries such as manufacturing, pharmaceuticals, healthware, environmental, materials, and alternative energy.	**6 days**
2. **Nanotechnology:** Students will study that nanotechnology is building innovative tools to study and manipulate objects at the nanometer scale, one billionth of a meter. Students will study the properties of materials such as strength, color, and resistance can be changed by nanotechnology. Students will grasp the concept that nanotechnology has an impact on many areas such as computing, electronics, manufacturing, energy, environment, health, medicine, and national security.	**10 days**
3. **Applied Physics:** Students will study the six simple machines and how they make work easier. Students will explore energy and how to change its state from potential to kinetic energy. Students will learn how to calculate work and the importance of prototyping to the design process.	**29 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 8 PLTW - Automation & Robotics	**Department:** Engineering & Technology
Grade Level: 8	**Duration:** 1 Semester

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Robots in Today's World**: Students will study that automation is the process of operating machines with minimal human control. Robotics is the specialized field of engineering and computer science that deals with the design and application of robots. The use of automation and robotics affects humans in various ways, both positively and negatively, including their safety, comfort, choices, and attitudes about a technology's development and use. Automation and robotics have had an influence on society in the past and present, and will influence society in the future.	**4 days**
2. **Mechanical Gears and Energy Transfer**: Students will study that energy is the capacity to do work. A mechanism can be used to change energy by transferring its direction, speed, type of movement, and force or torque. There are many types of mechanisms that can be used individually, in pairs, or in systems.	**12 days**
3. **Vex Robotics Parts and Programming in Robot C:** Students will learn that automated systems require minimal human intervention. An open-loop system has no feedback path and requires human intervention, while a closed-loop system uses feedback. Troubleshooting is a problem-solving method used to identify the cause of a malfunction in a technological system. Invention is a process of turning ideas and imagination into devices and systems. Some technological problems are best solved through experimentation.	**29 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 8 PLTW - Green Architecture	**Department:** Engineering & Technology
Grade Level: 8	**Duration:** 1 Semester

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **Introduction to Sustainable Architecture:** As consumers we are often confronted with lifestyle decisions that could have an impact on our environment. Over the last five years, a lot of emphasis has been placed on going green. In addition to encouraging individuals to change their habits so that the results will be more environmentally friendly, there has also been a push to design buildings to be more green. Sustainable architecture is a general term that describes environmentally conscious design techniques in the field of architecture. Sustainable architecture is framed by the larger discussion of sustainability and the pressing economic and political issues of our world. Sustainable architecture seeks to minimize the negative environmental impact of buildings by enhancing efficiency and moderation in the use of materials, energy, and development space. The goal of sustainability, or ecological design, is to ensure that our actions and decisions today do not inhibit the opportunities of future generations.	**10 days**
2. **Architectural Basics:** Architecture is the art and science of designing buildings. The basics of architectural design usually address feasibility and cost, as well as function and aesthetics. In this lesson students will learn how to use an architectural scale to accurately measure drawings and read architectural plans. They will learn about planning residential spaces, the different systems in a home, how to read the symbols found in architectural plans, and how to choose materials to remain within a given budget.	**15 days**
3. **Architectural Challenge:** Autodesk® Revit® Architecture building design software works the way that architects and designers think, which allows the user to develop high-quality, accurate architectural designs. It allows the user to design with both parametric 3D modeling and 2D drafting elements. Built for Building Information Modeling (BIM), Autodesk Revit helps capture and analyze concepts and maintain vision through design, documentation, and construction. BIM is a CAD paradigm that employs intelligent 3D objects to represent real physical building components such as windows, doors, furniture, and appliances. Therefore, students can make more informed decisions with information-rich models to support sustainable design, construction planning, and fabrication. In this lesson students will learn how to use the Autodesk Revit software to re-create their classroom and then design a sustainable home using shipping containers.	**20 days**

Mequon-Thiensville School District
Course Scope & Sequence

Course Name: Grade 8 PLTW - Flight and Space	**Department:** Engineering & Technology
Grade Level: 8	**Duration:** 1 Semester

Course Overview: Students are exposed to a variety of projects in the field of technology and engineering. Students will work independently and in teams to utilize computer aided drafting, geometry, problem solving, and project management skills to complete projects that are reflective of real world problems and issues. Students meet daily for 6 weeks in the PLTW course Design & Modeling in 6th grade. Seventh graders meet every other day and have opportunities to solve authentic engineering problems such as engineering a piece of playground equipment, designing and creating a pen using machine and hand tools, and prototyping and constructing working digital electrical circuits. Eighth grade students will participate in the Fluid Power Challenge, Automation & Robotics, Green Architecture and Flight & Space.

Primary Resource:

Topics/Units:	Time Frame:
1. **History of Flight and Space:** The study of aerospace engineering would not be complete without a basic understanding of the history of aerospace. Many students think that the space shuttle can go to the moon. Some even think people have been to Mars. These misconceptions are often the result of watching science fiction movies or television programs that look real to students. In this lesson students will be introduced to the history of flight through hands-on activities, research, and a presentation in the form of an infomercial. By having the entire class experience the flight characteristics of various vehicles, explore the differences between aircraft and rockets, research their respective histories, and view each other's infomercial productions, each student will gain a greater understanding of the evolution of flight.	**15 days**
2. **Aeronautics:** Aeronautics is the science and art of flying through the air. It refers to all aspects of flight in the atmosphere, from design and manufacturing to operation and maintenance of aircraft and spacecraft. To design an air or spacecraft, engineers must understand the elements of aerodynamics, propulsion, materials and structures, and stability and control. In this unit your students will be exposed to all of these elements as they discover the science of flying, design and test propulsion systems, use simulations to create airfoils to test in a wind tunnel, and then use their knowledge to design, build, and test an airfoil.	**19 days**
3. **Traveling and Living in Space:** The layer of gases about 100 miles above the Earth is known as the atmosphere. Space is the region above the Earth's atmosphere or beyond the solar system. For hundreds of years, humans watched the sky and dreamed of someday visiting other planets and moons in space. In 1969 this dream was realized when astronaut Neil Armstrong took his "giant leap for mankind" and walked on the moon. The National Aeronautics and Space Administration (NASA) space program has increased our knowledge of space flight and the solar system and has led to many technologies that we use on Earth. From the earliest rockets launched by the first rocket scientists to the latest space shuttle mission, space technology is an important part of our lives. Astronauts live in space for extended periods of time so they can conduct important research and experiments. Before leaving for their spaceflight, however,	**11 days**

	they need to consider issues like air, food, power, water, waste disposal, exercise, and personal cleanliness. How would you solve these problems? Space travel and living in space is made possible by engineers, from mechanical engineers who design the components for spacecraft to biomedical engineers who design ways to care for astronauts' health while traveling in space. From designing spacecraft to getting us to the moon safely to building tools to help humans someday live on the Moon, engineers play a vital role in space travel, space discovery, and living in space. In this lesson students will complete activities while learning about the history and principles of space travel. They will study the development of rocketry and the space program.	