



Northern York County School District

Curriculum Overview

Course: Introduction to Engineering

Grade Level: 9-12

Approval Date: March 2023

Length of Time: 90 days / 0.5 credits

Course Description:

This semester-long course, which is a prerequisite for Computer-Aided Drafting & Design, Engineering Design, and Architectural Design, introduces students to the foundational components of our S.T.E.M. program. Students begin by learning how to create simple 2-D drawings and 3-D models using AutoCAD and Autodesk Inventor. Next, they learn the steps of the engineering design process and work through those steps as they design a solution to a basic real-world engineering problem. While doing so, students are introduced to a variety of basic engineering principles, including measuring, accuracy, precision, measurement devices, density, and simple machines. Finally, students are introduced to the fundamentals of architectural design, as they apply what they've learned about the design process to design and model a simple residential structure using Autodesk Revit.

Course Objectives:

- Students will use AutoCAD to create simple 2-D technical drawings.
- Students will use Autodesk Inventor to create 2-D sketch geometry, as well as basic 3-D features and parts.
- Students will understand, measure, and apply a variety of engineering principles, including measuring, accuracy, precision, measurement devices, density, and simple machines.
- Students will understand and implement the steps of the Engineering Design Process while engaging in various engineering labs and challenges.
- Students will use Autodesk Revit to create a 3-D model of a simple residential structure.

Related Standards:

Pennsylvania Technology and Engineering Standards (Grades 6-12)

Nature and Characteristics of Technology & Engineering:

- Demonstrate the use of conceptual, graphical, virtual, mathematical, and physical modeling to identify conflicting considerations before the entire system is developed and to aid in design decision making.

Design Thinking in Technology and Engineering Education:

- Apply a broad range of design skills to a design thinking process.
- Evaluate and define the purpose of a design.
- Conduct research to inform intentional inventions and innovations that address specific needs and wants.

<ul style="list-style-type: none"> • Apply principles of human-centered design. • Analyze and use relevant and appropriate design thinking processes to solve technological and engineering problems. • Safely apply an appropriate range of making skills to a design thinking process. 	
Units: <ol style="list-style-type: none"> 1. Introduction to CADD 2. Engineering Principles 3. Introduction to Engineering Design 4. Introduction to Architectural Design 	
Concepts: <ul style="list-style-type: none"> • CADD • Creating 2-D technical drawings • Modeling 3-D features and parts • Measuring • Accuracy and precision • Measurement devices • Density • Simple machines • Mechanical advantage • Engineering design process • Plans • Elevations • Residential design and construction • Scale • Drawings • BIM • Careers in engineering and architecture 	Competencies: <ul style="list-style-type: none"> • <u>AutoCAD drawing tools and commands:</u> OSNAP/OTRACK, Polar/Ortho, Zoom/Pan, Line, Rectangle, Offset, Trim/Extend, Circle, Arc, Fillet/Chamfer, Rotate • <u>Inventor sketch tools and commands:</u> Line, Circle, Arc, Rectangle, Fillet, Chamfer, Move, Copy, Trim, Extend, Dimension • <u>Inventor modeling tools and commands:</u> Extrude, Revolve, Sweep, Fillet, Chamfer • <u>Engineering Principles:</u> Measuring, Accuracy and Precision, Measurement Devices, Density, Simple Machines (Inclined Plane, Lever, Wedge, Wheel and Axle, Pulley, Screw) • <u>Engineering Design Process:</u> Defining the Problem, Generating Concepts, Developing a Solution, Constructing and Testing the Solution, Evaluating the Solution, Presenting the Solution • <u>Using Autodesk Revit:</u> Setting Up Levels and Grids, Working with Walls, Understanding Dimensions, Adding Doors and Windows, Modifying the Design, Loading Families, Dimensioning a Plan
Learning Activities: <ul style="list-style-type: none"> • Instructional video tutorials • Teacher demonstrations • Individual classwork • Small/large group projects 	Performance Tasks: <ul style="list-style-type: none"> • Creating 2-D technical drawings using AutoCAD • Creating and modifying sketch geometry using Autodesk Inventor • Modeling 3-D parts using Autodesk Inventor • Measuring lab • Accuracy and precision lab

	<ul style="list-style-type: none"> • Measurement devices lab • Exploring density lab • Rocky measurements • Levers lab • Pulleys lab • Pulley extension lab • Rube Goldberg machine • Creating architectural plans and elevations using Autodesk Revit. • Modeling a simple residential structure using Autodesk Revit.
Other Assessment Measures: <ul style="list-style-type: none"> • Engineering notebook • Project and lab-specific data sheets • Crossword puzzles • Word searches • Online test/quizzes 	
Textbook/Primary Resource: <ul style="list-style-type: none"> • Engineering Design: An Introduction (John Karsnitz, Stephen O'Brien, and John Hutchinson) 	
Supplemental Resource Materials: <ul style="list-style-type: none"> • Pitsco Education Principles of Engineering Teacher's Guide • AutoCAD software • Autodesk Inventor software • Autodesk Revit software • Teacher-generated instructional resources 	