



Course Outcome Summary

Course Information: **Engineering 1**

Description: Develop your mechanical drafting skill using Autodesk Inventor during this semester long course. Develop your skills in dimensioning, working with layers, paper space, 3-D solid modeling and editing techniques. You will apply these skills in producing several sets of production drawings for various mechanical devices such as a gear puller, tool post and a locomotive screw jack. While a member of Engineering Design 1, you will become familiar with terminology, materials and design considerations used in the mechanical design field.

Instruction Level: **Grades 10-12**

Total Credits: **1**

Course Standards:

ACT College and Career Readiness Standards

- Interpret and use information from graphs in the coordinate plane
- Show strong understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion
- Show clear movement between general and specific ideas and examples
- Show competent use of language to communicate ideas

CTE Common Core Standards

- Students will communicate and collaborate with others to accomplish tasks and develop solutions to problems and opportunities.
- Students will identify and apply employability skills
- Students will assess the benefits and challenges of working in diverse settings and on diverse teams
- Students will apply leadership skills in real-world, family, community and business and industry applications.

Career and Technology Standards

- Compare and contrast systems found in nature and others made by humans.
- Identify that systems have parts or components that work together to accomplish a goal.
- Identify inputs, processes, outputs and, at times, feedback components for technological systems.
- Describe how systems can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities.
- Explain that tools are used to design, make, use, assess technology and extend human capabilities such as holding, lifting, carrying, fastening, separating and computing.
- Recognize that materials have many different properties that are leveraged in making things.

- Use appropriate tools to measure and layout a piece of material (e.g., length, width, thickness, angles, circles, arcs and volume) within tolerances.
- Students will analyze and demonstrate the attributes of design.
- Students will analyze and demonstrate engineering design.
- Students will demonstrate and analyze the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Students will develop abilities to apply the design process.
- Students will develop the abilities to use and maintain technological products and systems.
- Students will develop the abilities to assess the impact of products and systems.
- Learn basic methods of verbal, written and graphical communication as it relates to manufacturing.
- Comprehend and engage in communication methods to convey ideas, concepts and requirements to other individuals and teams.
- Design and publish documents using advanced publishing software and graphic programs to defend and promote results.
- Demonstrate scale and proportion (i.e. a toy car is a scale model of a full-sized car).
- Demonstrate use of the Standard Measuring System to the 1/4" and the Metric Measuring System to centimeters.
- Add, subtract, multiply and divide in the Standard Measuring System to the 1/4" and the Metric Measuring System to centimeters.
- Demonstrate basic dimensioning skills including the use of: dimension, extension, center and leader lines.
- Demonstrate use of the Standard Measuring System to the 1/16" and the Metric Measuring System to millimeters.
- Add, subtract, multiply and divide in the Standard Measuring System to the 1/16" and the Metric Measuring System to millimeters.
- Discuss the importance of keeping records.
- Explain the importance of communication.
- Expressing ideas to others, verbally and through sketches and models, is an important part of the design process.
- Identify symbols which can be used when communicating. (i.e., a logo)
- Demonstrate that letters, characters, icons and signs are symbols that represent ideas, quantities, elements and operations.
- Analyze how the use of symbols, measurements and drawings promotes clear communication by providing a common language to express ideas.
- Discuss how graphic communications can be used to influence how you see the world.
- List ways messages can be communicated without talking to someone.
- Identify the parts of a graphic message.
- Prepare a graphic communication message.

Unit

- 1. Intro to Engineering**
- 2. Design Process**
- 3. Fundamentals of AutoDesk Inventor**

4. Producing 2D/3D Designs and Assemblies

Unit Outlines

1. Intro to Engineering

Standards:

- Compare and contrast systems found in nature and others made by humans.
- Identify that systems have parts or components that work together to accomplish a goal.
- Identify inputs, processes, outputs and, at times, feedback components for technological systems.
- Describe how systems can fail because of design flaws, defect parts, poorly matched parts or they were used beyond their design capabilities.
- Explain that tools are used to design, make, use, assess technology and extend human capabilities such as holding, lifting, carrying, fastening, separating and computing.
- Recognize that materials have many different properties that are leveraged in making things.
- Use appropriate tools to measure and layout a piece of material (e.g., length, width, thickness, angles, circles, arcs and volume) within tolerances.

Essential Question:

Students will be able to answer the question(s):

- What is engineering?
- What kinds of engineers are employed in local industry?
- What is the importance of communication to an engineer?

Essential Knowledge:

- The student will be able to:
 - Explain the importance of engineers and what their roles are in industry
 - Define an engineering problem
 - Analyze everyday objects or problems and see improvements that can be made
 - Work with a team, as a team

2. Design Process

Standards:

- Students will analyze and demonstrate the attributes of design.
- Students will analyze and demonstrate engineering design.
- Students will demonstrate and analyze the role of troubleshooting, research and development, invention and innovation and experimentation in problem solving.
- Students will develop abilities to apply the design process.
- Students will develop the abilities to use and maintain technological products and systems.
- Students will develop the abilities to assess the impact of products and systems.

Essential Question:

Students will be able to answer the question(s):

- What is the design process?
- How do engineers design products?
- Why is it important to document design steps?
- Why is the engineering design process cyclical?

Essential Knowledge:

- The student will be able to:
 - Describe the engineering design process
 - Identify the when it is appropriate to move to the next stage are revert back to the previous stage
 - Communicate information regarding a design process stage accurately

3. Fundamentals of AutoDesk Inventor

Standards:

- Learn basic methods of verbal, written and graphical communication as it relates to manufacturing.
- Comprehend and engage in communication methods to convey ideas, concepts and requirements to other individuals and teams.
- Design and publish documents using advanced publishing software and graphic programs to defend and promote results.
- Demonstrate scale and proportion (i.e. a toy car is a scale model of a full-sized car).
- Demonstrate use of the Standard Measuring System to the 1/4” and the Metric Measuring System to centimeters.
- Add, subtract, multiply and divide in the Standard Measuring System to the 1/4” and the Metric Measuring System to centimeters.
- Demonstrate basic dimensioning skills including the use of: dimension, extension, center and leader lines.
- Demonstrate use of the Standard Measuring System to the 1/16” and the Metric Measuring System to millimeters.
- Add, subtract, multiply and divide in the Standard Measuring System to the 1/16” and the Metric Measuring System to millimeters.

Essential Question:

Students will be able to answer the question(s):

- What are the basic terms used in computer solid modeling?
- What are the techniques used for computer 2d sketching?
- What are the features used to create 3d shapes?
- What are the techniques used to computer assemble 3d parts?

Essential Knowledge:

- The student will:
 - Explore the Inventor 3D modeling user interface and basic navigating tools
 - Examine the Inventor 3D common modeling and modeling accuracy tools
 - Differentiate Inventor groups and components

- Explore Inventor modify tools
- Explore Inventor's toolsets of views, shadows, styles and layers
- Complete a Inventor project based on group-and component-modeling
- Apply Inventor skills to a building modeling project

4. Producing 2D/3D Designs and Assemblies

Standards:

- Identify that systems have parts or components that work together to accomplish a goal.
- Identify the types, functions and applications, of simple mechanical components (e.g. levers, linkages, cranks, cams, gears, pulleys & belts, sprockets & chains).

Essential Question:

Students will be able to answer the question(s):

- How do the skills and knowledge I am learning in this class get applied within a job setting?
- How can I work with a team to develop an answer to a question or solution to problem?
- How do I apply the skills that my future employers will value?

Essential Knowledge:

- The student will:
 - Utilize and be proficient in basic 3D Geometry
 - Be proficient in placed Features Modification
 - Document Parts
 - Be proficient in Assembly Modeling
 - Document Assemblies
 - Understand and describe Electrical/Hydraulic Subsystem Design