Engineering Design

Levels: **Grades 9-12**
Units of Credit:
CIP Code: **21.0115**
Core Code: **38-01-00-00-037**
Prerequisite: **None**
Skill Test: **None**

COURSE DESCRIPTION
This course is intended to introduce high school students to the engineering design process and the properties of good design.
Students will plan, complete, and document a number of analysis-based designs. Skills will be developed in the creation of memos, design reports, and technical drawings using computer aided design. The course content will be covered through a series of hands-on activities.

CORE STANDARDS, OBJECTIVES, AND INDICATORS

STANDARD 1
Students will recognize the role of design in society.

Objective 1: Describe history of engineering design.

Objective 2: Recognize and identify the role of engineering and engineered products in society.

Objective 3: Identify the requirements for and role of intellectual property in design.

Objective 4: Recall education requirements for professional success as a designer/engineer.

STANDARD 2
Students will identify the qualities of successful engineering design.

Objective 1: Identify the qualities of good design and their relationship to the design's user.

Objective 2: Examine a design with respect to its quality and usability.

Objective 3: Understand that these qualities are the result of choices made and constraints applied during the design process.

STANDARD 3
Students will develop a facility using the engineering design process.

Objective 1: Explain and perform the engineering design process.

Objective 2: Create design specifications considering such factors as time and financial resources, ergonomics, safety, and the state-of-of the art.

Objective 3: Locate and utilize a range of electronic, print, human information sources in the creation of a design.

Objective 4: Utilize science and mathematics skills to generate multiple ideas for solving a design challenge and be able to critically evaluate those ideas.

Objective 5: Explain the role of and be able to utilize mathematical and functional modeling in the creation and assessment of a design.

Objective 6: Be able to build and test a design against design specifications, evaluate the results of that testing, and present their analyses.

Objective 7: Recognize and demonstrate that the design process does not result in a single best design, but instead there are many possible successful designs.

Objective 8: Recognize and demonstrate that design is an iterative process, subject to continuous evolutionary improvement.

STANDARD 4
Students will plan, document, and communicate during the engineering design process.

Objective 1: Develop plans for the completion of an engineering design.
a. Develop a project charter.
b. Identify the steps required for completion of a specific project.
c. Be able to create a PERT chart.
d. Define and identify the critical path in a PERT chart.

Objective 2: Communicate and document engineering designs.
a. Prepare and maintain a design notebook.
b. Communicate their progress to others with memo.
c. Organize and prepare a design report.
d. Be able to present their designs to others.

STANDARD 5
Students will learn the use of Computer Aided Design Software.

Objective 1: Understand drafting fundamentals.
a. Demonstrate proper drawing layout by utilizing scales.
b. Utilize linetypes and lineweights properly on a drawing.
c. Understand basic lettering techniques.

Objective 2: Understand dimensioning.
a. Understand basic dimensioning fundamentals.
b. Demonstrate correct dimensioning techniques.
c. Compare and contrast baseline dimensioning and continuous dimensioning.
d. Discuss the importance of geometric dimensioning and tolerances.

Objective 3: Illustrate types of drawings.
a. Illustrate orthographic projection drawings.
b. Illustrate pictorial drawings.
c. Illustrate section view drawings.
d. Illustrate thread and fastener drawings.
e. Illustrate auxiliary view drawings.
f. Illustrate revolution drawings.
g. Create developments.
h. Illustrate assembly drawings.

Objective 4: Utilize 3D parametric modeling.
a. Apply basic drafting fundamentals utilizing 3D modeling software.
b. Utilize the 2D sketch tools.
c. Utilize the extrude tools.
d. Utilize the revolve tools.
e. Utilize the hole tools.

f. Utilize the advanced 3D modeling tools.
g. Utilize the 3D modification tools.