SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Engineering 2	Length of Course: 15 cycles
Grade Level(s): 10-12	Periods Per Cycle: 6
Units of Credit: .5	Length of Period: 43 minutes
Classification: Elective	Total Instructional Time: 64.5 hours

Course Description

This course promotes a hands-on focus to learning the concepts and roles of engineering, design, invention, and innovation in creating technology systems that improve the quality of life. The students apply and transfer this knowledge to real-life scenarios. The course incorporates the applications of math and science concepts and provides a strong background for students investigating careers. The class is a continuation of Engineering 1. The concepts and ideas developed in that class will be used as a background for this class.

Instructional Strategies, Learning Practices, Activities, and Experiences

Teacher Demonstration	Teacher Demonstration	Teacher Demonstration
Online Tutorials/Resources	Online Tutorials/Resources	Online Tutorials/Resources
Critical Thinking	Critical Thinking	Critical Thinking

Assessments

Final Exam	Unit Projects	Skills Mastery Checklists
Student Portfolio	Design/Lesson Rubrics	

Materials/Resources

Computer Lab	Variety of Power and Hand Tools.	Laser Cutter/Engraver
Materials Lab		3D Printer

Adopted: 6/20/2011
Revised: 5/21/18

Engineering Design Process	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Project management B. Time table	The students will be able to: • Apply systems analysis to predict results. • Compare and contrast several systems that could be applied to solve a single problem. • Evaluate the causes of a system's inefficiency. • Evaluate technological processes by collecting data and applying mathematical models. • Apply knowledge of complex physical models to interpret data and apply mathematical models. • Analyze and apply appropriate measurement scales when collecting data. • Evaluate experimental data correctly within experimental limits. • Judge that conclusions are consistent and logical with experimental conditions. • Interpret results of experimental research to predict new information or improve a solution. • Assess all aspects of the problem, prioritize the necessary information, and formulate questions that must be answered. • Propose, develop, and appraise the best solution and develop alternative solutions. Redesign and improve as necessary. • Communicate and assess the process and evaluate and present the impacts of the solution. • Analyze the principles of rotational motion to solve problems relating to angular momentum and torque. • Interpret a model that illustrates circular motion and acceleration. 3.4.10.A2 ~ Interpret how systems thinking applies logic and creativity with appropriate comprises in complex real-life problems. 3.4.10.A3 ~ Examine how technology transfer occurs when a new user applies an existing innovation developed for one purpose in a different function. 3.4.12.A2 ~ Describe how management is the process of planning, organizing, and controlling work. 3.4.12.A3 ~ Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM). 3.4.12.B2 ~ Illustrate how, with the aid of technology, various aspects of the environment can be monitored to provide information for decision making. 3.4.12.C2 ~ Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. 3.4.12.C3 ~ Apply the concept that many technological problems require a multi-disciplinary approach. 3.4.10.D1 ~ Refine a design by using prototypes and modeling to ensure quality, efficiency, and productivity of a final product. 3.4.10.D2 ~ Diagnose a malfunctioning system and use tools, materials, and knowledge to repair it.

Managing Engineering Design	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Computer models B. Translational motion	The students will be able to: • Appraise the importance of computer models in interpreting science and technological systems. • Implement and assess the solution. • Evaluate and assess the solution, redesign, and improve as necessary. • Communicate and assess the process and evaluate and present the impacts of the solution. • Analyze the principles of translational motion, velocity, and acceleration as they relate to free fall and projectile motion. • Apply knowledge of construction technology by designing, planning, and applying all the necessary resources to successfully solve a construction problem. • Compare resource options in solving a specific manufacturing problem. • Analyze and apply complex skills needed to process materials in complex manufacturing enterprises. 3.4.12.A3 ~ Demonstrate how technological progress promotes the advancement of science, technology, engineering and mathematics (STEM). 3.4.10.B4 ~ Recognize that technological development has been evolutionary, the result of a series of refinements to a basic invention. 3.4.12.B1 ~ Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies. 3.4.10.C1 ~ Apply the components of the technological design process. 3.4.12.C2 ~ Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. 3.4.12.D2 ~ Verify that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. 3.4.12.E4 ~ Synthesize the effects of information and communication systems and subsystems as an integral part of the development of the Information Age. 3.4.12.E6 ~ Compare and contrast the importance of science, technology, engineering, and math (STEM) as it pertains to the manufactured world. 3.4.12.E7 ~ Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.

Quality Assurance	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Recognize B. Investigate C. Describe D. Analyze E. Quality assurance	The students will be able to: • Demonstrate the safe use of complex tools and machines within their specifications. • Select and safely apply appropriate tools, materials, and processes necessary to solve complex problems that could result in more than one solution. • Evaluate the utility and advantages of a variety of absolute and relative measurement scales for their appropriate application. 3.4.10.B1 ~ Compare and contrast how the use of technology involves weighing the trade-offs between the positive and negative effects. 3.4.10.B2 ~ Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. 3.4.12.B1 ~ Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies. 3.4.12.C2 ~ Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. 3.4.12.C3 ~ Apply the concept that many technological problems require a multi-disciplinary approach. 3.4.10.E7 ~ Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency.

Product Development	
CONTENT/KEY CONCEPTS	**OBJECTIVES/STANDARDS**
A. Human abilities B. Societal needs	The students will be able to: • Apply appropriate tools, materials, and processes to solve complex problems. • Use knowledge of human abilities to design or modify technologies that extend and enhance human abilities. • Apply the use of ingenuity and technological resources to solve specific societal needs and improve the quality of life. 3.4.10.B1 ~ Compare and contrast how the use of technology involves weighing the trade-offs between the positive and negative effects. 3.4.10.B2 ~ Demonstrate how humans devise technologies to reduce the negative consequences of other technologies. 3.4.12.B1 ~ Analyze ethical, social, economic, and cultural considerations as related to the development, selection, and use of technologies. 3.4.12.C2 ~ Apply the concept that engineering design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. 3.4.12.C3 ~ Apply the concept that many technological problems require a multi-disciplinary approach. 3.4.10.E4 ~ Evaluate the purpose and effectiveness of information and communication systems. 3.4.10.E6 ~ Illustrate how manufacturing systems may be classified into types such as customized production, batch production, and continuous production. 3.4.10.E7 ~ Evaluate structure design as related to function, considering such factors as style, convenience, safety, and efficiency. 3.4.12.E3 ~ Compare and contrast energy and power systems as they relate to pollution, renewable and non-renewable resources, and conservation. 3.4.12.E4 ~ Synthesize the effects of information and communication systems and subsystems as an integral part of the development of the Information Age. 3.4.12.E6 ~ Compare and contrast the importance of science, technology, engineering and math (STEM) as it pertains to the manufactured world. 3.4.12.E7 ~ Analyze the technologies of prefabrication and new structural materials and processes as they pertain to constructing the modern world.