Environmental Engineering

Course Credit	1.0
Grade Level(s)	9-12
Prerequisite(s)	None

Environmental Engineering is designed to offer students an overview of environmental sustainability. It allows students to explore training, education, and career opportunities related to environmental engineering. Students will investigate and design solutions in response to real-world challenges related to clean and abundant drinking water, food supply, and renewable energy. Applying their knowledge through hands-on activities and simulations, students research and design potential solutions to these real-life challenges. And finally, students will describe the careers associated with environmental engineering and what roles they play in society.

Foundational standards, shown in the chart below, are an important part of every course. Through these standards, students learn and apply safety concepts, explore career opportunities and requirements, practice the skills needed to succeed in the workplace, learn and practice essential digital literacy skills, develop leadership, and take advantage of the opportunities afforded by Career and Technical Student Organizations (CTSOs). Students in this course may be affiliated with the Technology Student Association (TSA) or Skills USA. The foundational standards are to be incorporated throughout the course.

Foundational Standards	1. Incorporate safety procedures in handling, operating, and maintaining tools and machinery; handling materials; utilizing personal protective equipment; maintaining a safe work area; and following protocols for fire and electrical safety. 2. Demonstrate effective workplace and employability skills, including communication, awareness of diversity, positive work ethic, problem-solving, time management, and teamwork. 3. Explore the range of careers available in the field and investigate their educational requirements, and demonstrate job-seeking skills including resume-writing and interviewing. 4. Demonstrate digital literacy by using digital and electronic tools appropriately, safely, and ethically. 5. Participate in a Career and Technical Student Organization (CTSO) to increase knowledge and skills and to enhance leadership and teamwork.

Environmental Engineering Content Standards

Each content standard completes the stem, *"Students will…"*

Water Security in Society	1. Examine environmental and physical factors related to safe drinking water. a. Analyze the relationship between population growth and water resources. b. Obtain, evaluate, and share information on ways human health is affected by the quality of drinking water sources. c. List the characteristics of clean water. d. Explain why clean water is necessary for survival. e. Describe common sources of drinking water contamination.

Water Security Systems	2. Identify appropriate wastewater treatment processes and designs to eliminate common wastewater contaminants. a. Explain how water quality is quantitatively measured using chemically and/or biologically based testing processes. b. Outline the stages of sewage water treatment used in treatment facilities. c. Explain how water treatment plants remove nitrates from contaminated water. d. Use an engineering design process to create a water filtration system. e. Design and conduct a scientific experiment to test a variable affecting bacteria's ability to decompose oil.

Food Security in Society	3. Describe applications that engineers use to manipulate DNA to improve the quality, quantity, and reliability of food resources. a. Analyze environmentally and socially sustainable and unsustainable food production methods. b. Research the meaning and importance of food security. c. Describe the structure and function of DNA. d. Apply scientific techniques used in molecular biology to observe and/or experiment with plants, analyze results, and create plans that might increase the quality and quantity of food crops. e. Justify an argument for or against the use of genetic recombination methods as a means of improving food security.

Alternative Fuels	4. Analyze how engineers maximize the use and efficiency of renewable fuels and use results of the analysis to design alternative fuel sources. a. Demonstrate a working knowledge of various sources of energy and their environmental and economic impacts. b. Apply stoichiometric principles to the process of photosynthesis to predict and compare the experimental results of oxygen/carbon dioxide production and consumption. c. Conduct simulations of real-world situations to predict possible solutions. d. Debate the positive and negative aspects of using algae and biological free stocks as a fuel source. e. Demonstrate efficient fuel production methods from renewable sources. f. Plan various upstream and downstream processing methods to design an effective biofuels manufacturing plant.