Advanced Life Science: Plants and Soils is a two semester course that provides students with opportunities to participate in a variety of activities including laboratory work. Students study concepts, principles, and theories associated with plants and soils. Knowledge gained enables them to better understand the workings of agricultural and horticultural practices. They recognize how plants are classified, grow, function, and reproduce. Students explore plant genetics and the use of plants by humans. They examine plant evolution and the role of plants in ecology. Students investigate, through laboratories and fieldwork, how plants function and how soil influences plant life.

Advanced Life Science: Plants and Soils prepares students for many careers in agriculture, and more specifically, plant and soil science. These careers include but are not limited to: Agricultural Inspector, Agriculture Technician, Agronomic Services, Agronomist, Botanist, Plant Breeder, Plant Geneticists, Plant Pathologist, Soil and Water Specialist, and Sustainable Bioenergy Technician.

Course Specifications
- DOE Code: 5074
- Recommended Grade Level: Grade 10-12
- Recommended Prerequisites: Introduction to Agriculture, Food and Natural Resources, Plant and Soil Science, Chemistry, and Biology
- Credits: 1 credit per semester, maximum of 2 semesters, maximum of 2 credits
- Fulfills a Core 40 Science requirement for the General, Core 40, Core 40 with Academic Honors and Core 40 with Technical Honors diplomas or counts as an Elective or Directed Elective for any diploma
- This course is aligned with postsecondary courses for Dual Credit

Dual Credit
This course provides the opportunity for dual credit for students who meet postsecondary requirements for earning dual credit and successfully complete the dual credit requirements of this course.

Career and Technical Student Organizations
Career and Technical Student Organizations are considered a powerful instructional tool when integrated into Career and Technical Education courses. They enhance the knowledge and skills students learn in a course by allowing a student to participate a unique program of career and leadership development. Students in this course should be encouraged to participate in FFA.

Content Standards
Domain - Taxonomy and Classification

Core Standard 1 Students analyze the classification of organisms to understand diversity and the roles of each plant organism.
Standards
ALSPS-1.1 Explain the classification of organisms based on a hierarchical taxonomy
ALSPS-1.2 Distinguish the five kingdoms of organisms, and more specific taxonomy of agricultural species of plants
ALSPS-1.3 Identify plants using a taxonomic key
ALSPS-1.4 Develop a detailed knowledge base in plant biology (this includes cell biology, physiology, morphology, anatomy, genetics, classification, evolution and ecology of plants)

Domain - Molecules and Plant Cells

Core Standard 2 Students connect basic concepts of chemistry, biochemistry, and biological functions as they relate to the field of agriculture science.

Standards
ALSPS-2.1 Compare and contrast molecules
ALSPS-2.2 Explain the concepts of monomers and polymers
ALSPS-2.3 Compare and contrast the different types of chemical bonds
ALSPS-2.4 Identify and differentiate between common groups of molecules
ALSPS-2.5 Compare and contrast animal, plant, and bacterial cells at the biological and chemical levels
ALSPS-2.6 Describe biochemistry and functions of plant cells, membranes, organelles, and cell walls
ALSPS-2.7 Identify and demonstrate the principles of genetic expression within a genome
ALSPS-2.8 Describe and compare cellular respiration in plants and animals
ALSPS-2.9 Evaluate the impact of photosynthesis and cellular respiration and the factors that affect them on plant management, culture and production problems.

Domain - Development and Function of Plant Systems

Core Standard 3 Students confirm that plants have a variety of cells and tissues with specific functions and systems to illustrate the relationship between certain specific chemicals in their processes.

Standards
ALSPS-3.1 Apply the knowledge of cell differentiation and the functions of the major types of cells to plant systems
ALSPS-3.2 Define primary and secondary growth and the role of the apical meristem on regulating growth.
ALSPS-3.3 Relate the active and passive transport of minerals into and through the root system to plant nutrition
ALSPS-3.4 Devise plans for plant management that applies knowledge of transpiration, translocation and assimilation on plant growth.
ALSPS-3.5 Explain how leaves capture light energy and allow for the exchange of gases
ALSPS-3.6 Identify the different types of flowers, the components of a flower, the functions of a flower and the functions of lower components
ALSPS-3.7 Identify the macro and micro nutrients essential for plant growth and describe some of their functions in plants

ALSPS-3.8 Select and defend the use of specific plant growth regulators to produce desired responses from plants

Domain - Plant Genetics - Chemistry, Expression, and Modification

Core Standard 4 Students apply concepts of the roles of t-RNA, m-RNA, DNA, other chemistry of genes and genomes, and a plant's environment in reproduction and expression to understand how plants reproduce, and can be modified genetically.

Standards
ALSPS-4.1 Explain the structures of DNA and RNA
ALSPS-4.2 Explain the molecular basis for heredity and the tools and techniques used in DNA and RNA manipulations
ALSPS-4.3 Analyze factors that influence gene expression
ALSPS-4.4 Validate how genotype influences phenotype
ALSPS-4.5 Research the term genome
ALSPS-4.6 Compare and contrast DNA replication in mitosis and meiosis
ALSPS-4.7 Compare the different methods of genetic modification of crops throughout the history of domestication.
ALSPS-4.8 Evaluate the impact of plant breeding and other forms of genetic modification of crops on production practices, both locally and globally.
ALSPS-4.9 Evaluate and explain how scientists use the scientific method to develop new plant crop varieties
ALSPS-4.10 Evaluate methods of genetic modification for their short- and long-term benefits and risks
ALSPS-4.11 Devise and support an argument in favor of or against an ethical issue associated with biotechnology in agriculture

Domain - Evolutionary Trends and Ecology

Core Standard 5 Students evaluate a variety of environmental factors to understand how they contribute to the development and survival of plant species.

Standards
ALSPS-5.1 Explain the significance of genetic diversity to evolution.
ALSPS-5.2 Compare and contrast natural selection with artificial selection
ALSPS-5.3 Compare and contrast adaptations of plants for survival and seed dispersal in different environmental conditions
ALSPS-5.4 Explain how climate is a factor in the selection of both crop and ornamental plants
ALSPS-5.5 Define hybridization, and describe how it can lead to the development of unique species and varieties
ALSPS-5.6 Describe methods of producing transgenic plants and ways in which they are used
ALSPS-5.7 Explain the roles of plants in the global carbon cycle
ALSPS-5.8 Describe the nitrogen and phosphorus cycles
ALSPS-5.9 Describe various approaches to control plant and animal pests
ALSPS-5.10 Explain how plants sense changes in their environment and respond
ALSPS-5.11 Develop a familiarity with plants and sharpen observational skills and appreciate their role in human affairs.

Domain - Physical Environment: Soils - Formation, Nutrients and Chemistry
Core Standard 6 Students evaluate different soil types to understand how they are formed, determined and how they compare to each other.

Standards
ALSPS-6.1 Define and describe the role of water holding capacity and hydraulic conductivity for and how that influences irrigation and drainage practices.
ALSPS-6.2 Describe how decomposers affect organic material formation
ALSPS-6.3 Describe the inverse relationship between drainage and oxygen availability
ALSPS-6.4 Compare and contrast ion exchange capacity in natural soils and artificial media
ALSPS-6.5 Define anion and cation, and describe their roles in soil science
ALSPS-6.6 Describe the physical and chemical structures and functions of soil components including sand, silt, clay, and organic matter
ALSPS-6.7 Identify and describe the various soil horizons and their roles
ALSPS-6.8 Explain the physical, chemical, geological and biological processes of soil formation
ALSPS-6.9 Discuss the effects of soil pH on mineral availability and toxicity and apply necessary changes for maximum fertility.
ALSPS-6.10 Interpret laboratory analyses of soil and tissue samples and prescribe applications based on the results.
ALSPS-6.11 Identify, calculate and calibrate appropriate fertilizer applications to meet plant nutrient needs.

Domain - Careers
Core Standard 7 Students examine the scope of career opportunities in and the importance of agriculture to the economy.

Standards
ALSPS-7.1 Evaluate the nature and scope of animal sciences in agriculture, society, and the economy
ALSPS-7.2 Describe career opportunities and means to achieve those opportunities in plant and soil sciences
ALPS-7.3 Identify how key organizational structures and processes affect organizational performance and the quality of products and services

ALPS-7.4 Demonstrate those qualities, attributes and skills necessary to succeed in, or further prepare for a chosen career while effectively contributing to society

Domain - Leadership

Core Standard 8 Students validate the necessity of leadership skills development in conjunction with participation in The National FFA Organization (FFA) as a critical component to a well-rounded agricultural education.

Standards
ALPS-8.1 Communicate clearly, effectively, and with reason through speaking, writing, visuals, and active listening in formal and informal settings

ALPS-8.2 Recognize and explain the role of the FFA in the development of leadership, education, employability, communications and human relations skills

ALPS-8.3 Examine roles within teams, work units, departments, organizations, inter-organizational systems, and the larger environment

ALPS-8.4 Acquire the skills necessary to positively influence others

ALPS-8.5 Develop a skill set to enhance the positive evolution of the whole person

Domain - Supervised Agriculture Experience

Core Standard 9 Students validate the necessity of a Supervised Agricultural Experience (SAE) program as a critical component to a well-rounded agricultural education.

Standards
ALPS-9.1 Explain the nature of and become familiar with those terms related to an SAE program

ALPS-9.2 Explore the numerous possibilities for an SAE program which a student might develop

ALPS-9.3 Develop an individual SAE program and implementation plan for record keeping skills